

Module 2- Spatial Boundaries

Based on Chapter 3 and 7 for Architecture: Form, Space and Order

Terminology:

- HORIZONTAL ELEMENTS
- VERTICAL ELEMENTS
- OPENINGS

ENCLOSURE CONCEPTS

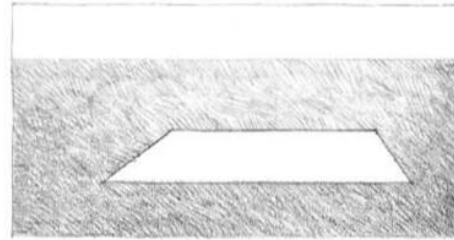
- AXIS
- SYMMETRY
- HIERARCHY
- RHYTHM
- DATUM
- TRANSFORMATION

ORDERING PRINCIPLES

Horizontal Elements

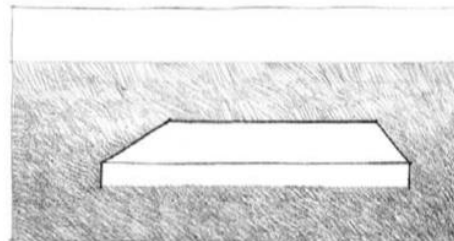
Base Plane

A horizontal plane laying as a figure on a contrasting background defines a simple field of space. This field can be visually reinforced in the following ways.



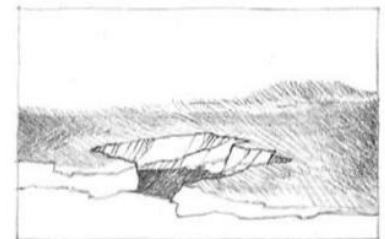
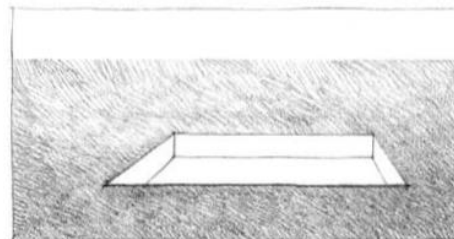
Elevated Base Plane

A horizontal plane elevated above the ground plane establishes vertical surfaces along its edges that reinforce the visual separation between its field and the surrounding ground.



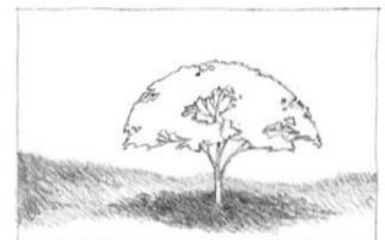
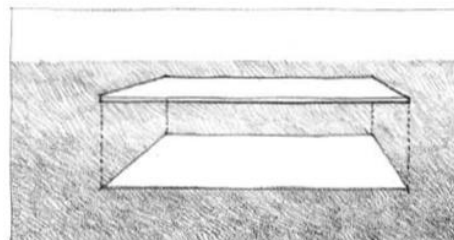
Depressed Base Plane

A horizontal plane depressed into the ground plane utilizes the vertical surfaces of the lowered area to define a volume of space.

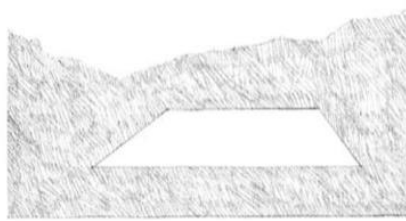


Overhead Plane

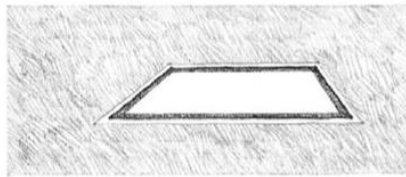
A horizontal plane located overhead defines a volume of space between itself and the ground plane.



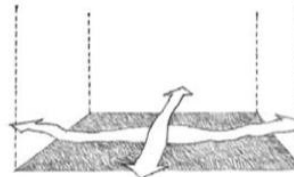
Base Plane



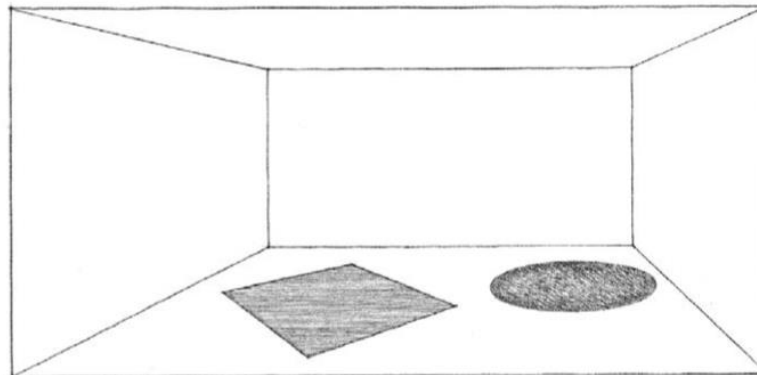
For a horizontal plane to be seen as a figure, there must be a perceptible change in color, tone, or texture between its surface and that of the surrounding area.



The stronger the edge definition of a horizontal plane is, the more distinct will be its field.

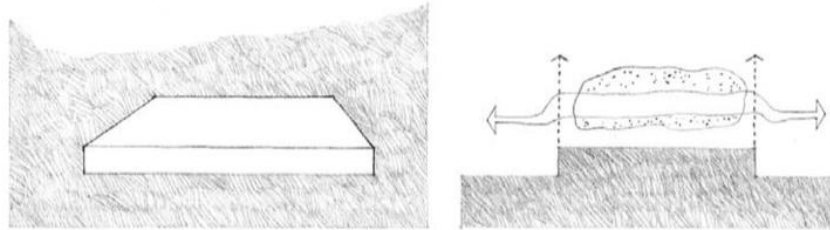


Although there is a continuous flow of space across it, the field nevertheless generates a spatial zone or realm within its boundaries.

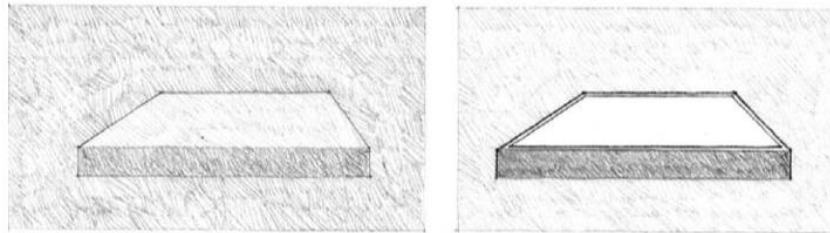


The surface articulation of the ground or floor plane is often used in architecture to define a zone of space within a larger context. The examples on the facing page illustrate how this type of spatial definition can be used to differentiate between a path of movement and places of rest, establish a field from which the form of a building rises out of the ground, or articulate a functional zone within a one-room living environment.

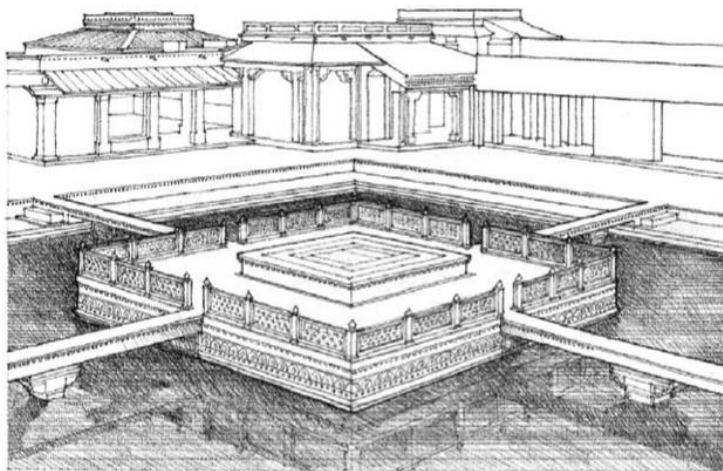
Elevated Base Plane



Elevating a portion of the base plane creates a specific domain within a larger spatial context. The changes in level that occur along the edges of the elevated plane define the boundaries of its field and interrupt the flow of space across its surface.



If the surface characteristics of the base plane continues up and across the elevated plane, then the field of the elevated plane will appear to be very much a part of the surrounding space. If, however, the edge condition is articulated by a change in form, color, or texture, then the field will become a plateau that is separate and distinct from its surroundings.



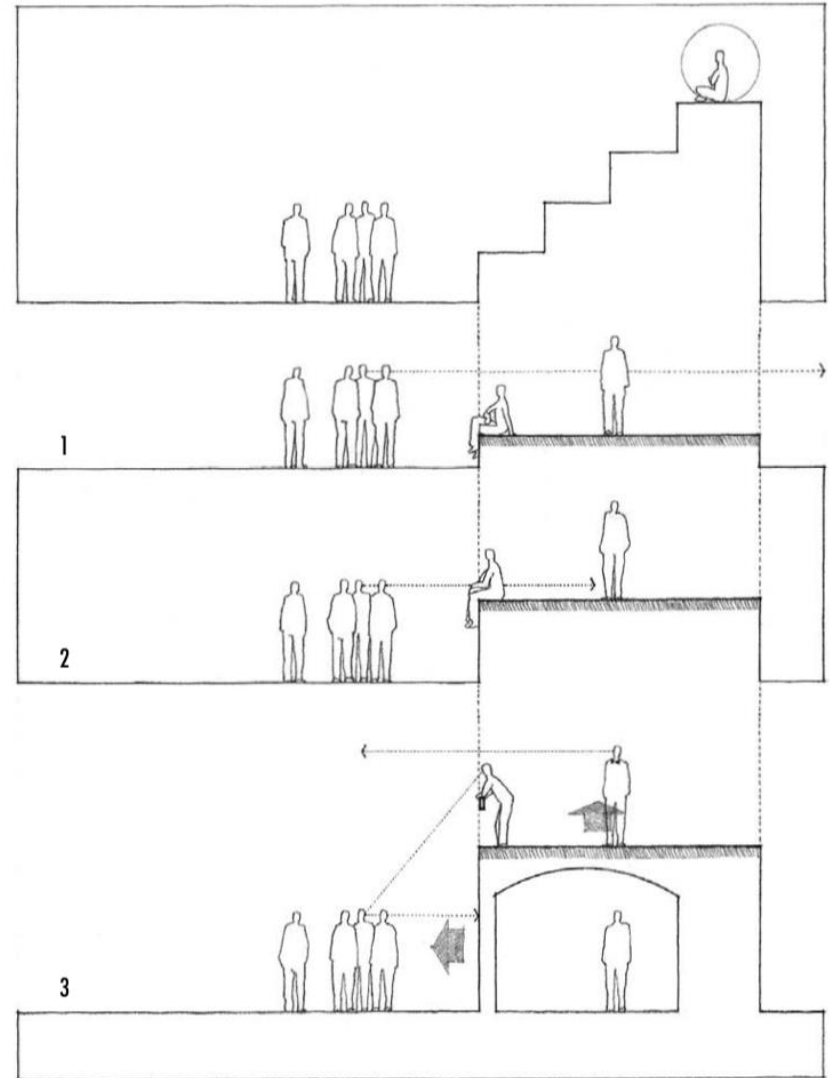
Fatehpur Sikri, Palace Complex of Akbar the Great, Mogul Emperor of India, 1569–74.

A special place is established by a platform in an artificial lake surrounded by the emperor's living and sleeping quarters.

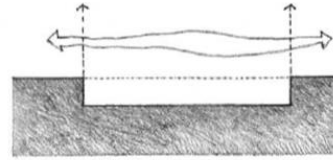
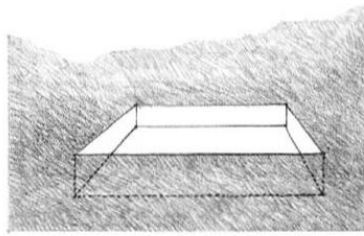
Elevated Base Plane

The degree to which spatial and visual continuity is maintained between an elevated space and its surroundings depends on the scale of the level change.

