



Organic Architecture, the Gaia Charter and Frank Lloyd Wright

Ionic volute Ephesus Turkey

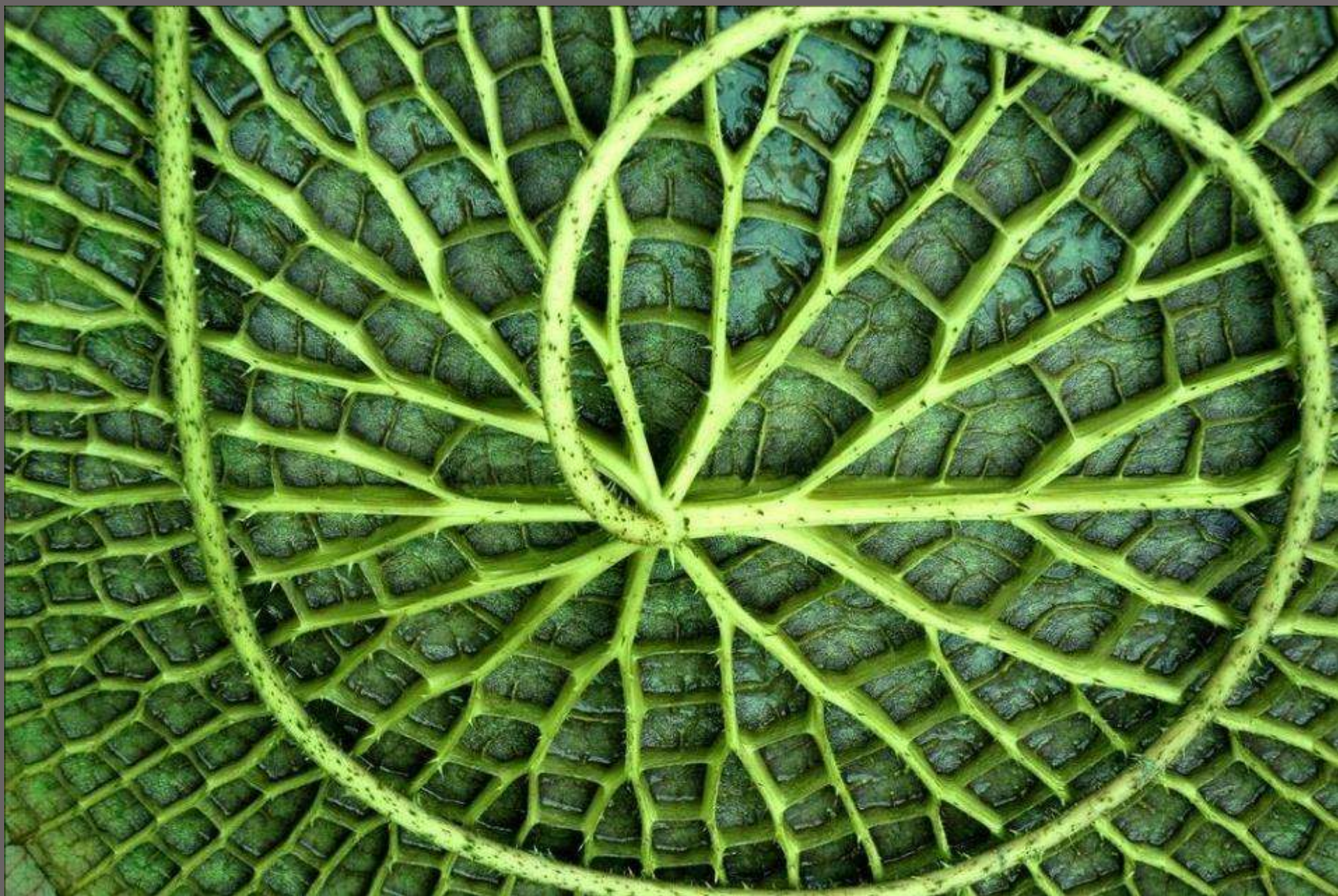
- Organic architecture? Discuss.....

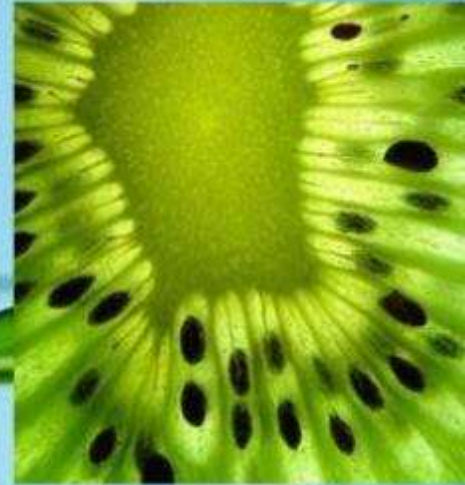
Organic?

- **Origin** - Late Middle English: via Latin from Greek organikos 'relating to an organ or instrument'.
- Denoting or characterized by a harmonious relationship between the elements of a whole - *'the organic unity of the integral work of art'*
- Characterized by gradual or natural development - *'the organic growth of community projects'*

Architecture?

- Architecture – ‘the art and practice of designing and making buildings’
- What would constitute ‘inorganic architecture?’





Organic Architecture

Roots and Concepts

- Primitive vernacular architecture was innately organic, based on natural forms and structures and simple, local materials.
- More deeply, it was part of a spiritual continuum of survival and fertility, life and death that linked earth to spirit.

PLAN OF PREHISTORIC DWELLINGS AT SKARA BRAE



Skara Brae





Skara Brae is a stone-built Neolithic settlement, Bay of Skail on the largest Orkney island in Scotland. Consisting of eight clustered houses, it was occupied from roughly 3180 BCE to about 2500 BCE

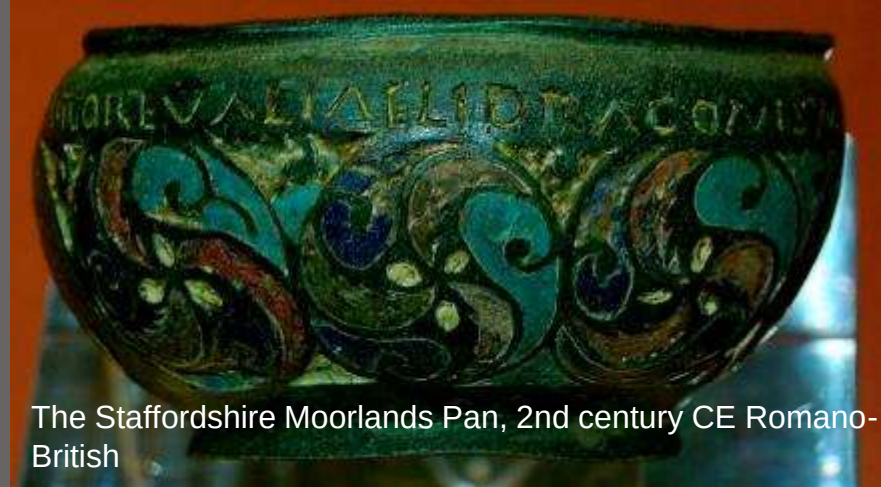
CELTIC ART

- Early Celtic art, like nature, abhorred straight lines and preferred the organic forms of the tree, plants, water, and earth.
- Rather than representing nature as it appears, the Celtic artist expressed a mystical and ambiguous world of highly stylized abstract forms.



Celtic gold-plated bronze disc from Auvers-sur-Oise, Val-d'Oise, dated to early 4th century BCE

CELTIC ART



The Staffordshire Moorlands Pan, 2nd century CE Romano-British



Carved stone ball from Towie in Aberdeenshire, 3200–2500 BCE

Egyptian Art and Architecture

- Egyptian and Ancient Greek civilizations studied natural forms and the human body and abstracted them as geometry.
- They used the circle, ellipse, triangle, and rectangle to derive harmonious proportions for their shrines and temples and so promote harmony between themselves and their elemental gods and spirits of earth and cosmos.



Temple of Horus at Edfu, Egypt, 237 BCE







The Ascendancy of Geometry

- Plato believed that all things flow and change in nature but are directed by eternal and immutable patterns, forms, or ideas that are the true reality.
- Aristotle, however, as a founder of the scientific approach, used observation to understand and classify nature.

PRIMITIVE HUT



The idea of the primitive hut stems from Vitruvius' *Ten Books of Architecture*, but owes its place in architectural theory to the *Essay on Architecture* published by the Abbé Laugier in 1753. Advocating the 'honest' structural use of the Classical Orders, Laugier proposed a cleansing of architecture by returning to its origins.



- The Doric temples at Paestum in southern Italy feature the most generous – *entasis* - of any surviving ancient Greek buildings much admired by Neoclassical architects. Whatever its elaboration, the post and lintel is the fundamental form used in buildings all over the world.

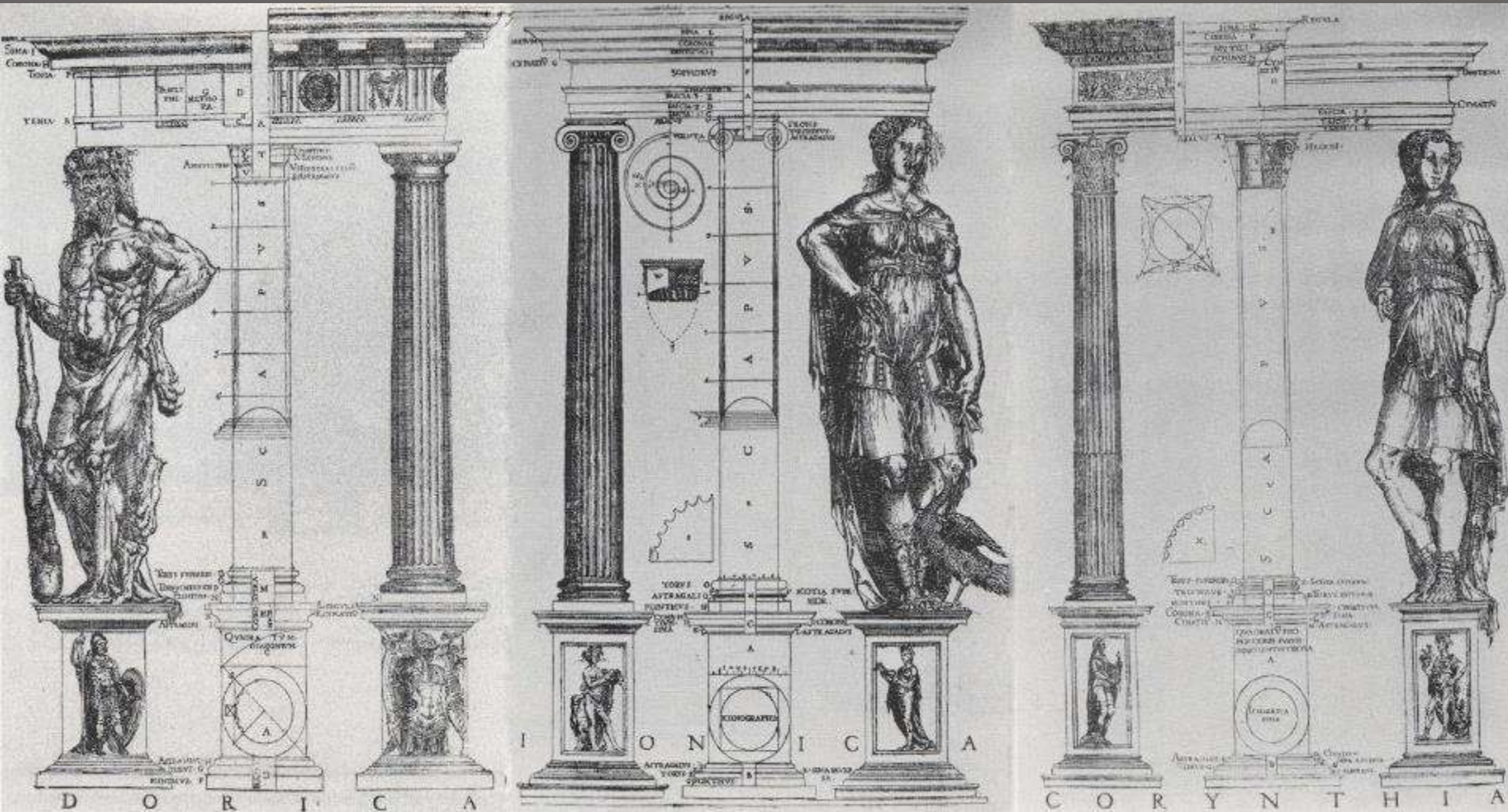
ROMAN ARCHITECTURE

- The Romans moved on from philosophy to practice and to develop arches, vaults, and domes - structurally stronger and more economical of materials than earlier straight post and beam designs.

Roman Architecture

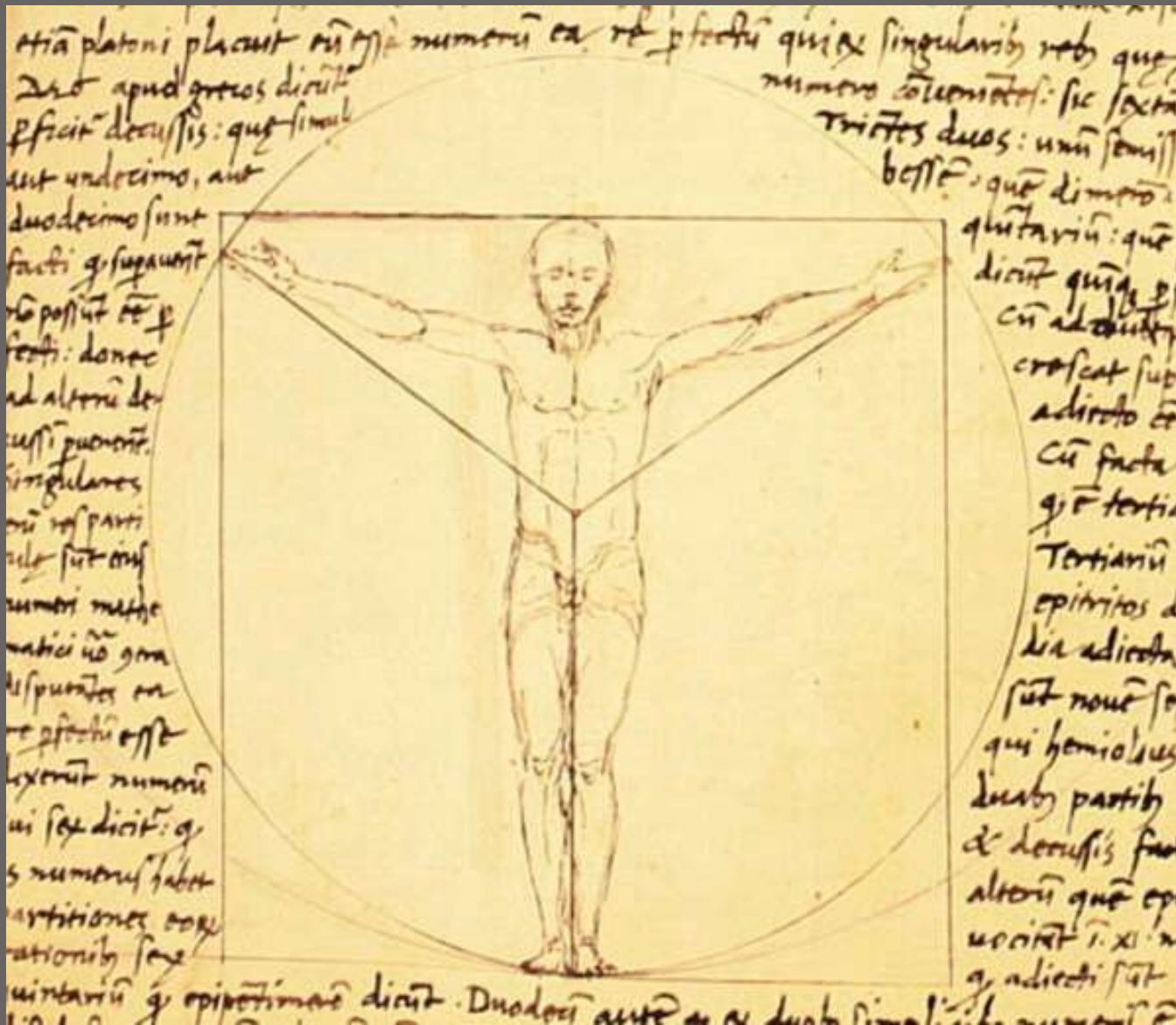


The Roman Hall - Chiesa di S. Bernardo alle Terme, Rome 306 CE



- Vitruvius saw architecture as the imitation of nature. Just as birds and bees nests, so humans construct housing from natural materials to shelter them against the elements.

