THE SAGRADA FAMILIA by Antoni Gaudi

Bacherlor of Architectural Technology and Construction Management

7th Semester Dissertation

Cristina Miret Román

Cosultant: Erik Toft

22th of November 2012

VIA UNIVERSITY COLLEGE

TITLE PAGE

Dissertation title: The Sagrada Familia by Antoni Gaudi

Consultant: Erik Toft

Author: Cristina Miret Román

Date/Signature: 22th Novembre 2012

Student Identity Number: 163844

Number of copies: 2

Number of pages: 62

Font: Century Gothic 12

VIA UNIVERSITY COLLEGE

NOTE: This dissertation was completed as part of a Bachelor of Architectural Technology and Construction Management degree course – no responsibility is taken for any advice, instruction or conclusion given within!

INDEX

INDEX

PREFACE

This dissertation talk about the basiilc os Sagrada Familia by Gaudi in Barcelona, Spain.

The Sagrada Familia is one of the most important construction in Barcelona, Spain and in the world.

It's different to other cathedrals, it's original and unique. This is the main reason for I chose this topic.

The author of this construction is Antoni Gaudi, an Catalan architect.

One of his characteristics is his influence in the nature and the rules surface. It´s impossible know the Sagrada Familia without know Antoni Gaudi, so in the dissertation I will talk about the cathedral, his geometry, his originality, his influence, the influences in Gaudi, his ideas, etc.

It´s divided in 3 main sections:

1. Antonti Gaudi
2. The Sagrada Familia
3. Geometry

PROBLEM STATEMENT

The Sagrada Familia and Antoni Gaudi have become one of the main icons of Catalonia and Spain too. This is the main reason why I have chosen this topic.

Gaudi´s works reflect his highly individual and distinctive style . Gaudi studied every detail of his creations and he introduced new techniques in the treatment of materials. After a few years under the influence of neo-Gothic art and Oriental techniques, he became part of the Catalan *Modernista* movement.

After undertaking the Sagrada Familia´s project, Gaudi devoted himself exclusively to building it. The Sagrada Familia is his best important construction. In this cathedral he did so combining geometrical forms, chosen for their formal, structural, luminous, acoustic and constructive qualities: hyperboloids, paraboloids, helicoids, conoids and ellipsoids.

The Sagrada Familia is a church with five naves and a crossing with three, forming a Latin cross. About the structure, Gaudi planned a balanced structure of columns that branch out likes trees, as the culmination of the structural studies of his other buildings.

I think it´s interesting study this cathedral because it is unique. It has different elements that other cathedrals, new geometric, new technologies, etc.

The aims and objectives in doing this research study are:

- Influences in Gaudi, his inspiration and how to do
- Geometric. Gaudi introduced new geometrical forms, so we are going to studied his functions and where are situated in the Sagrada Familia
- Beyond the gotic. Gaudi inspired in old constructions like oriental and gothic construcctions, but he went far away, his architecture started the beyond the ghotic.
- The future, what artist are influenced by Gaudi and representing the Sagrada Familia.

To carry out this project will use computer resources, books, articles and internet.

ORIENTAL INFLUENCES

-ARTISANS WORKS WITH IRON AND STONES

-DRAGONS

-ORNAMENTAL AND DEEP SENSE OF POLYCRHROME ARCHITECTURE

EXAMPLES

EL CAPRICHO

CASA VICENS

NEO-GOTHIC INFLUENCES

VIOLLET-LE-DUC

COME TO MODERN ARCHITECTURE

JUAN MARTORELL MONTELLS

GOTHIC VAULTS QUADRIPARTITE AND TOWERS WITH BELFRY

GOTHIC INFLUENCES

-PERFORMANCE OUTSIDE ACADEMIC LESSONS

-THE ARCHITECTURE IS PRACTICALITY

-TRASCENDENT MEANING OF ARCHITECTURE

NATURALISM

-BONES

-TREES

-PLANTS

-SPINAL COLUMNS

CASA BATLLO

SAGRADA FAMILIA

BEYOND THE GOTHIC

-PARABOLIC ARCHS

-INCLINED COLUMNS

-REMOVE FLYING BUTTRESS AND BUTTRESS

-DOUBLE ROOF OF STONE

-VERTICALISATION OF THE WHOLE PROJECT

http://www.galiciacad.com/fotos/sagrada_familia_3d.jpg

http://upload.wikimedia.org/wikipedia/commons/0/01/Gaudi's_Casa_Batllo,_Barcelona,_Spain_(IMG_5380a).jpg