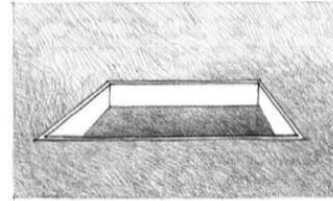
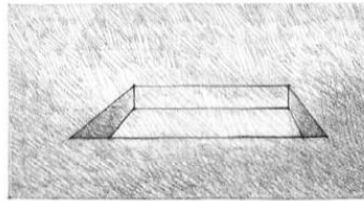
1. The edge of the field is well-defined; visual and spatial continuity is maintained; physical access is easily accommodated.
2. Visual continuity is maintained; spatial continuity is interrupted; physical access requires the use of stairs or ramps.
3. Visual and spatial continuity is interrupted; the field of the elevated plane is isolated from the ground or floor plane; the elevated plane is transformed into a sheltering element for the space below.



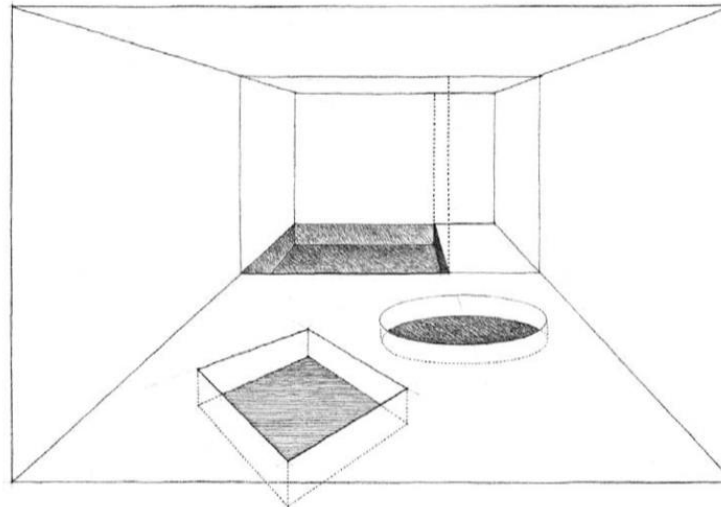
Depressed Base Plane



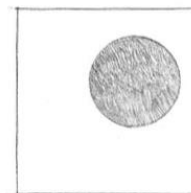
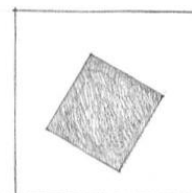
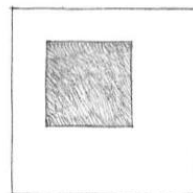
Lowering a portion of the base plane isolates a field of space from a larger context. The vertical surfaces of the depression establish the boundaries of the field. These boundaries are not implied as in the case of an elevated plane, but visible edges that begin to form the walls of the space.



The field of space can be further articulated by contrasting the surface treatment of the lowered area and that of the surrounding base plane.



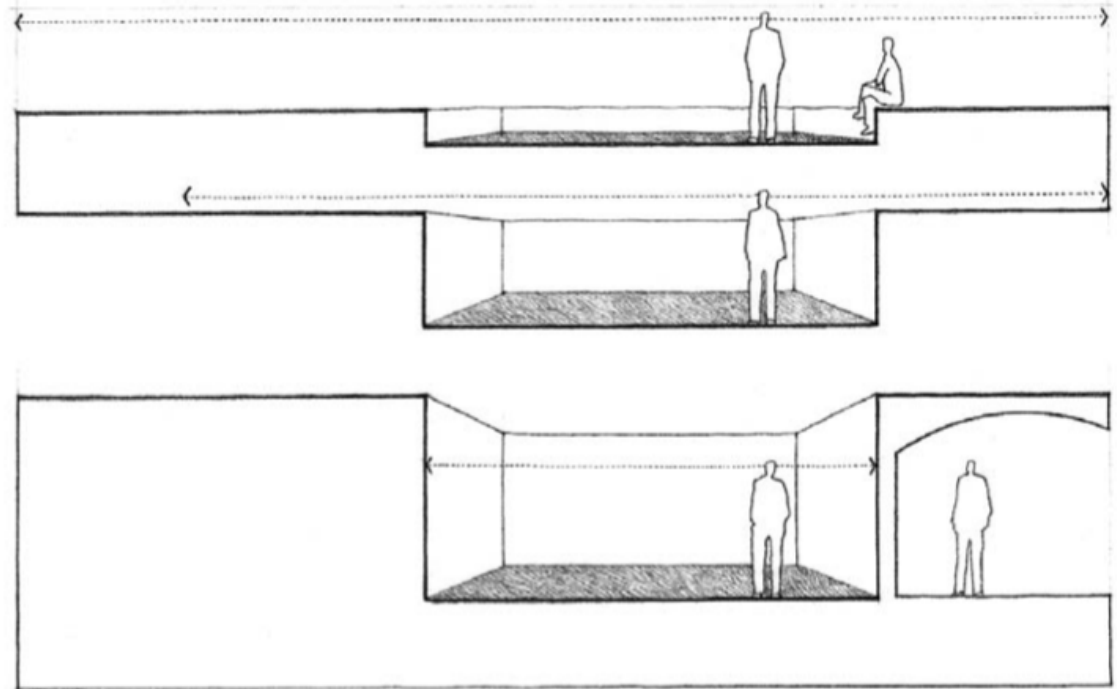
A contrast in form, geometry, or orientation can also visually reinforce the identity and independence of the sunken field from its larger spatial context.



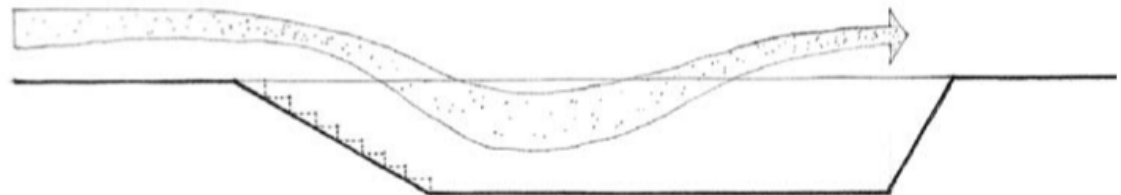
Depressed Base Plane

The degree of spatial continuity between a depressed field and the raised area surrounding it depends on the scale of the level change.

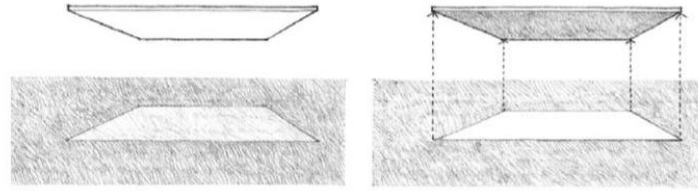
- The depressed field can be an interruption of the ground or floor plane and remain an integral part of the surrounding space.
- Increasing the depth of the depressed field weakens its visual relationship with the surrounding space and strengthens its definition as a distinct volume of space.
- Once the original base plane is above our eye-level, the depressed field becomes a separate and distinct room in itself.



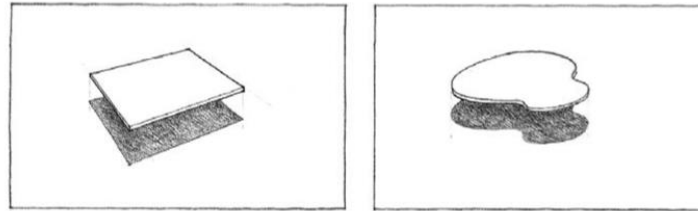
Creating a stepped, terraced, or ramped transition from one level to the next helps promote continuity between a sunken space and the area that rises around it.



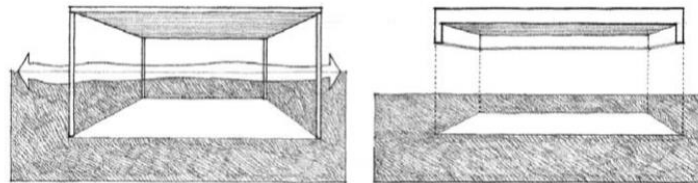
Overhead Plane



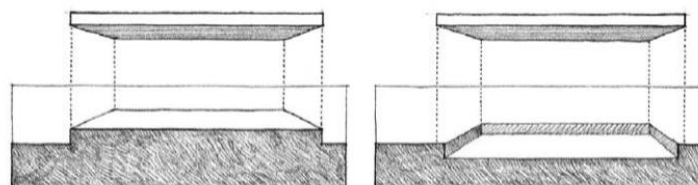
Similar to the manner in which a shade tree offers a sense of enclosure beneath its umbrella structure, an overhead plane defines a field of space between itself and the ground plane. Since the edges of the overhead plane establish the boundaries of this field, its shape, size, and height above the ground plane determines the formal qualities of the space.



While the previous manipulations of the ground or floor plane defined fields of space whose upper limits were established by their context, an overhead plane has the ability to define a discrete volume of space virtually by itself.



If vertical linear elements such as columns or posts are used to support the overhead plane, they will aid in visually establishing the limits of the defined space without disrupting the flow of space through the field.

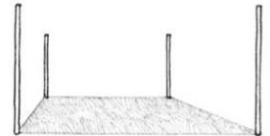
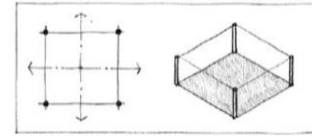


Similarly, if the edges of the overhead plane are turned downward, or if the base plane beneath it is articulated by a change in level, the boundaries of the defined volume of space will be visually reinforced.

Vertical Elements Defining Space

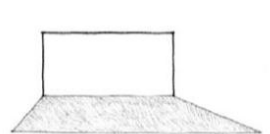
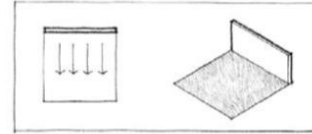
Vertical Linear Elements

Vertical linear elements define the perpendicular edges of a volume of space.



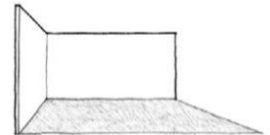
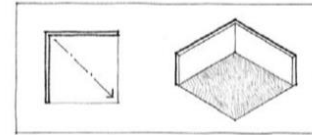
Single Vertical Plane

A single vertical plane articulates the space on which it fronts.



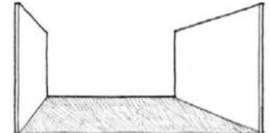
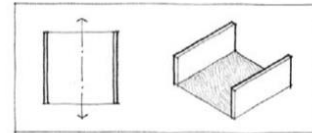
L-shaped Plane

An L-shaped configuration of vertical planes generates a field of space from its corner outward along a diagonal axis.



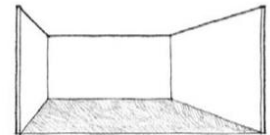
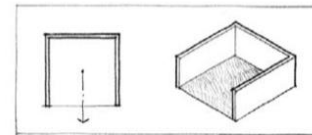
Parallel Planes

Two parallel vertical planes define a volume of space between them that is oriented axially toward both open ends of the configuration.



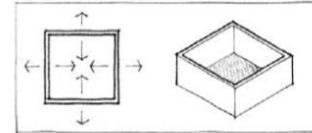
U-shaped Plane

A U-shaped configuration of vertical planes defines a volume of space that is oriented primarily toward the open end of the configuration.