The Ascendancy of Geometry



homo quadratus - the figure of a man

Mathematics and Geometry

- Mathematics is an instrument that has been used by builders throughout history. To this day, it remains a bridge between design and construction.
- Geometry, the branch of mathematics exploring spatial characteristics of bodies and relationships between them, has been an inspiration and a tool for architectural design since ancient times.

Geometric shapes

- **Geometric shapes** - The earliest civilizations found their inspiration for simple, basic geometric shapes in nature.
- They created harmonic proportions by connecting the circle, ellipsis, triangle and rectangle (i.e. the Golden Section), which generated the logarithmic spirals, basic curves and growth.

Geometric shapes

- From basic geometric shapes, the Etruscans developed the arch and the vault, and the Romans continued this development by expanding it into the dome.



Greek Architecture - Parthenon and the Golden Section.

GOLDEN SECTION

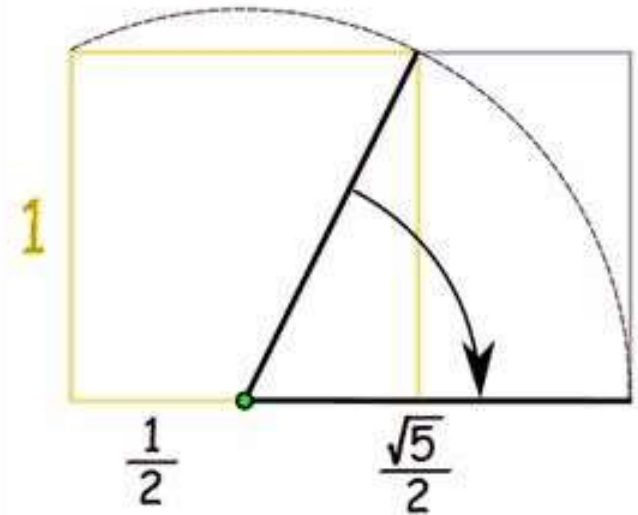
- By means of the Golden Section, the

Drawing It

Here is one way to draw a rectangle with the Golden Ratio:

- Draw a square (of size "1")
- Place a dot half way along one side
- Draw a line from that point to an opposite corner (it is $\sqrt{5}/2$ in length)
- Turn that line so that it runs along the square's side

Then you can extend the square to be a rectangle with the Golden Ratio.



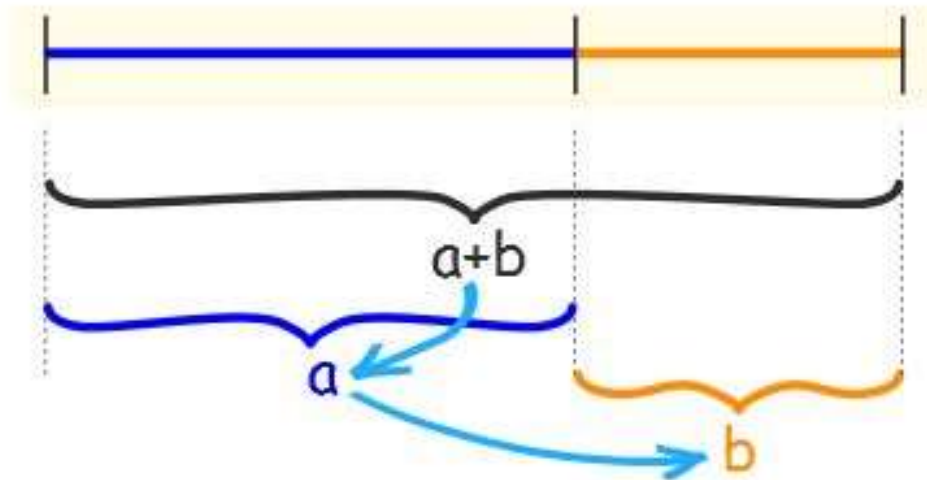
GOLDEN SECTION

- By means of the Golden Section, the Greeks defined the distances between columns.

the whole length divided by the long part

is also equal to

the long part divided by the short part

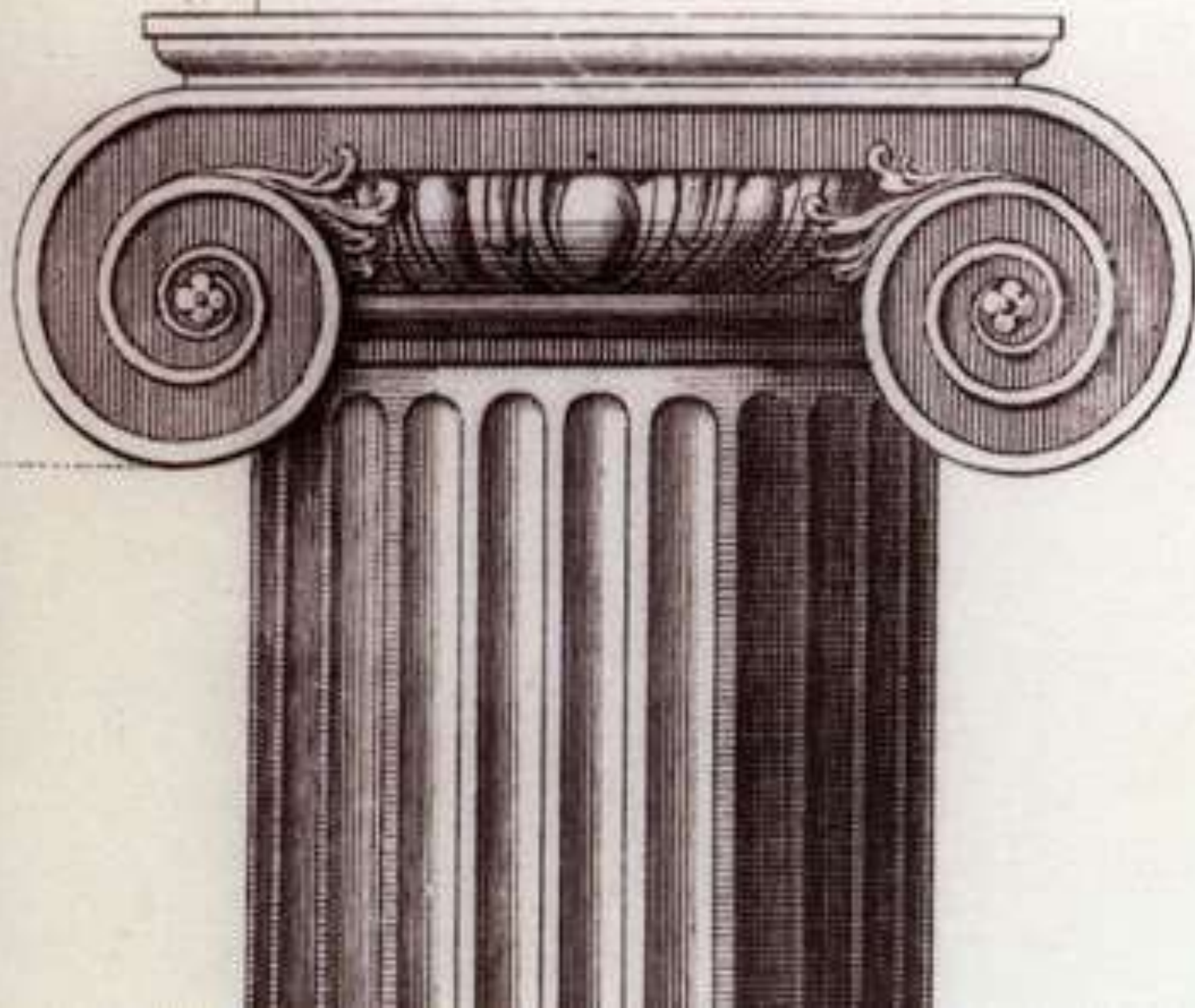


$$\frac{a+b}{a} = \frac{a}{b} = 1.618... = \phi$$

Spirals are represented in the volute of the Ionic column,



Fragment of a capital from the Temple of Apollo at Delphi, 5th century BC. The capital is made of marble and features a spiral volute design. The fragment shows the central part of the capital, with the spiral and the central floral motif.



Byzantine and Islamic Architecture



Hagia Sophia, Istanbul 547 CE

BYZANTINE ARCHITECTURE



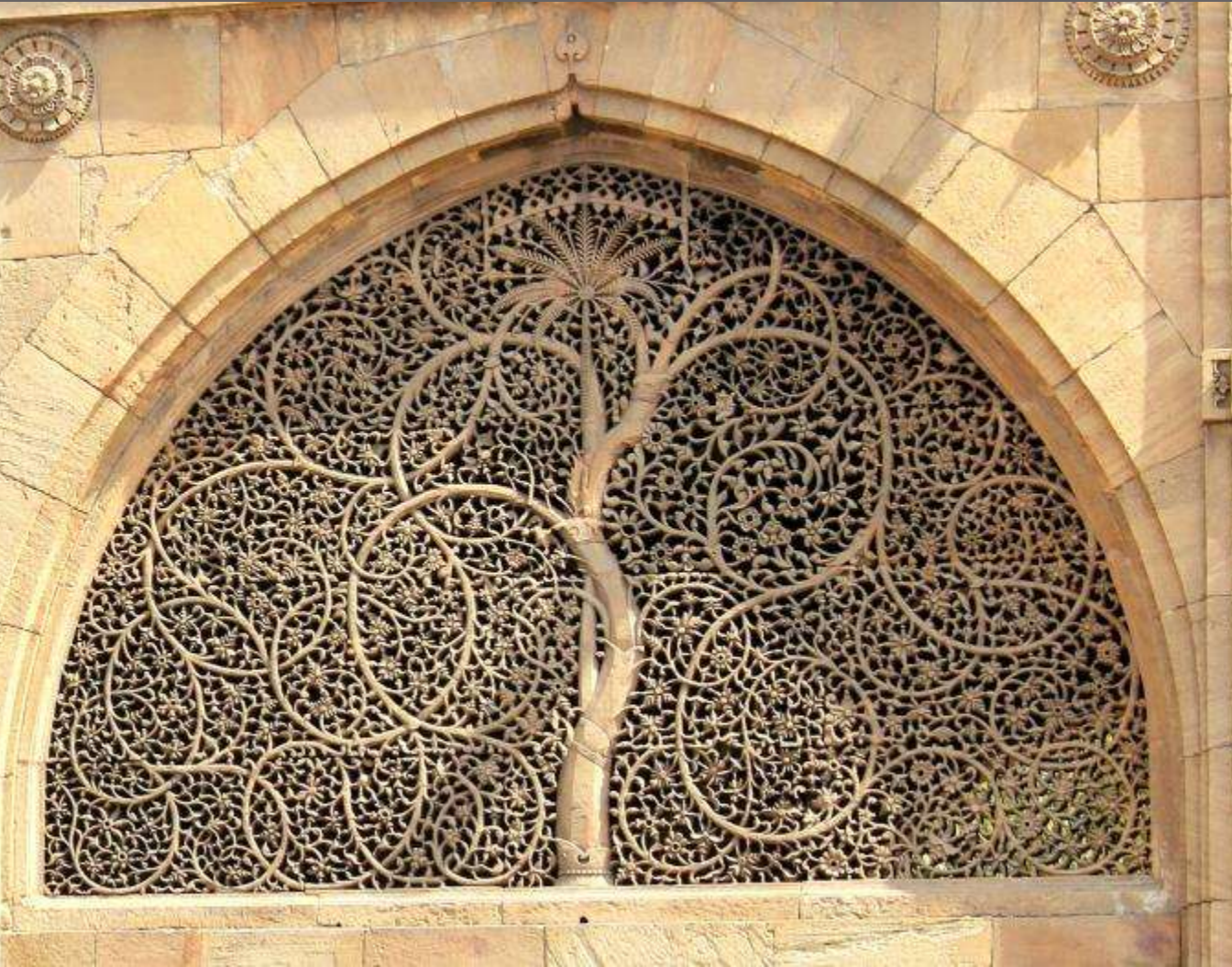
In the Byzantine Empire, Christian spirituality re-inspired architecture with ideas of divine proportion and the mystique of numbers, and developed the Roman form of the dome placed on a square to create the typical Byzantine cross-in-square church plan.

Hagia Sophia, Istanbul 547 CE



Alhambra Palace, Granada 1338-90 CE

Islamic Architecture



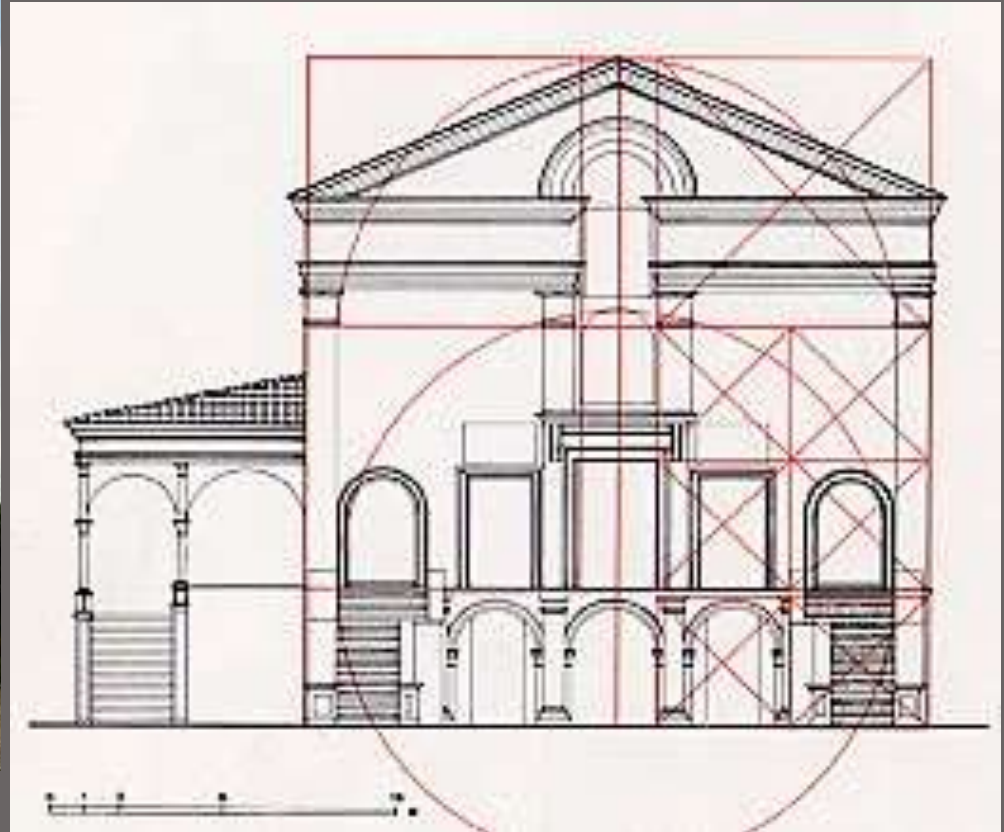
Mosque of the Palace of Ahmedabad, India
This elegant mosque was built by Sidi Saiyed in 1573 CE. The *Jalis* are in rear wall of the mosque. The *Jalis* have fine carving design in geometrical and intertwined tree and foliage, palm and parasite motif.

