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DEPARTMENT OF ARCHITECTURE



Course Handout

PROJECT THEORY 2

**SPECIALITY:
ARCHITECTURE**

**1ST YEAR
SEMESTER 2**

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Scope and Objectives

This pedagogical handout is intended for students beginning their first year of architectural training. The objective is to develop students' abilities in spatial perception and design. Through regular and progressive learning, students will acquire foundational theoretical knowledge, practical skills, and an appreciation for form and space.

General Objective

This course aims to introduce architecture students to the architectural object by exploring its main dimensions. It progresses from the exterior aspects of the building to the attributes related to structure, while also covering the formation of interior space and the functionality of the architectural space.

Specific Objectives

Understand the principles of the Vitruvian triptych (utility, solidity, beauty) and their application to architectural projects.

Analyze architectural spaces by identifying and interpreting their fundamental components: form, structure, and function.

Evaluate the interdependence and interaction between the elements of form, structure, and function in the architectural design process.

A basic understanding of architectural language and concepts is recommended. These foundational skills will support learning and help students grasp more complex architectural concepts and practices.

This handout aims to guide students through their 1st year architectural training, while providing them with the elementary foundations to approach the architectural design process.

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Foreword

Marcus Vitruvius Pollio: known as Vitruvius, was a Roman architect who lived in the 1st century BC (his birth is thought to have been around 80 BC and his death around 15 BC). It is from his treatise, *De Architectura*, that most of our knowledge of building techniques in classical antiquity comes.

The Vitruvian triad:

- *Firmitas* (solidity, or robustness)
- *Utilitas* (convenience or usefulness)
- *Venustas* (beauty, Voluptuousness).

Chapter 1: Façades in Architecture: Design and engineering

Introduction

The facade of a building plays an important role in defining its overall appearance and impact. The facade is not just a simple building element; it is crucial to the building's visual identity and its relationship with the surrounding environment.

1. Definition

A facade refers to the front or exterior face of a building, serving as its envelope and designed to be aesthetically pleasing. It is a key element when observing a building from the outside and has a significant impact on the interior. Beyond its actual space within the structure, a facade influences the surrounding space. (Martin, P. 2012)

The design process for a facade involves communication and decision-making, focusing on shaping the building and its exterior features. (Manzel et al, 2012)

Therefore: The façade is the architectural interface where beauty—*venustas*—is negotiated between the building and its environment. It is not merely a surface, but a spatial and symbolic threshold that embodies proportion, identity, and urban resonance. (Vitruve, 1980)

2. From wall to façade

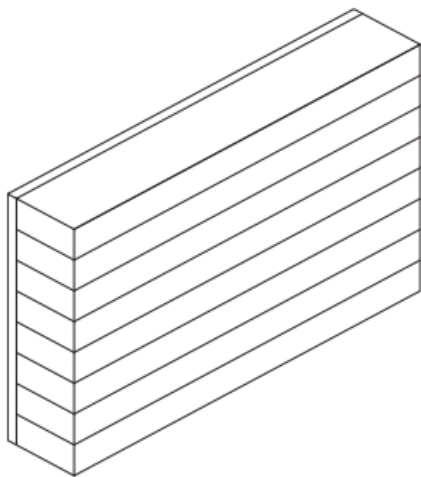
The design and function of modern walls and facades have evolved over a long history closely tied to human development. Walls and facades in architecture stem from two basic forms of human life: settled and nomadic. This evolution has been influenced by different climates and lifestyles, leading to two main principles for building exteriors:

- Solid, permanent walls for stationary buildings
- More flexible or temporary facades for less permanent structure

2.1 Solid wall construction

In colder climates and settled communities, there was a preference for constructing solid walls using materials such as stones or bricks. The aim was to create durable structures that could withstand harsh weather conditions while keeping the construction process straight forward.

The goal was durability against weather conditions while maintaining a simple construction process.



Solid Wall : Constructed from monolithic or composite elements, with or without a separate layer to provide climatic protection (here in the form of exterior rendering).

Figure 1: Solid wall principal

(Knaack et al., 2007)

2.2 Warm façades vs Cold façades

Warm facades are engineered to enhance thermal performance and reduce heat loss, while cold facades aim to minimize heat gain and maximize airflow, ensuring comfort in different environmental conditions.

- **Warm Facades:**

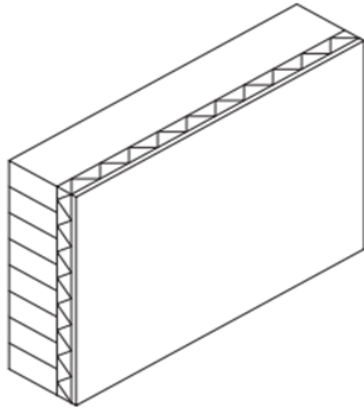
Typically designed to provide insulation and retain heat within the building.

- Often used in colder climates to improve energy efficiency and comfort.
- Constructed with multiple layers, including insulation materials and a protective outer layer.
- Examples include double walls with thermal insulation.

- **Cold Facades:**

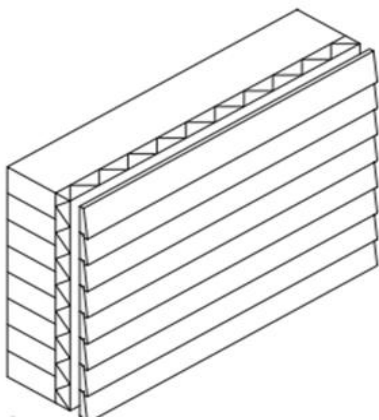
- Primarily used in warmer climates where heat retention is less of a concern.
- Focuses on ventilation and shading to keep the interior cool.

- May include features like louvered panels, sunshades...etc.



Warm façade:

The insulation layer is mounted directly on the outside or inside of the façade construction.



Cold Façade:

The insulation layer is separated from the climatic protection layer by a gap of air

Figure 2: Warm and cold façades

(Knaack et al., 2007)

2.3 Openings in solid wall construction

Openings were originally made in the walls to allow smoke to escape.

At a later stage in the development, the openings were enlarged to let light in.

The method used initially to solve the problem of the weakening of the fabric of the solid wall by the creation of openings in it was to use horizontal beams as lintels. Since the use of lintels to span large openings in walls very soon reached its structural limits, the next stage in the development was the use of arches for this purpose.

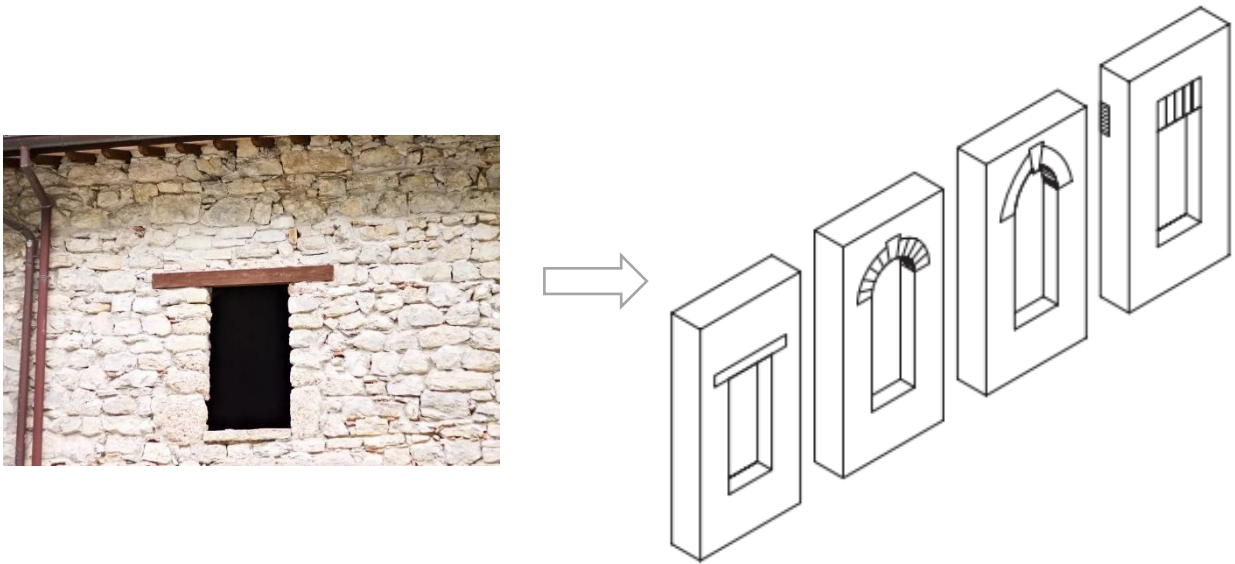


Figure 3 : Openings in solid wall construction
(Knaack et al., 2007)

2.4 Single glazing

Glazing in architecture started with translucent materials like thin marble sheets and later moved to glass.

At first, small glass panes were used, limiting window size.

The glass-in-lead technique made bigger windows possible, and when combined with stained glass, created stunning effects in sacred buildings.

Note: In modern times, large single glazing is commonly used, often mounted in steel frames for enhanced structural support

2.5 Box window

The box window, as a further advancement in architecture, incorporates a second pane of glass for added climatic flexibility.

Bilbao : Loggias in façade, These loggias built in front of the actual windows may be regarded as a variant of the box window: in spring and autumn, these spaces can be used as an additional room while in winter they are closed off to act as an extra climatic buffer."



Figure 4: Example of Box window

(Knaack et al., 2007)

2.5 Insulated glazing

The next advancement in box window technology is insulated glazing, also known as double glazing. It involves two glass panes bonded together with an insulating layer of air or inert gas in between, creating a more efficient shield between indoor and outdoor environment.

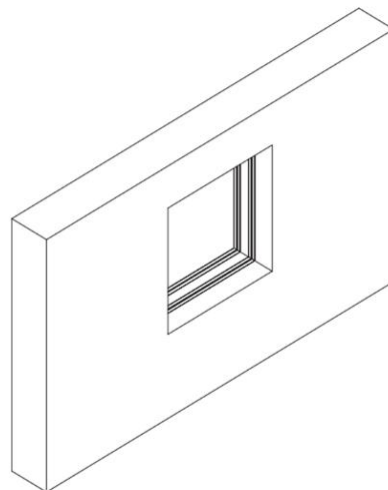


Figure 5: Double glazing façade

(Knaack et al., 2007)

3. Facades Evolution

3.1 Support/Enclosure separation in Buildings

In nomadic societies, there was no place for massive structural elements. Therefore, it was necessary to separate the functions of support and enclosure.

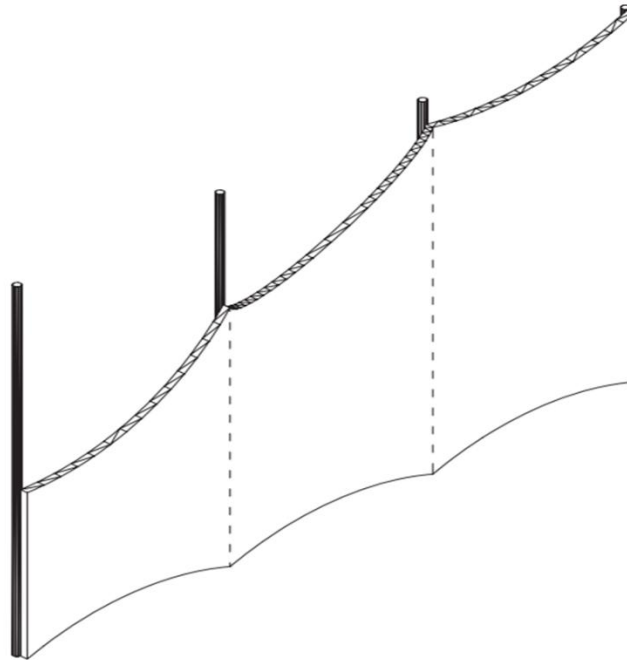


Figure 6: Tent: Separating the functions of support and enclosure.

(Knaack et al., 2007)

Two architectural advancements:

- The shift from solid walls to larger windows
- The adoption of a tent-like structure that separates support and enclosure.

This transforms solid walls into lightweight modern facades by using a supporting frame and appropriate cladding.



Figure 7: Half-timber houses, Detmold, 16th century

The wooden frame provides structure, while lightweight materials fill the spaces for shelter.

(Knaack et al., 2007)

The American variant of this principle is the timber-frame construction. This consists of bearing timber members, the spaces between which are infilled with sheets of wood product.

Over time architecture succeeded in separating the outer envelope of a building completely from its loadbearing structure,

The bearing function is provided by columns, which are as far as possible enveloped into the interior of the building, while the façade leads an almost independent existence on the exterior



Figure 8: Farnsworth House, Plano, Illinois,
Ludwig Mies van der Rohe, 1950

(Knaack et al., 2007)

3.2 Post-and-beam façade

From solid walls to contemporary glass boxes, architectural evolution led to post-and-beam facades with storey-high posts and horizontal beams.

These elements serve multiple functions, including structural support, cladding, lighting, and ventilation.

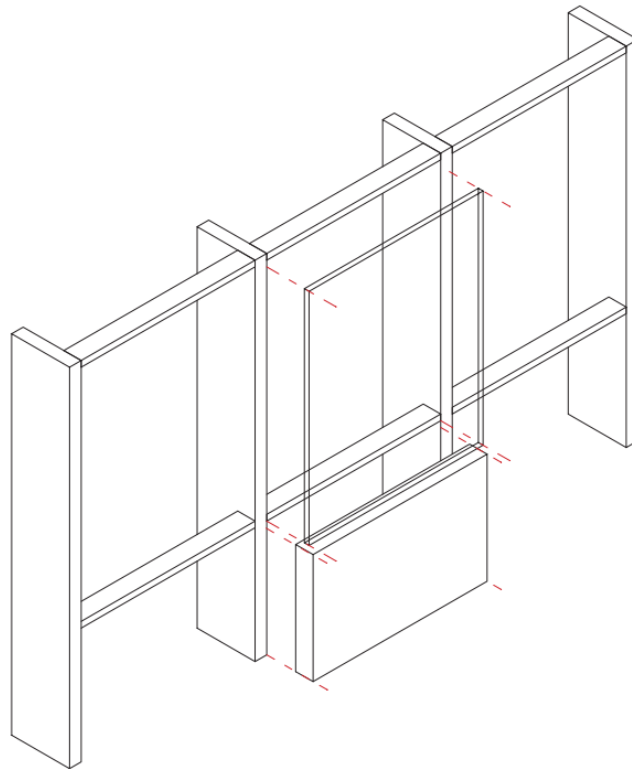


Figure 9: Post-and-beam façade

(Knaack et al., 2007)

3.3 Curtain wall

"Curtain facades" refers to a type of building facade that is predominantly made of glass or other transparent materials, creating the appearance of a curtain-like surface.

This design allows for extensive natural light, views, and often characterizes contemporary architecture.

It provides significant autonomy from the building's primary structure.



Figure 10: Curtain wall façade

https://www.archdaily.com/955204/transparent-buildings-and-the-illusion-of-democracy/6001ff1a63c01727af00045c-transparent-buildings-and-the-illusion-of-democracy-image?next_project=no

Contemporary curtain walls can be classified into stick and unit systems. Depending on the construction method, individual components may be prefabricated and assembled on-site, or the entire wall system can be manufactured off-site and installed as a complete unit.



Figure 11: Westhafen Haus, Frankfurt, Schneider + Schumacher, 2005

The separation of the façade from the building's loadbearing structure by means of the supporting elements behind the façade is distinct.

(Knaack et al., 2007)

3.4 Double façades

A double façade is created by incorporating an additional glazing layer on the exterior, enhancing ventilation or sound insulation. The implementation of this system varies based on the intended functionality and specific façade requirements..