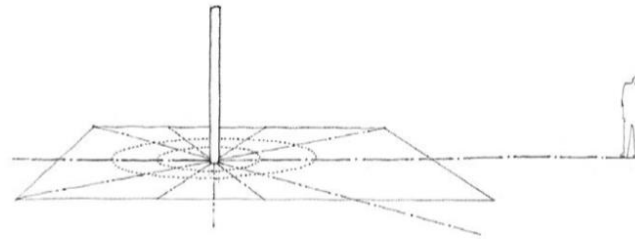


Four Planes: Closure

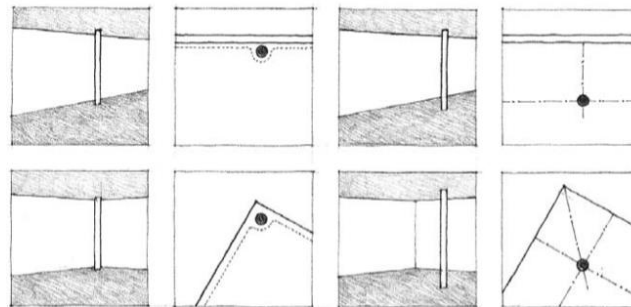
Four vertical planes establish the boundaries of an introverted space and influence the field of space around the enclosure.



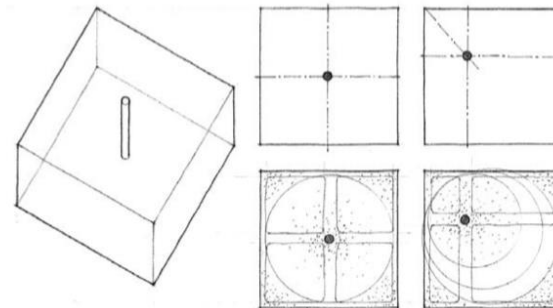
Vertical Linear Elements



A vertical linear element, such as a column, obelisk, or tower, establishes a point on the ground plane and makes it visible in space. Standing upright and alone, a slender linear element is nondirectional except for the path that would lead us to its position in space. Any number of horizontal axes can be made to pass through it.



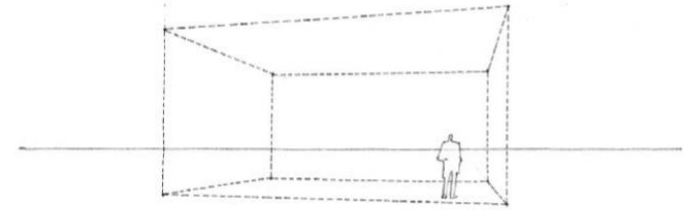
When located within a defined volume of space, a column will generate a spatial field about itself and interact with the spatial enclosure. A column attached to a wall buttresses the plane and articulates its surface. At the corner of a space, a column punctuates the meeting of two wall planes. Standing free within a space, a column defines zones of space within the enclosure.



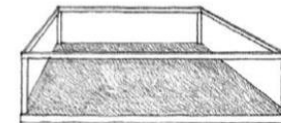
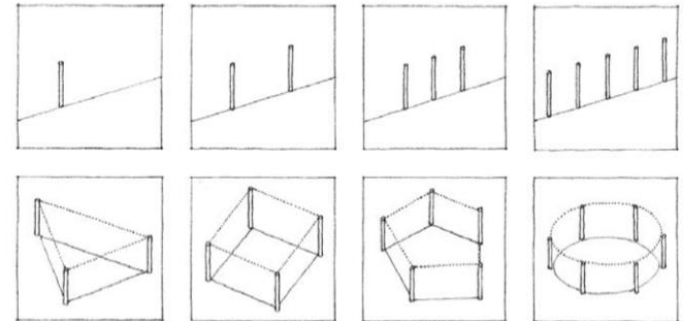
When centered in a space, a column will assert itself as the center of the field and define equivalent zones of space between itself and the surrounding wall planes. When offset, the column will define hierarchical zones of space differentiated by size, form, and location.

Vertical Linear Elements

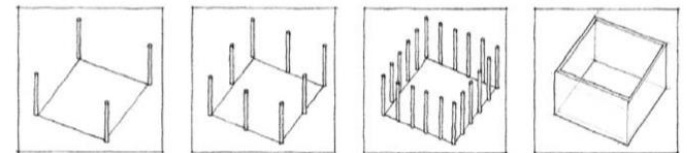
No volume of space can be established without the definition of its edges and corners. Linear elements serve this purpose in marking the limits of spaces that require visual and spatial continuity with their surroundings.



Two columns establish a transparent spatial membrane by the visual tension between their shafts. Three or more columns can be arranged to define the corners of a volume of space. This space does not require a larger spatial context for its definition, but relates freely to it.

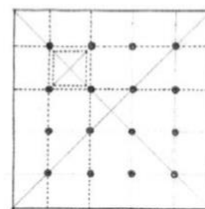
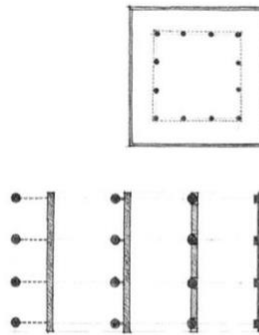
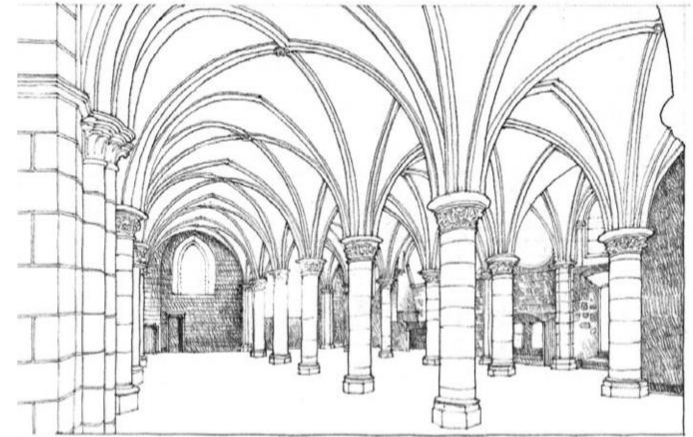
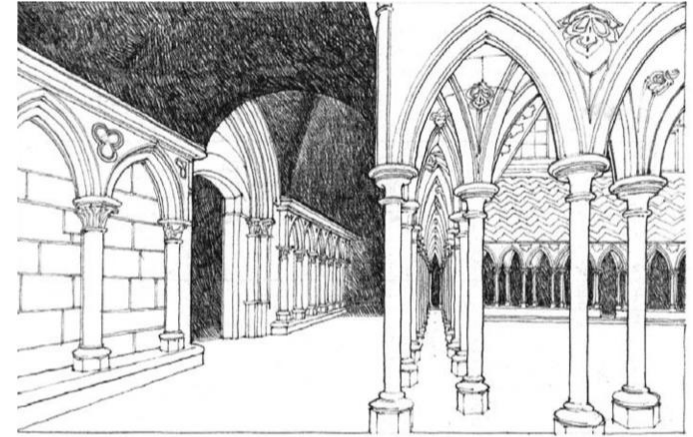


The edges of the volume of space can be visually reinforced by articulating its base plane and establishing its upper limits with beams spanning between the columns or with an overhead plane. A repetitive series of column elements along its perimeter would further strengthen the definition of the volume.



Vertical Linear Elements

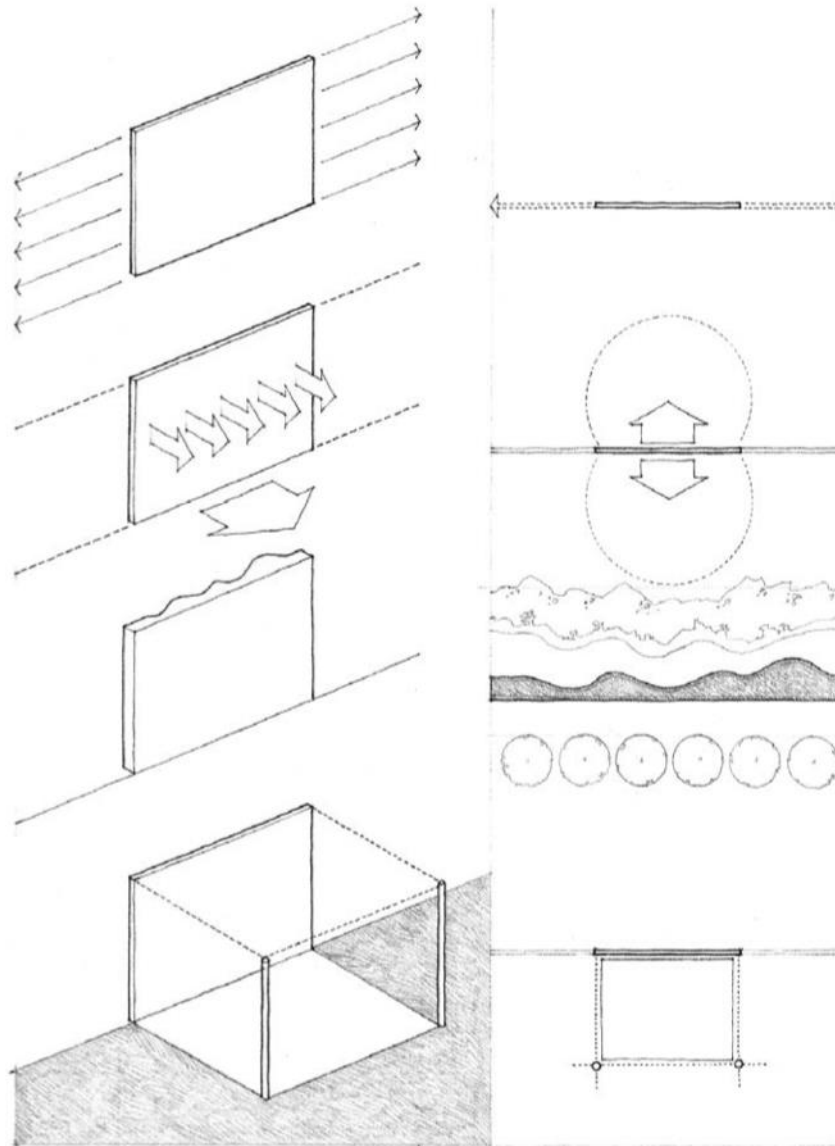
*Cloister and Salle des Chevaliers,
Mont S. Michel, France, 1203–28*



A regularly-spaced series of columns or similar vertical elements form a colonnade. This archetypal element in the vocabulary of architectural design effectively defines an edge of a spatial volume while permitting visual and spatial continuity to exist between the space and its surroundings. A row of columns can also engage a wall and become a pilastrade that supports the wall, articulates its surface, and tempers the scale, rhythm, and proportioning of its bays.

A grid of columns within a large room or hall not only serves to support the floor or roof plane above. The orderly rows of columns also punctuate the spatial volume, mark off modular zones within the spatial field, and establish a measurable rhythm and scale that make the spatial dimensions comprehensible.