- Renaissance elevated architecture into a new science.
- It demanded that every part of a building be integrated into a system of mathematical ratios.

Early Renaissance Architecture

Proportional facade

The coherent proportional system of Alberti's Palazzo Rucellai emerges from its arrangement of the orders. Doric pilasters at ground level, Ionic on the first floor and Corinthian above frame the repeating series of windows to give the whole façade a sense of order, a principle Alberti also deployed in the facade of S. Maria Novella in Florence.



S. Sebastiano in Mantua, Italy 1460CE

Baroque and Rococo Architecture



*Interior of the dome decorated by Antonio Raggi, Pietro Sassi and others;
(right) interior of the lantern gilded by Vincenzo Corallo
Sant' Andrea al Quirinale 1661-70, architect Gian Lorenzo Bernini*

Baroque and Rococo Architecture

S. Carlo alle Quattro Fontane 1638-41CE



Architect - Francesco Borromini –

S. Carlo was the first major work by Francesco Borromini, Bernini's great rival



Rococo Architecture

Rococo -denoting furniture or architecture characterized by an elaborately ornamental late baroque style of decoration prevalent in 18th-century continental Europe, with asymmetrical patterns involving motifs and scrollwork.

Johann Michael Fischer, Ottobeuren Abbey, Bavaria, 1737-66 CE

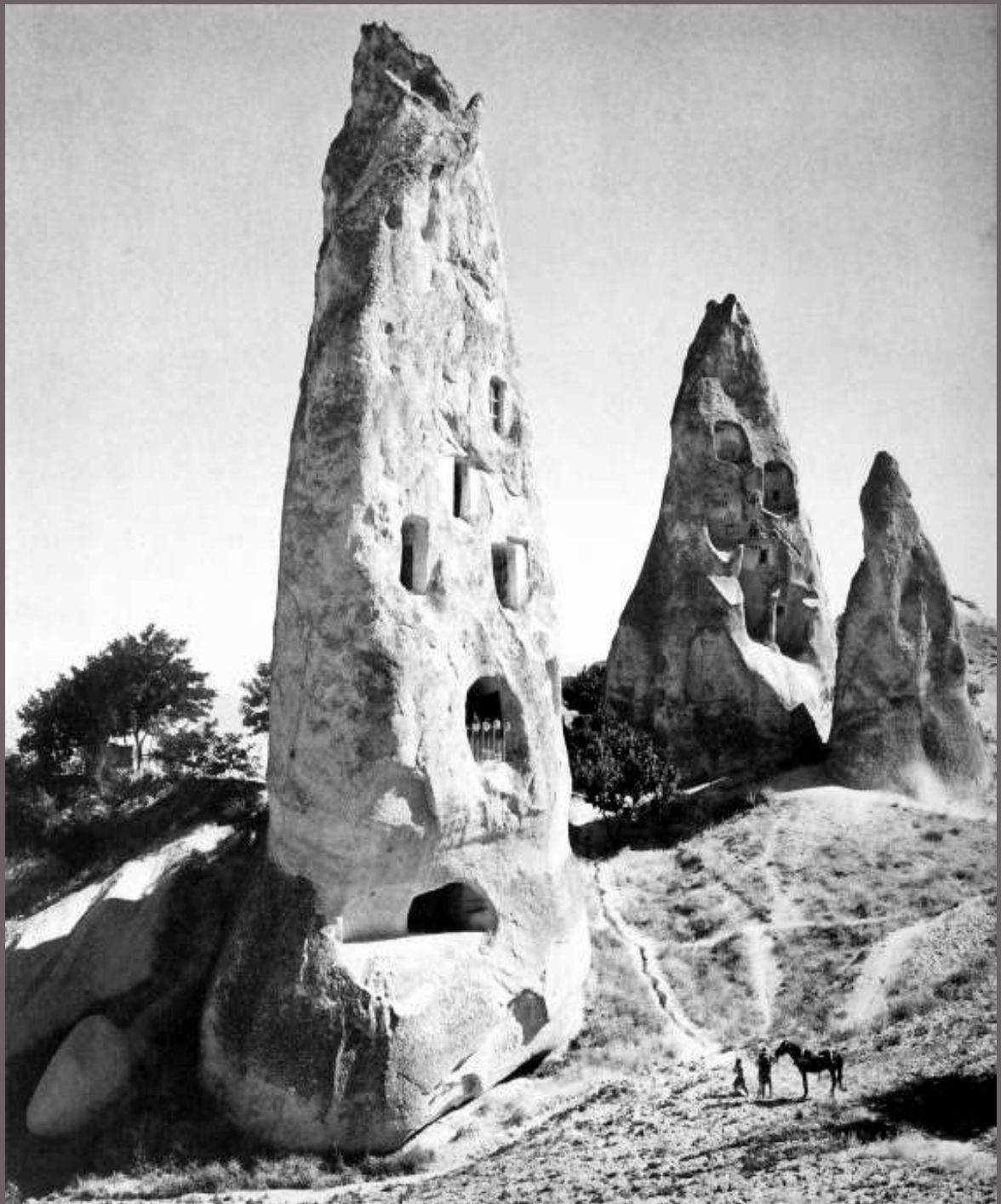
Rococo Architecture



Johann Balthasar Neuman, Spiegelkabinett (mirror cabinet) Residenz, Würzburg, Bavaria 1740-45 CE (rebuilt after WW2)

Tufa- Pinnacle Houses

Tufa-Pinnacle Houses
Located in Cappadocia
in Central Turkey in an
area remarkable for its
volcanic rock
formations.
The tufa has eroded to
leave a landscape of
eccentric phallic
obelisks.



Time for





Sir John Soane Bank of England, London by JM Gandy

Interpretations of Organic Architecture

- The second half of the 19th century saw a new revival of Gothic architecture as well as the classical rules of Greek architecture.
- Viollet-le-Duc and John Ruskin, were inspired by natural shapes and processes
- They advocated the continuation of the medieval handcrafted art tradition as opposed to introducing new industrial methods.



Sir John Soane – Lecture comparing Gothic Architecture to tree canopies

Ruskin and Morris

- Despite the comparative stylistic freedom granted to architects, a prevalent and significant school of thought, led by the Englishmen John Ruskin (1819-1900) and later William Morris (1834-96), was suspicious of the effect of the new social, economic and material conditions of modernity on traditional craftsmanship.
- Ruskin reacted strongly to the encroachments of mechanization and standardization in architectural production.
- His essay *The Seven Lamps of Architecture* (1849) codified his theory of architecture as the direct expression of its craftsman, through whose honest workmanship and fidelity to the qualities of materials a transcendent beauty might be attained.

- Gothic architecture adopted Greek geometry and enhanced it by incorporating the Celtic emulation of natural shapes.
- In decoration, trees and plants shapes were used as the first true triumph of matters organic in architecture.

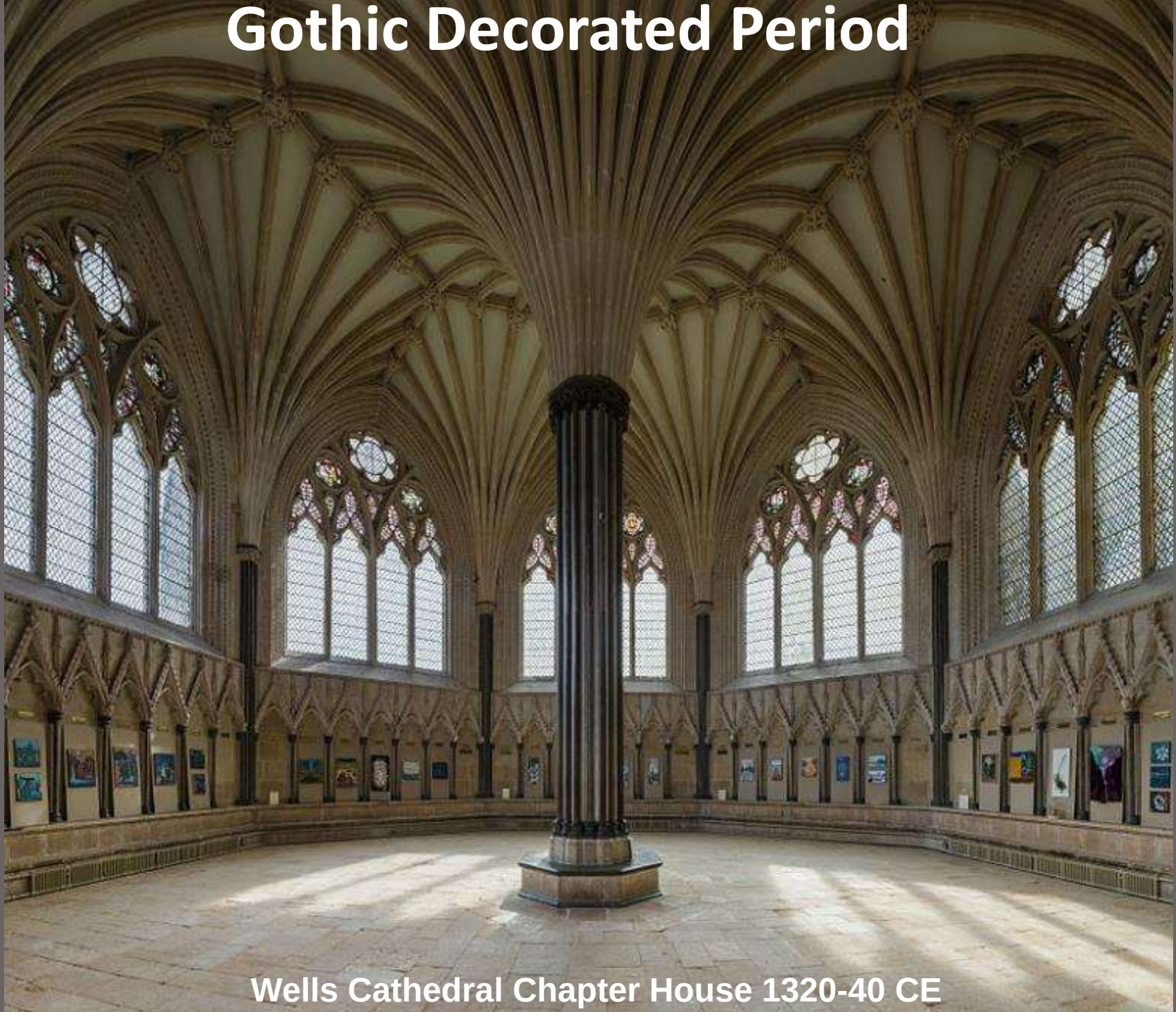
Gothic Perpendicular Period



Gloucester Cathedral Choir 1331-55CE

- Along with other geometric shapes, the circle became the basic design aid of a Gothic cathedral.
- The structures derived from underlying star diagrams, subdivided by polygons (especially pentagons and decagons), which related directly to the Golden Section.

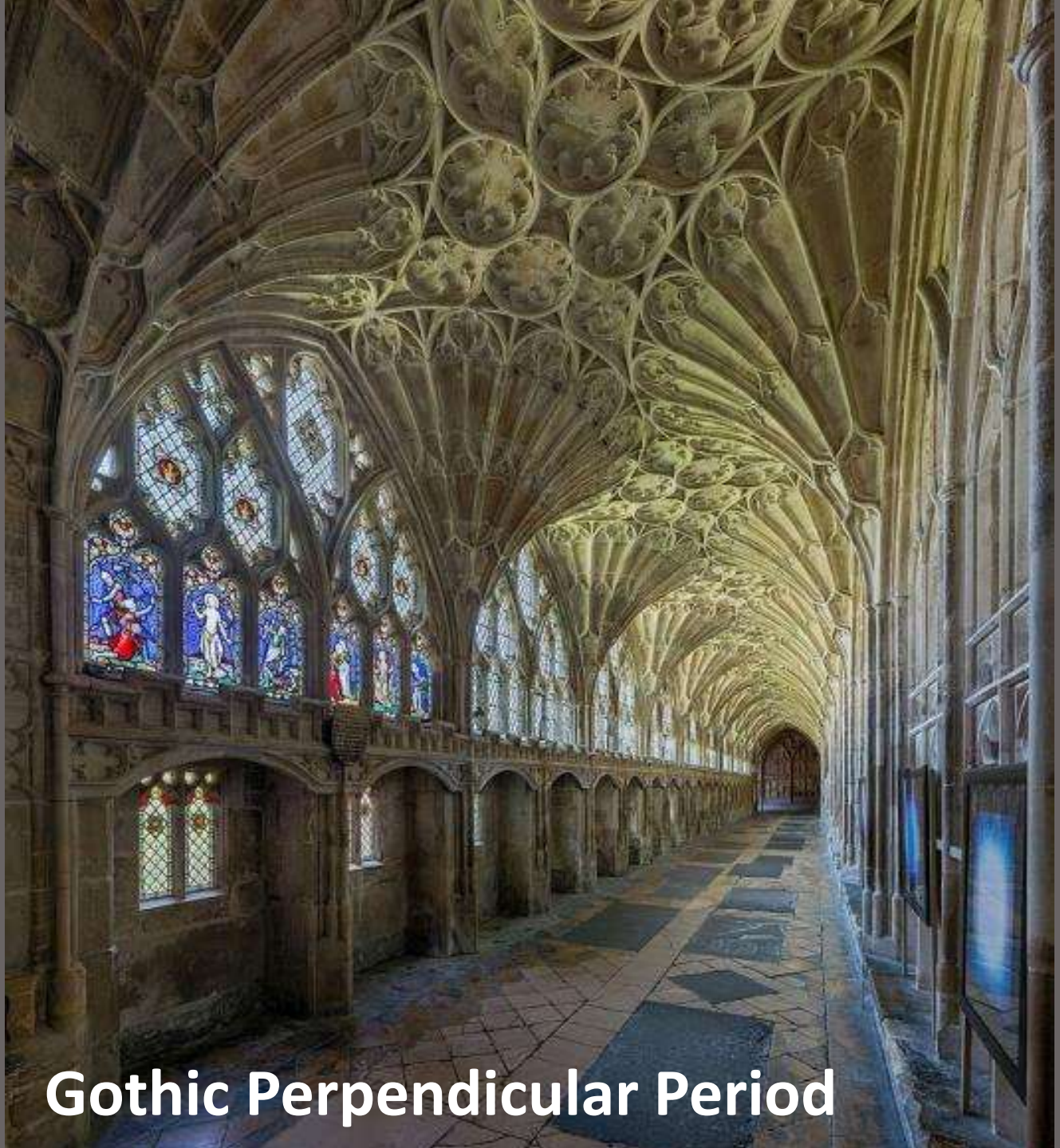
Gothic Decorated Period



Wells Cathedral Chapter House 1320-40 CE

The cloisters at
Gloucester Cathedral
1367-1377 CE

Gothic Perpendicular Period





Traditional building crafts were combined with an eclectic range of architectural styles; Morris's own Red House, Kent, designed by Philip Webb (1831-1915) in 1859, for example, combined medieval influences with Queen Anne Style round-headed windows.

Arts and Crafts

- Despite his opposition to modernity (also reflected in his instrumental role in founding the Society for the Protection of Ancient Buildings SPAB in 1877), he found commercial, as well as artistic, success with his firm Morris & Co. making furniture, fabrics, carpets and wallpapers inspired by late medieval precedents.
- Morris revived numerous traditional skills, although he took care not to slavishly imitate the past but rather to revive its methods and remain true to its principles in an era of great change.