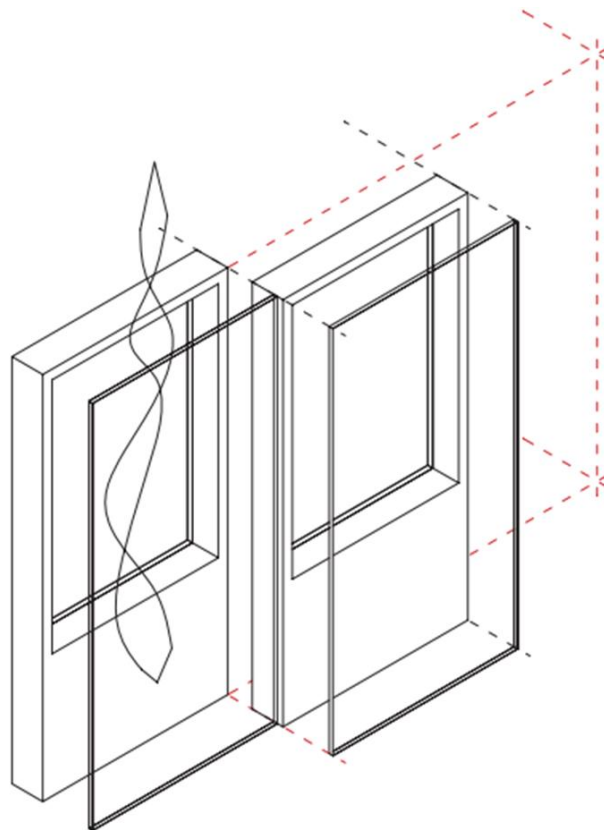


Figure 12: A double façade détail.

(Knaack et al., 2007)



Figure 13 : Single and double façade: Triangle Building, Cologne, Gatermann + Schossig, 2006.

This high-rise building façade demonstrates adaptable functionality based on specific requirements. On the right, a single façade is visible, while on the left, an extra layer of glazing has been integrated, forming a double façade with a ventilated space between the two layers.

(Knaack et al., 2007)

Double façades are not necessary on all sides of every new building. However, in specific situations—such as excessive street noise, strong wind loads, or increasing building height—they can provide significant advantages.

3.5 Ventilated façade

A ventilated facade is a type of building covering with a gap between the outer wall and the cladding.

This gap lets air flow naturally, helping to regulate temperature, reduce moisture, and improve insulation. It keeps the building cooler in warm weather and protects it from damage caused by trapped moisture.

The system works by allowing air to move freely, preventing heat buildup and improving energy efficiency. Ventilated facades can be made from materials like glass, metal, stone, or composite panels, depending on the building's needs.

Ventilated facades offer benefits such as *improved* **thermal insulation**, **moisture management**, **noise reduction**, **aesthetic flexibility**, and increased **durability**.

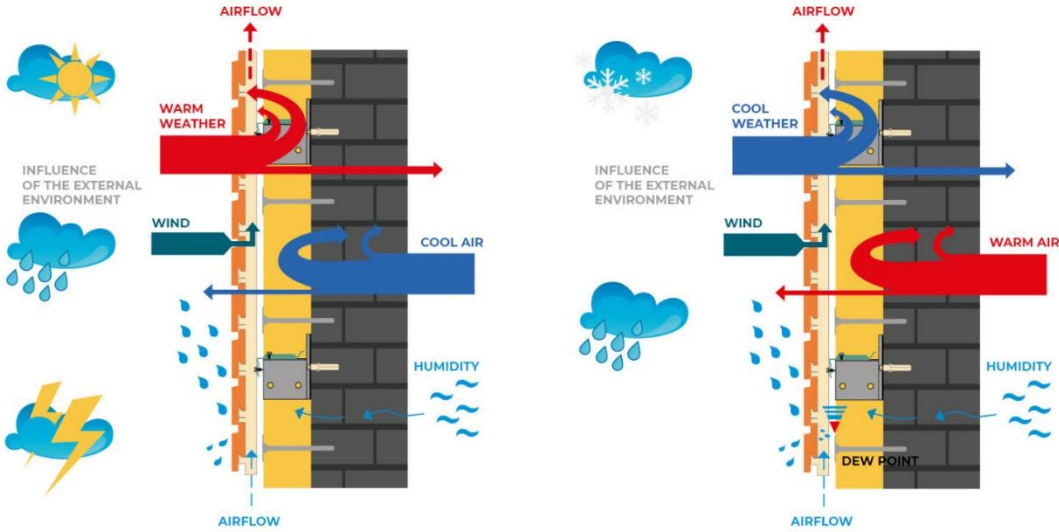
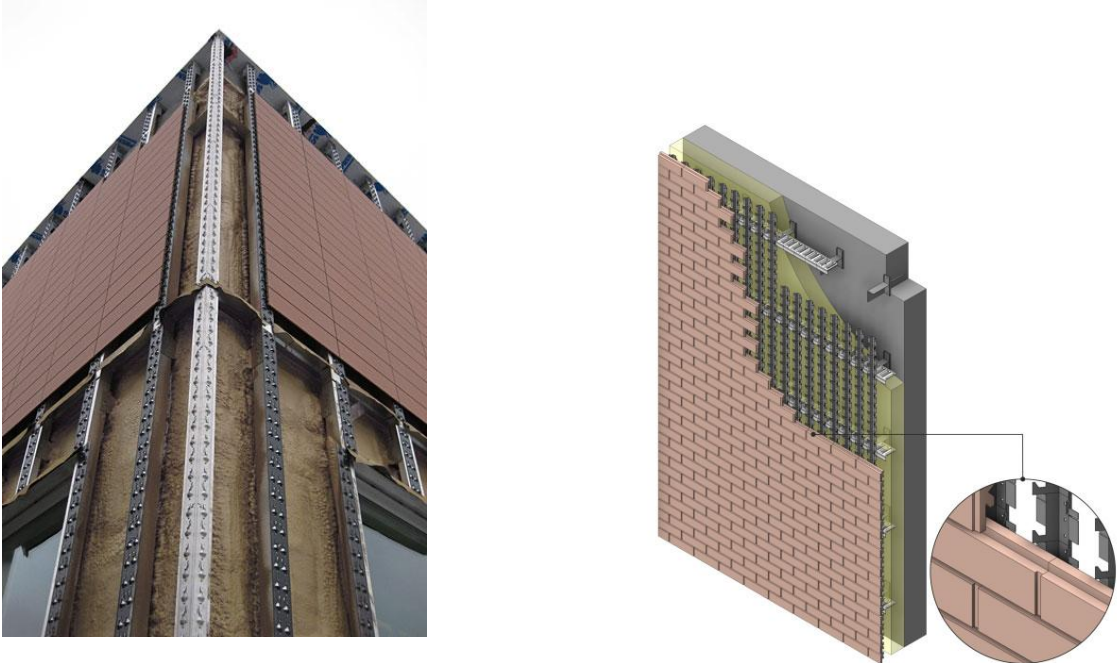


Figure 14: Illustration of Ventilated facades

Source: <https://kingklinker.com/en/technical-information/ventilated-facades>.

3.6 A double-skin façade

A double-skin facade is a specialized building system designed to enhance thermal insulation, energy efficiency, and acoustic performance. It consists of two separate layers—an inner skin and an outer skin—which are separated by an air gap or another insulating material.

- **How It Works?**

The air gap between the two skins plays a crucial role in regulating temperature. In colder months, it can act as a thermal buffer, reducing heat loss from the building interior. In warmer months, it allows for natural ventilation, helping to prevent overheating.

The space between the layers may be ventilated, semi-ventilated, or sealed, depending on the building's design and the climate conditions.

Some designs incorporate automated louvers or openings, allowing for dynamic control of airflow, optimizing the facade's performance throughout different seasons.



Figure 15: Detail of double skin façade.

[//www.archdaily.com/922897/how-do-double-skin-facades-work](http://www.archdaily.com/922897/how-do-double-skin-facades-work)

Observation:

A **ventilated facade** has an outer cladding with a small gap, allowing air to move naturally and helping with insulation.

A **double-skin facade** has two layers with a space between them, improving temperature control and noise reduction.

Conclusion:

Facades have evolved from simple walls to complex designs like double-skin facades, adapting to changing needs for comfort, energy efficiency, and aesthetics. Early facades mainly provided protection, while modern ones help regulate temperature, reduce noise, and improve sustainability.

Chapter 2: Form and space in architecture

Introduction

Form and space are fundamental, inseparable elements of architecture, working together to shape our built environment. Architects orchestrate these components to create meaningful architectural experiences.

I. Form-space definition

Architects arrange form and space to create Architecture (Ching, 2007)

- **Form**, encompasses all tangible, solid elements that can be seen, touched, and constructed. It defines the physical presence of a structure. It also can be defined as the physical structure, shape, and volume of a building.
- **Space** is the intangible void, the areas we inhabit, traverse, and interact with, even though we cannot physically grasp it. It includes the volume within and around a building, shaping the way it is experienced and used.

The relationship between form and space is often referred to as the "solid-void relationship".

Architects manipulate form to define and generate space, ensuring functionality and experiential quality.

A building creates both interior and exterior spaces, which may engage in dynamic interaction, influencing each other through physical continuity, transparency, or spatial flow.

II. Planes in architectural design

In architectural design, we manipulate two types of planes (Fig.14):

- Horizontal planes: Floor and roof
- Vertical planes: Walls

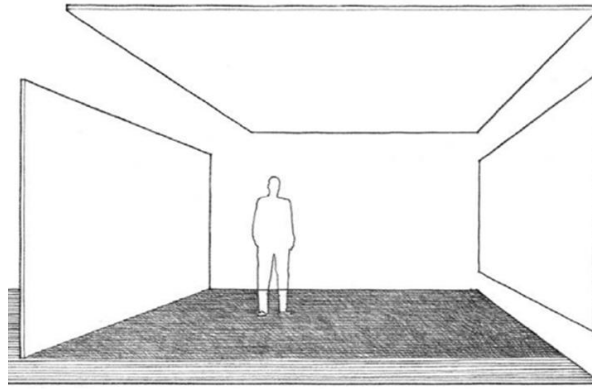


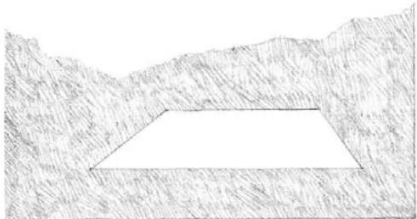
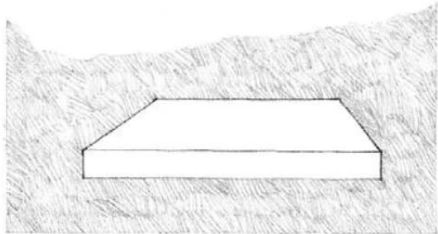
Figure 16 : Horizontal and vertical plans

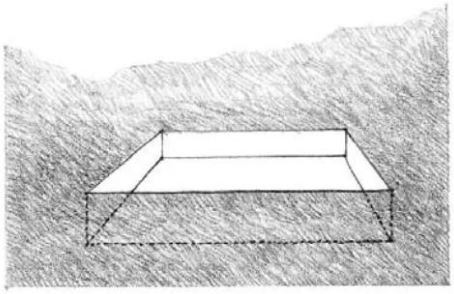
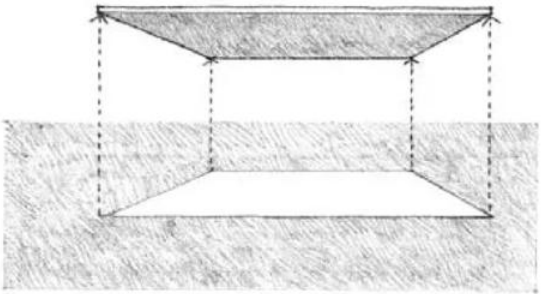
Source: (Ching, 2007) P19)

II.1 Horizontal planes:

Horizontal planes—floors, ceilings, platforms, and overhead structures—are essential in shaping spatial experience. They define boundaries, organize movement, and influence perception of openness, scale, and hierarchy.

Table 1: Types of horizontal plans

Plane Type	Description	Architectural Uses	Figure
Base Plane	Fundamental horizontal surface (usually the floor).	Grounding spaces, marking boundaries with textures.	 https://archi-monarch.com/form-and-space-in-architecture/
Elevated Plane	Raised horizontal surface above the base level.	Podiums, platforms, raised terraces.	 https://archi-monarch.com/form-and-space-in-architecture/

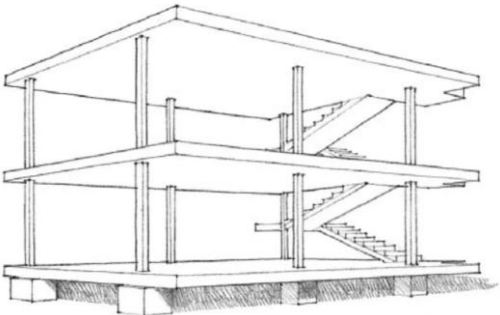
<p>Depressed Base Plane</p>	<p>Horizontal surface sunken below the surrounding ground.</p>	<p>Pits, courtyards, amphitheaters.</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>
<p>Overhead Plane</p>	<p>Horizontal surface above the viewer's field of vision (e.g., ceiling).</p>	<p>Roofs, ceilings, canopies, pergolas.</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>

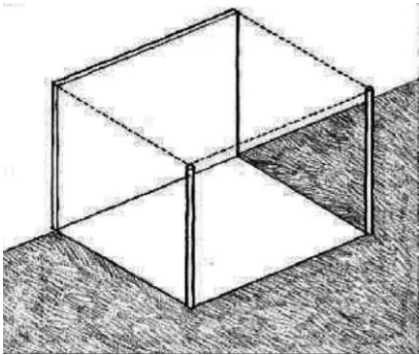
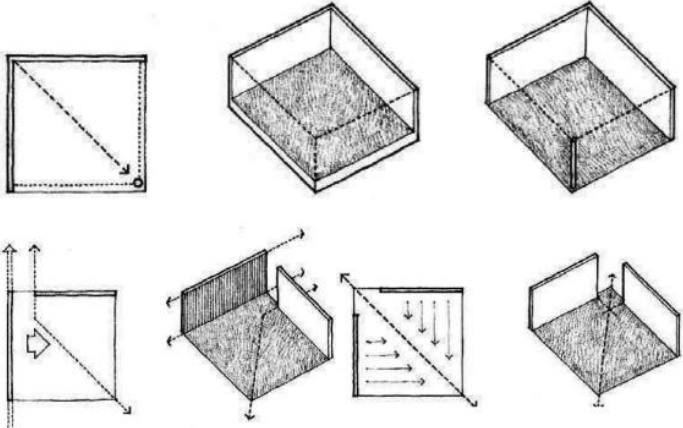
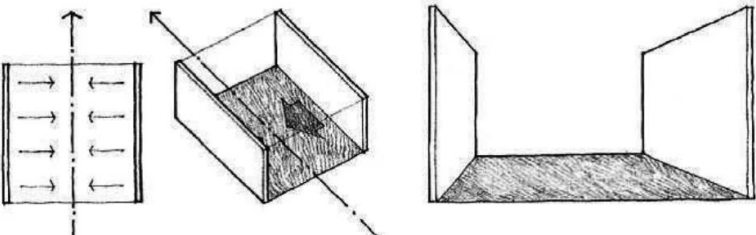
Author, 2025

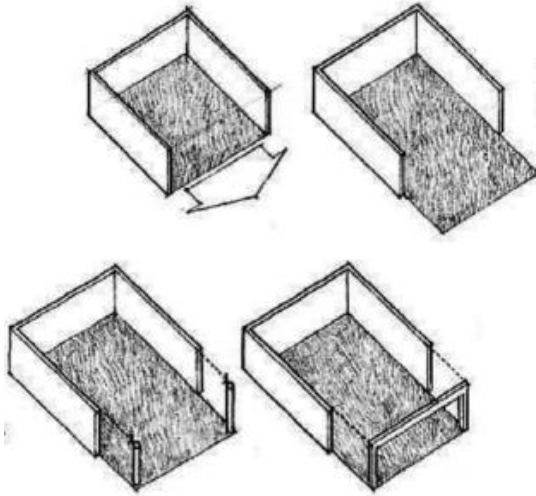
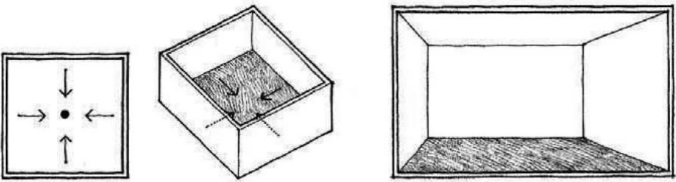
II.2 Vertical planes:

Vertical planes are fundamental spatial-defining elements in architecture. They shape and articulate space through their placement, orientation, and configuration. These planes can be singular or combined to create varying degrees of enclosure, directionality, and openness.