Single Vertical Plane



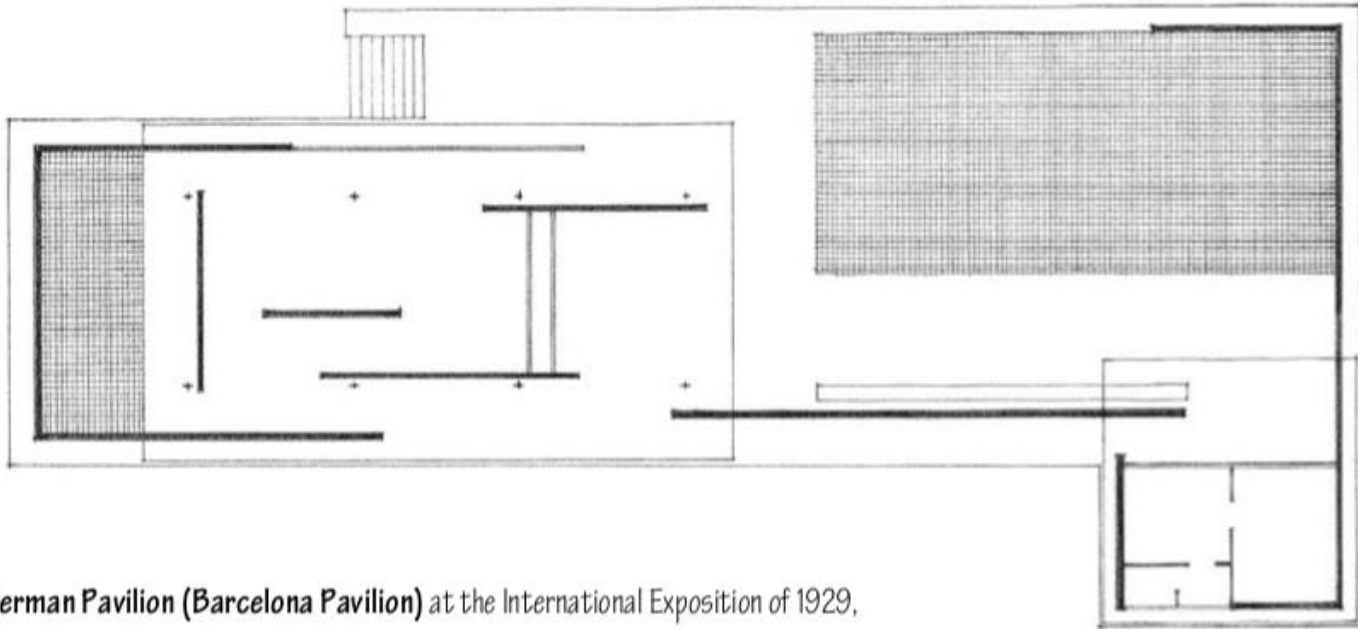
A single vertical plane, standing alone in space, has visual qualities uniquely different from those of a freestanding column. A round column has no preferred direction except for its vertical axis. A square column has two equivalent sets of faces and therefore two identical axes. A rectangular column also has two axes, but they differ in their effect. As the rectangular column becomes more like a wall, it can appear to be merely a fragment of an infinitely larger or longer plane, slicing through and dividing a volume of space.

A vertical plane has frontal qualities. Its two surfaces or faces front on and establish the edges of two separate and distinct spatial fields.

These two faces of a plane can be equivalent and front similar spaces. Or they can be differentiated in form, color, or texture, in order to respond to or articulate different spatial conditions. A vertical plane can therefore have either two fronts or a front and a back.

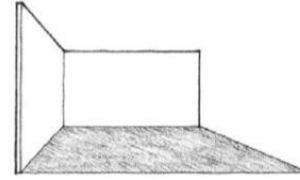
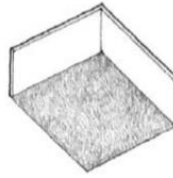
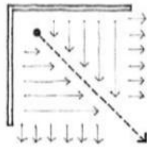
The field of space on which a single vertical plane fronts is not well-defined. The plane by itself can establish only a single edge of the field. To define a three-dimensional volume of space, the plane must interact with other elements of form.

Single Vertical Plane

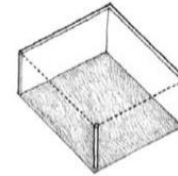
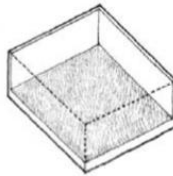
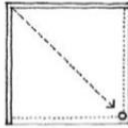


German Pavilion (Barcelona Pavilion) at the International Exposition of 1929,
Barcelona, Ludwig Mies van der Rohe

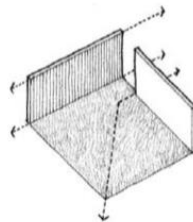
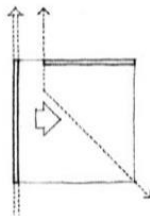
L-Shaped Vertical Planes



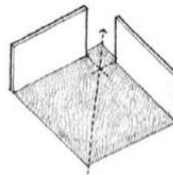
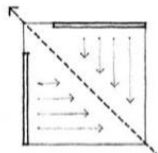
An L-shaped configuration of vertical planes defines a field of space along a diagonal from its corner outward. While this field is strongly defined and enclosed at the corner of the configuration, it dissipates rapidly as it moves away from the corner. The introverted field at the interior corner becomes extroverted along its outer edges.



While two edges of the field are clearly defined by the two planes of the configuration, its other edges remain ambiguous unless further articulated by additional vertical elements, manipulations of the base plane, or an overhead plane.



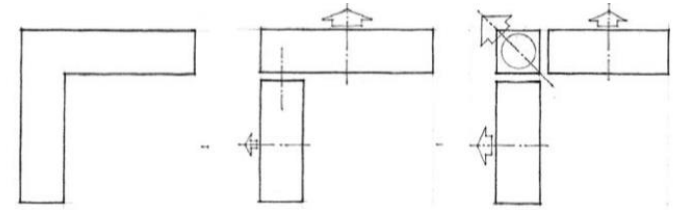
If a void is introduced to one side of the corner of the configuration, the definition of the field will be weakened. The two planes will be isolated from each other and one will appear to slide by and visually dominate the other.



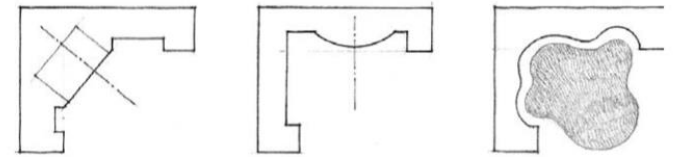
If neither plane extends to the corner, the field will become more dynamic and organize itself along the diagonal of the configuration.

L-Shaped Vertical Planes

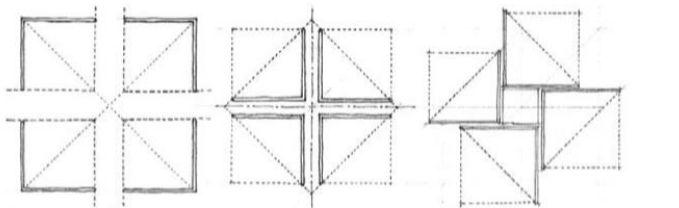
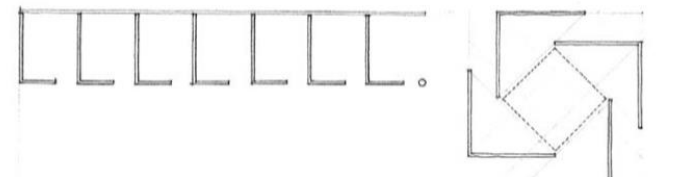
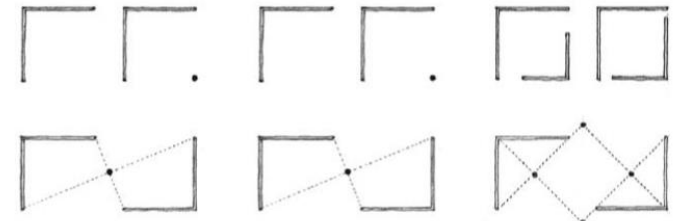
A building form can have an L-shaped configuration and be subject to the following readings. One of the arms of the configuration can be a linear form that incorporates the corner within its boundaries while the other arm is seen as an appendage to it. Or the corner can be articulated as an independent element that joins two linear forms together.



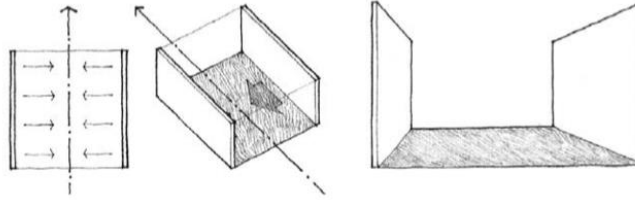
A building can have an L-shaped configuration to establish a corner of its site, enclose a field of outdoor space to which its interior spaces relate, or shelter a portion of outdoor space from undesirable conditions around it.



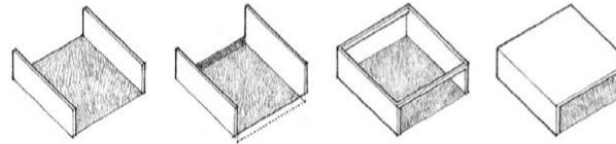
L-shaped configurations of planes are stable and self-supporting and can stand alone in space. Because they are open-ended, they are flexible space-defining elements. They can be used in combination with one another or with other elements of form to define a rich variety of spaces.



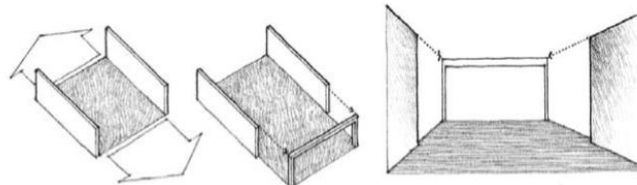
Parallel Vertical Planes



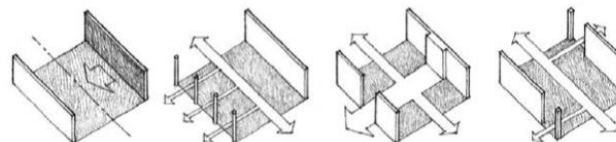
A pair of parallel vertical planes defines a field of space between them. The open ends of the field, established by the vertical edges of the planes, give the space a strong directional quality. Its primary orientation is along the axis about which the planes are symmetrical. Since the parallel planes do not meet to form corners and fully enclose the field, the space is extroverted in nature.



The definition of the spatial field along the open ends of the configuration can be visually reinforced by manipulating the base plane or adding overhead elements to the composition.



The spatial field can be expanded by extending the base plane beyond the open ends of the configuration. This expanded field can, in turn, be terminated by a vertical plane whose width and height is equal to that of the field.



If one of the parallel planes is differentiated from the other by a change in form, color, or texture, a secondary axis, perpendicular to the flow of the space, will be established within the field. Openings in one or both of the planes can also introduce secondary axes to the field and modulate the directional quality of the space.

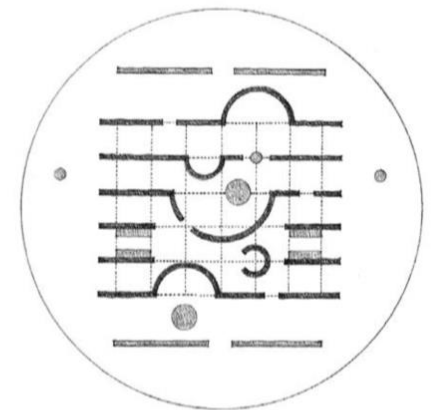
Parallel Vertical Planes



Sarabhai House, Ahmedabad, India, 1955, Le Corbusier

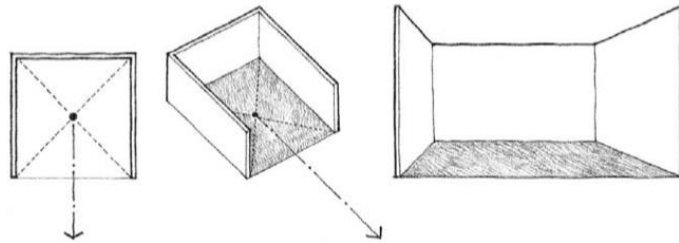
The parallel vertical planes of a bearing-wall structural system can be the generating force behind the form and organization of a building. Their repetitive pattern can be modified by varying their length or by introducing voids within the planes to accommodate the dimensional requirements of larger spaces. These voids can also define circulation paths and establish visual relationships perpendicular to the wall planes.

The slots of space defined by parallel wall planes can also be modulated by altering the spacing and configuration of the planes.