Viollet-le-Duc

- Eugène Emmanuel Viollet-le-Duc (1814-1879) was a French Gothic revival architect
- He perceived architecture as a harmonious system of construction and composition
- He defended the scientific rational approach to nature, based on geometric and physical laws.

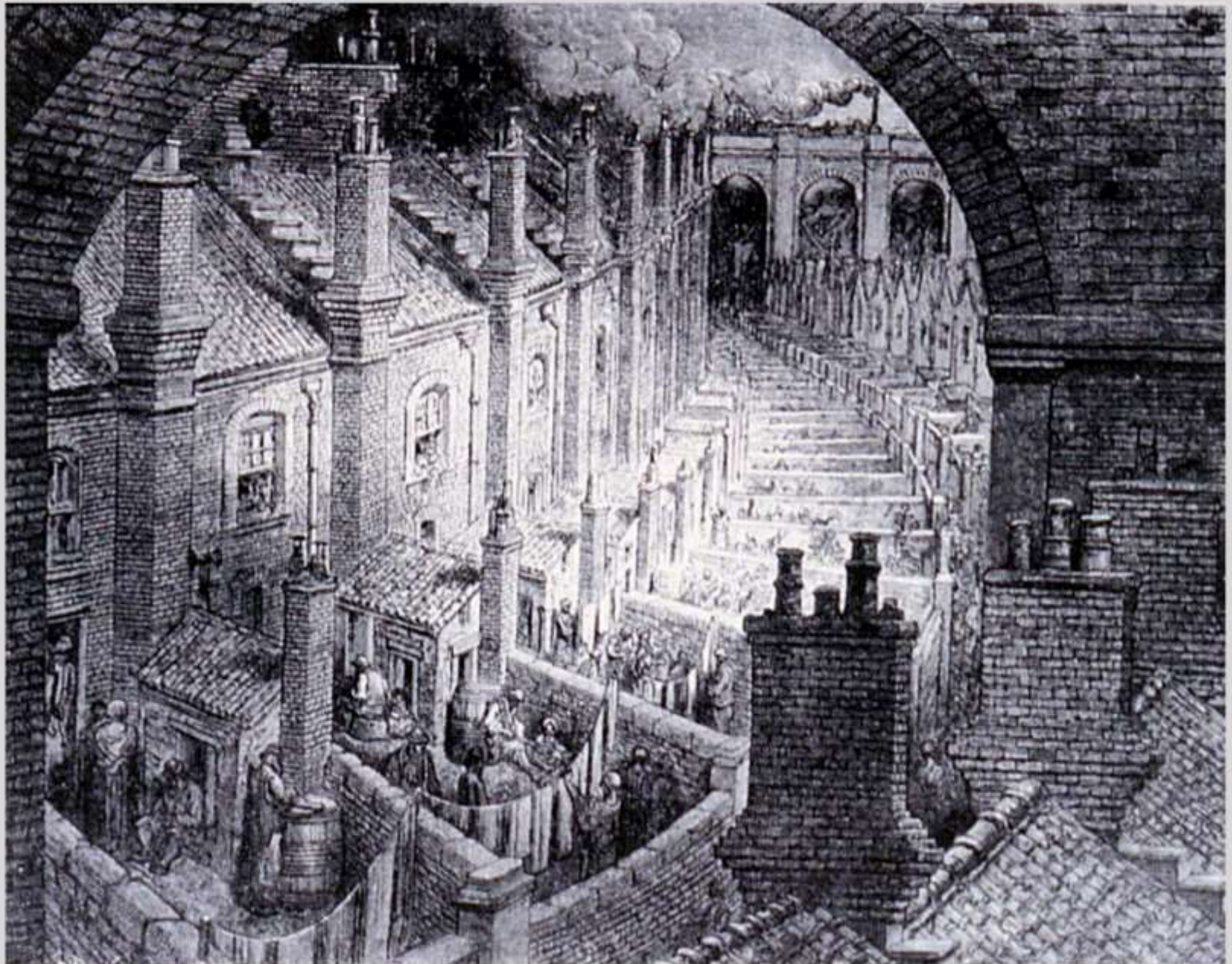
Viollet-le-Duc

- Architecture must not simply imitate nature, but should emulate its laws.
- He sought inspiration in the study of organic shapes such as leaves and animal skeletons (i.e. bats' wings).
- According to Viollet-le-Duc, the laws of nature stand in a complex mathematical, physical and functional interdependence, culminating in Unity (*Unité*).

Viollet-le-Duc

- Using the gothic model he insisted that materials must be used honestly and that buildings' exterior should reflect rational construction.

Gustave Doré, *Traversée de Londres en train*, 1872.



John Ruskin (1819-1900)

- *'All perfectly beautiful forms must be composed of curves; since there is hardly any common natural form in which it is possible to discover a straight line.'*
- **John Ruskin, *The Seven Lamps of Architecture*, 1880**

John Ruskin (1819-1900)

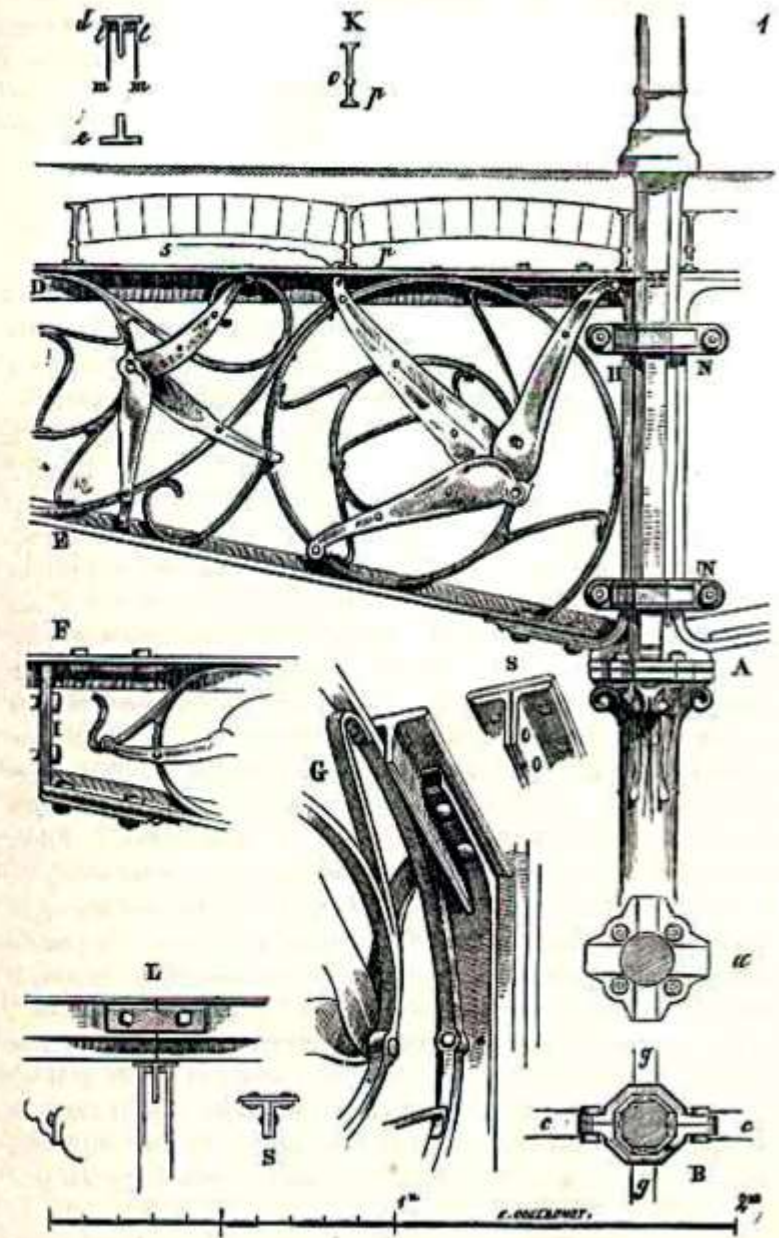
- *The Seven Lamps of Architecture* (1849), emphasizing the significance of the handcrafted and honest display of material and construction.
- He insisted that buildings should express the power of nature, and ornamentation should draw on nature and its creations. Beauty should stem from nature and be designed to fit mankind.

Eugène-Emmanuel Viollet-le-Duc (1814-1879), « Vue d'un marché avec salle au-dessus (fer et maçonnerie) ». Planche XXI, 12e entretien, *Entretiens sur l'architecture*, 1863-1872.



Eugène-Emmanuel Viollet-le-Duc (1814-1879),
 poutre en fer sur colonne en fonte.
 Figure tirée du 13e entretien,
Entretiens sur l'architecture, 1863-1872.

du chapiteau a). Les deux autres colonnes antérieures se composent



de même, de la partie inférieure de 8 mètres de hauteur, et de la partie

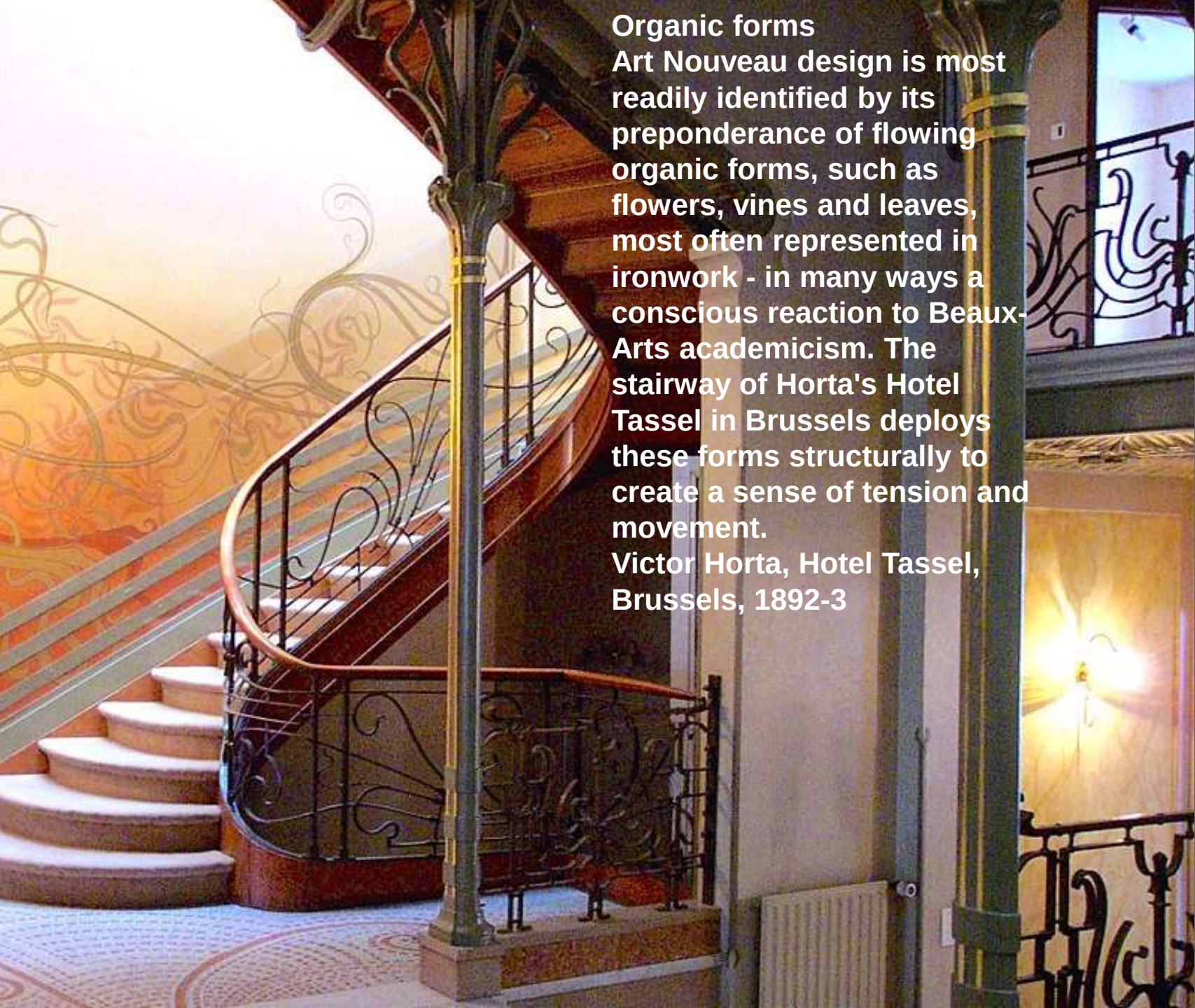
Viollet le-Duc

- In the late 19th and early 20th century, Viollet le-Duc and Ruskin strongly influenced entire generations of their readers both in Europe and in the USA.
- Architecture turned in a new direction and we see the emergence of organic architecture, to be further refined into different interpretations.

- It could be argued the entire history of shapes in architecture is based on geometric shapes found in nature.
- In the late 19th and early 20th centuries, shapes used in the revival of Greek and Gothic architecture were based on mathematical laws and further scientific research.

Art Nouveau

- Emerging at the end of the nineteenth century and prevalent until the outbreak of World War I in 1914
- Art Nouveau was arguably the first avant-garde architectural style. Rejecting historicism, if not tradition itself, Art Nouveau, or Jugendstil as it was known in Germany, encompassed all areas of design and the decorative arts.



Organic forms

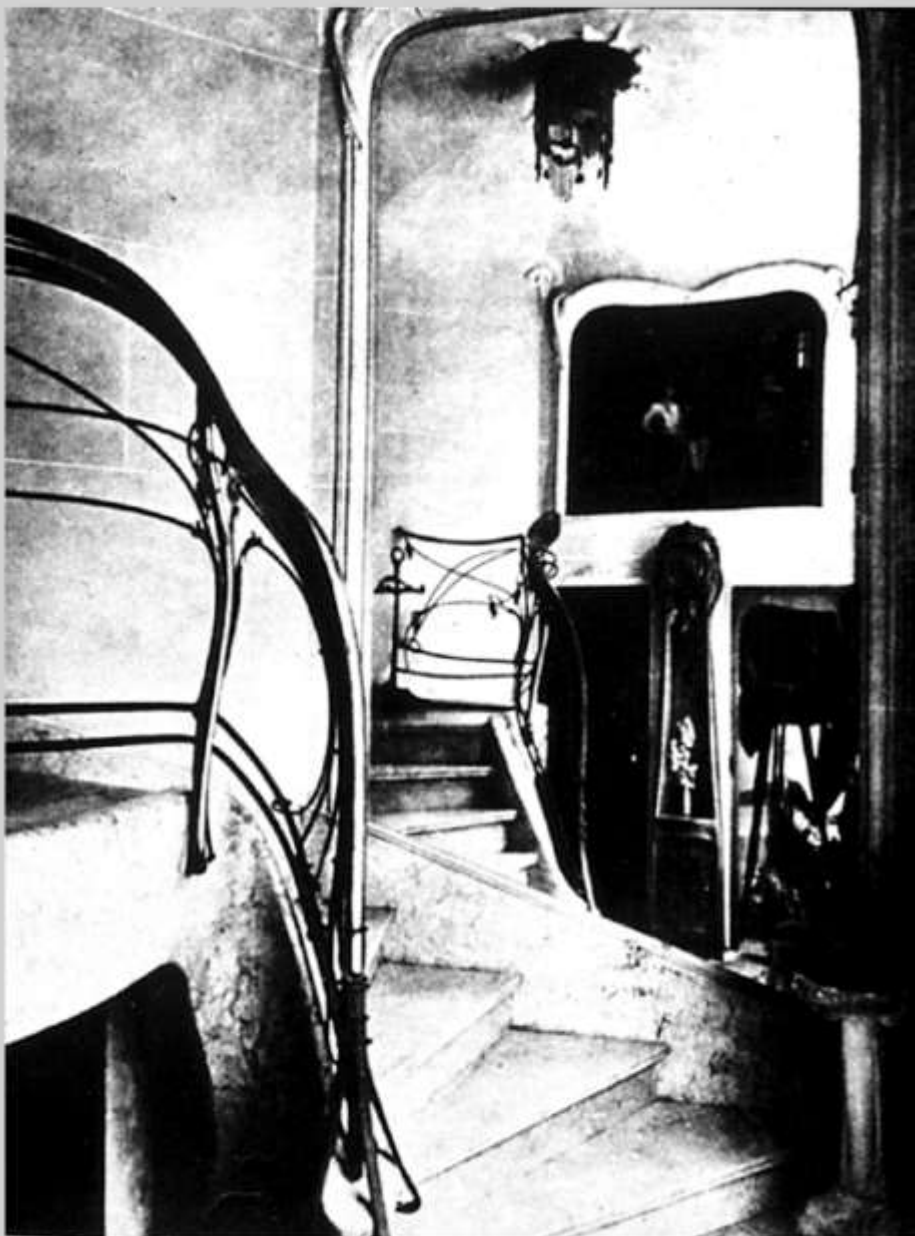
Art Nouveau design is most readily identified by its preponderance of flowing organic forms, such as flowers, vines and leaves, most often represented in ironwork - in many ways a conscious reaction to Beaux-Arts academicism. The stairway of Horta's Hotel Tassel in Brussels deploys these forms structurally to create a sense of tension and movement.