Table 2: Types of Vertical planes

Configuration	Description	Figure
<p>Vertical Linear Elements</p>	<p>Columns or slender uprights that suggest boundaries without enclosure</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>

<p>Single Vertical Plane</p>	<p>A solitary wall or façade that fronts and defines one edge of a space</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>
<p>L-Shaped Configuration</p>	<p>Two connected planes forming a corner</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>
<p>Parallel Vertical Planes</p>	<p>Two facing walls creating a linear field</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>

<p>U-Shaped Configuration</p>	<p>Three planes enclosing space on three sides</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>
<p>Four Vertical Planes</p>	<p>Four walls fully enclosing a space</p>	 <p>https://archi-monarch.com/form-and-space-in-architecture/</p>

-Architects can manipulate architectural planes—whether organic and flowing or rigid and right-angled—to shape a particular environment and spatial experience.



Figure 17: Organic/flowing shapes

Le Corbusier: La Chapelle Notre-Dame-du-Haut, Ronchamp (France)

https://www.archdaily.com/989329/in-search-of-the-ineffable-a-look-into-the-chapel-of-notre-dame-du-haut-in-ronchamp/631b81f0f55c6621b9be39e8-in-search-of-the-ineffable-a-look-into-the-chapel-of-notre-dame-du-haut-in-ronchamp-photo?next_project=no



Figure 18: Right-angled shapes

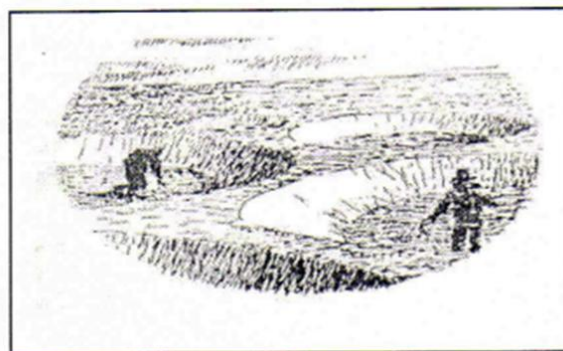
Le Corbusier: La Villa Savoye, Poissy (France)
<https://www.archdaily.com/84524/ad-classics-villa-savoye-le-corbusier>

III. Defining Space in Architecture

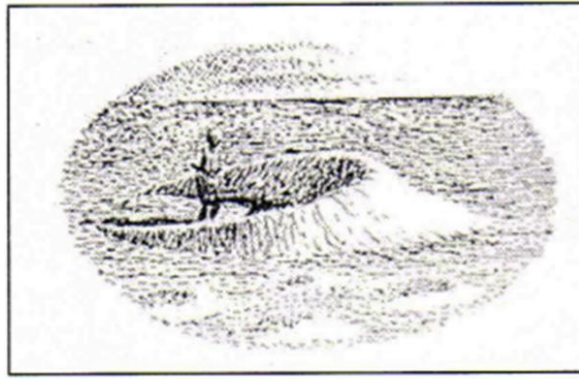
What defines space in architecture?

III.1 Boundaries

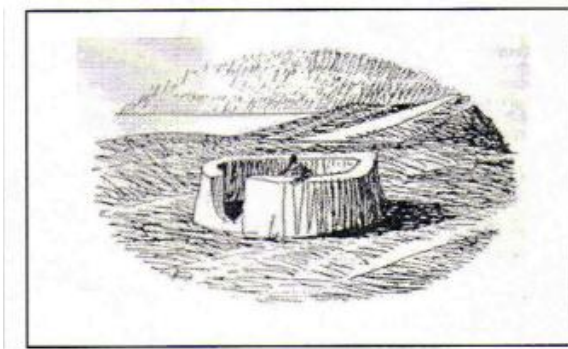
Space in architecture is defined through its boundaries, which establish limits, organization, and interaction within the built environment. It can be: A depression , an elevation or a limitation



(a)



(b)



(c)

Figure 16:

Figure 19: (a) Depression, (b) Surelevation, (c) Limitation

Source: (Cousin, 1980)

In architecture bouderies can be created by : **a Roof**



The old port of Marseille : The roof crates a real space in in the esplanade of the old port.

Figure 20: A boundary created by a roof.

<https://marseille.love-spots.com/par-quartier/vieux-port>

In architecture bouderies can be created by : **Staircase step and tiers**



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

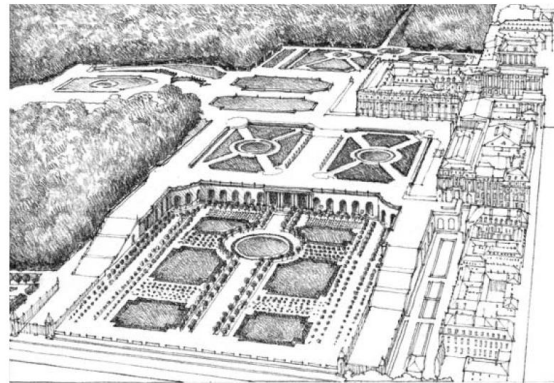
Figure 21: Bouderies created by a staircase.

Source: (Ching, 2007)

In architecture bouderies can be created by: **ground marking**



Street in Woodstock, Oxfordshire, England



Parterre de Broderie, Palace of Versailles, France, 17th century, André Le Nôtre

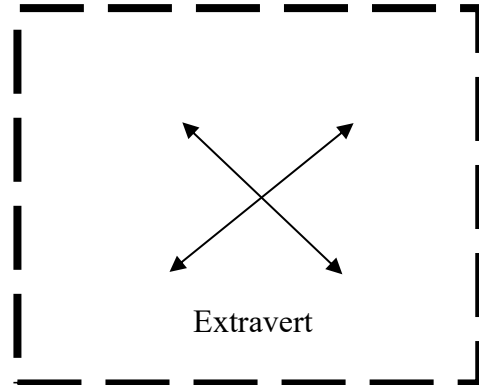
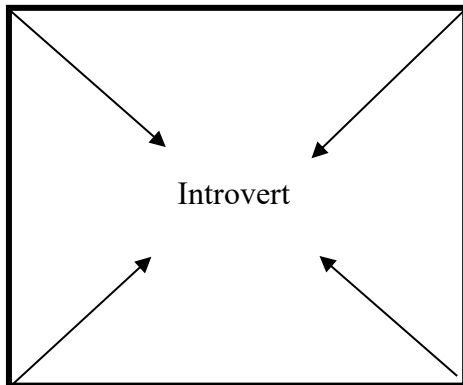
Figure 22: Bouderies created by the ground making

Source: (Ching, 2007) P105)

III.2 Openings

Architectural spaces are shaped by how openings are placed. An **introverted** design has enclosed spaces that offer privacy and control light. An **extroverted** design has open spaces that connect

with the outside, using large windows and open facades. The way these elements are arranged affects how people experience the space.



(a) A patio onto which the interior façades of the residence open

<https://alger.mta.gov.dz/fr/dar-aziza/>
pha



(b) A contemporary extravert facade

<https://www.archdaily.com/456117/villa-in-decin-studio-pha>

Figure 23: Introvert and extravert configurations.

III.3 Density

Density is obtained by dividing space in different ways.

- **Columns and Colonnades:** Density in architectural design can indeed be influenced by how space is divided and structured. Columns and colonnades play a crucial role in defining spatial rhythm, accessibility, and the perception of density within a built environment.

Columns create vertical divisions, influencing spatial continuity and density—closer spacing encloses space, while wider gaps open it up. Colonnades, as series of columns, shape rhythm and hierarchy, balancing openness and shelter.

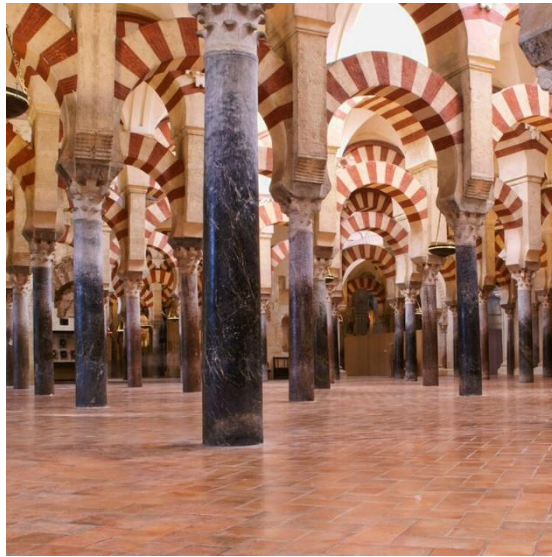


Figure 24: The mosque of Cordoba/Spain

<https://whc.unesco.org/en/list/313/>

- **By patterning the floors, walls or ceilings** (the room appears to be filled, hollow or empty).



Figure 25:The Hall of Mirrors, Château de Versailles, France.

<https://www.chateauversailles.fr/decouvrir/domaine/chateau/galerie-glaces#la-galerie-des-glaces>

III.4 Spatial relationships:

Spatial relationships: **autonomous** spaces or **linked** spaces?

- **Juxtaposition:**

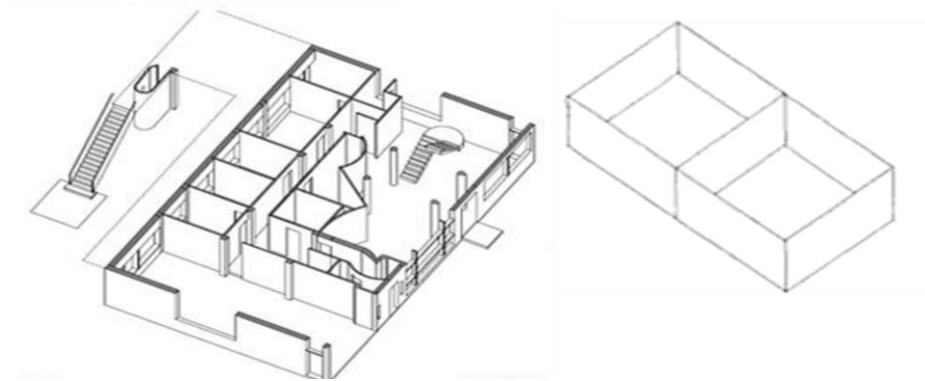


Figure 26: Juxtaposition of spaces

Source: (Ching, 2007)

- Emphasis on autonomy.
- Relatively well-defined, enclosed spaces.
- These spaces are connected to neighbouring spaces by doors or windows.

- **Interpenetration**

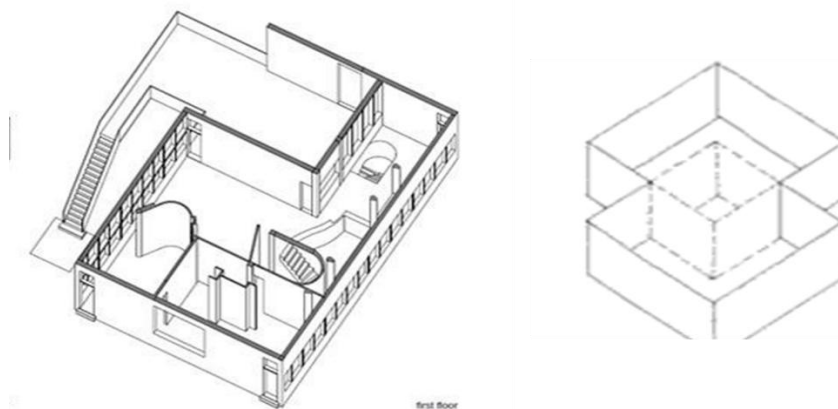


Figure 27: Interpenetration of spaces

Source: (Ching, 2007)

- **Spatial continuity**, allowing fluid movement between connected areas.
- **Shared defining elements** by visually linking two or more rooms.
- **Virtual separation**, preserving openness while subtly suggesting distinct zones.

III.5 Depth

Depth is a measurable spatial dimension, defining the distance between objects or an observer and an object.

Depth has both objective and subjective aspects. As a measurable dimension, it defines spatial relationships and can be quantified with precision. However, its interpretation varies depending on perception, influenced by perspective, lighting, and cognitive processing.

Different perceptions of depth:

- **Perception in enfilade and perspective**

Positioning the observer at the center of the aperture enhances enfilade and perspective perception by creating a continuous spatial flow and guiding visual focus through aligned openings. This technique strengthens depth perception and emphasizes spatial hierarchy.



Figure 28: Perception in enfilade and perspective

Generated by AI

When identical apertures are aligned in a row with the observer at their center, depth is strongly perceived. This arrangement creates a focused visual corridor, reinforcing perspective and spatial hierarchy, making the environment feel structured and immersive.

- **Diagonal perception and space in motion**

Diagonal perception enhances depth perception through movement, often referred to as "serial vision." This concept, explored in architectural and visual studies, emphasizes how sequential viewpoints create a dynamic spatial experience. As the observer moves, shifting perspectives reveal depth progressively, reinforcing spatial hierarchy and continuity

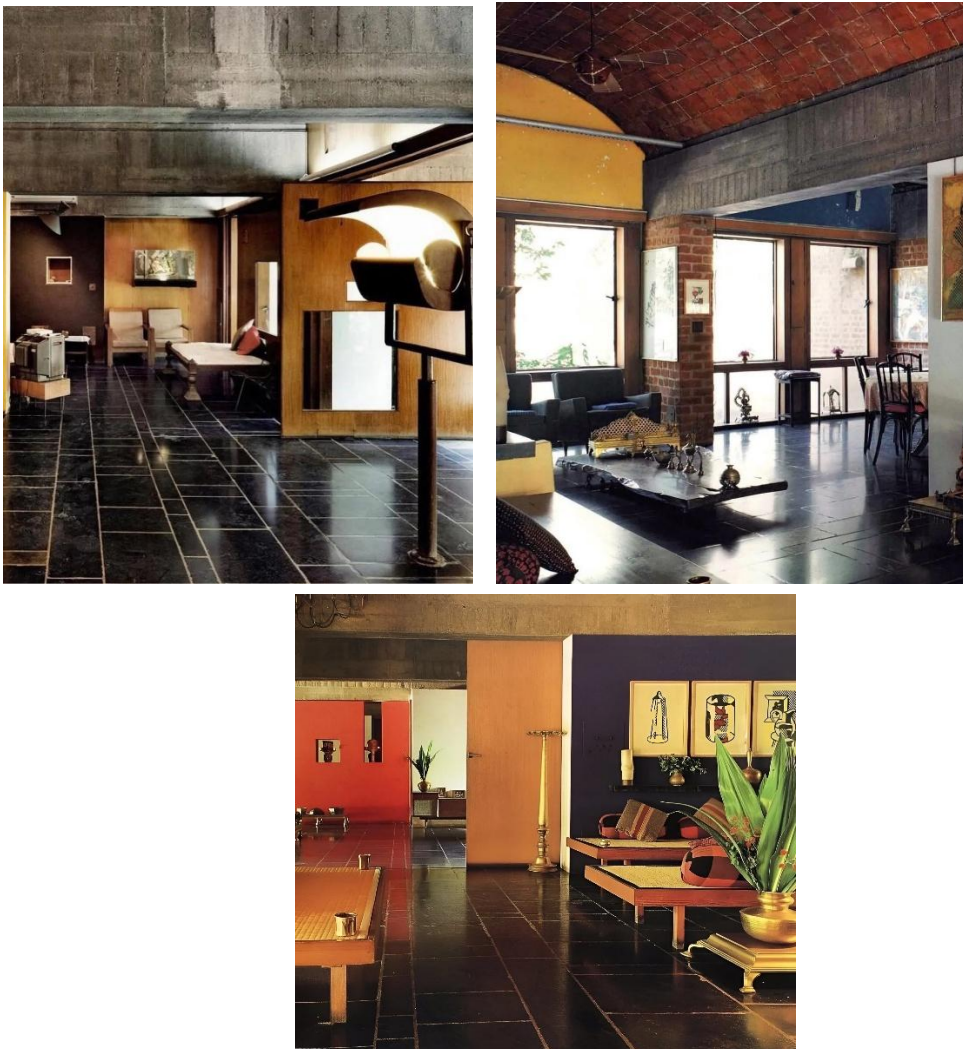


Figure 29: Diagonal perception in villa Sarabhai by Le Corbusier

<https://archeyes.com/villa-sarabhai-le-corbusiers-modernist-vision-rooted-in-indian-tradition/>

- **Surface Perception**

Transparency in architecture influences depth perception by allowing light to pass through materials like glass, creating layered and dynamic spatial effects.