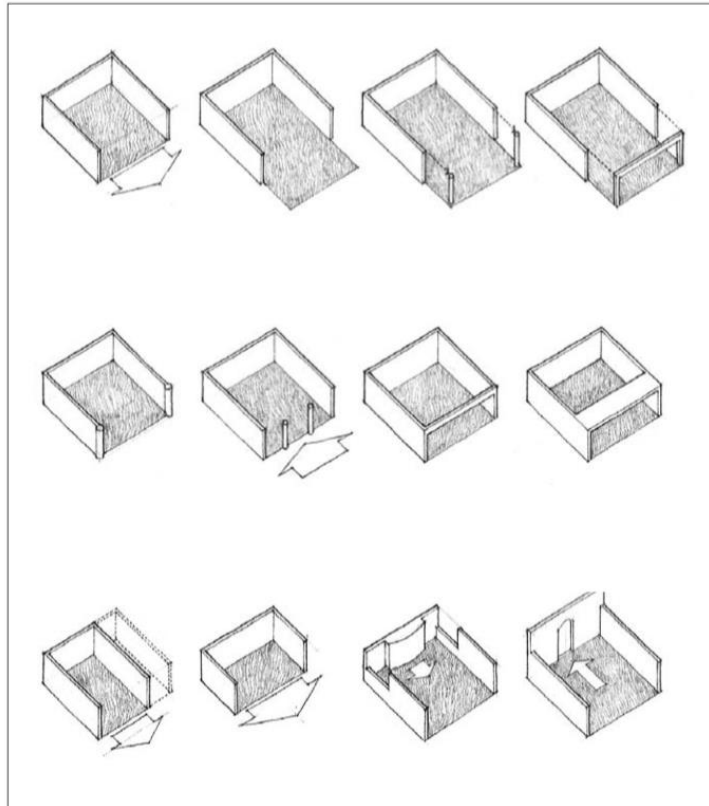


Arnhem Pavilion, The Netherlands, 1966, Aldo van Eyck

U-Shaped Vertical Planes



A U-shaped configuration of vertical planes defines a field of space that has an inward focus as well as an outward orientation. At the closed end of the configuration, the field is well defined. Toward the open end of the configuration, the field becomes extroverted in nature.



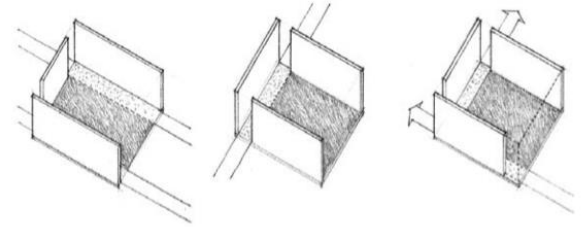
The open end is the primary aspect of the configuration by virtue of its uniqueness relative to the other three planes. It allows the field to have visual and spatial continuity with the adjoining space. The extension of the spatial field into the adjoining space can be visually reinforced by continuing the base plane beyond the open end of the configuration.

If the plane of the opening is further defined with columns or overhead elements, the definition of the original field will be reinforced and continuity with the adjoining space will be interrupted.

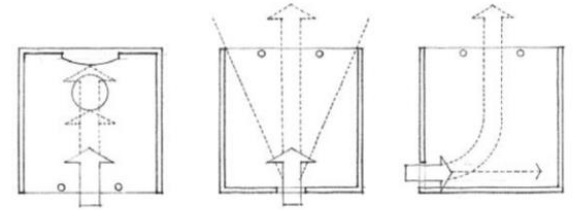
If the configuration of planes is rectangular and oblong in form, the open end can be along its narrow or wide side. In either case, the open end will remain the primary face of the spatial field, and the plane opposite the open end will be the principal element among the three planes of the configuration.

U-Shaped Vertical Planes

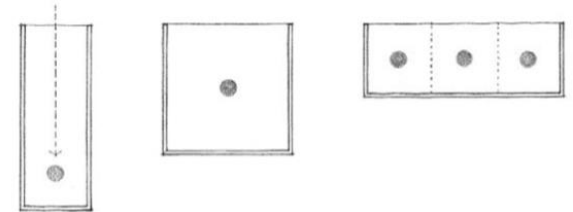
If openings are introduced at the corners of the configuration, secondary zones will be created within a multidirectional and dynamic field.



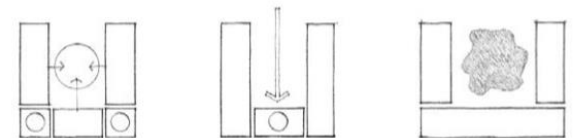
If the field is entered through the open end of the configuration, the rear plane, or a form placed in front of it, will terminate our view of the space. If the field is entered through an opening in one of the planes, the view of what lies beyond the open end will draw our attention and terminate the sequence.



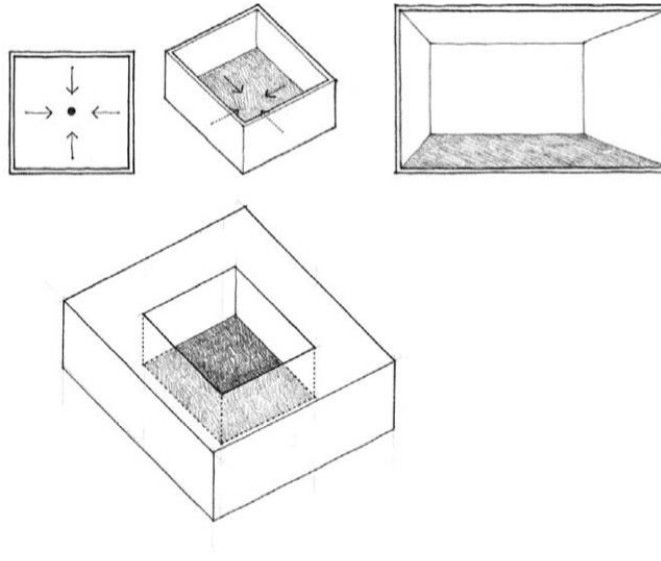
If the end of a long, narrow field is open, the space will encourage movement and induce a progression or sequence of events. If the field is square, or nearly square, the space will be static and have the character of a place to be in, rather than a space to move through. If the side of a long, narrow field is open, the space will be susceptible to a subdivision into a number of zones.



U-shaped configurations of building forms and organizations have the inherent ability to capture and define outdoor space. Their composition can be seen to consist essentially of linear forms. The corners of the configuration can be articulated as independent elements or can be incorporated into the body of the linear forms.



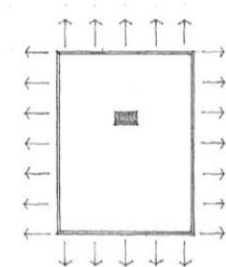
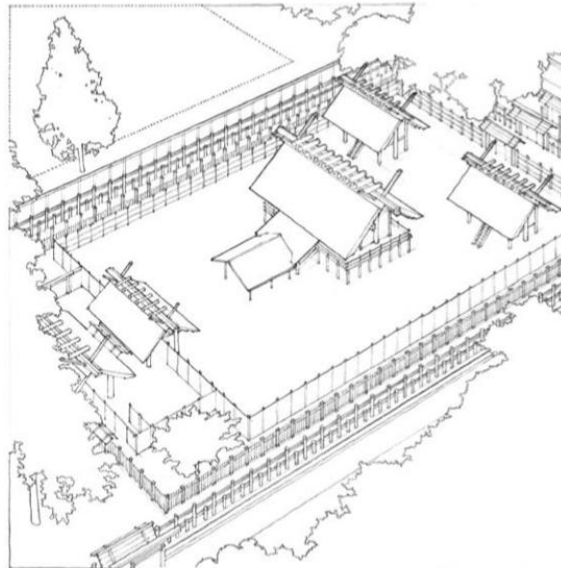
4 Vertical Planes: Closure



Four vertical planes encompassing a field of space is probably the most typical, and certainly the strongest, type of spatial definition in architecture. Since the field is completely enclosed, its space is naturally introverted. To achieve visual dominance within a space or become its primary face, one of the enclosing planes can be differentiated from the others by its size, form, surface articulation, or by the nature of the openings within it.

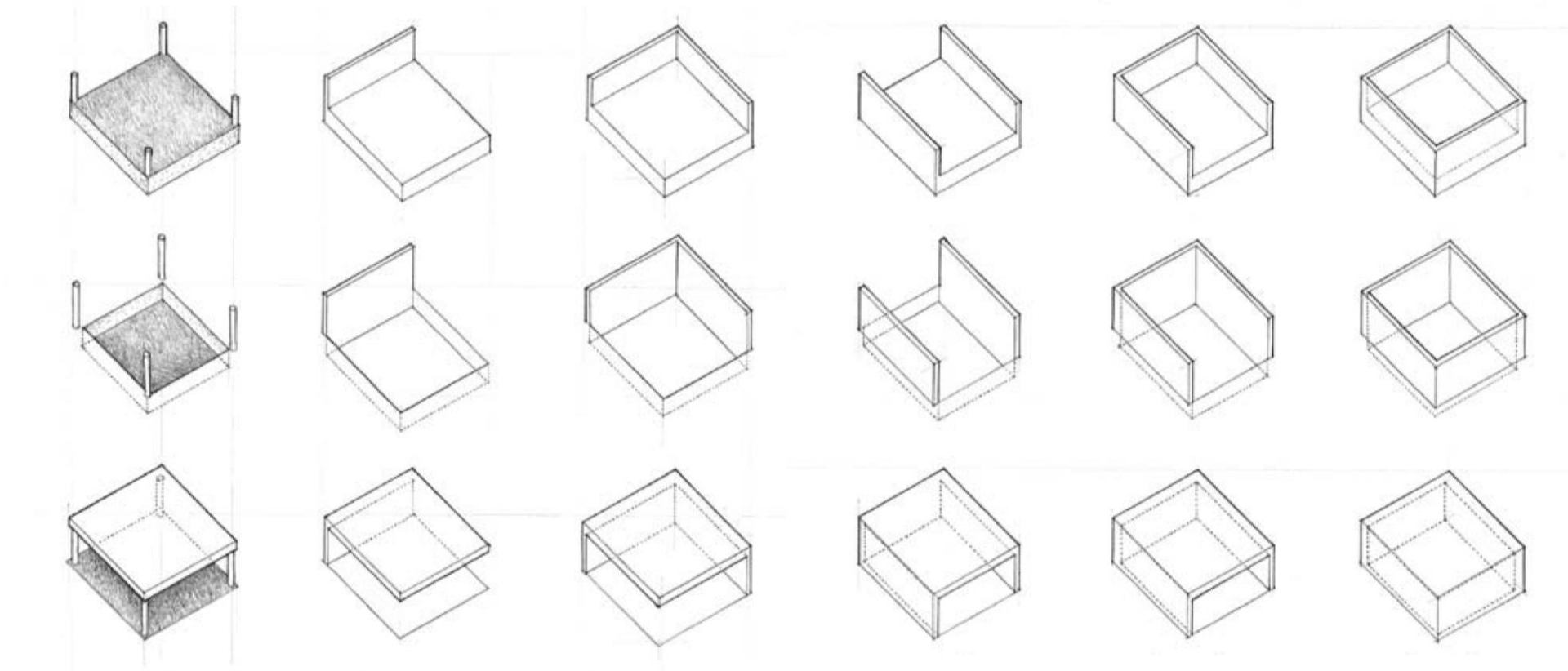
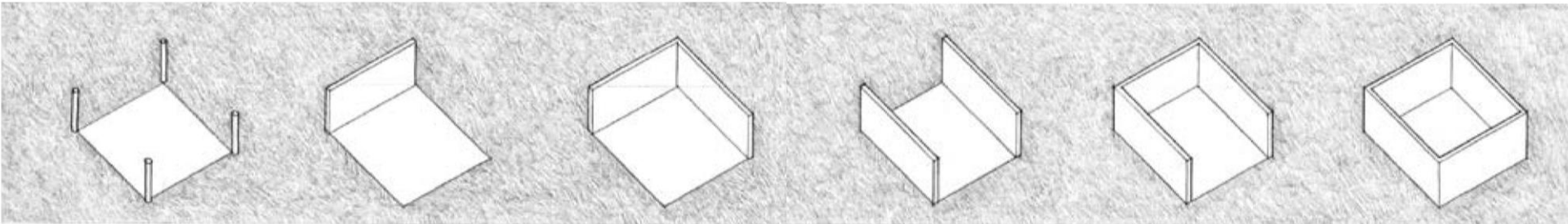
Well-defined, enclosed fields of space can be found in architecture at various scales, from a large urban square, to a courtyard or atrium space, to a single hall or room within a building complex. The examples on this and the following pages illustrate enclosed spatial fields in both urban and building-scale situations.