Victor Horta, Hotel Tassel, Brussels, 1892-3

Hector Guimard (1867-1942),
stations du Métropolitain, 1898-1900.
Entrée de la station Abbesses,
anciennement située station Hôtel de Ville.



Hector Guimard (1867-1942), hôtel Guimard, 122, avenue Mozart, Paris, 1909-1912.



Hector Guimard (1867-1942), École du Sacré-Cœur, avenue de la Frillère, Paris, 1895.



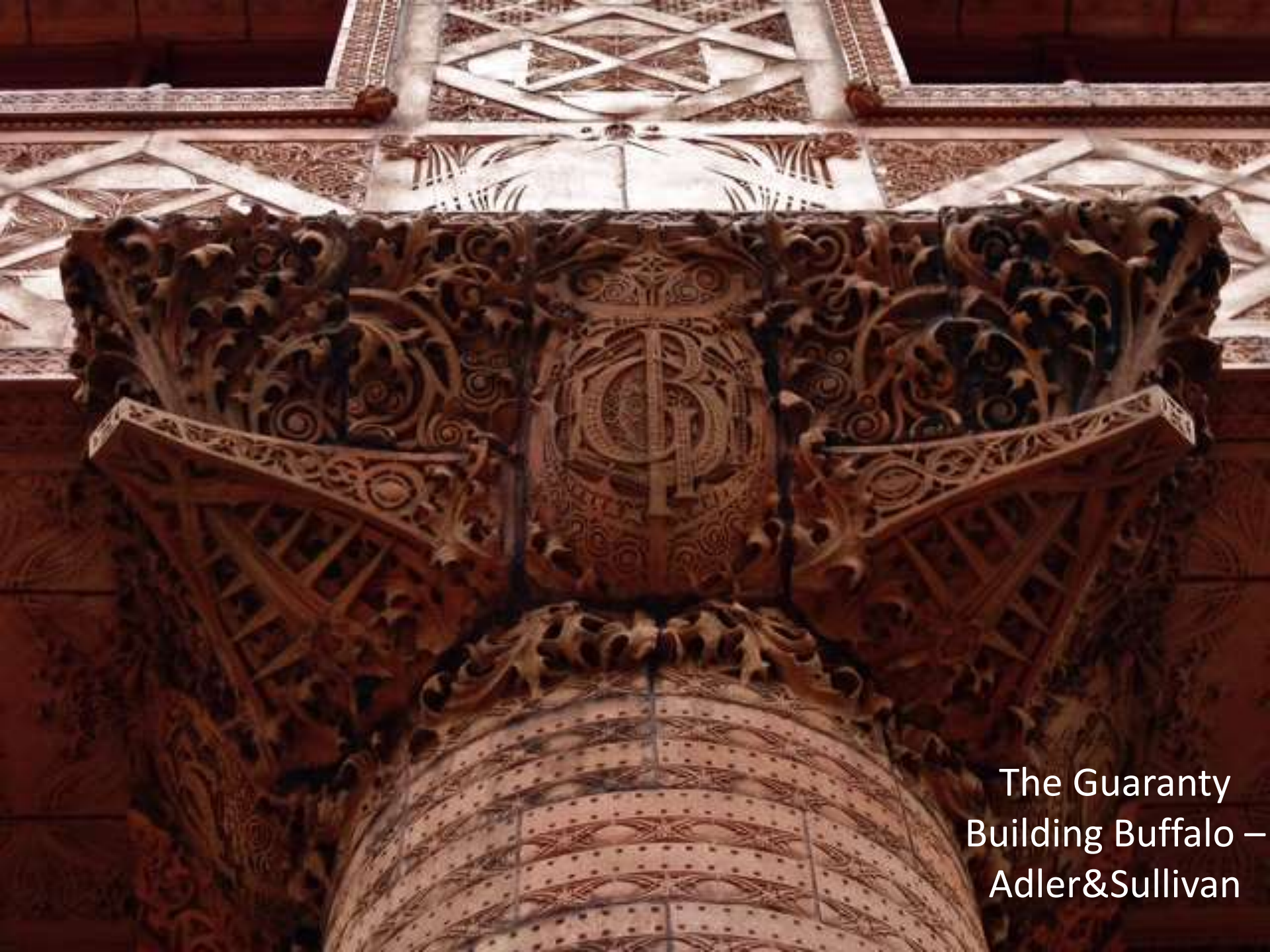
Origins of Organic Architecture

Louis Sullivan

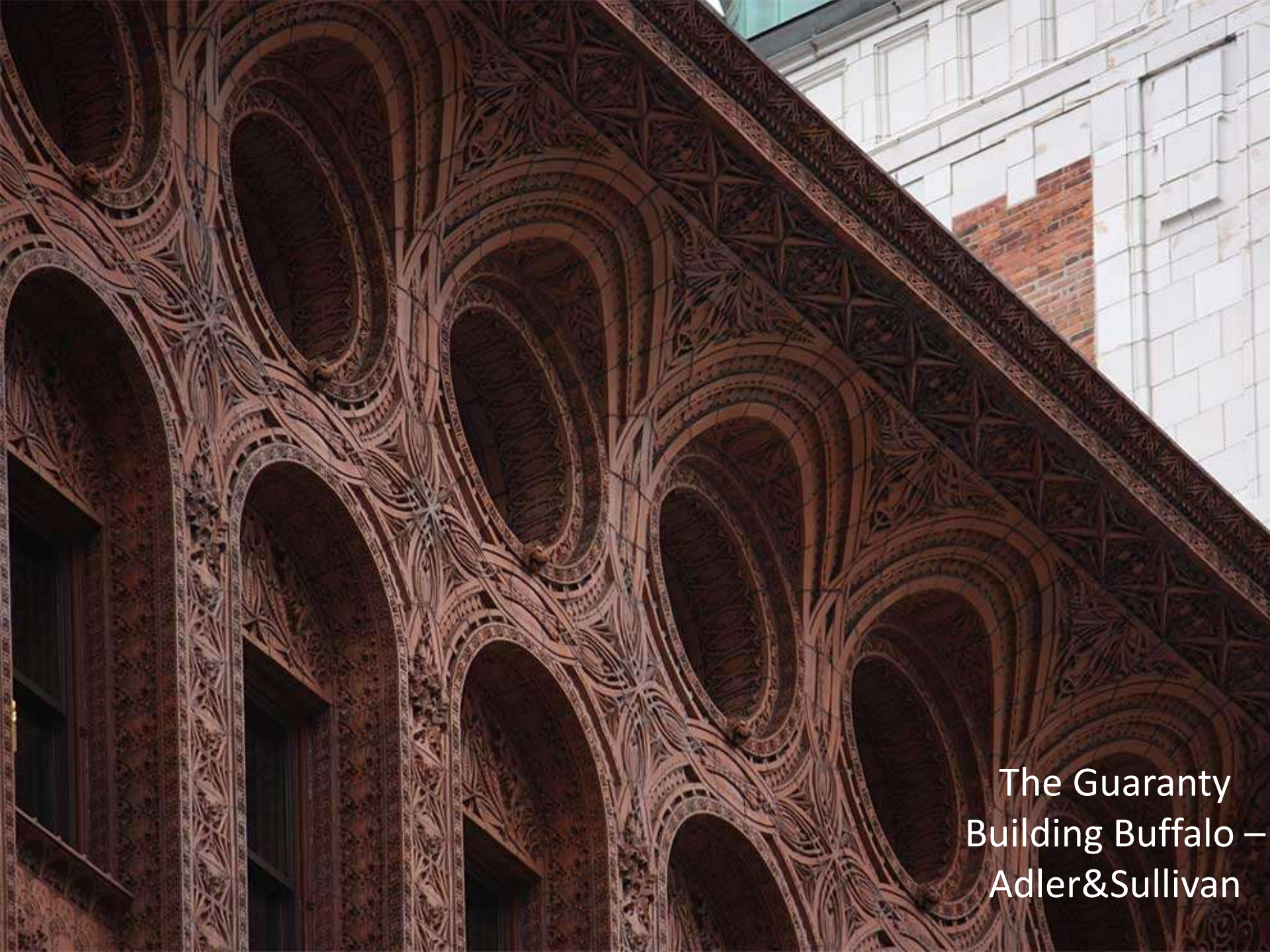
- The first definition of "organic architecture" was introduced by Louis Sullivan (1856-1924) in his work *Kindergarten Chats* (1901).
- Sullivan defined the concept of 'organic' in correlation with the concepts of 'organism', 'structure', 'function', 'growth', 'development' and 'form'.

Louis Sullivan

- He claimed that "if the work is to be organic, the function of the parts must have the same quality as the function of the whole".
- The key concept of organic design is derived from Sullivan's "form follows function" axiom.



The Guaranty
Building Buffalo –
Adler&Sullivan



The Guaranty
Building Buffalo –
Adler&Sullivan

Frank Lloyd Wright

- Wright's understanding of Japanese architecture gave rise to his demand for unity, harmony and simplicity as well as for the demand to respect the nature of building materials and the uniqueness of anything individual.
- Wright failed to fully verbally define his organic architecture, yet its principles are expressed in his works.



Katsura Imperial Villa, Japan 17th Century



Shoken Tei, Katsura, Japan 17th Century

Frank Lloyd Wright

- The nature of the location - susceptible respecting the landscape - The location's nature entails observing local tradition and creating a building with natural materials.
- The building is a frame of its environment or showcases unusual elements of the surrounding terrain.
- To him, it was important to bring the outside world into the house and let the inside of the house go outside.



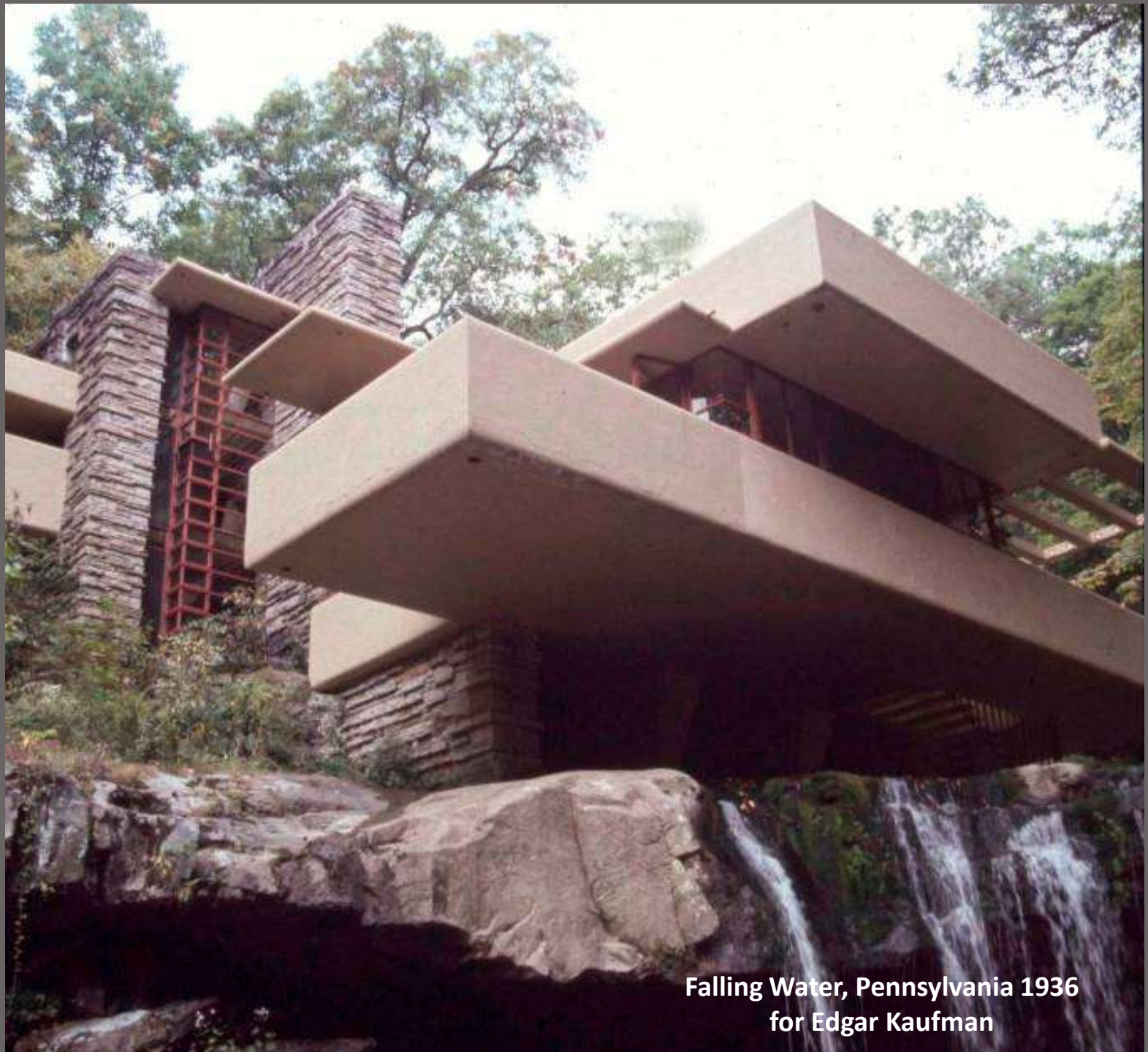
Frank Lloyd Wright: Fallingwater House, Bear Run, Pennsylvania, 1936.