http://www.gaudiallgaudi.com/images/Gb_Casa_Vicens_Torre_FVA.JPG

ANTONI GAUDI

Figure 1. Antoni Gaudi

Antoni Gaudi i Cornet (Reus, June 25th 1852 – Barcelona, June 10th 1926) Catalan architect, leader of modernism and one of the leading pioneers of the avant-garde of the twentieth century. His figure is one of the most amazing architectural history, both for its innovations, seemingly intuitive, and its current practice of international isolation and often imbued mere craftsmanship.. He was first and foremost an architect, but he also designed furniture and objects, and worked in town planning and landscaping.

"In the books rarely find what you are looking for and, when found, is often wrong, so that in the end things always end up thinking themselves directly." by Antoni Gaudí

He was a sick child, which it prevented him from representing to class and forcing him to pass long seasons in Riudoms's family farmhouse, where he caught the Mediterranean light and the images of the Nature, which he always would consider his great teacher.

Gaudí was conscious from very young man of his role of genius of the art, of which his ideas were not a repetition or a mere continuity of what had made the architects till then. He had studied and discovered the geometric and constructive laws with which it's made the Nature —the masterpiece of the Creator— and he was trying to realize his art with the same models

Antoni started from a local artistic milieu combined with the characteristics of

modernism and "Art Nouveau", which marked his time, but took their art to conceptual goals, technical and aesthetic with which it passed. He had a critical consciousness that led to an attempt to overcome the tendencies of his time and expressed a genuine language.

Gaudi is the Catalan modernist expressionist side, looking at their works follow the logic of the creative process to achieve new and solid forms.

Gaudi synthesized all that he knew what geometric and constructive schools of France and Germany and the information I had on the aesthetic evolution that occurred in England and Austria, thus got an architecture independent, unique and innovative, technically and artistically different from which was done in Europe in the same years.

Antoni opened the door to further experimentation with his ruled surfaces an spatial funiculars and catenary archs, with difficult numerical calculation, using models and graphic calculations, allowing him to reach and implement practical solutions economic architecture.

.

ORIENTAL INFLUENCE

8

In the last quarter of the nineteenth century began to take shape in Europe architectural trend in which mingled neo-gothic and exoticism. In the end, this mixture led to Modernism.

Gaudi, who had read Walter Pater and John Ruskin, sought exoticism through English architecture, in the Far East, especially in the architecture of India, Persia and Japan.

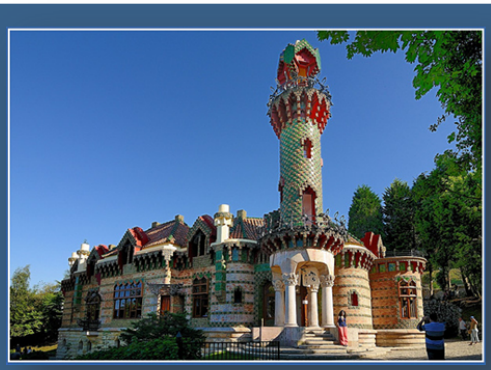
Gaudí, whose openness allowed exalt art forms of India, Persia, Egypt and other structures in the Arab world, was inspired mainly in photographs and art prints that could look in the library of the School of Architecture while studied. At the time that Gaudí studied at the School of Architecture of Barcelona, the architectural movement was quite poor stylistically as builders were only foremen.

This motivates Gaudí seek inspiration outside the borders.

Since it was so difficult for him to travel, given the economic difficulties and health of Young Gaudí, his journey as far away was an imaginary journey through the photographs of the nineteenth century adventurous travelers.

But where it is easier to appreciate this stylistic influence is in the use of ceramics and especially in creating the mosaic *trencadís* technique very similar to the Zellig or Zillij North Africa, widely used in Morocco for coating mosques, minarets and other public and private buildings where the ceramic coating adds shine and cut texture geometry walls.

There are four works of Gaudi's youth where his interest is evidenced East. *El Capricho* (1883 - 1885), in the town of Comillas, is a glazed ceramic clad building with a tall, slender tower that resembles a cylindrical minaret Isphanan. It still presents technical innovations, but a step forward in his personal style.