Historically, four planes have often been used to define a visual and spatial field for a sacred or significant building that stands as an object within the enclosure. The enclosing planes may be ramparts, walls, or fences that isolate the field and exclude surrounding elements from the precinct.



The Sacred Enclosure, Ise Shrine, Mie Prefecture, Japan, reconstructed every 20 years since A.D. 690.

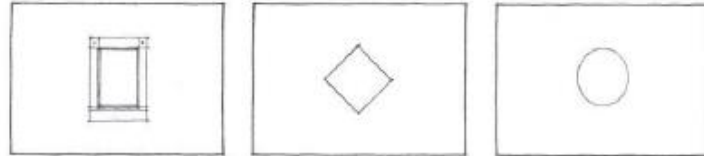
Summary Typology: Space Defining Elements



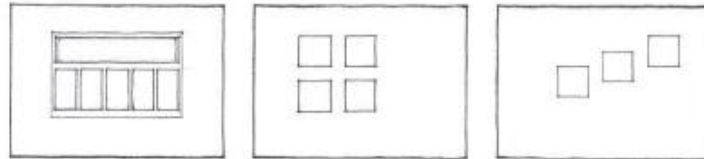
Degree of Enclosure- Openings in Planes



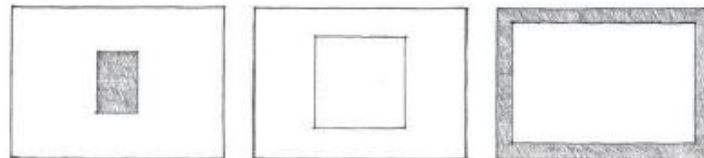
An opening located wholly within a wall or ceiling plane often appears as a bright figure on a contrasting field or background. If centered within the plane, the opening will appear stable and visually organize the surface around it. Moving the opening off-center will create a degree of visual tension between the opening and the edges of the plane toward which it is moved.



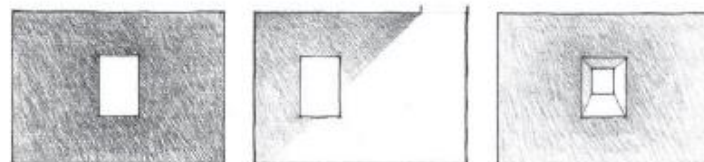
The shape of the opening, if similar to the shape of the plane in which it is located, will create a redundant compositional pattern. The shape or orientation of the opening may contrast with the enclosing plane to emphasize its individuality as a figure. The singularity of the opening may be visually reinforced with a heavy frame or articulated trimwork.



Multiple openings may be clustered to form a unified composition within a plane, or be staggered or dispersed to create visual movement along the surface of the plane.

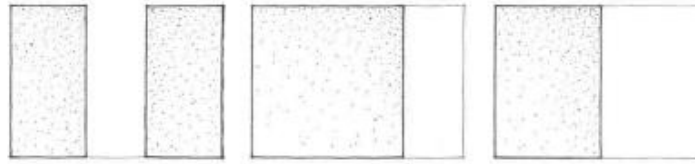


As an opening within a plane increases in size, it will at some point cease to be a figure within an enclosing field and become instead a positive element in itself, a transparent plane bounded by a heavy frame.

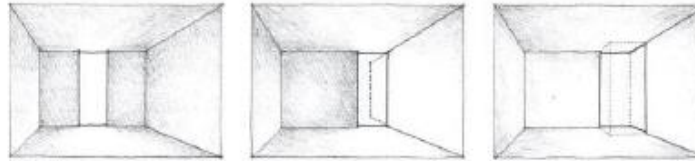


Openings within planes naturally appear brighter than their adjacent surfaces. If the contrast in brightness along the edges of the openings becomes excessive, the surfaces can be illuminated by a second light source from within the space, or a deep-set opening can be formed to create illuminated surfaces between the opening and the surrounding plane.

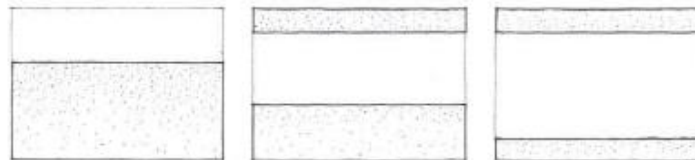
Degree of Enclosure- Openings Between Planes



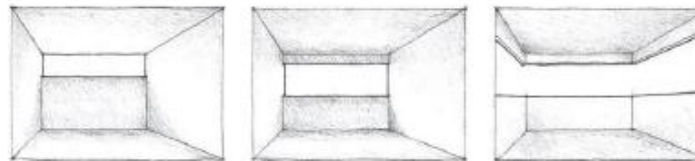
A vertical opening that extends from the floor to the ceiling plane of a space visually separates and articulates the edges of the adjacent wall planes.



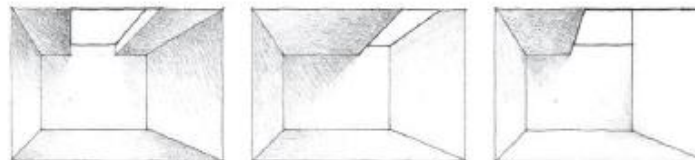
If located at a corner, the vertical opening will erode the definition of the space and allow it to extend beyond the corner to the adjacent space. It will also allow incoming light to wash the surface of the wall plane perpendicular to it and articulate the primacy of that plane in the space. If allowed to turn the corner, the vertical opening will further erode the definition of the space, allow it to interlock with adjacent spaces, and emphasize the individuality of the enclosing planes.



A horizontal opening that extends across a wall plane will separate it into a number of horizontal layers. If the opening is not very deep, it will not erode the integrity of the wall plane. If, however, its depth increases to the point where it is greater than the bands above and below it, then the opening will become a positive element bounded at its top and bottom by heavy frames.



Turning a corner with a horizontal opening reinforces the horizontal layering of a space and broadens the panoramic view from within the space. If the opening continues around the space, it will visually lift the ceiling plane from the wall planes, isolate it, and give it a feeling of lightness.



Locating a linear skylight along the edge where a wall and ceiling plane meet allows incoming light to wash the surface of the wall, illuminate it, and enhance the brightness of the space. The form of the skylight can be manipulated to capture direct sunlight, indirect daylight, or a combination of both.

“...if there is not order,
there is no way of telling what the work is trying to say.”

Rudolf Arnheim
The Dynamics of Architectural Form
1977 (Ching, p. 319)

Architecture: Form, Space and Order Chapter 7- Ordering Principles

- Axis
- Symmetry
- Hierarchy
- Rhythm
- Datum
- Harmony

Renovation of [Jørn Utzon](https://www.dezeen.com/2019/02/05/ahm-house-jorn-utzon-modernist-midcentury-renovation/) house By Coppin Dockray, <https://www.dezeen.com/2019/02/05/ahm-house-jorn-utzon-modernist-midcentury-renovation/>

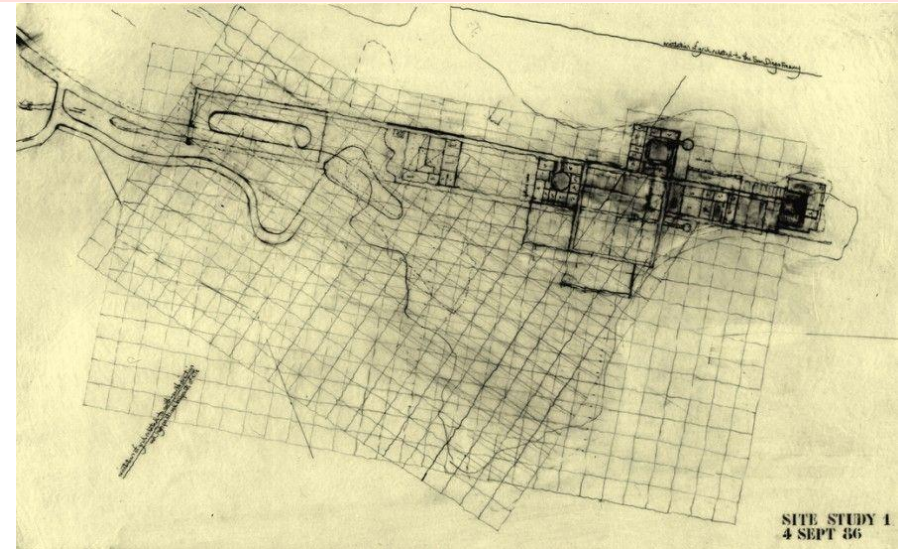


Axis

An imaginary line established by two points in space about which forms and spaces can be arranged. Powerful regulating force with qualities of length and direction inducing movement.

Terminating elements:

- points in space established by vertical forms, centralized building forms
- vertical planes, symmetrical building facades preceded by a forecourt
- well defined spaces, regular in form
- gateways opening to a view



Getty Center, Los Angeles, Richard Meier

Symmetry

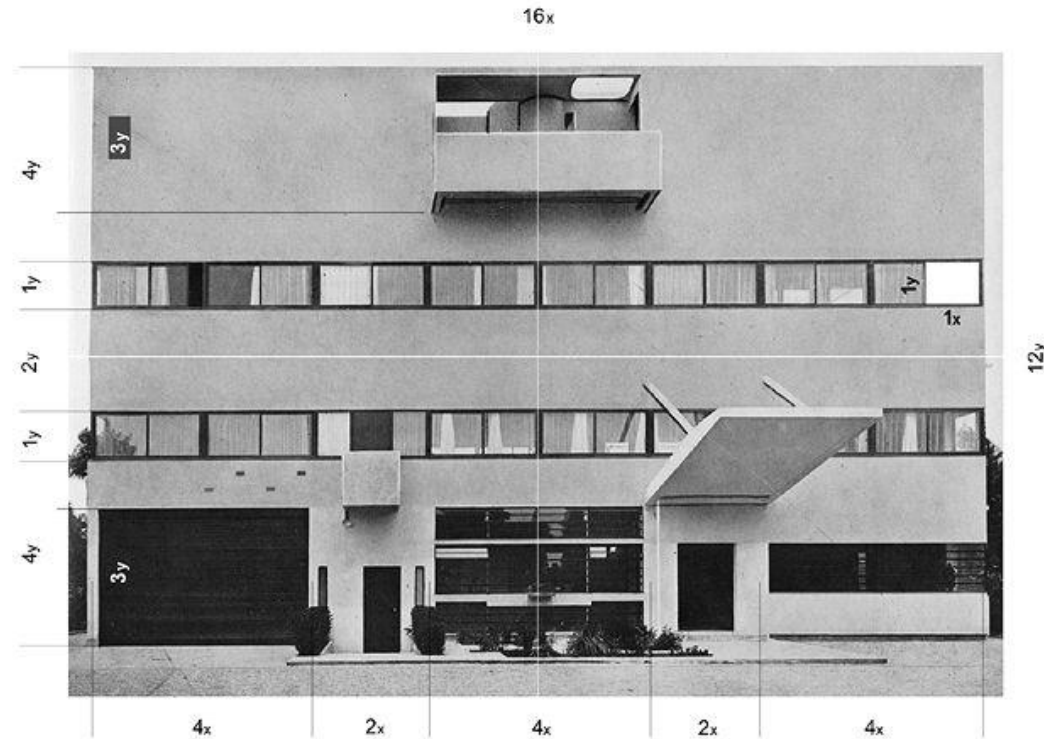
Symmetry implies an axis with balanced patterns of form and space on either side.