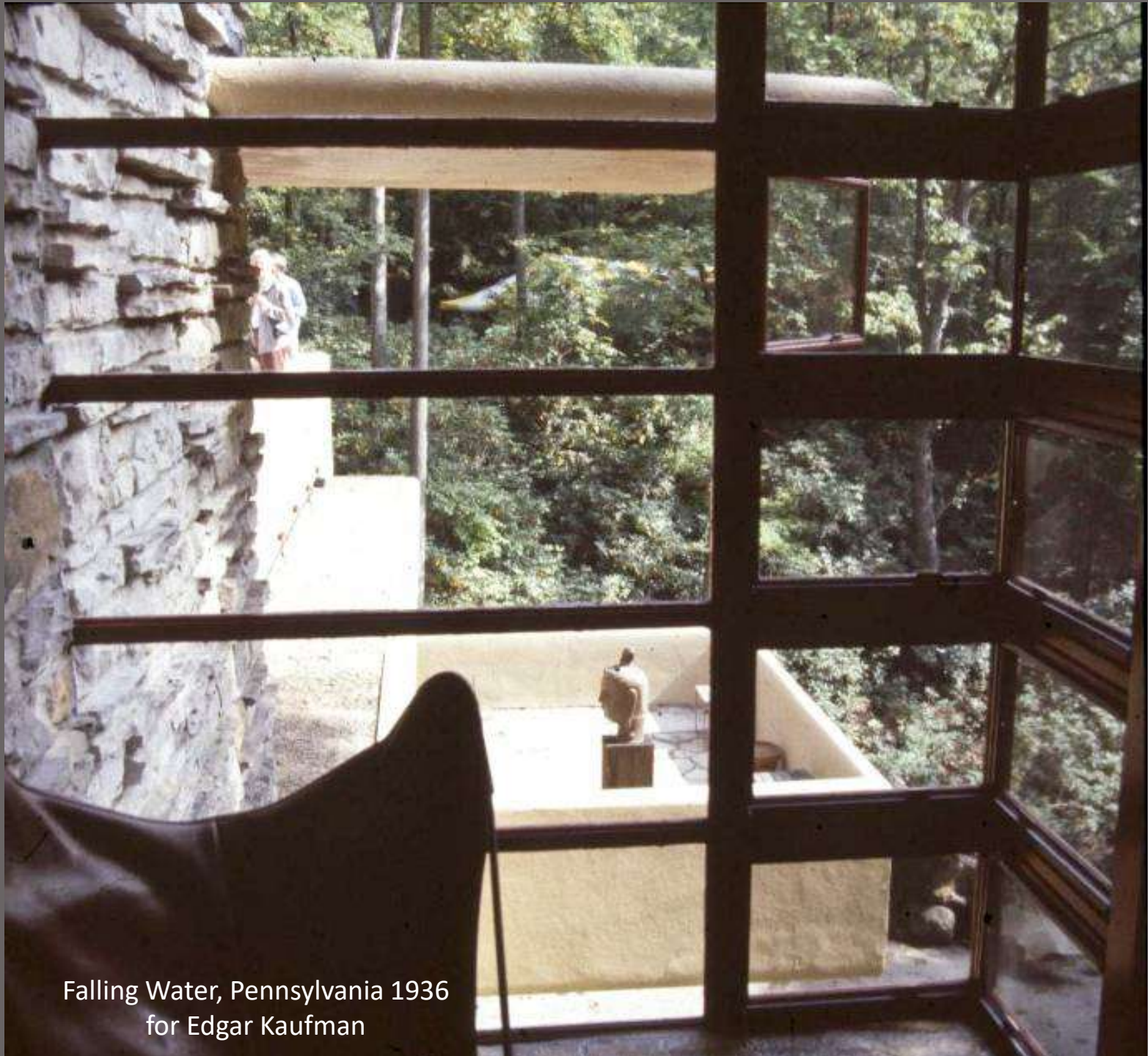
Falling Water, Pennsylvania 1936
for Edgar Kaufman





Falling Water, Pennsylvania 1936
for Edgar Kaufman





Falling Water, Pennsylvania 1936
for Edgar Kaufman



Frank Lloyd Wright

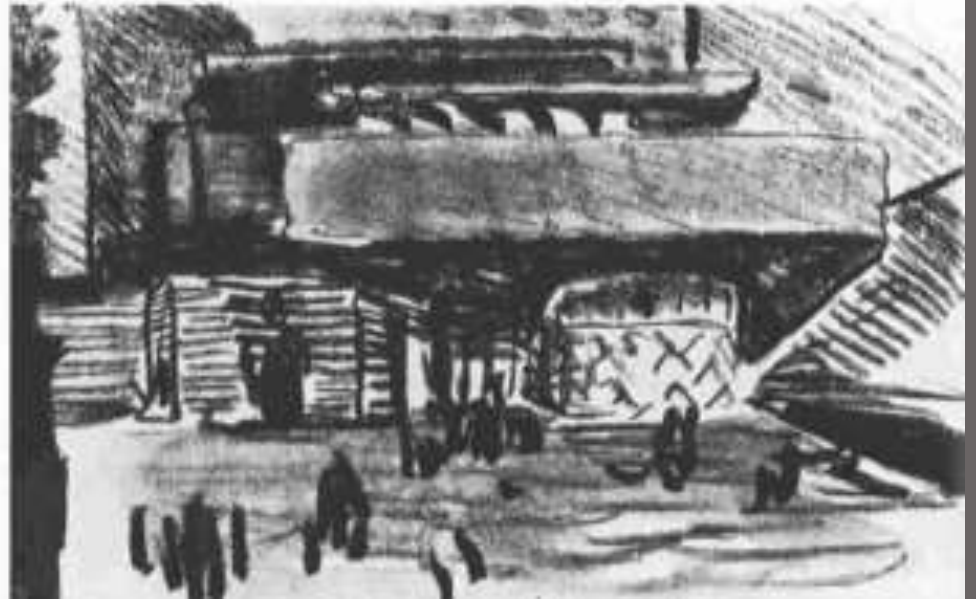
- Wright's worship of nature is expressed through his dominant horizontal lines rising from the starting point –
- the plains of the prairie landscape; through the organic connection between the building and its surroundings –
- the buildings seem to grow from the ground connected with nature by terraces, covered garden walls, flower beds and decorative urns



Robie House 1909



Carlo Scarpa and Frank Lloyd Wright



Carlo Scarpa and Frank Lloyd Wright



**Avery Coonley house
Riverside, IL. Frank Lloyd Wright,
architect, 1907**



**Carlo Scarpa, Angelo Masieri,
Romanelli House, Udine, 1950-55.
Partial exterior facade and roof
overhang with perforations.**

Frank Lloyd Wright

- Wright beautifully connects architecture and nature, matters organic and geometric, natural stone and concrete, the interior with the exterior, and nature with space.
- Wright for many is the true father of organic architecture and indeed, he inspired entire generations of younger architects.

The organic architecture of Antoni Gaudí

(1852-1926)

- Gaudí created a unique organic architecture profoundly different from Wright's.
- He adopted Ruskin's idea that "ornament is the origin of architecture" and under Viollet-le-Duc's influence recognised the Gothic as the only true acceptable style of architecture.



Casa Mila, 1906-1912 by the architect
Antoni Gaudí

Antoni Gaudí

- The Gothic form was for Gaudí at the same time functional and aesthetic, and he discovered how to adapt the language of nature to the structural forms of architecture.

Antoni Gaudí and Cesar Manrique both preferred to develop their designs on the day, at the site, working with the craftspeople rather than fixing ideas entirely as drawings on paper.



Casa Mila, 1906-1912 – Architect Antoni Gaudí

Antoni Gaudí

- Gaudí was inspired by the organic shapes of nature. He found abundant examples of these, for instance in rushes, reeds and bones.
- Unlike Wright, Gaudí did not integrate a building's natural surroundings by connecting it with the interior; instead, he explored the static forces of nature and used its principles in the structure of the building.

Casa Mila,
1906-1912 by
Antoni Gaudí



Antoni Gaudí

- He established a sensitive relationship with nature and translated it into a highly original and often zoomorphic ornament that features prehistoric, extinct species of gigantic monsters, dragons and dinosaurs, as well as trees and plants.
- He blended all of the above into a unique style of organic architecture.



Casa Mila,
1906-1912 by
Antoni Gaudí



Casa Batlló ,
1904-06 by Antoni Gaudí



Casa Batlló ,
1904-06 by Antoni Gaudí

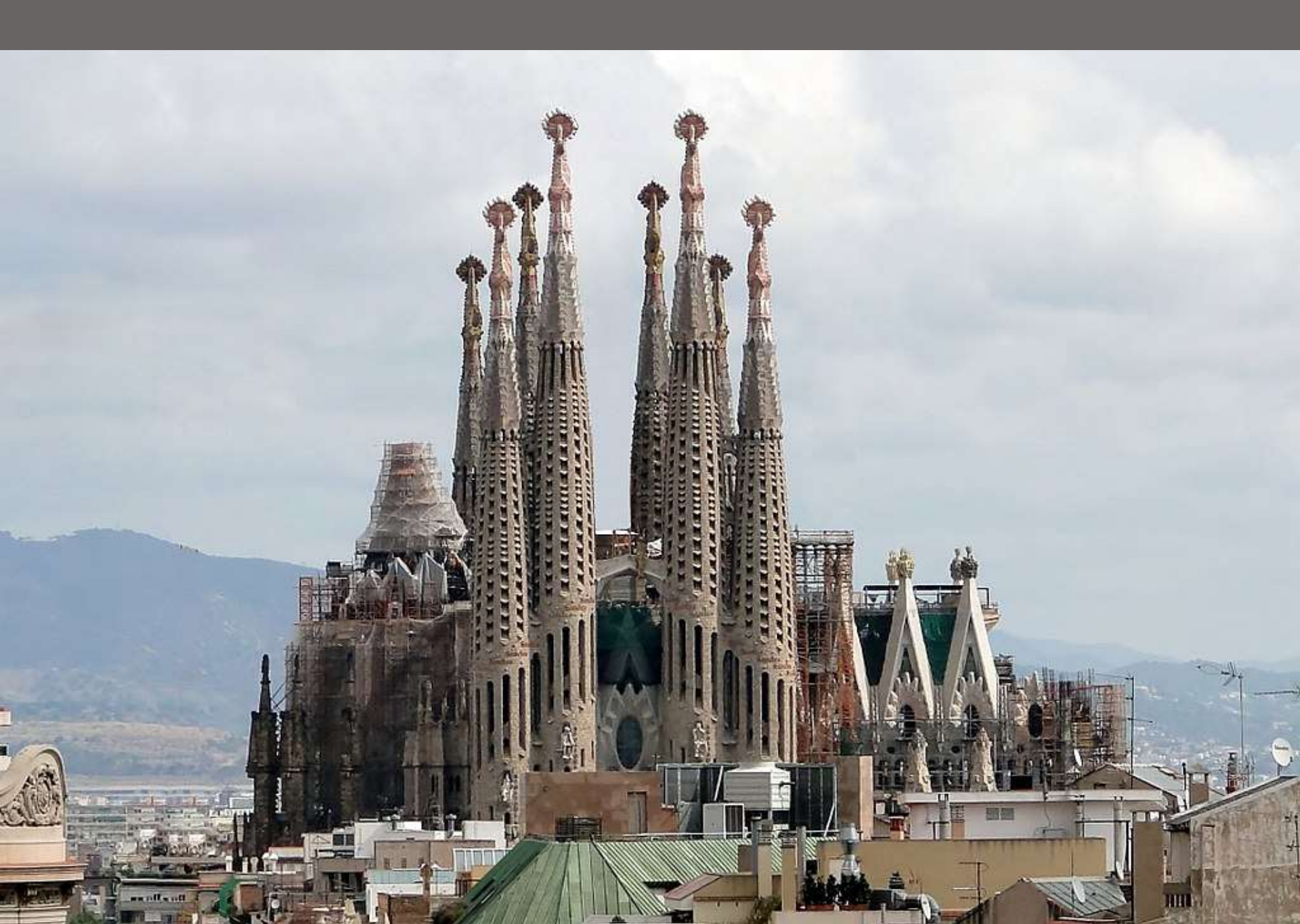
Antoni Gaudí

- He explored and developed these approaches throughout his life: each and every Gaudí's project is innovative and all are integrated through their author's love and respect for nature and geometry.



Each level of Gaudi's masterwork, the Sagrada Familia in Barcelona, increases in fantasy, moving towards and then beyond Art Nouveau. Drawing from North African Berber architecture as well as Gothic and organic forms, Gaudi created a dynamic tension between the rationalism of Barcelona's grid and his almost metaphysical architecture that alludes to the work of the Surrealists, notably his fellow Catalan Salvador Dali.

Antoni Gaudi, Expiatory Church of the Holy Family (Sagrada Familia), Barcelona, Spain, begun 1884



Time for





Barcelona Pavilion, Ludwig Mies Van Der Rohe, 1929



Barcelona Pavilion, Ludwig Mies Van Der Rohe, 1929

- In 1917, D'Arcy Wentworth Thompson, in his study *On Growth and Form*, found that the biological shapes of plants and animals were not influenced only by evolution.
- The guiding principle of evolution is optimisation, which can also be described or proven with the laws of mathematics, physics and mechanics.

Organic versus Inorganic

- Man then used these laws to create patterns of built structures. According to Thompson, form is a mathematical problem, whereas the problem of its growth is a physical problem.
- Thompson's book became an instant classic for the understanding of natural geometry in the dynamism of growth and physical processes.



Gropius House, Lincoln USA Architect, Walter Gropius 1938



Gropius House, Lincoln USA Architect, Walter Gropius 1938



**Gropius House, Lincoln USA Architect,
Walter Gropius 1938**





**Gropius House, Lincoln USA Architect,
Walter Gropius 1938**



**Schminke House, Loebau, Saxony - Architect
Hans Scharoun, 1930**



Inside/Outside

Herta Hammerbacher designed the garden as a dynamic connection between architecture and landscape. Basic design and materials of structural elements were continued into the garden in order to generate a composition of both organic and inorganic.

This design approach was a very typical one by the landscape architect Herta Hammerbacher, who had previously worked with the Karl Foerster and Hermann Mattern "Arbeitsgemeinschaft Gartengestaltung" (a landscape gardening consortium) for more than two decades.

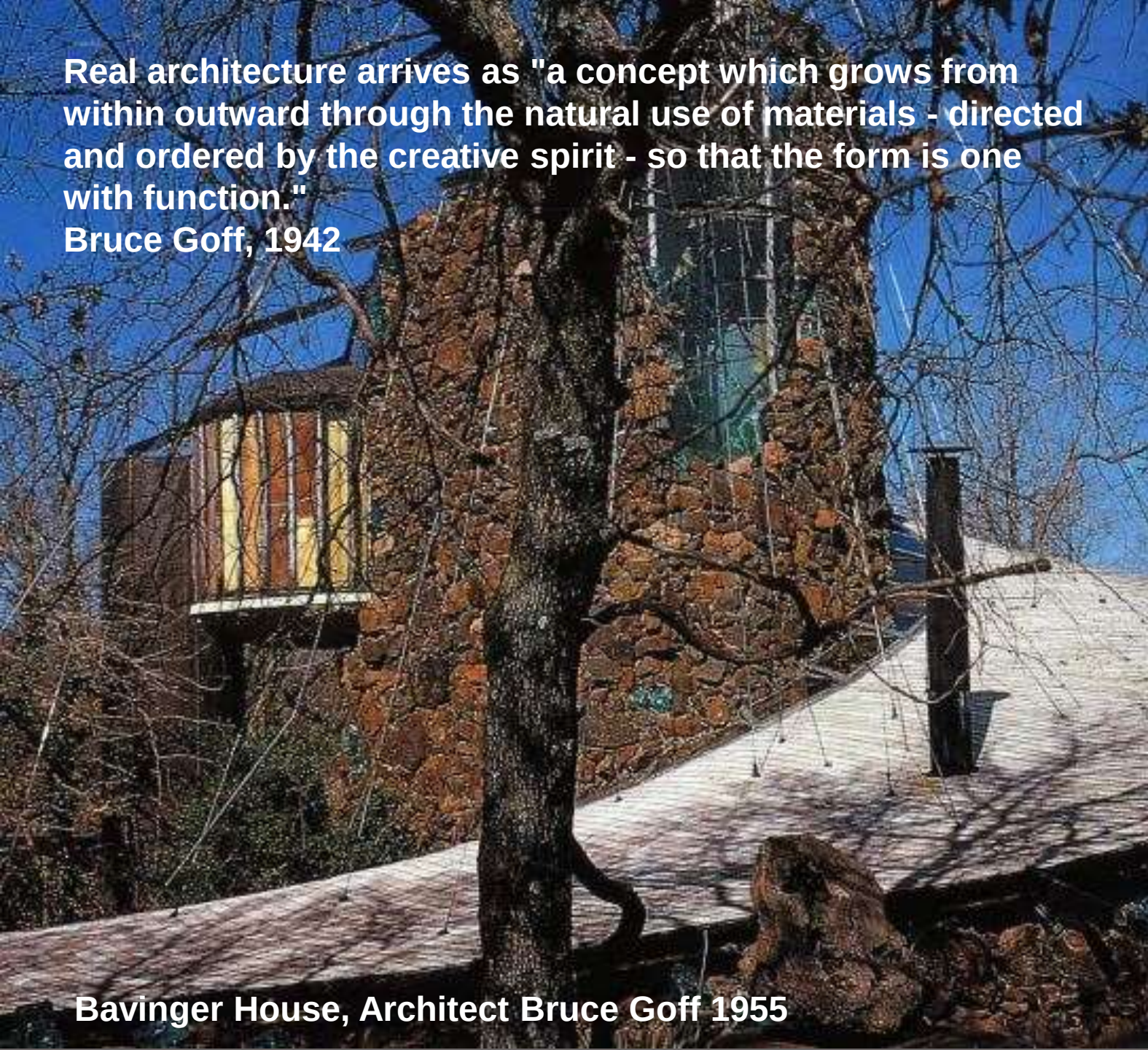
**Schminke House, Loebau, Saxony -
Architect Hans Scharoun, 1930**



**Schminke House, Loebau, Saxony - Architect
Hans Scharoun, 1930**

Real architecture arrives as "a concept which grows from within outward through the natural use of materials - directed and ordered by the creative spirit - so that the form is one with function."