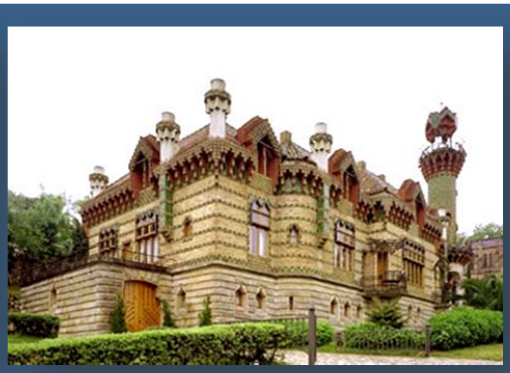


Figure 2/ Figure 3. El Capricho

La Casa Vicens (1883-1888), in the Gracia district of Barcelona, is within these Eastern ways, especially by the use of glazed ceramics. In this building, Gaudi introduces the use of the bow professor in the garden waterfall and naturalism in the fence with palm leaves cast iron. Also in this house studied furniture design and interior decorating *papier maché* with brightly painted.

Figure 4. Casa Vicens

At *Finca Güell* (1883-1887), on the outskirts of Barcelona, Gaudí built, among other things, the goal, the stables and the arena entrance to the large park around the house of Eusebio Güell. Externally the buildings have a glittering appearance

Figure 5. Finca Güell

thanks to the eastern wall tiles, but inwardly present new structural forms. Arches and vaults and domes hiperboloidales catenary profile.

El Palau Güell (1886-1888), in the old quarter of Barcelona, is largest project, with a large number of new solutions in the structure and distribution of spaces and volumes also conjugated with oriental look. The decor was due in part to Gaudí, but also intervened painters.

Figure 6. Palau Güell

NEO-GOTHIC INFLUENCE

The Neo-gothic wanted to bring out medieval mysticism. While Gaudi's contemporaries Neo-gothic took this as a romantic dream, Gaudi developed a set of guidelines that led to what was later called beyond the Gothic.

The Neo-Gothic style influenced by the vogue at the time, but combined with his previous stage. It shows an approach and penchant for curves and dynamic forms. Rationality is achieved through the proper use of the effect of light, mass, color and incorporate pinnacles, battlements, arches, fireplaces and columns. Start using traditional decoration techniques (glass, wrought iron, wood, fragments of brightly colored ceramic, masonry, brick and marble).

Some examples of the Neo-Gothic influence are:

1.Palacio Güell

2.Casa Botines

3.Casa Bellesguard

Figure 7. Palacio Güell

Figure 8. Casa Botines

Figure 9. Casa Bellesguard

GOTHIC INFLUENCE

Gaudi's architecture shares a number of characteristics with the philosophy that followed the Gothic's architects:

- Performance outside academic lessons:

  The ground for developing is searching in the experience. By not relying on prior theoretical abstractions, the result of lessons learned is built on fundamental working tool.

- The architecture is practicality

  The solutions correspond to a spontaneous intuitive nature. Many of the solutions adopted by those builders, even though they were based on scientific principles then unknown, they approached empirically, fabulous fruit of intuition.

- Transcendent meaning of architecture

  The gothic buildings look the sublimation of spirit and this is undeniable at the sight of the impressive results achieved. They are building house of God, and will be used to achieve the union of all the will and commitment of all necessary means.

On the other hand, it existed new gothics concepts, it was existing before but was then found it's peak. These are:

- The use of the pointed arch.
- The use of columns and walls to get casts light incorporation in temples.
- The arrangement of flying buttresses and buttresses acting in this way to cancel the horizontal forces of arches and vaults.
- The use of ribs and dome-like key joint elements

NATURALISM

13

It is for the most creative period of Gaudi to freely develop their ideas of architecture inspired by nature.

Realizing that in nature there is no straight line or plane, and yes, a huge variety of curved forms, changed the normal procedure to project above a plane and rushed straight to the third dimension by all kinds of models and models.

He admired the beauty of it, discovering that nature has no intentions aesthetics but functional. Concluded that searching functionality leads to beauty.

Gaudi imposed finding new shapes to be used in the construction of buildings. Forms were extracted broad that nature offered selflessly and which served to be adapting and improving everyday solutions to the needs found in the practice of architecture.

Gaudí geometry is intended to facilitate the construction processes, to take full advantage of the traditional formulas and ensure the stability of the buildings, and born of personal discoveries made after a search continued.

Gaudí Nature provides the model from which designs original structures and forms that characterize his work. The hyperbolas, parables, spirals, ellipses, or catenaries that are in the shapes of the branches and leaves of trees, shells and limbs of animals are observed by the architect and evoked in their bows in its columns, in their facades.