Bi-lateral symmetry- across an axis

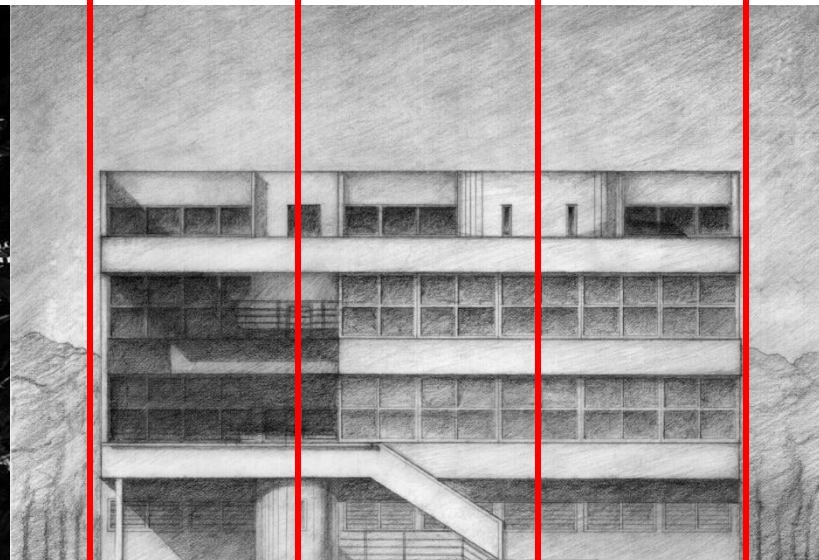
Radial Symmetry- across a centerpoint

Overall symmetry- must eventually reconcile conditions of the site

Localized symmetry- can organize irregularity around itself, reserved for significant or important spaces

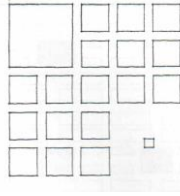


Villa Garches,
Vaucluse,
France, 1926-27,
Le Corbusier



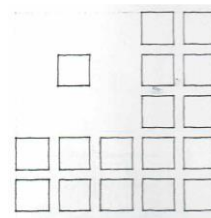
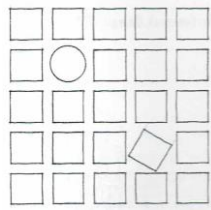
Hierarchy

The degree of importance between elements of a composition



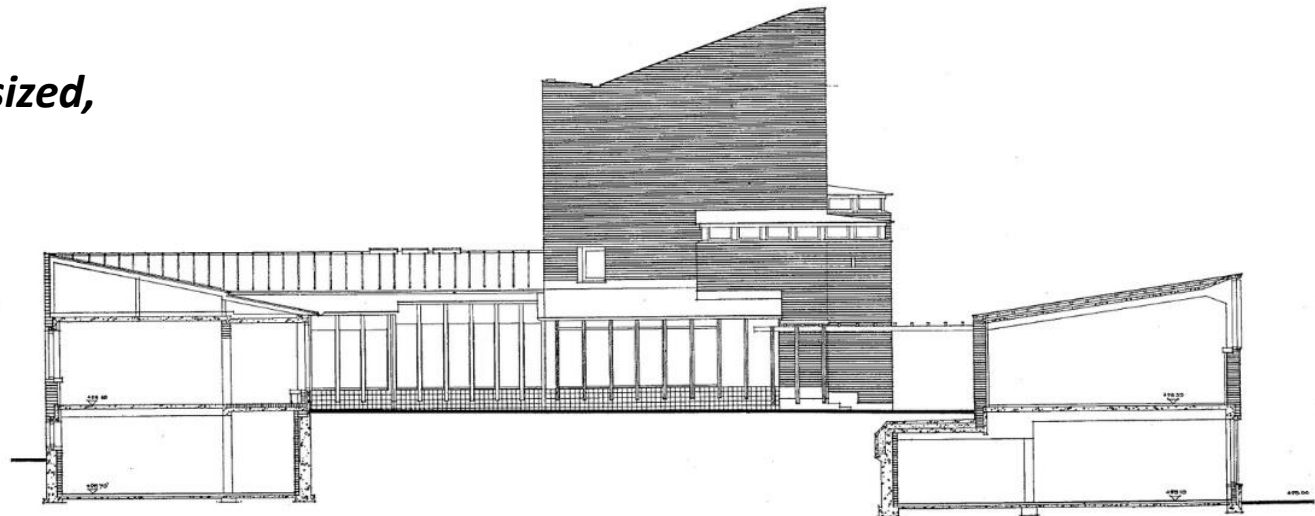
Elements become more important when they have have:

- exceptional size
- unique shape
- strategic location



Secondary elements can also accommodate variety, rhythm and tension but remember:

When everything is emphasized, nothing is emphasized.

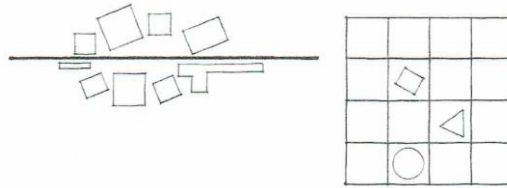


Town hall, Seinajoki, 1961-65, Alvar Aalto

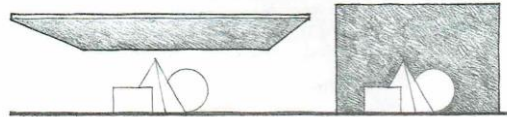
Datum

A line, plane or volume of reference to which other elements in a composition relate

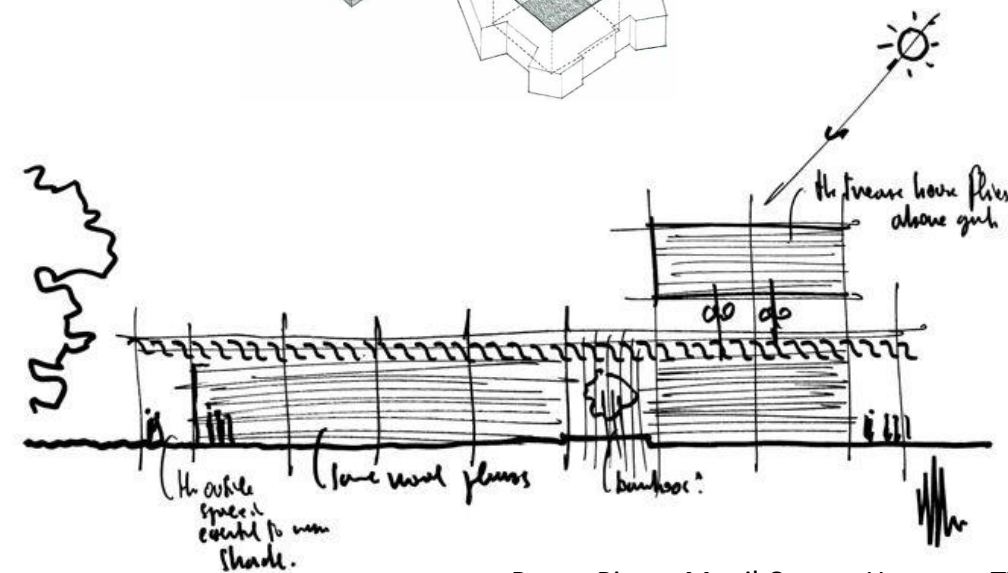
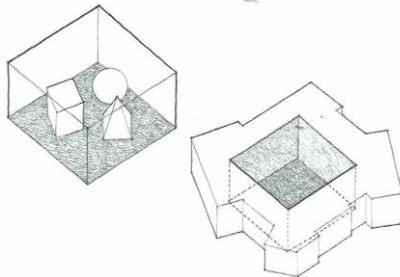
Line



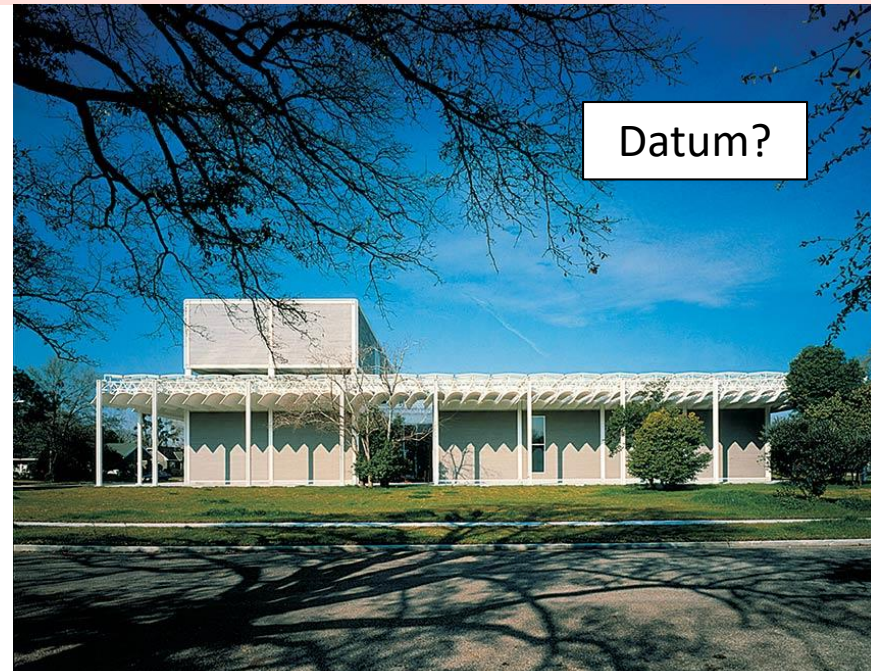
Plane



Volume



Renzo Piano, Menil Center, Houston, TX.

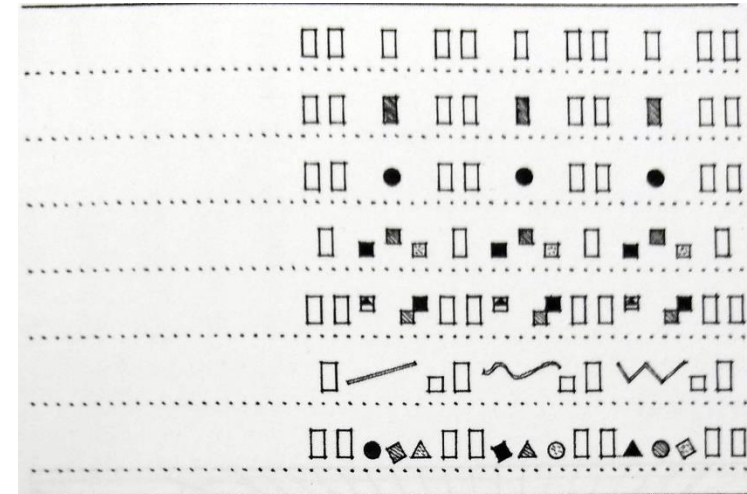


Rhythm

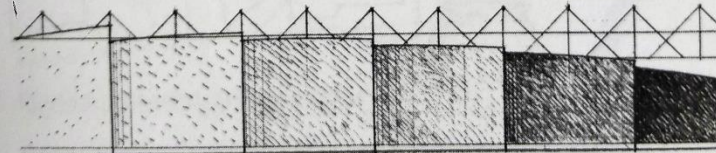
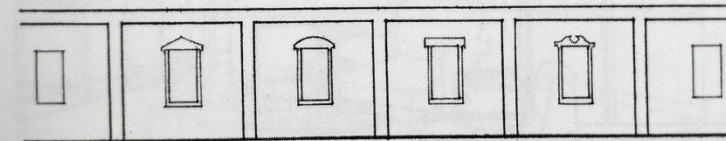
Fundamental notion of repetition of elements in a composition causing movement of our eyes or bodies across space.