It blurs boundaries, enhances openness, and alters the sense of scale and distance.



https://www.archiproducts.com/fr/produits/brugg/facade-ventilee-en-cellon-facades-ventilees_657812



<https://mbeyazli.wordpress.com/2016/04/20/transperancy/transparent-glass-facade-with-glass-facade-construction/>

Figure 30: The impression of depth: Opaque façade vs transparent façade

Architects strategically use varying levels of transparency to shape spatial perception and create an illusion of depth. Materials like glass, perforated panels, and mesh allow light and visibility to pass through, generating layered visual effects that enhance a sense of openness while defining spatial boundaries. Transparency can blur distinctions between interior and exterior spaces, making environments feel more dynamic and interconnected.

Reflections, shadows, and gradients of opacity further manipulate depth, guiding the observer's experience within an architectural composition.

By adjusting transparency, architects control how light interacts with surfaces, influencing scale, distance, and spatial continuity to craft immersive and engaging built environments.



Figure 31: Experiencing Depth in Architecture by different level of transparency

<https://www.archdaily.com/955204/transparent-buildings-and-the-illusion-of-democracy>

The way light reflects off a surface influences depth perception by creating variations in brightness, contrast, and shadow. Glossy or reflective materials enhance spatial depth by mirroring surroundings, while matte surfaces absorb light, appearing flatter. These effects help define spatial relationships and add visual complexity to architectural design.

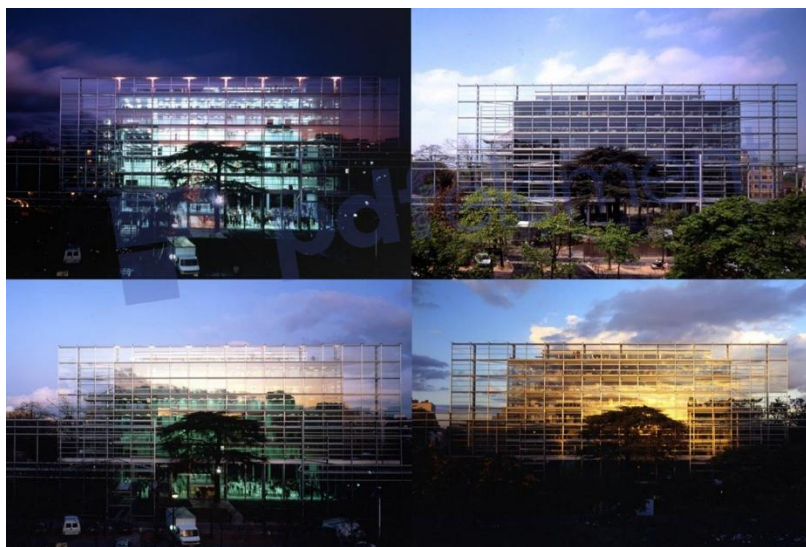


Figure 32: Light reflection and its impact on depth perception in architecture

<https://www.jeannouvel.com/projets/fondation-cartier-2/>

Glass façades can mirror their surroundings, creating dynamic interactions between architecture and the environment. This reflective quality enhances depth perception, integrates buildings into their context, and alters visual impressions based on light conditions and angles of view.

Architects use this effect to make structures feel more open, fluid, and visually connected to their surroundings (fig.29).

III.4-Depth with *trompe l'oeil*

Creating depth with *trompe-l'œil* involves manipulating perspective, light, and shading to create an illusion different from reality.

The gallery of Palazzo Spada in Rome, designed by Francesco Borromini, is a remarkable example of *trompe-l'œil* and forced perspective in architecture. Although the actual length of the corridor is only 8.82 meters, Borromini masterfully manipulated proportions to create the illusion of a 35-meter-long space.

Architects create the illusion of extended depth by gradually decreasing column height and width, subtly inclining the floor while lowering the ceiling, and progressively reducing spacing between columns. Light and shadow further enhance perspective, making the space appear much longer than its actual dimensions.



Figure 33: The gallery of the Palazzo Spada / Rome (Borromini)

<https://galleriaspada.cultura.gov.it/fr/visite/la-perspective/>

Architectural space is also characterized by:

The geometry of its components, Ambience, Colors, Light, Shadows...etc.

IV. Ambience in architectural space

Ambience refers to the emotional and sensory atmosphere created through the interplay of light, material, proportion, sound, and spatial configuration. It's not just about how a space functions, but how it feels: calm or dynamic, intimate or monumental, warm or austere.

Architects shape ambience by orchestrating elements like natural light, acoustic comfort, visual framing, and tactile surfaces.

Ambience is what transforms space into experience — making architecture not only inhabitable, but memorable.

Sensorial ambience in architecture refers to the immersive experience created by engaging the senses: sight, sound, touch, temperature, and even smell within a spatial environment. It goes beyond visual aesthetics to shape how a space is felt, lived, and remembered.

- **Light and shadow** influence mood and perception, revealing textures and guiding movement.
- **Acoustic qualities** echo, silence, resonance—affect comfort and emotional tone.
- **Materiality and texture** invite tactile engagement, from the warmth of wood to the coolness of stone.
- **Thermal and atmospheric conditions:** airflow, humidity, sunlight, contribute to spatial comfort and identity.
- **Olfactory cues (smell)**, like the scent of vegetation or aged materials, subtly anchor memory and place.

V. Evolution of the architectural space

Classical architecture has clear, structured spaces that feel stable and defined. Contemporary architecture, however, breaks away from this by creating open, flexible, and dynamic spaces. This shift, implies the "destruction of the box," allows for fluid movement and a stronger connection between inside and outside.

Architects like Frank Lloyd Wright, Le Corbusier, Mies van der Rohe, and Walter Gropius helped shape this change, designing buildings that feel freer and more adaptable. Their work redefined space, making it more open and connected.

Destroying the box in architecture introduces new spatial characteristics that redefine how spaces interact:

- It dissolves rigid physical boundaries, creating free and relaxed environments where movement feels effortless.
- Spaces flow into one another with seamless articulation, enhancing fluidity and openness.
- Eliminates the traditional divide between interior and exterior, merging them into a unified experience that fosters connection with the surroundings.
- Architects use this concept to design dynamic, adaptable spaces that prioritize freedom and spatial harmony.

How to design Open space?

VI. Examples of new architectural design

Three types of open concepts:

- The Organic Plan: by Frank Lloyd Wright
- Open Plans: by Mies van der Rohe
- The Free Plan (Plan Libre): by Le Corbusier

VI.1 The Organic plan: By Frank Lloyd Wright

- **A short biography**

Frank Lloyd Wright (1867-1959) was an American architect known for his organic architecture philosophy, integrating nature and human habitation.

He designed iconic buildings like Fallingwater and the Guggenheim Museum, emphasizing clean lines and seamless indoor-outdoor integration.

He's considered as one of the greatest architects of all time..

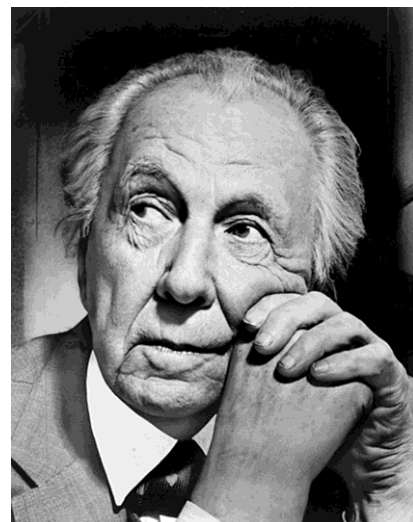


Figure 34: Photograph of Frank Lloyd Wright

https://fr.m.wikipedia.org/wiki/Fichier:Frank_Lloyd_Wright_portrait.jpg

- **The discourse of the revolution**

“So here I stand before you preaching organic architecture: declaring organic architecture to be the modern ideal and the teaching so much needed if we are to see the whole of life, and to now serve the whole of life, holding no ‘traditions’ essential to the great TRADITION. Nor cherishing any preconceived form fixing upon us either past, present or future, but—instead—exalting the simple laws of common sense—or of super-sense if you prefer—determining form by way of the nature of materials...”

— Frank Lloyd Wright, *An Organic Architecture*, 1939

- **Organic architecture, according to FLW**

Organic refers to qualities found in living organisms—growth, harmony, and adaptability.

In architecture, Frank Lloyd Wright redefined this idea, using organic architecture to express a deep connection between buildings and their environment.

Rather than imitating nature’s forms, he sought to integrate structures into their surroundings, reflecting natural principles like continuity, balance, and material authenticity. His designs, showcase flowing spaces, natural materials, and a seamless relationship between built forms and landscapes, demonstrating how architecture can grow naturally from its setting rather than imposing itself upon.



Figure 35: *Fallingwater, designed by Frank Lloyd Wright in 1935, is widely hailed as his masterpiece and one of the greatest architectural achievements of the 20th century.*

<https://franklloydwright.org/>

- **The Organic plan: Inspiration**

The Shingle¹ House style is an architectural form characterized by the use of wooden shingles as the primary exterior cladding material. Emerging in the late 19th century (1880-1900), particularly in the United States, the Shingle House style was influenced by the Arts and Crafts movement, favoring simplicity and artisanal detailing over elaborate ornamentation.



Figure 36: The Shingle House style

Rendering of the John Conant House, Seattle - 1890

<https://dahp.wa.gov/historic-preservation/historic-buildings/architectural-style-guide/shingle-style>

The Shingle Style had a notable influence on Frank Lloyd Wright, particularly in its emphasis on openness and fluid spatial transitions. Wright admired how Shingle houses achieved a sense of continuity by expanding doorways, reducing rigid compartmentalization.

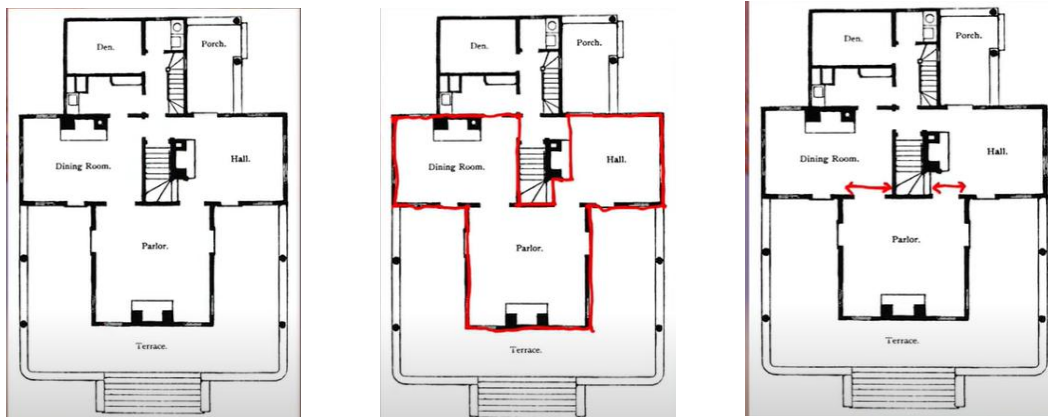


Figure 37: Achieving Openness by increasing the size of the doorways in shingle houses.

<https://www.youtube.com/watch?v=YEt6QoyzRg>

¹ The "shingle" is a roofing material, also known as a "wooden shake" or "roofing tile," widely used in North America and increasingly popular in other parts of the world. It consists of sheets of asphalt or bitumen felt, reinforced with fiberglass to enhance rigidity and durability.

- **The organic plan: foundations**

The organic plan is a fundamentally different way to thinking a building then as a collection of rooms. The building has to be considered as one cohesive entity each space flow to the next.

FLW described this architecture like an Organism with rooms and objects considered like organs inside of a body.

Some key characteristics:

- To achieve the desired openness FLW target the room itself. The Diagonal Room Strategy enhances spatial fluidity by using diagonal alignments to redefine room boundaries, making their definition dependent on individual perception. This approach minimizes rigid separations, allowing spaces to flow dynamically. A key effect is the continuous appearance of the floor, reinforcing the illusion of openness and seamless movement, particularly in open-plan designs.

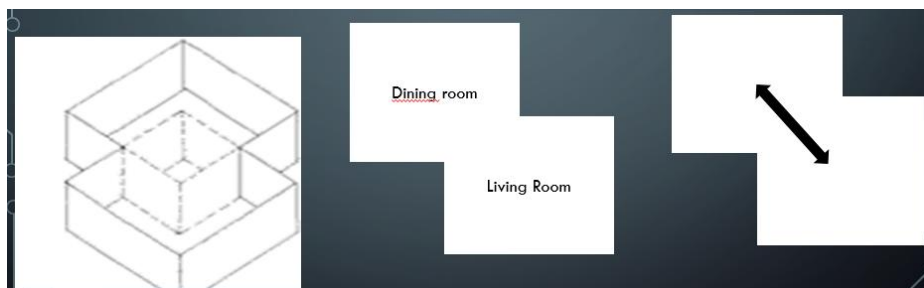


Figure 38: The diagonal room strategy in the organic plan (Author 2025)

- Using furnishing objects for spatial separation maintains openness while subtly defining areas. The key is ensuring that separation elements are unobtrusive, allowing fluid transitions.



Figure 39: Furniture for separation at the Fallingwater house.

<https://fallingwater.org/>

- The Corner Window serves as a dynamic architectural element, seamlessly integrating the inhabitant's experience from the exterior into the interior. By eliminating traditional framing constraints, it enhances spatial continuity, creating a 180° panoramic view that dissolves boundaries between inside and outside.



Figure 40: The corner window at Fallingwater house

<https://fallingwater.org/>

Important: The Organic plan of FLW is an Inside/Out, diagonally composed continuous, interdependent room strategy,

VI.2 The Open Plan: by Mies Van Der Rohe

- **A short biography**

Ludwig Mies van der Rohe (1886-1969) was a German-American architect known for his modernist designs.

He directed the Bauhaus School of Design and later immigrated to the United States, settling in Chicago.

His iconic works include the Farnsworth House and the Seagram Building. Mies's minimalist approach and use of steel and glass have had a lasting impact on architecture.



Figure 41: Mies Van Der Rohe

https://en.wikipedia.org/wiki/Ludwig_Mies_van_der_Rohe

- **Key Works of Mies Van Der Rohe**

In 1923, Mies van der Rohe explored two distinct architectural visions through unbuilt residential projects: the Lessing House and the Brick Country House. Though both remained on paper, they illuminate his early experimentation with modernist space.

- *Lessing House*

Mies's design for the Lessing House presents a rectangular envelope subdivided into a series of adjacent rectangles—rooms and courtyards—arranged in a modular grid.

This scheme contains both interior and exterior spaces within a unified architectural shell.

The perimeter walls act as a spatial filter, enclosing the entire composition and creating a sense of privacy and introspection.

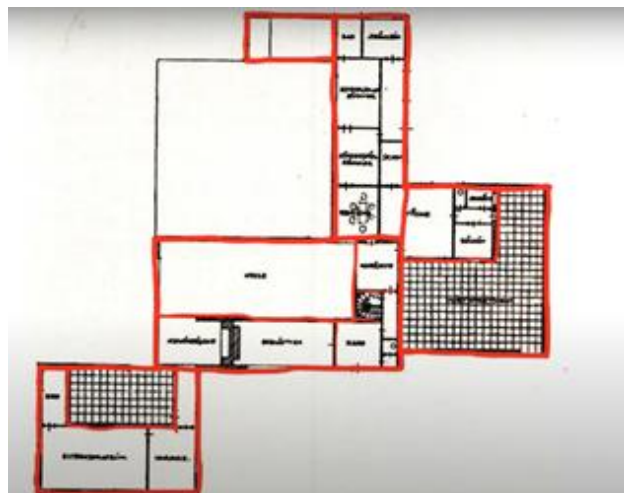


Figure 42:The Lessing House by Mies Van der Rohe

<https://www.youtube.com/watch?v=YEt6QoyzRg>

<https://archive.org/details/usmodernist-mies-vander-rohe-lessing-house>

○ *The brick country house*

Mies van der Rohe's Brick Country House (1923) was a bold architectural concept. In this design, the wall was no longer just a barrier, it became a tool to shape space. Instead of enclosing rooms, the walls were placed freely to guide movement and create open, flowing areas.