Thus, traditional inverted domes to create hanging domes of the Church of the Colonia Güell, made with wire, chains and pouches, which transposes suspended models using mirrors or photographs to determine the construction of arches paraboloids of Colegio Teresiano; manufactures columns double twist from the intersection of opposite orientation spiral columns in The Sagrada Familia.

All these natural forms were polychromatic, brightly colored and varied. At Casa Batlló and La Pedrera there isn't straight line, as in nature. In La Pedrera, one of its buildings more organic, wanted to convince residents to fill the

NATURALISM

balconies of climbing plants, which give the feeling of a living building, composed of independent parts and throbbing a body.

Finally, based on the theory of ruled geometry (his great contribution architectural) defined three different surfaces from nature and taken to the architecture: the helix, and the hyperbolic paraboloid hyperboloid.

Inspiration comes from the helix eucalyptus trunk. Gaudí him into columns busts of the College of the Sisters, later also using it in the Park Güell.

Figure10. Parc Güell

The hyperboloid is the shape of the femur. It can be found in the columns of the first floor windows of the Casa Batllo, where one can see clearly that shaped bone.

Figure11. Bone - Figure12. Casa Batlló

NATURALISM

Figure 13. Tendons - Figure 14 .Colonia Güell

The form taken tendons between the fingers of one hand inspired him to define the hyperbolic paraboloid, which was introduced for the first time in the history of architecture in the vaults of the crypt of the Colonia Güell.

Antoni tried not only to the influence of nature were present in their works through the use of architectural structures of forms were reflex natural, but it went further.

Gaudí ecologist thinking led him to recycle materials, and reused tiles, broken pottery, china, glass, ... These were broken into small pieces and then used to coat their buildings. He introduced a new system so decorative, "trencadís" which has become flag and symbol of Modernism.

Also, Antoni Gaudi gave much importance to colors. He tried to imitate in this field to nature. For this reason, all his works are polychromatic, brightly colored and varied.

For him, the ornamentation in both architecture and design was instrumental in the creative process. He claimed that the color was a sign of life and that is why all his work is colorful living. In his works reveals its bold plastic imagination, a rich and complex decorative

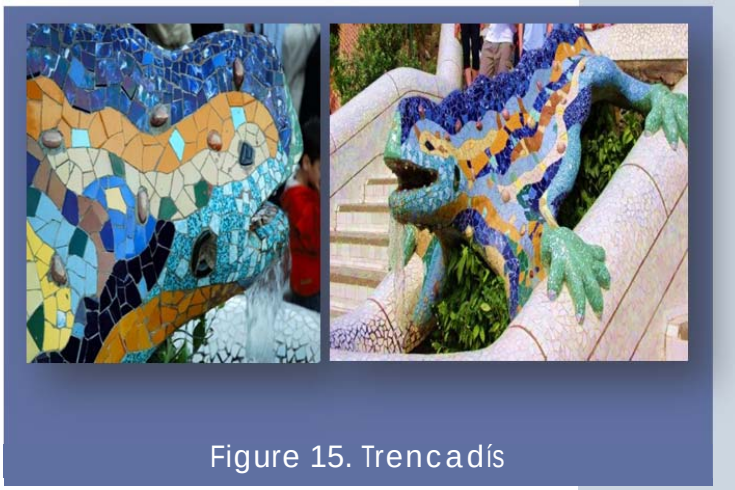


Figure 15. Trencadís

NATURALISM

decorative universe, full of symbols in its smallest details.

He explored the most of the traditional techniques: the use of brick, ceramic coatings (the "trencadís"), woodwork, etc.

The natural elements has five advantages in the constructions:

1. Maxim practical experience: The performance guarantee of these forms is based on experience involving testing by nature from the origin of the world.
2. Suitability of the mechanical behavior: Natural shapes have greater strength, rigidity and stability to the flat surfaces commonly used in architectural composition.
3. Continuity: there aren´t corners or edges.
4. Playability
5. Formal plasticity: These figures provide a formal plasticity and a new generating expressive variations versus boxing sensations produced by repeated orthogonal schemes of the places we live and inhabit.

SAGRADA FAMILIA

The Sagrada Familia has a classic Latin cross plant, with five longitudinal ships and a cruise of three, an apse and a crypt under the main altar. The Temple will have in the future three facades. The main gate, located at the foot of the shaft, called the Gloria, symbolize the resurrection of Jesus Christ. The other two entries, already built, are located at the ends of the transept and are dedicated to the Nativity and the Passion of Christ. Each door will have four towers. The set will be surrounded by a rectangular cloister. In addition, six large towers crowned the structure on the decks of the cruise and the apse dedicated to the evangelists, Christ and the Virgin Mary.