Bruce Goff, 1942



Bavinger House, Architect Bruce Goff 1955



Bavinger House, Architect Bruce Goff 1955



Bavinger House, Architect Bruce Goff 1955



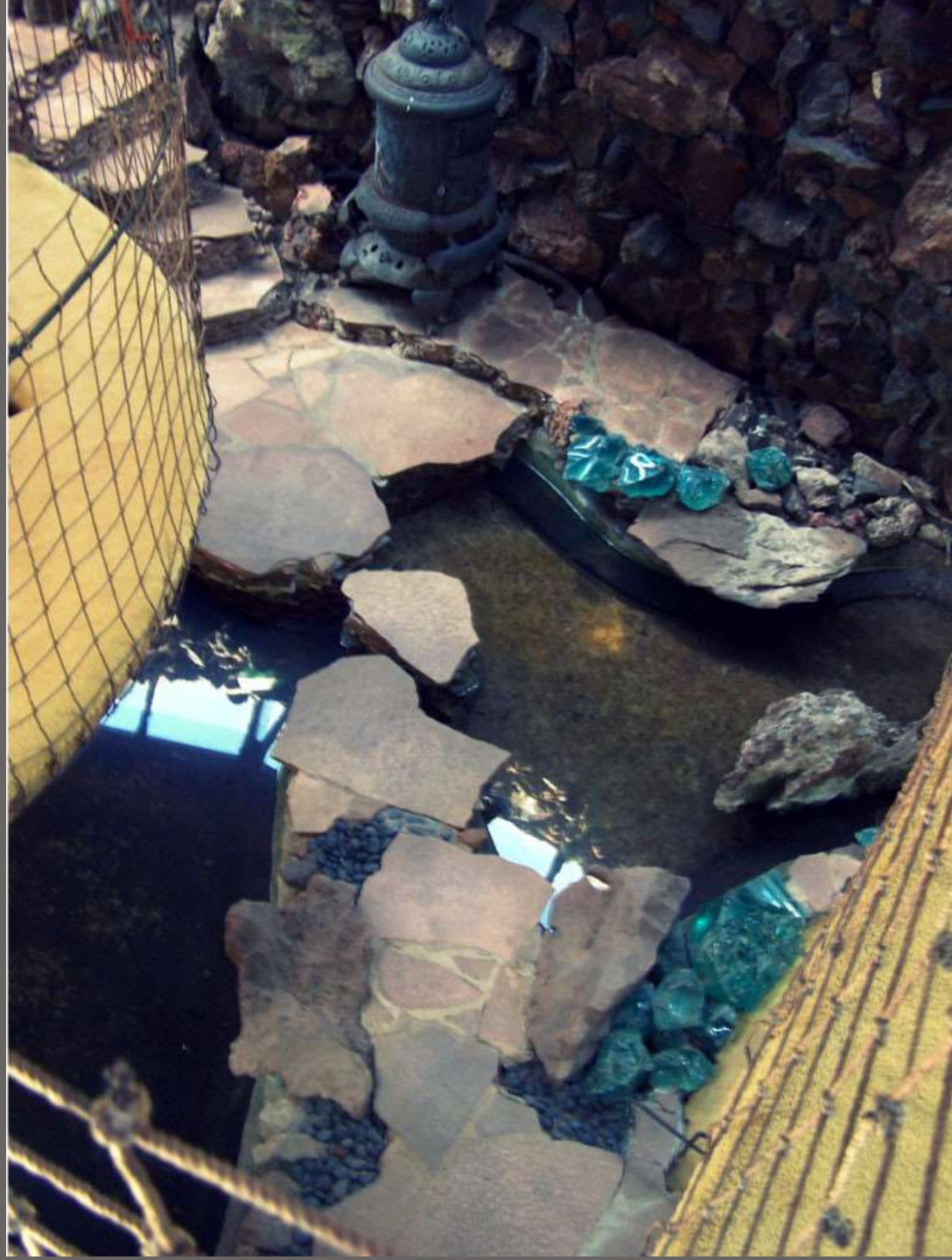
Bavinger House, Architect Bruce Goff 1955



Bavinger House, Architect Bruce Goff 1955



Bavinger House, Architect Bruce Goff 1955

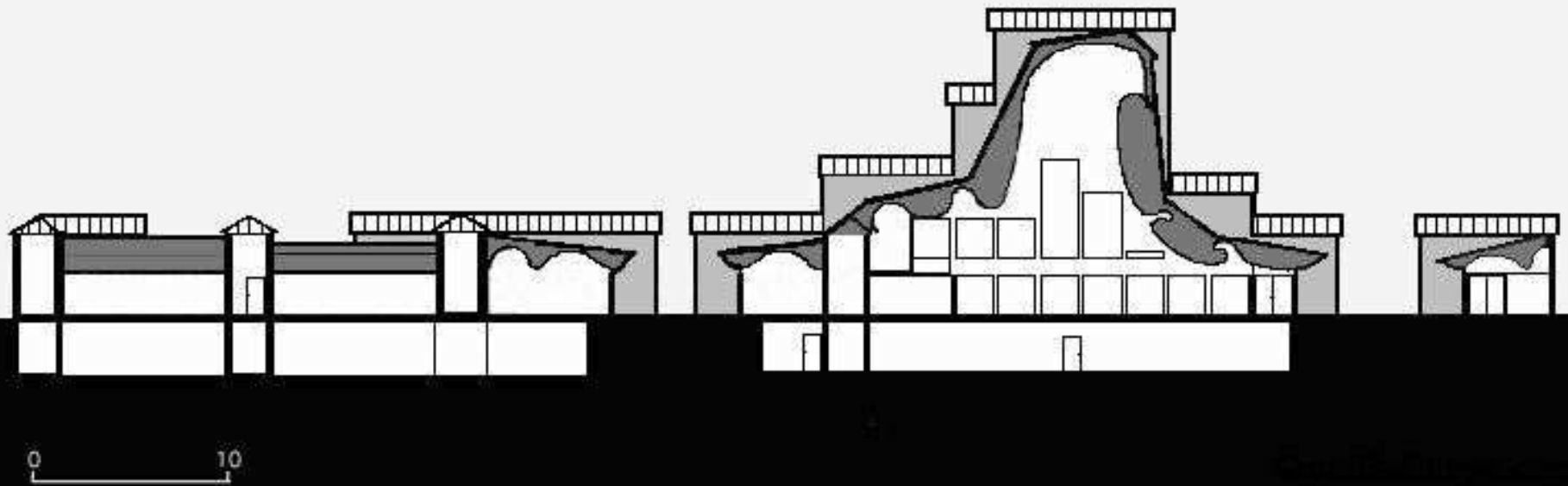




Alvar Aalto: Villa Mairea 1937-39



Alvar Aalto: Villa Mairea 1937-39



Jørn Utzon: Bagsvaerd Church section Denmark 1974-76 CE



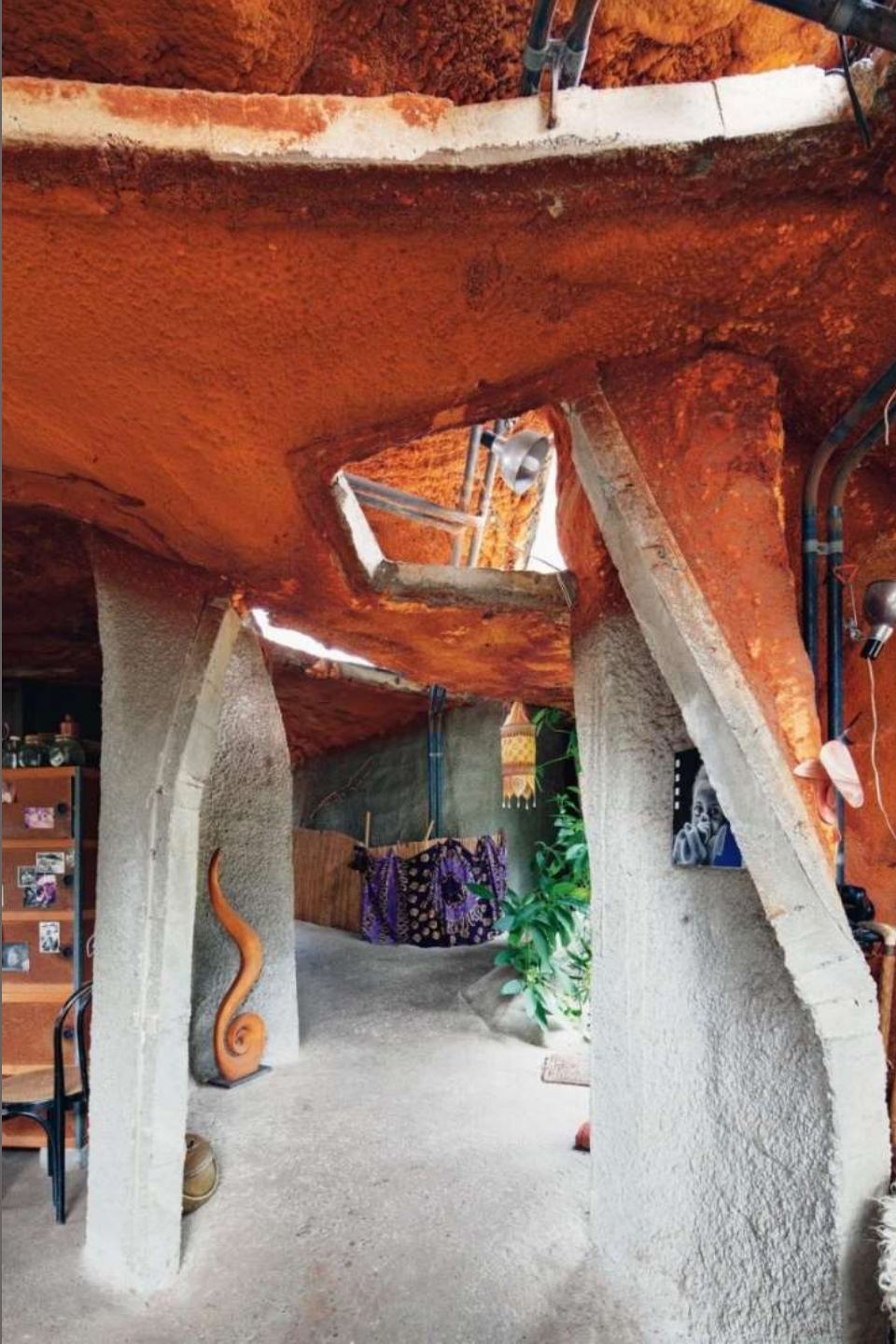
Jørn Utzon: Bagsvaerd Church
Denmark 1974-76 CE



The Sculpture House, Liege, Belgium Jacques Gillet 1962



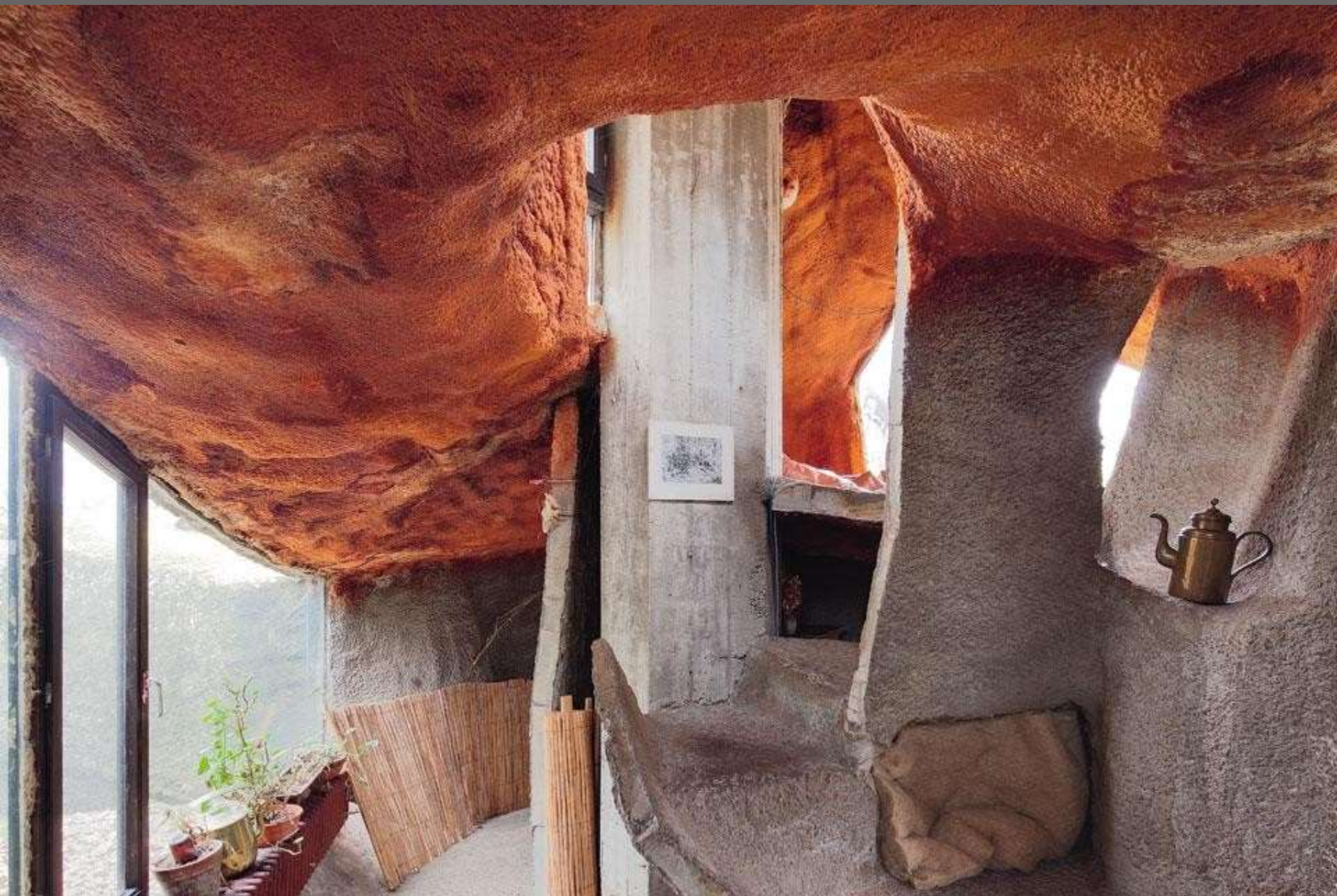
The Sculpture House, Liege, Belgium Jacques Gillet 1962



In collaboration with Sculptor Felix Roulin and engineer Rene Greisch.