- ✓ The walls are independent
- ✓ Explode into a composition of right-angled lines
- ✓ The walls stop and started at will
- ✓ the line between interior and exterior is hardly registered by the walls alone
- ✓ Some walls extended too far outside in the landscape

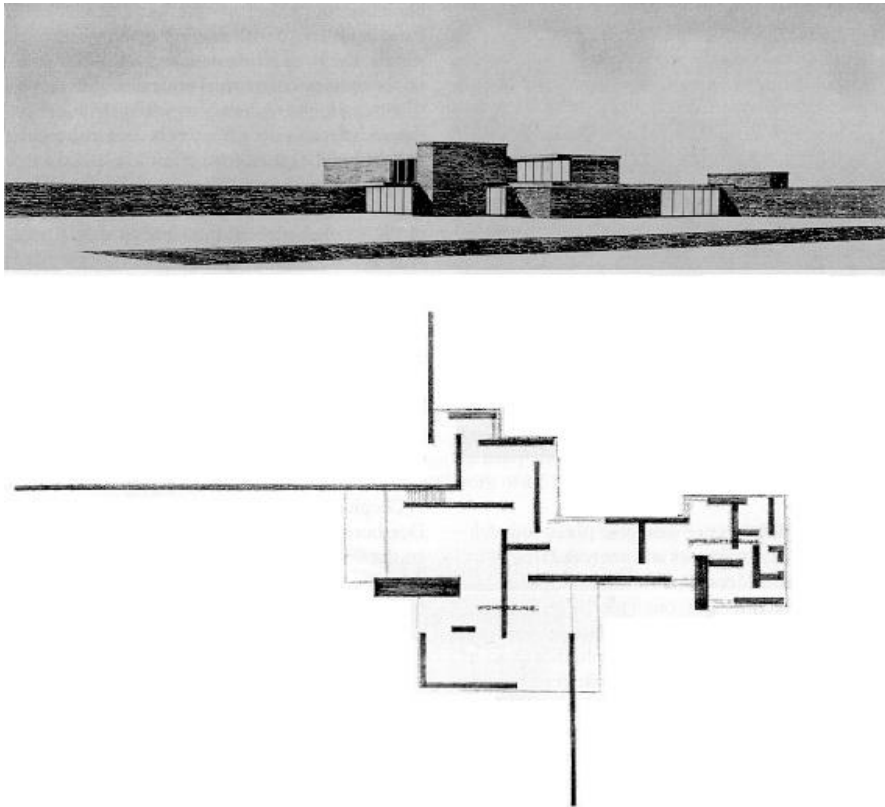


Figure 43: The brick house by Mies Van der Rohe

<https://www.cgarchitect.com/projects/7f0c499c-mies-van-der-rohe-1923-brick-country-house>

○ *Barcelona Pavillion*

designed by Mies van der Rohe for the 1929 International Exposition, is a landmark of modernist architecture. Though built as a temporary reception space for the Spanish king, it became an enduring icon. With its refined proportions, elegant materials, and open spatial flow, the Pavilion exemplifies Mies's innovative approach and redefines architectural perception.

1/The Pavilion's open rectangular plan and sliding walls (extending from exterior to Interior) create fluid, continuous space.

2/A fully articulated slab reinforces the horizontal emphasis, unifying ground and ceiling while enhancing spatial clarity.

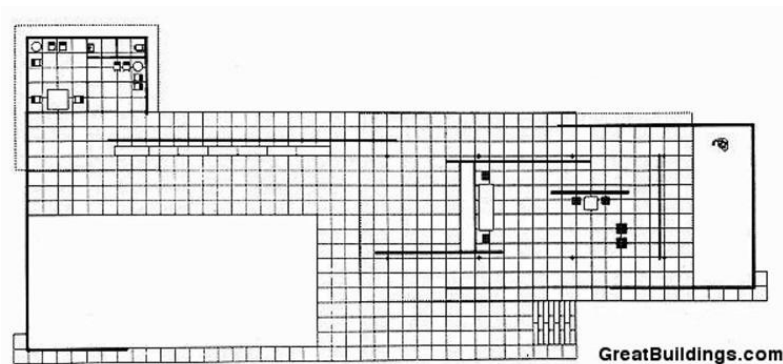
3/The roof is supported by eight, cruciform steel columns that create an elegant structural rhythm while liberating the surrounding space from any visual or physical obstruction

4/The window wall dissolves boundaries between inside and outside through spatial and visual openness.

5/A blend of natural (marble) and industrial (glass, chrome) materials enhances sensory experience.



Figure 41 : The Barcelona Pavilion by Mies Van der Rohe



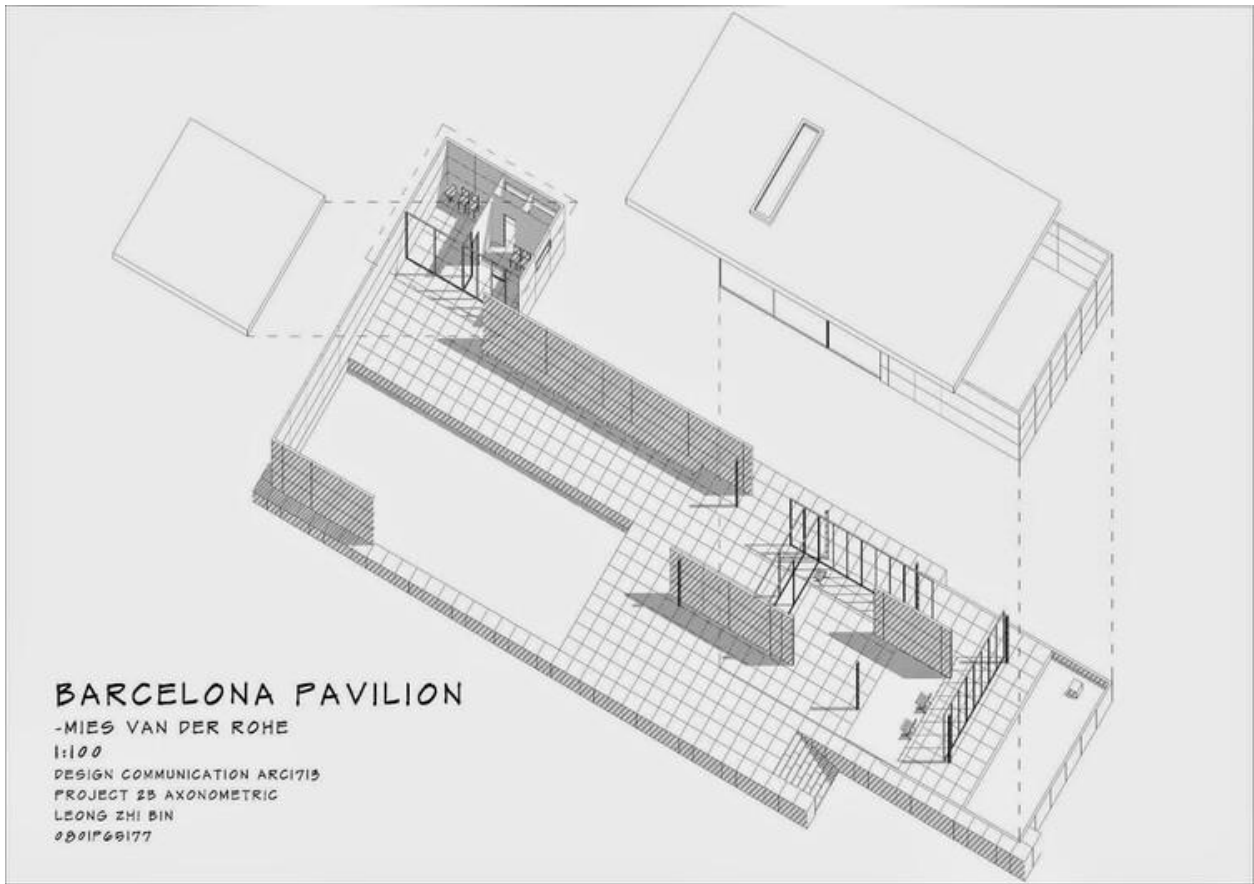


Figure 42: Plan of the Barcelona Pavilion by Mies Vander Rohe

www.archdaily.com

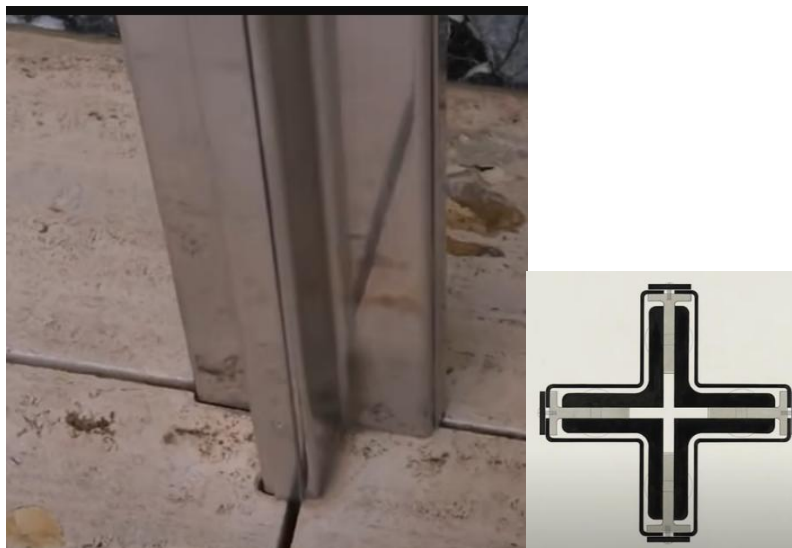


Figure 43: The cruciform steel column of the Barcelona Pavilion

<https://www.youtube.com/watch?v=YEt6QoyzRg>

The open plan by Mies van der Rohe is a foundational concept in modern architecture, characterized by :

- Using freestanding walls and columns to define rather than enclose space.
- A fully articulated slab
- Encouraging non-linear movement, where the visitor navigates through visual and material cues rather than fixed pathways.
- Treating walls as objects—sometimes solid, sometimes transparent, and sometimes absent—to create layered spatial experiences.
- Integrating glass and open façades to dissolve boundaries between interior and exterior.

VI.3 The Free Plan (*Le plan Libre*) by Le Corbusier

- **Biography**

Le Corbusier (1887–1965) was a Swiss-French architect and urban planner who revolutionized modern architecture. Known for works like Villa Savoye and Unité d'Habitation, he promoted functional design, geometric forms, and concrete as a key material. His planning ideals, such as the Radiant City, aimed to reshape urban life, influencing cities worldwide.

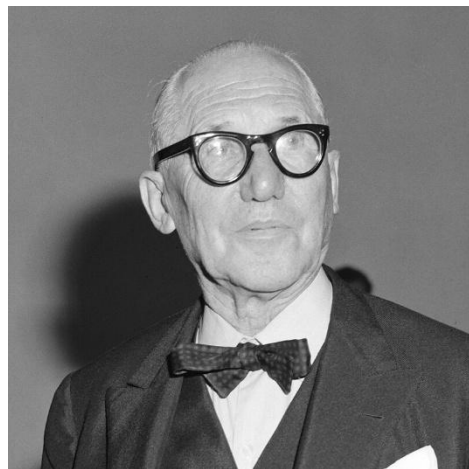
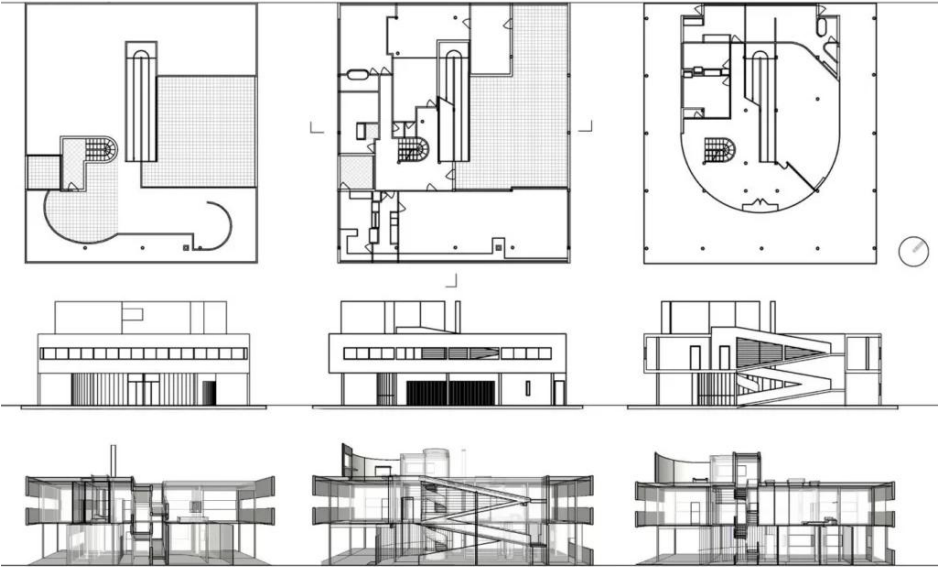


Figure 44:Photography of Le Corbusier.

[https://fr.wikipedia.org/wiki/Le_Corbusier#/media/Fichier:Le_Corbusier_\(1964\).jpg](https://fr.wikipedia.org/wiki/Le_Corbusier#/media/Fichier:Le_Corbusier_(1964).jpg)

Le Corbusier's approach to architecture introduced a clear segregation between structural and spatial elements: he distinguished the components that bear the building's weight such as columns and beams, from those that define and modulate interior space, like partitions and walls. This separation allowed for greater flexibility in layout, enabling fluid, open-plan designs

unconstrained by the structural framework and reinforcing his philosophy of functionalism and modernity in built environments.



VILLA SAVOYE - LE CORBUSIER



Figure 45: Villa Savoye details

<https://www.archdaily.com/84524/ad-classics-villa-savoye-le-corbusier/5037e69428ba0d599b00035d-ad-classics-villa-savoye-le-corbusier-image>

- **Structural Independence:** Columns are arranged in a grid. Load-bearing **pilotis (columns)** support the building, freeing walls from structural constraints. Walls and columns don't need to be in a same place.
- **Flexible Layout:** Interior walls can be placed wherever needed, allowing for adaptable and open spatial arrangements. Columns are show-cased to be admired. The columns can creat subdivisons into zones for different activity. Columns can creat Visual spatial understanding giving mors depth to the space.
- **Fluid Circulation:** Movement flows naturally through the space, guided by light, form, and visual axes rather than enclosed corridors.
- **Z shape :** dynamic path with no singular destination
- **Large ribbon :** gives a frame that cut off the top and a bottom of the landscape focusing on horizon.
- **Zoning Without Enclosure:** Spaces are defined by function and experience, not by rigid partitions.



Figure 46: Interior space with Z shape

(Le Corbusier, 1995)adapted by author



Figure 47: The Cropped View by Ribbon Windows

<https://www.youtube.com/watch?v=YEt6QoyzRg>

Conclusion

Modern architecture has moved beyond rigid enclosures. Today, form and space are no longer confined to static boxes—they are fluid, adaptive, and responsive to human needs. Contemporary architecture is actively “destroying the box,” opening interiors to nature and movement. This shift, rooted in the organic principles of Frank Lloyd Wright, blurs boundaries between inside and outside and sets the stage for spatial continuity.

Chapter 3: Introduction to the function in architecture. The relationship form/space/function

Introduction

In architecture, function is more than a technical requirement—it is a fundamental driver of form, space, and experience. A building’s purpose shapes its layout, circulation, material choices, and the interaction between occupants and environment. Whether it’s a home, a school, or a public plaza, understanding how a space will be used is key to designing it effectively.

I. Definition of the function

In architecture, function is a foundational concept it refers to the purposes, activities, and requirements that buildings or spaces are intended to fulfill.

It explains why a space exists, what it enables, and how it supports human activity. When designing buildings or urban environments, architects must think not only about aesthetics and structure, but also how each part serves practical, cultural, and environmental roles.

II. Function in modern architecture

« Form follows function » is a foundational principle in modern architecture and design, famously coined by Louis Sullivan,

- **Biography**

Louis Sullivan (1856–1924) was a pioneering American architect often called the “father of skyscrapers” and “father of modernism”. Born in Boston, he studied briefly at MIT and later at the École des Beaux-Arts in Paris before settling in Chicago, where he became a key figure in the Chicago School of Architecture.



Figure 48: Photography of Louis Sullivan.

https://en.wikipedia.org/wiki/Louis_Sullivan

- **The importance of function**

All things in nature have a shape, that is to say, a form, an outward semblance, that tells us what they are, that distinguishes them from ourselves and from each other.

This principle, famously coined by Louis Sullivan, suggests that the shape of a building or object should primarily relate to its intended purpose. In essence: The building's form emerges from how it will be used: its function.

III. Functionality in architecture

Functionality refers to the capacity of a system, object, or design to perform its intended tasks effectively. It's about how well something works in relation to its purpose.

In architecture, functionality refers to how effectively a building or space serves its intended purpose. It's the principle that design decisions: form, layout, materials, are guided by use, not just aesthetics.