The Holy Family has gone through several phases to be defined by Gaudi.

At first, Gaudi largely influenced by the initial project architect Villar, had opted for a neo-Gothic, but also with a great personal contribution. According to his disciples, the first proposal for the temple represented a refinement of Gothic, because, thanks to the use of parabolic arches very stilted, were unnecessary buttresses and flying buttresses.

The second version, in 1917, marked a radical change in the formal proposals,

following the experience of the church of Colonia Guell. Gothic language is definitely going to Gaudi. The factory remained the monorresistente stone, and the idea of perfecting the Gothic remained in the overall design. The new procedure, which culminated tree system was no longer based on the arches balanced, but the inclination of the central pillars, experienced in the church of Colonia Guell.

The third version of the work did not involve any substantial change, unless extraordinary enrichment of language based on geometric shapes regulated relatively easy to build. The plant-based composition monorresistente remained. Verticalization was increased loads through a larger volume of the cover.

SAGRADA FAMILIA

However, Gaudí could not take any of these ideas, except in the apse and four towers, three of which are not finished and all shapes based monorresistente stone factory.

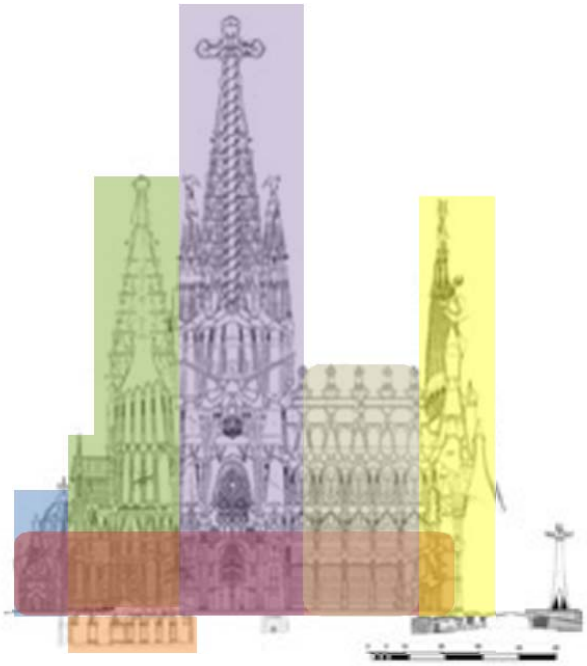
Below is a table of the various architects who have participated in the construction of the basilica

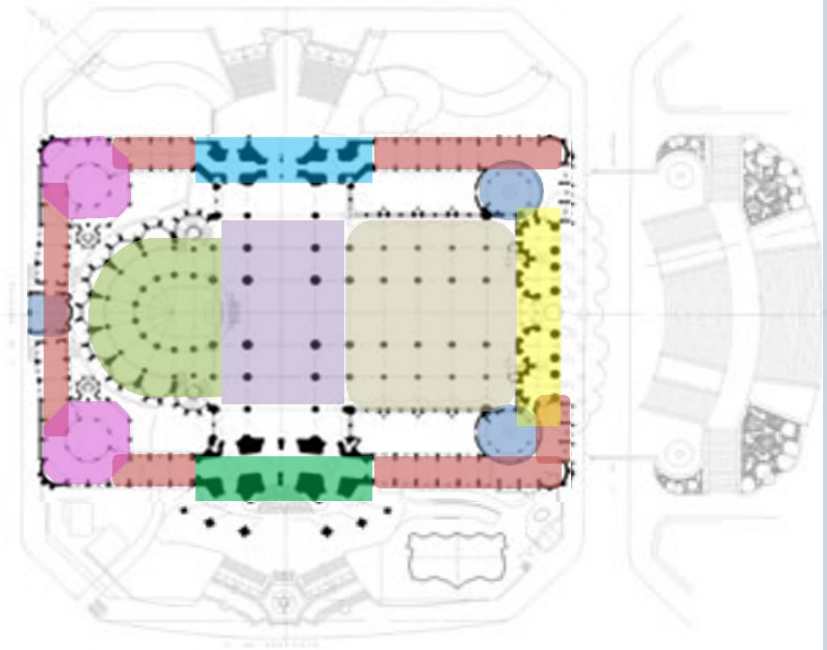
However, Gaudí could not take any of these ideas, except in the apse and four towers, three of which are not finished and all shapes based monorresistente stone factory.