Variation:
Size, Shape, Detail Characteristics

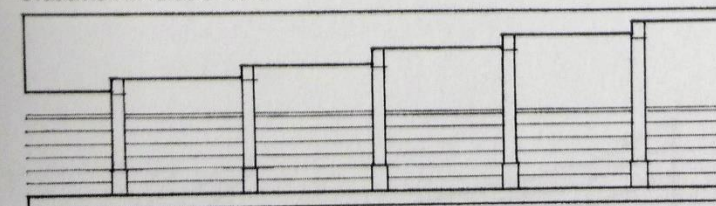
Organization:
Radial, Linear, Grouped



Detail variations in rhythm



Gradation in value or color



Gradation in size

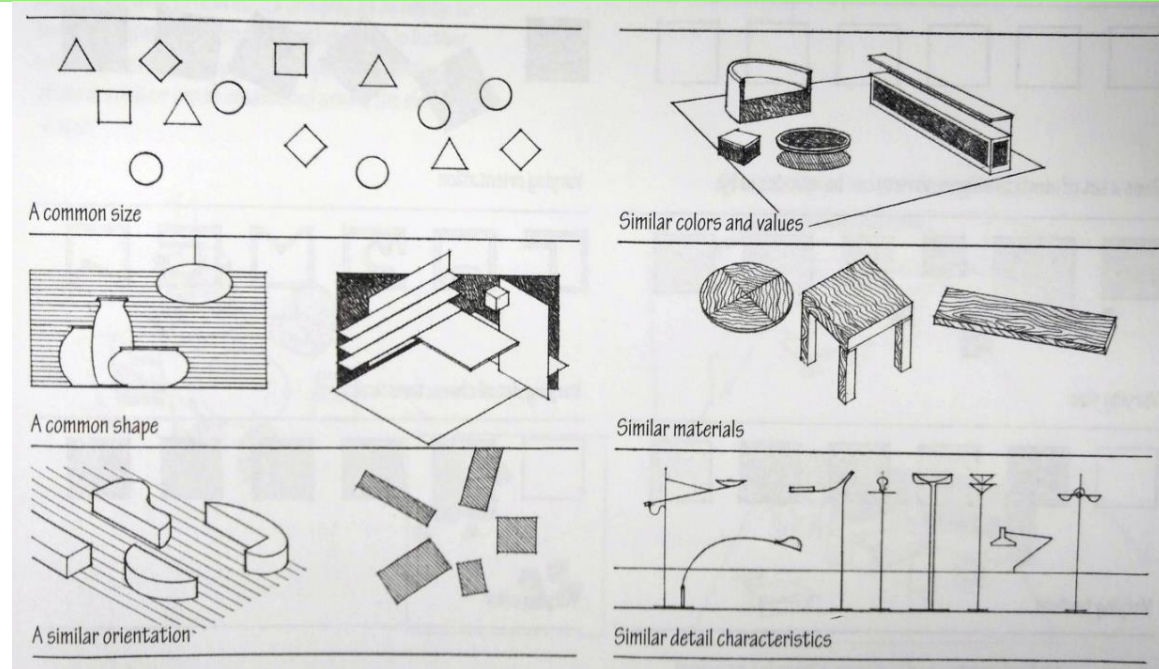
UIC SES Math and Science Learning Center



If this picture was a song, what would be the beat?

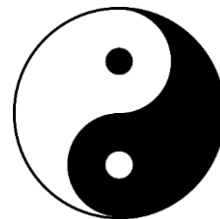
Order + Variety = Harmony

- *Order* can also be thought of as *Unity* through adherence to principles and organizational strategies.
- *Variety* can also be thought of as *Diversity* through careful introduction of contrasting, different, or unlike elements.
- *Harmony* is the balance between order and variety.



Order without Variety = Monotony

Variety without Order = Chaos

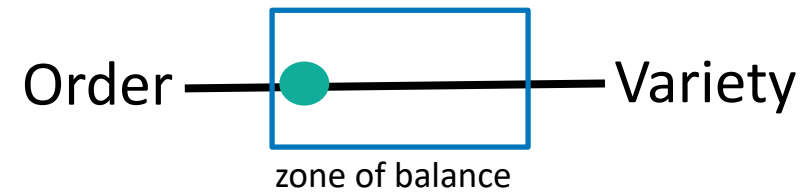


BALANCE AND HARMONY

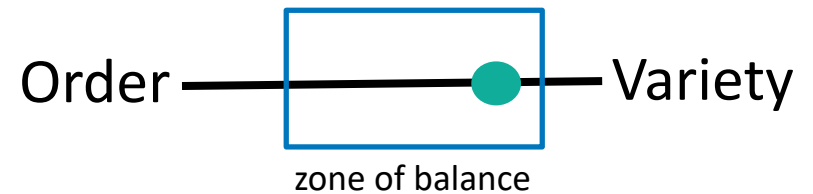
A mix of elements that incorporate order and variety together



Farrell and McNamara



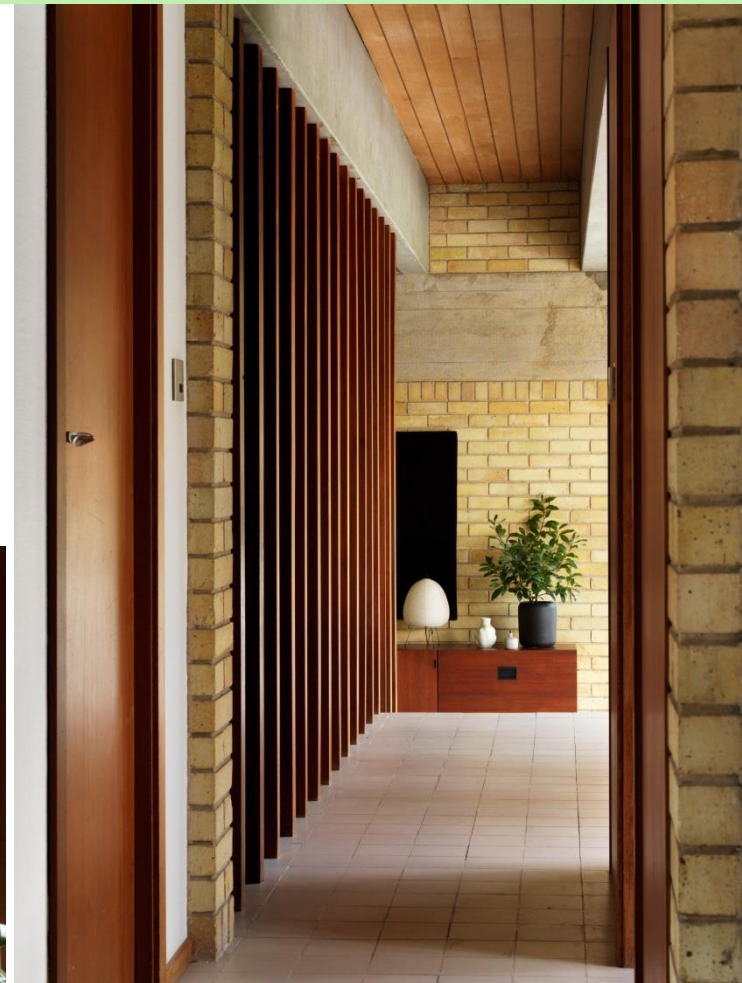
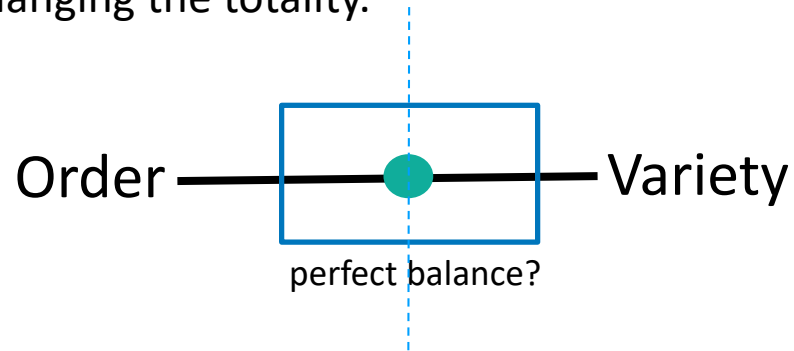
Zaha Hadid



IDEAL HARMONY

Ideal Harmony is a situation where nothing can be added, removed, or altered without changing the totality.

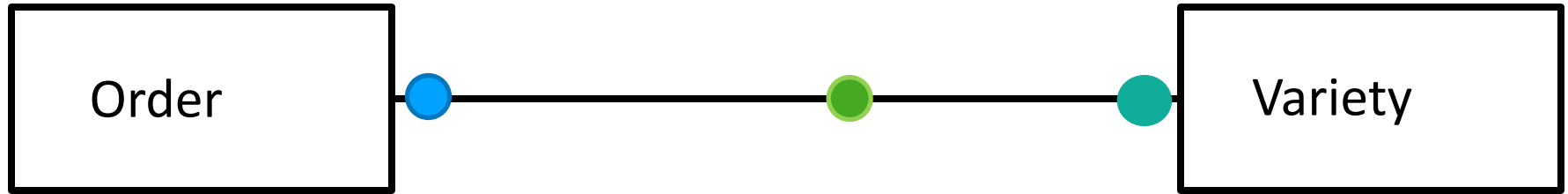
Is this possible?



*Design+ Philosophy =
YOUR design philosophy*

Renovation of [Jørn Utzon](https://www.dezeen.com/2019/02/05/ahm-house-jorn-utzon-modernist-midcentury-renovation/) house By Coppin Dockray,
<https://www.dezeen.com/2019/02/05/ahm-house-jorn-utzon-modernist-midcentury-renovation/>

One framework for understanding architectural aesthetics



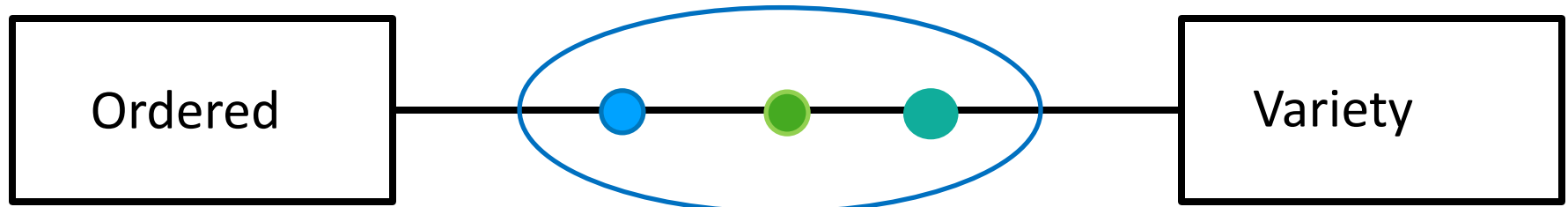
Tools:

- Symmetry
- Platonic Shapes
- Regular Proportions
- Simple Rhythm
- Few Materials
- Even Lighting
- Muted Colors
- Linear sequence
- Single Emphasis
- Unified forms

Tools:

- Asymmetry
- Irregular Shapes
- Extreme Proportions
- Complex Rhythm
- Varied Materials
- Contrasted Lighting
- Bright Colors
- Winding sequence
- Multiple Emphasis
- Contrasting forms

One framework for understanding architectural aesthetics



Extreme Effect:

- Boring
- Drab
- Unmemorable
- Inauthentic
- Generic
- Uneducated

*tends to feel more calm,
subdued, and restful*



The ZONE of
BALANCE
or
HARMONY

And maybe beauty?

Extreme Effect:

- Confusing
- Uncomfortable
- Chaotic
- Silly
- Illegible
- Uneducated

*tends to feel more active,
tense, and anxious*