In architecture functionality encompasses various considerations such as:

- Spatial organization,
- User needs,
- Building codes,
- Environmental factors, and cultural contexts.

III.1 Functionality and space organization

When designing a building, an architect needs to plan how each part of it works together, making sure everything runs smoothly (Frederick, 2007).

Different building types have specific needs. That's why a hotel looks and feels different from a school or a hospital. The way spaces are arranged depends on the building's function.

Some may think it's enough to just place rooms side by side based on their use. But designing a truly functional building takes more than that, it requires a smart layout where all parts connect and support each other. Just putting rooms next to each other doesn't guarantee the building will work well.

Before any starting the desing, the architect must engage in a strategic and analytical process to understand the building's purpose and how its different components will work together.

III.2 Functional organigram

A functional scheme is a diagram or layout that shows how different parts of a building or project are organized based on their purpose.

To realize the functional scheme, the architect must:

- **Receive a Preliminary program from the Client:** The future client provides an initial proposal outlining the purpose and desired features of the building.
This program typically includes the types of activities the building will host, the number and nature of required spaces, and any specific technical or regulatory constraints.

- **Identify Functional Units:** The architect analyzes the programme and defines key operational zones—called functional units.
These might include reception areas, working spaces, service zones, technical rooms, or circulation corridors.
Each unit serves a specific function, and its spatial characteristics must reflect its role (e.g. quiet, private...etc.).

- **Establish the Links Between Functional Units**

Beyond identifying units, the architect must study how they interact and relate to each other (Mazouz, S, 2006):

- Which zones need proximity?
- Which need separation or restricted access?
- What are the expected flows of people, goods, or information?

These relationships are critical for operational efficiency and are often represented as functional diagrams before formal plans are drawn.

Example: In a school, classrooms are often grouped, with nearby access to restrooms and recreation areas, while administration may be separated for privacy.

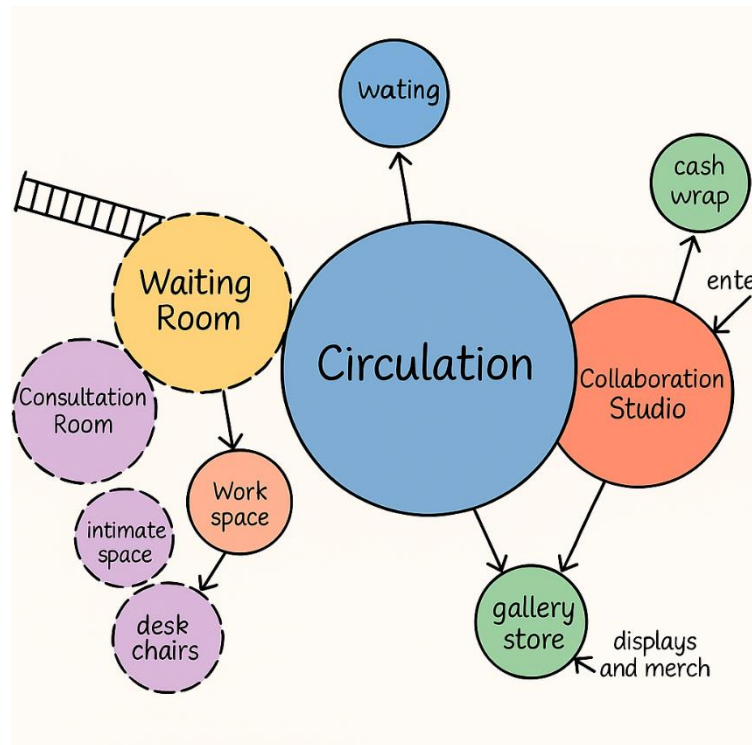


Figure 49: Functional organigram

Generated by AI

IV. Functionality considerations

IV.1 Spatial organization

Organizing spaces efficiently involves considerations such as:

- **Circulation:** Plan movement paths for smooth flow and easy circulation.
- **Zoning:** Group areas by function to improve clarity and efficiency.
- **Accessibility:** Ensure all users can access and use spaces comfortably.
- **Interior–Exterior Links:** Connect inside and outside spaces to enrich experience and integrate with the surroundings.

IV.2 User Needs and Activities

Understanding the needs, behaviors, and activities of the users is essential for designing functional spaces.

Architects often conduct research and analysis to determine the specific requirements of the people who will inhabit or utilize the building.

IV.3 Building Codes and Regulations

Architects must adhere to building codes, regulations, and standards that govern safety, accessibility, environmental sustainability, and other aspects of construction.

Compliance with these requirements ensures that buildings are safe, habitable, and legally permissible.

IV.4 Flexibility and Adaptability

Designing with flexibility means creating spaces that can respond to changing needs: whether social, operational, or technological. This is crucial for facilities that serve diverse or evolving user groups over time.

Adaptable structures are not fixed in form or function; they use modular layouts, movable partitions, scalable systems, and multi-purpose zones to support future changes without requiring major renovations.

This kind of design improves spatial longevity, allowing buildings to remain relevant and efficient across different phases of use.

IV.5 Contextual considerations

Architectural design is fundamentally shaped by many contextual factors: climate, topography, culture, history, and urban dynamics, each contributing to the identity and functionality of built environments. Responsive design begins with understanding these parameters not as constraints, but as opportunities for innovation.

- **Climate and topography**

Climate-adaptive architecture leverages passive design strategies such as natural ventilation, solar orientation, and thermal mass to reduce energy demands and improve occupant comfort. Topographical features offer potential for spatial layering, terracing, and contextual framing, turning elevation, slope, or water bodies into design assets.

- **Cultural and historical context**

Drawing from local traditions and architectural heritage allows designers to embed meaning and continuity into new constructions, preserving collective memory while embracing innovation.

- **Urban context and livability**

Urban context refers to the surroundings and conditions in which a building or space exists—its streets, neighboring structures, local economy, culture, and rhythms of daily life. Livability is about how well a space supports people’s well-being, comfort, and everyday activities.

Good architectural design responds to the urban context by:

- Respecting scale and character of nearby buildings
- Connecting to public spaces like parks, sidewalks, and plazas
- Improving mobility, especially for walking, cycling, or public transport

IV.6 Sustainability:

Sustainable design means creating smart, healthy spaces that are good for people and even better for the planet by reducing the environmental footprint of buildings, promoting smarter use of resources, and prioritizing people’s health and comfort. It’s not just about green technology, but about thoughtful decisions at every stage of design.

Here are some key principles of sustainable design:

- **Energy efficiency:** Buildings should consume less energy through design solutions (such as orientation, insulation, and natural lighting) and technology systems (such as solar panels and high-efficiency heating and cooling).
- **Resource conservation:** Using local and recycled materials, reducing waste, and designing for longevity help preserve natural resources.
- **Occupant well-being:** Healthy indoor environments (good air quality, daylight access, thermal comfort), support physical and mental wellness.

IV.7 Aesthetic Expression:

Balancing functionality with aesthetics is essential in architectural design because it ensures that spaces not only perform effectively in terms of usability, safety, and energy efficiency but also inspire and engage through visual appeal, cultural resonance, and emotional connection.

A well-designed space seamlessly integrates practical elements like layout, comfort, and environmental performance with artistic qualities such as form, light, texture, and style, resulting in environments that people can use intuitively, enjoy visually, and remember meaningfully.

V. The relationship form/space/function

The relationship between form, space, and function in architecture and design is fundamental. Form refers to the three-dimensional shape of an object, while space is the area or volume it occupies or defines. Function is the purpose or use of the space. These three elements are interconnected; the form of a structure shapes the space, and the intended function dictates the form and spatial organization.

Indeed, the principle that "form follows function" remains relevant, while being enriched by Tschumi's perspective: "form follows fiction," which emphasizes that narratives and culture precede function.

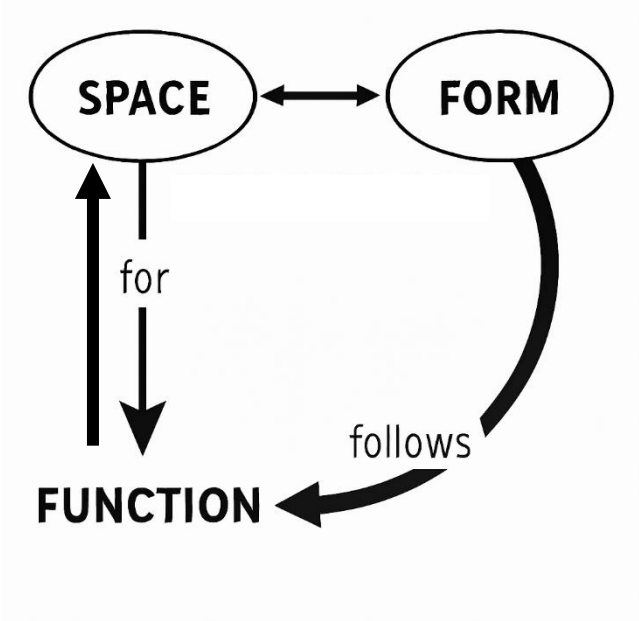


Figure 50: The relationship form/space/function

Source: author, 2025

Conclusion:

Function is not merely a technical requirement, it is the driving force behind spatial logic, user experience, and architectural meaning. It determines how spaces are used, navigated, and perceived, shaping both the form and the organization of space. While form and space may complement one another visually and conceptually, it is function that anchors them in purpose and relevance.

Chapter 4: Structure in architecture. The relationship between form, space and structure

Introduction

Structure is what holds a building up. But structure isn't just about support, it also helps shape how a building looks and feels. In many designs, the structure is part of the beauty, showing patterns, shapes, or ideas. It connects the building's purpose with its form.

I. Definition and historical notes

Structure refers to the load-bearing system of a building—its framework of beams, columns, slabs, and foundations. It forms the skeletal core that supports, stabilizes, and shapes architectural form.

At first glance, structure appears to serve only a technical function, ensuring the building's stability. This perception has historically created a conceptual divide between structure and architecture, where the latter was often treated as a superficial layer applied over a rigid framework. In earlier periods, this disconnect led to buildings that lacked spatial and formal harmony, resulting in designs where architecture merely concealed the structural system rather than engaging with it.

However, following the Industrial Revolution, the emergence of new materials and construction techniques gave rise to innovative architectural movements such as Modernisme, and later High-Tech architecture.



The Sydney Opera House, designed by Jørn Utzon, stands as an emblematic example of 20th-century architecture where structure and form are inseparable. Its iconic silhouette emerges directly from its structural concept: two series of three vast, overlapping “shells.” Rather than concealing the framework, the building's structure defines its spatial identity, illustrating how architectural expression can be born from structural innovation.

Figure 51: The Sydney Opera House

<https://www.bbc.com/travel/article/20231102-the-sydney-opera-house-the-monument-that-represents-australia>



Santiago Calatrava.
“I try to break down the boundaries between architecture and sculpture, and to see architecture as art”

The structure in Calatrava's work is an important component of the architecture and the aesthetics of the building,

Figure 52: Lyon station, By Santiago Calatrava.

https://calatrava.com/projects/lyon-saint-exupery-airport-railway-station-colombier-saugnieu.html?view_mode=gallery&image=2

II. The relationship between structure and architecture

Structure and envelope are two key elements in shaping architectural form. Their interaction and the way they evolve together, plays a major role in how buildings are designed and built.

As construction technologies have advanced, the balance between structure and envelope has led to a new generation of buildings that are both technically innovative and visually striking.

This relationship between structure and architecture can be understood as follows:

II.1 Structural design

In architectural design, structural requirements such as: load distribution, material behavior, and stability do not merely serve technical functions. When thoughtfully integrated, they become part of the building's formal logic and contribute to its visual language.

Rather than being hidden or treated as a constraint, the structure can guide the overall form, influencing proportions, rhythm, and spatial organization. Beams, columns, trusses, and other elements are not only calculated for performance but also composed for expression—creating architecture that is both rational and poetic.

This approach allows structural design to act as a generator of form, where engineering principles shape the aesthetic and spatial experience. It reflects a deeper synthesis between architecture and structure, where form follows force, and force becomes form.

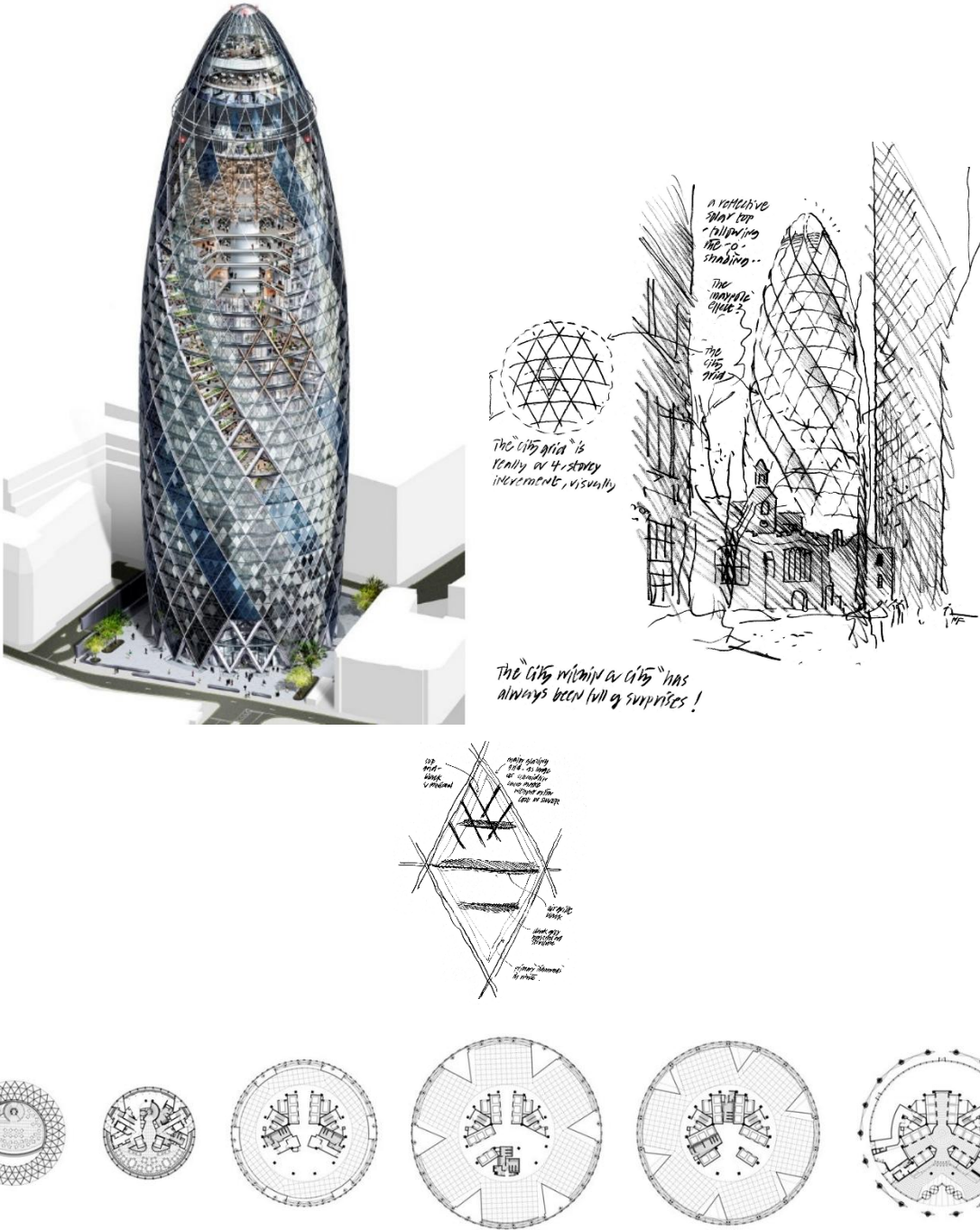


Figure 53: Le30 St Mary Axe (the Gherkin) London by Norman Foster

<https://www.fosterandpartners.com/projects/30-st-mary-axe>

II.2 Structure as design

Structure as design refers to the integration of structural elements such as beams, columns, and load-bearing systems, into the architectural language of a project, where engineering logic becomes a driver of form and expression.

Rather than concealing the mechanics of support, this approach celebrates them, using material properties, load paths, and modular rhythms to shape spatial experience and visual identity. Iconic examples like the Centre Pompidou or the Seagram Building demonstrate how structure can be both functional and poetic, reinforcing the idea that architecture is not just built, but composed through the articulation of force.