A freeform armature of metal rods covered with gunite, the building combines organic shapes, high thermal efficiency, fluid interior spaces and good natural day light.

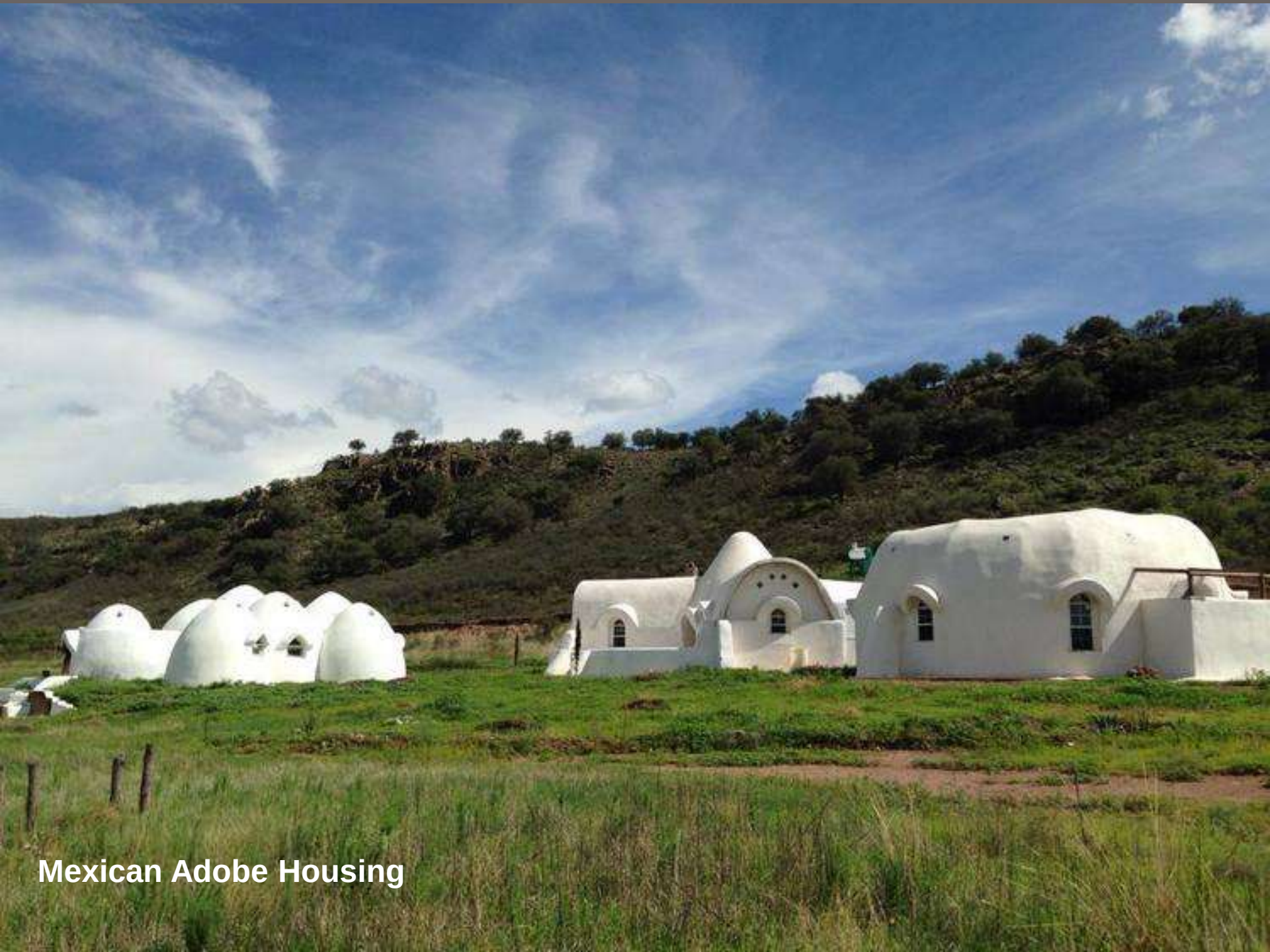
**The Sculpture House, Liege, Belgium
Jacques Gillet 1962**



The Sculpture House, Liege, Belgium Jacques Gillet 1962

David Pearson and Gaia

- An architect who draws from 20 years of experience in the fields of ecological design and Gaia philosophy.
- The premise of Gaia theory is the view that Earth is a living organism, of which human beings and their activities are but a small part. This thinking certainly informs Pearson's ideas for organic home building.



Mexican Adobe Housing





*"My dreams were of a simple house, built with human hands out of simple materials of this world: the elements - Earth, Water, Air, and Fire. To build a house out of earth, then fire and bake it in place, fuse it like a giant hollow rock. The house becoming a kiln, or a kiln becoming a house. Then to glaze this house with fire to the beauty of a ceramic glazed vessel." **Nader Khalili***



Californian Adobe Housing



Californian Adobe Housing

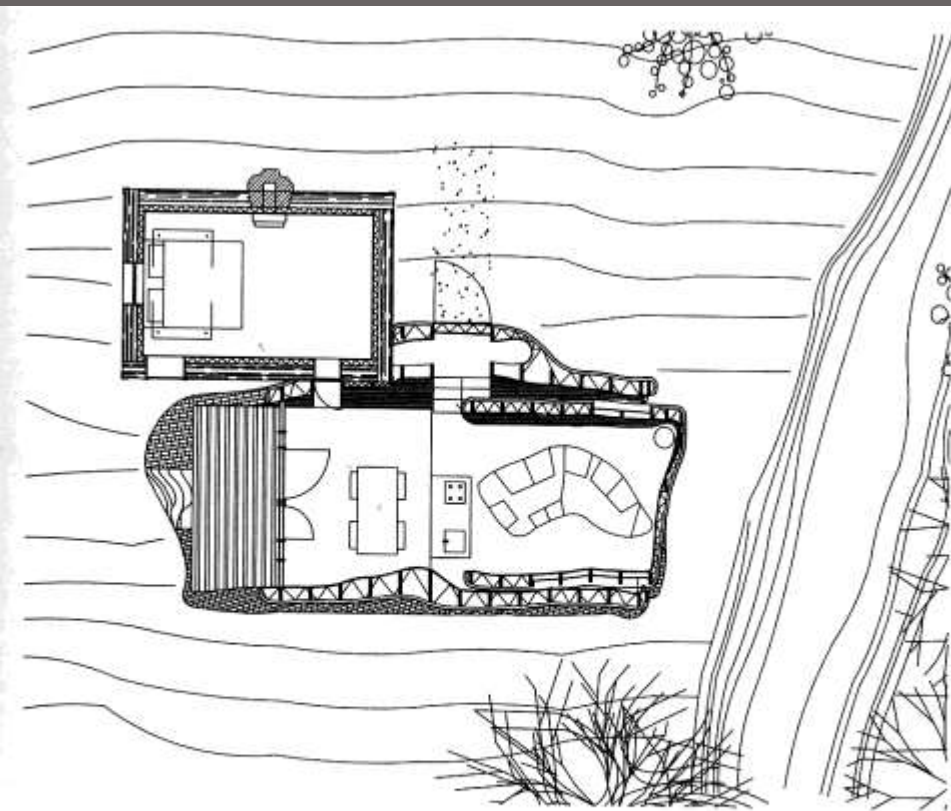


**Lutheran Church, Siofok,
Hungary, Imre Makovecz
1986
Revealing Animalesque
forms**

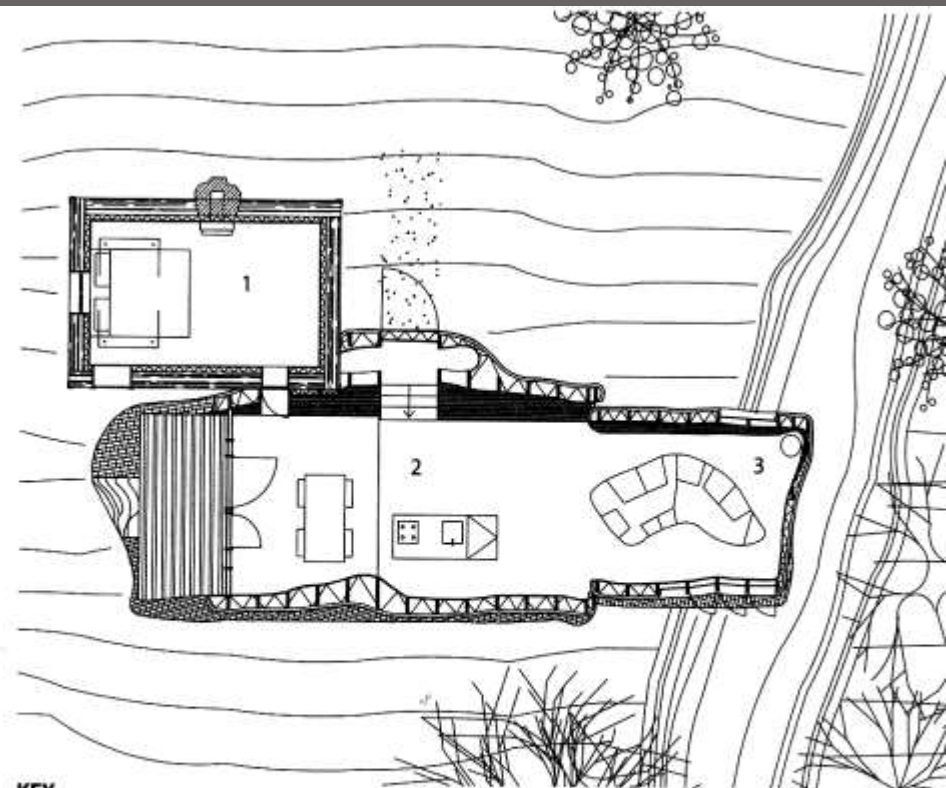
Swedish
Summer
House 2002-
Biomorphic
Architecture



Swedish Summer House Plans



ground floor plan



KEY

- 1 sleeping
- 2 living
- 3 extension

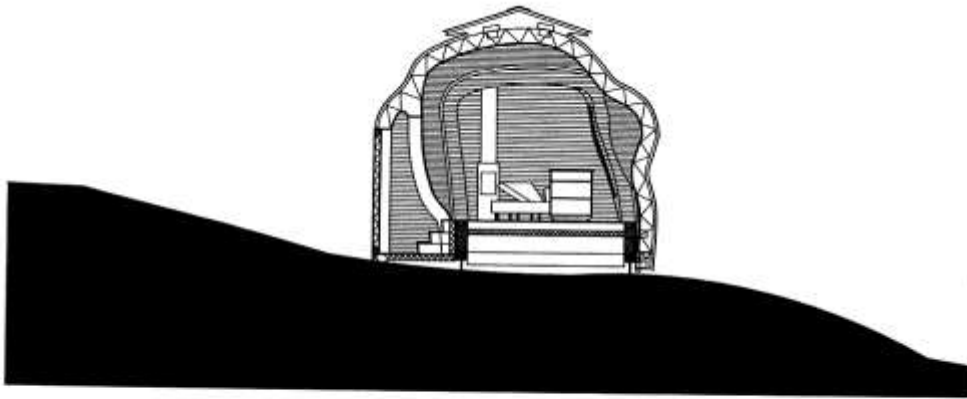


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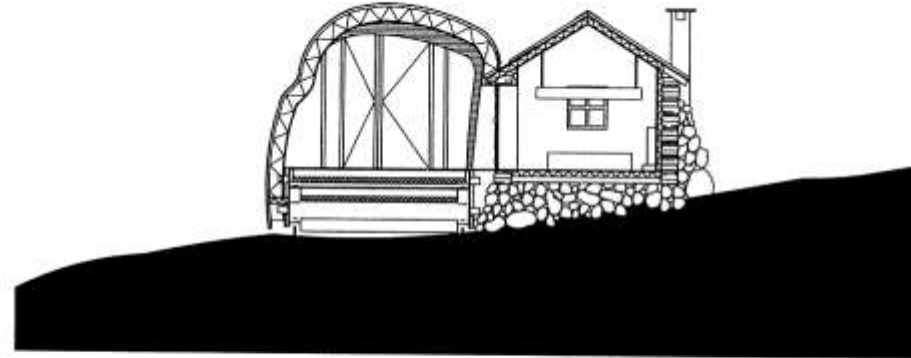
10m

ground floor plan extended

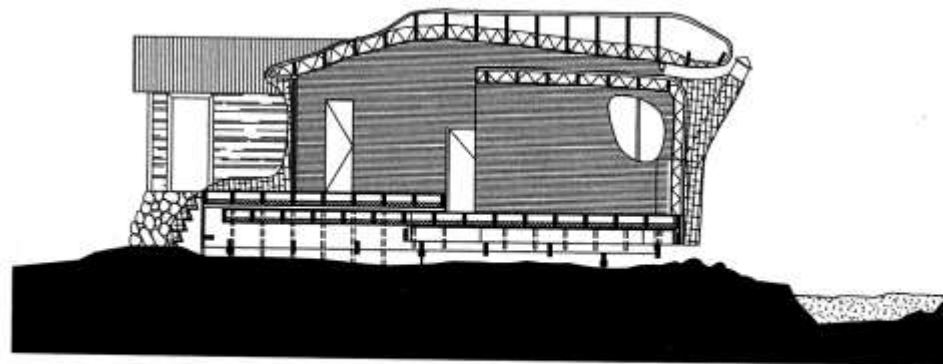
Swedish Summer House Sections



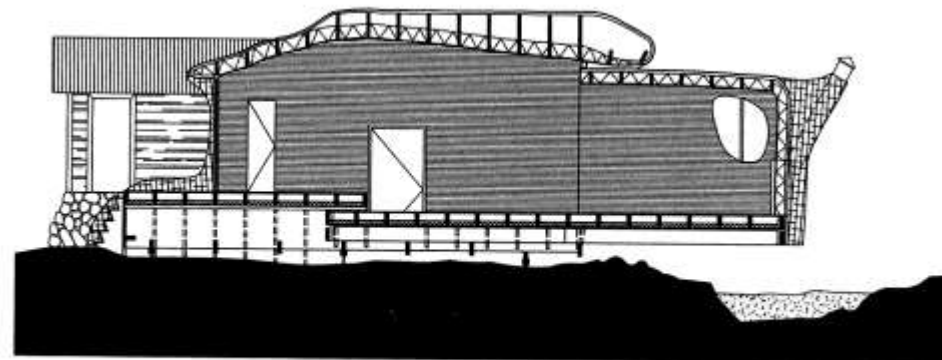
section through extension



section at original cabin



elevation



elevation extended

Swedish Summer House Interior





Luciano Pia

Apartment complex Turin Italy by Architect Luciano Pia 2012



BIOMIMICRY - ARCHITECTURE
INSPIRED
BY NATURE

BIOMIMICRY

A SOURCE OF ARCHITECTURE INNOVATION

Praveen Rohilla
13001006049



Graz Art Museum, Austria 2003 – Peter Cook, Colin Fournier



"Organic form is a space-time structure. It creates its space-time. Being in an organic form we partake of its distinctive space time; its possibility of non-local interconnections over multiple dimensions."

Mae-Wan Ho, "New Age of Organicism", *Architectural Design Profile* 129 "New Science, New Architecture", 1997

Mirador Del Rio



Mirador Del Rio

- "For some, organic is curved, organic is asymmetrical, organic is natural materials, organic is individualistic, organic is holistic."
- Sidney K. Robinson, "The Continuous Present of Organic Architecture", *Architectural Design* 7/8, 1993