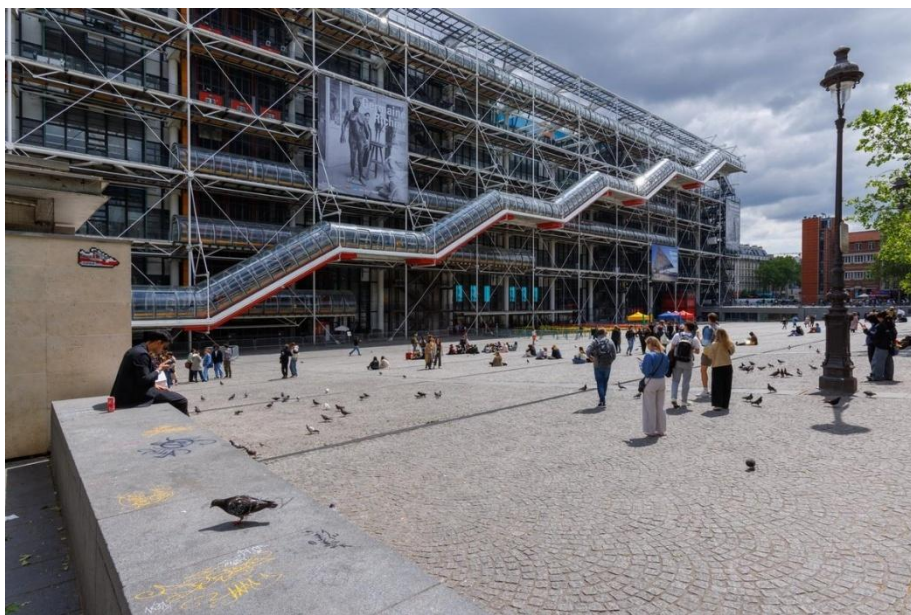


Figure 54: The Centre Pompidou in Paris by Renzo Piano and Richard Rogers

<https://www.centrepompidou.fr/fr/le-centre-pompidou-se-metamorphose/une-architecture-icone>

II.3 Structure ignored

Structure ignored or neglected structure refers to architectural approaches where the structural system is treated purely as a technical necessity, with little or no consideration for its visual or spatial contribution. In such cases, the structure is concealed or minimized, excluded from the aesthetic and conceptual narrative of the building.



Figure 55: Michigan Theatre

<https://www.historicdetroit.org/buildings/michigan-theatre>

II.4 Accepted structure

It refers to architectural designs where structural requirements significantly influence the form and layout of the building, even though the structure itself is not overtly exposed or celebrated. The Chapelle Notre-Dame-du-Haut in Ronchamp, designed by Le Corbusier and completed in 1955, is a powerful example of accepted structure in architecture. At Ronchamp, Le Corbusier shaped the chapel's form through structural needs, curved walls, a floating roof, and asymmetry all respond to material and load-bearing logic. Yet the structure remains visually discreet: the concrete frame is hidden within thick walls, and the roof appears to levitate thanks to concealed supports.



Figure 56: The Chapelle Notre-Dame-du-Haut in Ronchamp by Le Corbusier

<https://lecorbusier-worldheritage.org/chapelle-notre-dame-du-haut/>

III. Type of structure

The envelope typically consists of:

- **Load-bearing parts:** Structural elements that carry loads, such as walls, columns, beams, or frames.
- **Covering parts:** Elements that provide protection against weather, thermal insulation, and aesthetics. These can be horizontal (like roofs), vertical (like walls or facades), or inclined surfaces.

In many building designs, the load-bearing and covering functions are integrated into the same architectural or constructional elements.

III.1 Definition of load-bearing capacity

The load-bearing capacity of the structure is the maximum load it can support without experiencing failure or excessive deformation.

This capacity depends on several factors including the materials used (such as steel, concrete, timber), the design of the structural elements (beams, columns, walls), and the stability of the foundation soil.

A well-designed structure ensures stability, safety, and durability by efficiently transmitting these loads through structural components to the ground.

Architects and civil engineers carefully analyze and calculate the structure's load-bearing capacity as a fundamental step in building design. This ensures that each load path is capable of handling its respective forces without compromising the integrity of the building, taking into account safety factors and serviceability requirements.

III.2 The main components of a building structure

The building structure is generally composed of two main parts that work together to support the entire construction:

III.2.1 The Infrastructure (Substructure)

The infrastructure, also known as the substructure, comprises all parts of the building that are below ground level. This includes the foundation, basement, footings, piles, and any retaining structures. The substructure's primary function is to safely transmit the loads received from the superstructure down to the soil or rock beneath. It ensures stability by accommodating soil pressure and preventing settlement or movement that might compromise the overall integrity of the building.

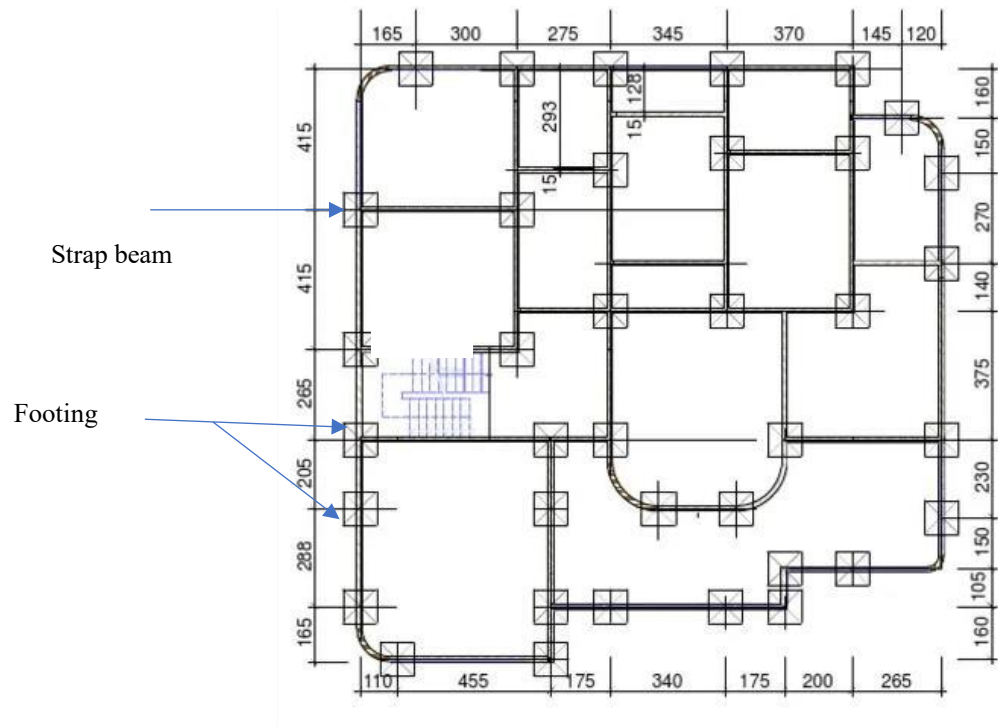


Figure 57: Foundation plan

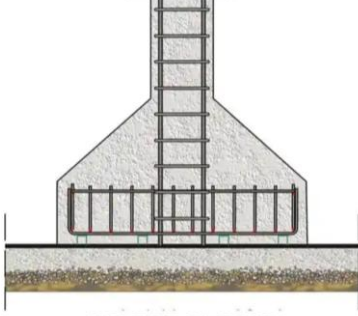
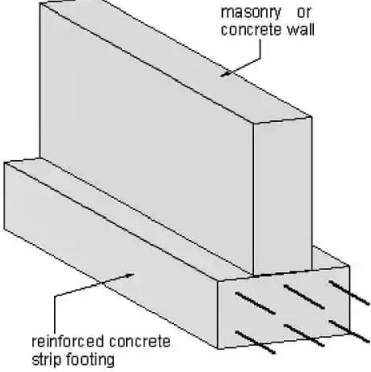
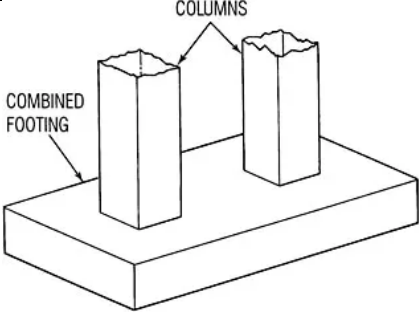
In the context of foundation and civil engineering, infrastructure is typically classified into two main categories based on depth:


- **Shallow Infrastructure**

Shallow structures are built close to the ground surface, typically within the upper few meters of soil, and are commonly used for applications such as strip footings, or isolated footings...etc. (Tab.3). Their main advantages include cost-effectiveness, ease of construction and maintenance, and suitability for stable soils and lightweight structures.

However, they are not recommended for areas with weak or compressible soils due to their limited load-bearing capacity, which can compromise structural integrity under heavier loads or unstable ground conditions.

Table 3: Types of footings

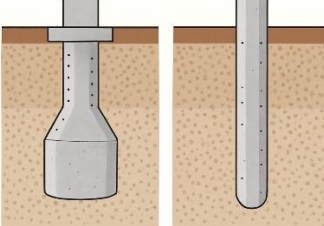
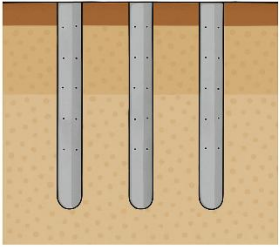
Type of footings	Function	Figure
<p>Isolated Footings</p>	<p>These types of footings may be square, circular, or individually rectangular slab of uniform thickness provided under each column.</p>	 <p style="text-align: center;">ISOLATED FOOTING</p> <p style="text-align: center;">https://dailycivil.com/types-footings-used-building-construction/</p>
<p>Strip Footing</p>	<p>Strip footing is a component of shallow foundation which distributes the weight of a load bearing wall across the area of the ground. It is also known as wall footing.</p> <p>This type of footing is commonly used as foundations of load-bearing walls where the soil is of good bearing capacity.</p>	 <p style="text-align: center;">https://dailycivil.com/types-footings-used-building-construction/</p>
<p>Combined footing</p>	<p>When two or more columns are supported by a footing it is called combined footing. This type of footing may be rectangular or trapezoidal in plan. Combined footing is provided under the following situations:</p> <ul style="list-style-type: none"> • When columns are close to each other and their individual footings overlap. • Soil having low bearing capacity and requiring more area under the individual footing. • The column end is situated near the property line and the footing can not be extended. 	 <p style="text-align: center;">https://dailycivil.com/types-footings-used-building-construction/</p>

<p style="text-align: center;">Raft Foundation</p>	<p>This foundation covers the entire area under the structure. This foundation has only RCC slab covering the whole area or slab and beam together.</p> <p>These types of footing are adopted when heavy structures are to be constructed on soft made-up ground or marshy sites with uncertain behavior. Raft foundation is also known as mat foundation.</p>	 <p>https://dailycivil.com/types-footings-used-building-construction/</p>
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- **Deep Infrastructure**

Deep structures extend well below the ground surface to reach stable soil layers, making them essential for complex infrastructure such as caissons foundations, pile foundations. Their key advantages lie in their ability to provide high structural stability, support substantial loads, and adapt to challenging geotechnical conditions. However, these benefits come with higher construction costs and the need for specialized equipment and technical expertise, making deep foundations more suitable for demanding environments and large-scale projects.

Table 4: Types of deep foundations

Type of deep foundation	Brief Description	Figure
Caisson foundation or drilled shaft	Enlarged vertical excavation, often filled with reinforced concrete. Used for heavy loads.	 <p style="text-align: center;">Generated by AI</p>
Pile foundation	Long, slender element driven into the ground to transfer loads to deep, stable soil layers.	 <p style="text-align: center;">Generated by AI</p>

III.2.2 The superstructure



The term superstructure refers to the part of a building or construction that is above the ground level or foundation. It's everything that rises above the base and contributes to the visible, functional, and architectural aspects of the structure.


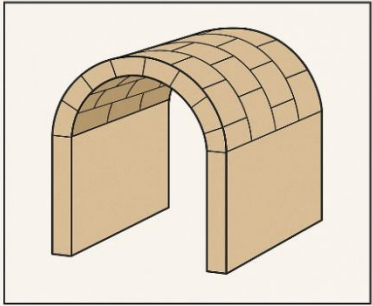


In construction and architecture: Superstructure includes walls, floors, roofs, columns, beams, and any other components built above the foundation.

It supports the loads from occupants, furniture, and environmental forces like wind or snow.

- **Traditional Structures:** often reflect cultural heritage and local materials: think bamboo huts, timber-framed houses, pagodas, and stone temples. They emphasize craftsmanship, climate adaptation, and symbolic design.

Table 5: Types of traditional superstructure


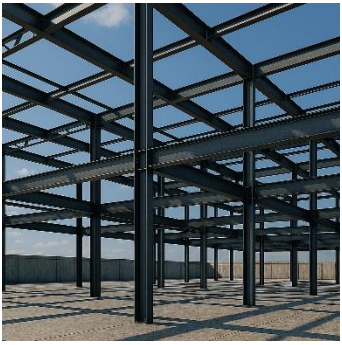

Type	Structural Role	Common Materials		Figure
Load-bearing walls	These walls support vertical loads from roofs, floors, and upper stories.	Stone & Brick Masonry	Dominant in Mediterranean and North African vernacular architecture.	 https://www.alamy.com/texture-of-brickwork-and-stone-masonry-background-of-an-old-wall-combination-of-plinths-special-thin-brick-and-limestone-as-as-building-materials-image471226190.html
		Adobe or Earth Blocks:	Used in arid regions for thermal mass and local availability.	 https://algerie-architecture.com/

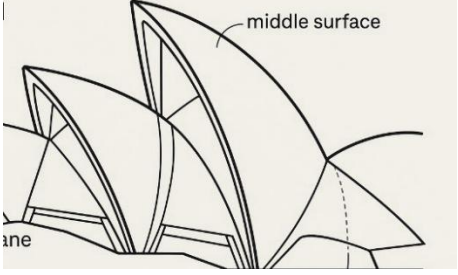
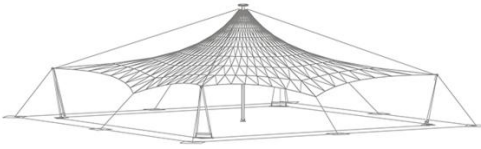

		<p>Timber Frames (wood)</p>	<p>Seen in traditional European and some, in USA, turkey...etc.</p>	 <p>https://www.gettyimages.com/detail/photo/traditional-wooden-buildings-in-istanbul-turkey-royalty-free-image/530293861</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Domes and vaults</p>	<p>A vault is a curved roof formed by extending an arch, designed to channel compressive forces downward and sideways. Common in corridors and naves, it appears in forms like barrel, groin, and ribbed vaults.</p>	 <p>Barrel vault: genrated by AI</p>  <p>Groin vault: genrated by AI</p>		
	<p>A dome is a rounded architectural element that resembles the upper half of a sphere or an arch rotated around its vertical axis. It's often used to crown buildings with grandeur</p>		 <p>A dome: genrated by AI</p>	

- **Modern Structures :**

A modern superstructure integrates structural elements such as columns, beams, walls, floors, roofs with contemporary materials that reflect technological innovation, environmental responsiveness, and aesthetic clarity

Table 6: Types of modern superstructure

Type	Structural Role	Figure
Post and beam	<p>Post and beam system A structure made up of posts and beams is covered by a shell.</p> <p>This system has been widely used since the 19th century, thanks to the emergence of new materials.</p> <p>A column-beam system is a series of portals spaced a certain distance apart, called a span,</p> <p>The portal frame is made up of two columns connected by a beam.</p> <p>Portals can be made of reinforced concrete, steel or wood</p>	<div style="text-align: center;">  <p>A concret post and beam sutructure: genrated by AI</p> </div> <div style="text-align: center; margin-top: 20px;">  <p>A steel post and beam sutructure: genrated by AI</p> </div> <div style="text-align: center; margin-top: 20px;">  <p>Wooden (Timber) post-and-beam</p> </div>

<p>Thin-shell system</p>	<p>It is a structural system composed of curved surfaces whose thickness is small relative to their other dimensions. These systems are designed to efficiently carry loads primarily through membrane action (tension and compression) rather than bending.</p>	 <p>Thin-shell system of Opera of Sydney : generated by AI</p>
<p>Stretched structure</p>	<p>Textile structures are a flexible, cost-effective construction system that can span large spans. They are suitable for a wide range of applications, including urban spaces, theme parks, shopping centres, sports facilities and the hotel industry.</p>	
<p>Inflatable systems</p>	<p>Inflatable systems have largely met the needs of users of non-permanent covers, Hot-air balloons gave manufacturers the idea of using inflated volumes to cover large areas (always for specific periods). Inflatable structures do not require a tensioning structure, as is the case with stretched canvas, but only an anchoring system.</p>	 <p>https://www.vector-build.com/pnevmo/eng_pnevmo69.htm</p>

Conclusion

Structure in Vitruvius’s triptych is not just about strength, it also helps shape how spaces work (utilitas) and how they look and feel (venustas). Whether visible or hidden, it acts like a language that connects how a building is built with how people experience it, both practically and emotionally.

Chapter 5 : The projection process: Scales & stages.

Introduction

This chapter tries to give a definition of the architectural project, while acknowledging that such a definition is inherently difficult to fix. The architectural project is not a static object but a concept in perpetual evolution, shaped by context, scale, intention, and time. Rather than offering a rigid formula, the chapter explores how the project unfolds through successive stages, each refining and reinterpreting the initial vision as it moves from idea to build reality.

I. Definition of the architectural project

The concept of the project has long been intrinsic to architecture, but it is during the Quattrocento that a decisive separation emerges between design and execution. This historical moment marks the birth of the architectural project as an autonomous intellectual act, where drawing, planning, and conceptualization become distinct from the act of building. The architect begins to operate not only as a master builder but as a thinker and designer, giving rise to architecture as a discipline grounded in representation, intention, and spatial foresight.

The idea of a "project" is often unclear or used in many different ways. But in architecture and other fields, it's important to give it a clear and objective meaning. A project is more than just an idea, it is a planned process that helps turn a concept into something real.

In architecture, it connects design, space, and purpose, helping guide decisions from the first sketch to the final building.

- “The project is one of those rare figures that stand somewhere between theory and practice [...]. It could therefore be one of those objects responsible for reconciling theory and practice by putting one foot in the realm of discourse and the other in that of doing” (Boutinet, J. -P. 1990).

- Philippe Boudon finds it preferable to speak in terms of design, and secondly to designate the completed building that is the product of this design as an "architectural object". (Boudon P.2003).
- Donald Schön, prefer to talk about a project situation, which they see as a situation of "uncertainty, instability, singularity and conflict of values". (Schön, 1994, P.75)

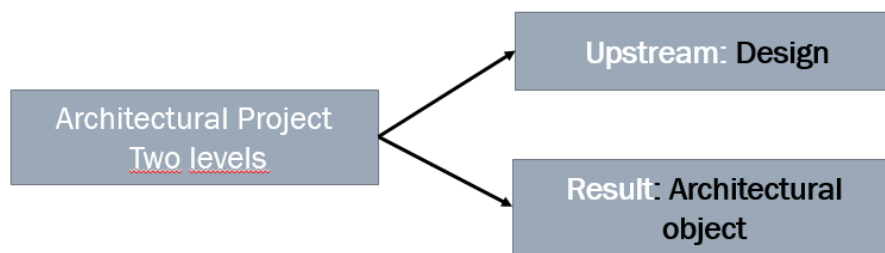


Figure 58: Two levels of the architectural project

Author 2025

- Jean-Pierre Chupin sees that the project: "Consists in bringing together heterogeneous realities, with no prior logical relationship between them :
 - A social programme,
 - Supporting structures,
 - Fluid networks,
 - Urban forms,
 - Regulations,
 - Colours, materials, etc.,

II. Architectural Design: Singular Purpose, Shared Methodology

The development of an architectural project is inherently singular, shaped by its future purpose, specific context, and unique historical trajectory, making exact repetition impossible.

While it never merely replicates a pre-existing model, similarities may emerge across projects due to recurring phases and procedural patterns.

Despite variations in stakeholders, budget, and environmental conditions, each project must navigate a set of essential stages that structure its progression, ensuring coherence and feasibility within the broader architectural and regulatory framework.

III. Participants in the construction project

III.1 The project owner

It is the initiating client, responsible for commissioning and overseeing the development.

This role may be fulfilled by a private individual or a professional entity within the public or private sector.

As the originator of the project request, the project owner defines the objectives, secures funding, and ensures that the construction aligns with their expectations, regulatory requirements, and strategic goals.

The project owner has a number of tasks that do not require any technical skills:

- Establishing and communicating requirements,
- Drawing up full specifications,
- Defining the works schedule and budget.

The project owner has the final decision making powers and is responsible for paying the bills. The customer is usually accompanied by a project manager, who advises the customer on all decisions.

III.2 The project manager

The project manager serves as the central orchestrator of the construction project, ensuring that all phases progress efficiently and in alignment with the client's objectives.

While this role is most commonly assumed by the architect, it may also be fulfilled by other professionals such as a technical design office or engineering consultant, depending on the project's complexity and contractual arrangements.

The architect, when acting as project manager, is responsible for coordinating the various stakeholders, supervising site activities, and maintaining coherence between design intent and execution. Throughout the process, they provide continuous support and strategic guidance to the client, facilitating informed decisions and smooth project delivery.

III.3 Companies /Building contractors

The role of building contractors is to execute construction work by mobilizing the necessary personnel, materials, and equipment, while strictly adhering to deadlines, site schedules, and technical specifications.

Contractors may operate as general contractors, overseeing the entire project, or as single-lot contractors responsible for specific trades. They often engage subcontractors for specialized tasks such as electrical installations, tiling, or painting. In such cases, the subcontractors fall under the responsibility of the contracting company.

IV. Scales of the architectural project

Scale is a key tool in architectural design, linking physical reality to its representation. It guides the level of detail and reflects the project's stage, smaller scales for broad concepts, larger ones for technical precision. Choosing the right scale depends on the purpose, audience, and required accuracy.

IV.1 Territorial scale

It usually uses Small scales of representation: 1:50.000 to 1:2.000 (drawings that reduce reality).

They are best suited for large dimensions. They are commonly used in cartography, regional and urban maps, and even small towns, as they allow for the visualization of broad, comprehensive data.



Figure 59: Map of Material Flows - Physical traces of commodities trading. Courtesy of the Brazilian Pavilion at the Venice Biennale 2018

<https://www.archdaily.com/904882/understanding-and-using-architectural-scales/5bd76b4bf197cc1727000219-understanding-and-using-architectural-scales-image?auth=hadid>

IV.2 Urban / Site scale

At the urban scale, projects that require contextual analysis without covering vast territorial areas are best represented at scales between 1:1000 and 1:500. These scales are ideal for site plans, offering a clear view of a building's placement within its surrounding urban fabric, such as: a block or neighborhood. They allow for the identification of key elements like infrastructure availability and circulation patterns. In research and survey contexts, these scales are also useful for analyzing building heights, land use, and spatial relationships.



Figure 60: Urban fabric at 1/1000

Generated by AI

IV.3 Architectural scale:

As the design process progresses, scale becomes a key tool for adjusting the level of detail and focus. Intermediate scales like 1/250 and 1/200 are ideal for site plans and early design studies, making spatial relationships and key components legible. Larger scales such as 1/100 and 1/50 allow for more precise representations, suitable for structural elements and refined layouts. In all cases, the choice of scale should reflect the intent of the representation and highlight the most relevant aspects of the project.

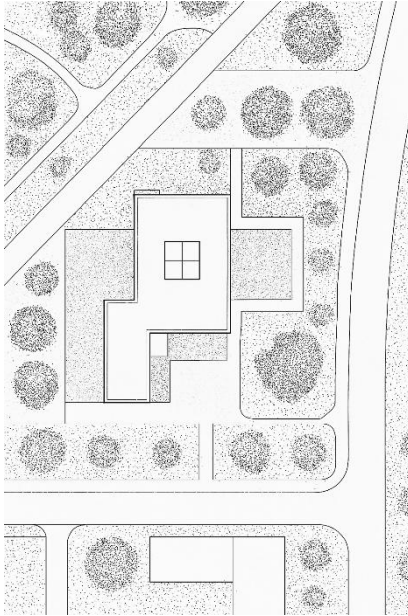


Figure 61: Site plan at 1/200

Generated by AI

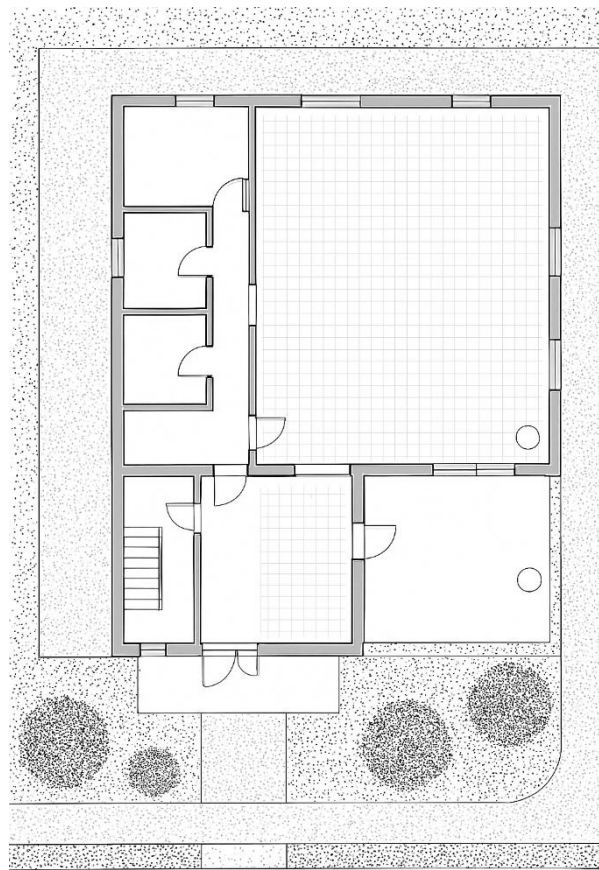


Figure 62: Architectural plan at 1/100

Generated by AI

IV.4 Detail scale

At the detail scale, typically 1:20 or 1:10, representation focuses on smaller elements like furniture, fixtures, and construction joints. These scales are essential for both architects and furniture designers, as they allow for precise visualization of components, materials, and assembly logic. Because the objects are smaller, a larger scale is necessary to clearly express their structure, proportions, and functional relationships, making these drawings crucial for fabrication, technical coordination, and design refinement.

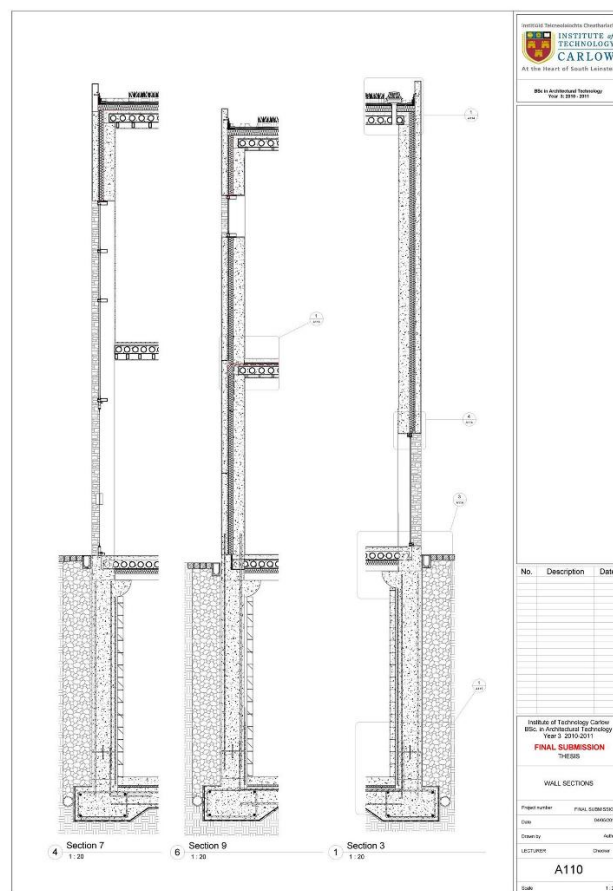


Figure 63 : Detail scale

<https://www.behance.net/gallery/21689735/ARCH-TECH-Revit-Leisure-Centre-Project/modules/145137101>

V. The main phases of an architectural project

The elaboration of an architectural project unfolds in two distinct yet interdependent stages.

- **The first is the preparatory phase**, which encompasses the conceptual design, technical planning, and site preparation necessary to establish the project's feasibility and coherence.

This phase enables the client's requirements to be translated into a program. the building to be designed and the consultation with contractors to be organized. It is led by the client and the project management team.

- **The second is the operative phase**, marked by the physical realization of the project on-site, where design intentions are translated into built form through coordinated execution.

This stage is carried out by construction companies, who are subject to cost, deadline and quality constraints.

Within these two main stages, we can identify several phases that correspond to key moments in the life of a project:

- The design and cost estimation phase,
- The tendering and site preparation phase (construction choices, operating procedures, methods and planning),
- The construction phase (structural work, finishing work), which may involve
- A large number of subcontractors,
- The handover

VI. Focus on the preparatory phase

VI.1 The Sketches

The sketches represent the first phase of an architect's work. Also referred to as feasibility studies or preliminary studies, they serve as a critical starting point for evaluating the potential of a site or building before initiating detailed design processes.

This phase fulfills two essential functions:

- **Assess Project Feasibility**
 - Conduct a summary inventory of existing conditions
 - Identify constraints and opportunities of the site or structure
- **Define the Architect's Remit**
 - Establish the scope and terms of the assignment
 - Provide a summary of intended works
 - Include initial sketches and 3D visualizations

Sketches enable the architect to:

- Analyze the advantages and disadvantages of a plot or building.
- Determine whether the project is viable before committing to full-scale design.
- Align expectations between stakeholders through visual and contractual clarity.

VI.2 Preliminary Design

Following the preliminary studies, the architect begins work on the general design of the project. This phase marks the transition from feasibility to conceptualization and aims to:

- Define the main dimensions of the structure
- Establish the general appearance and architectural intent
- Provide a first version of the final project, serving as a basis for refinement

During this stage:

- The project manager and the client engage in discussions.
- Proposed plans are reviewed, adjusted, and validated.
- Key decisions are made regarding spatial organization, aesthetics, and technical feasibility.

VI.3 Final Design

The final design phase marks the culmination of the architectural project. It transforms conceptual intentions into a precise and executable plan, serving as the foundation for technical documentation and construction.

This stage aims to:

- Establish the definitive dimensions of the building
- Justify the technical solutions adopted
- Specify the materials to be used

- Draw up a detailed description of the work

Table 7: Comparative Table between the main phases of the preparatory phase of the project

Phase	Sketch / Feasibility Study	Preliminary Design	Final Design
Main Objective	Assess site potential and project feasibility	Define the general concept and layout	Finalize dimensions and technical solutions
Architectural Content	Initial sketches, massing studies, 3D visuals	General plans, spatial organization, volumetry	Detailed plans (floor layouts, sections, façades)
Technical Data	Site data (soil, topography, climate, networks)	Conceptual approach to systems and structure	Justification of chosen technical solutions
Materials	Not specified; exploratory phase	Suggested or indicative materials	Precise specification of materials
Project Description	Summary of site constraints and opportunities	Summary of design intentions	Detailed description of works and execution
Client–Project Manager Interaction	Define scope and expectations	Discuss design direction and options	Validate choices and prepare for execution
Level of Precision	Exploratory / diagnostic	Approximate / conceptual	Precise / construction-ready

Author, 2025

VII: Evolution of the triad form / space / function throughout the architectural design process:

In architectural design, the interplay between form, space, and structure evolves across each project phase, shaping how ideas are conceived, organized, and built.

- **Form** begins as conceptual massing during the sketch and feasibility phase, then becomes more refined in the preliminary design phase through adjusted geometry and expressive intent. In the final design phase, it is fully defined, integrating structure, materials, and technical constraints.
- **Space** is first explored through functional needs and user flows. It is then organized into clear zones and circulation paths during the preliminary design phase, and finally dimensioned and optimized in the final design phase for coherence and usability.

- **Structure** starts as an intuitive framework, develops into a coordinated system during the preliminary design phase, and is fully detailed in the final design phase to ensure stability and alignment with the architectural form.

Conclusion:

The architectural projection process is not a linear checklist, but a layered progression that unfolds across scales and stages, from conceptual sketches to execution-ready plans.

Each phase builds upon the previous, refining intentions, integrating constraints, and aligning technical, spatial, and regulatory dimensions.

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