Below is a table of the various architects who have participated in the construction of the basilica

PERIOD	YEAR	ARCHITECT
1º	1882-1883	Francesc de Paula Villar
	1883-1926	Antoni Gaudí I Cornet
	1926-1936	Domènec Sugranyes I Gras
2º	1939-1966	Francesc Quintana Vidal
	1966-1974	Isidre Puig Boada
	1971-1983	Lluís Bonet Garí
3º	1983-1985	Francesc de P.Cardoner I Blanch
	1985-	Jordi Bonet I Armengol

PARTS OF THE CHURCH





ÁBSIDE
CLOISTER
CRYPT
THE NAVITY FAÇADE
MAIN NAVE
CHAPELS
CROSSING AND TRANSEPTS
GLORY FAÇADE
PASSION FAÇADE
SACRISTIES

DESCRIPTION OF THE PARTS OF THE CHURCH

ÁBSIDE

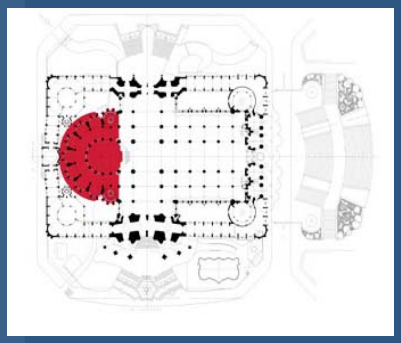


Figure 16. Sagrada Familia - Figure 17. Abside location

The exterior of the ábside, and the crypt, was one of the first built elements and also keeps the Gothic character that gave the architect Villar, and Gaudí respected.

The outside and in particular the seven chapels surrounding the choir is currently under construction. Each of these hoods will be illuminated by three windows, the central one being higher than the other two, to allow placement under an image without the tape.

The pillars of the edges of the chapels, are finished in mid-high pinnacles and gargoyles binoculars with Dragons, lizards, snakes, salamanders, frogs, etc.. used for roof drainage.

Figure 18. Gargoyles

DESCRIPTION OF THE PARTS OF THE CHURCH

The headlights of the chapels are inclined step pyramids with clerestory pilasters that crowns the apse. Invocations will be culminated by the antiphons of Advent.

At both ends, climbing stairs of the crypt and continuing to rise to higher levels, have four series of overlapping windows and a clerestory at the top, are topped by spikes. Here also decorated with gargoyles and land snails are a very naturalistic decorative element. At each end was built a sacristy.

Figure 19. Naturalistic decorative

DESCRIPTION OF THE PARTS OF THE CHURCH

22

CHAPEL

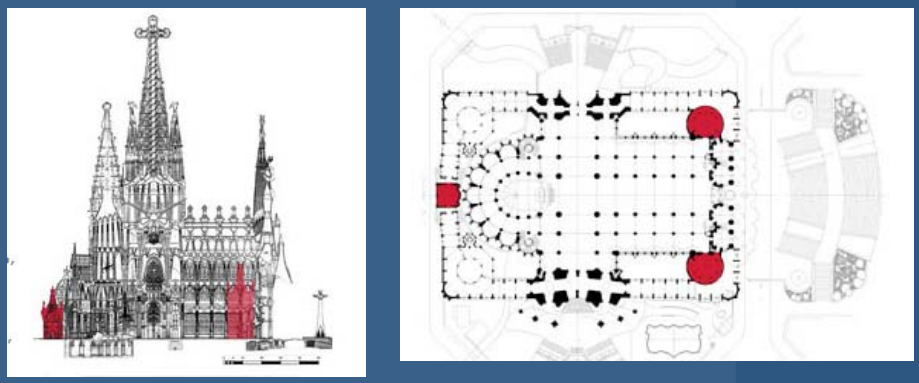


Figure 20. Chapel location

On the Ábside façade, the chapel of the Assumption will be built, dedicated to the Assumption of the Virgin. Gaudí's project, inspired by an existing one in Girona cathedral, includes the crown dedicated to the Virgin, the pillars that form the structure and the curtains hanging from it, as well as the angels that

Figure 21. Model of Chapel

are represented on the Girona model. Gaudí's proposal will present these elements in stone and according to their personal language, in other words, with parabolic geometrical forms and decidedly modern figurations.

DESCRIPTION OF THE PARTS OF THE CHURCH

23

CLOISTER

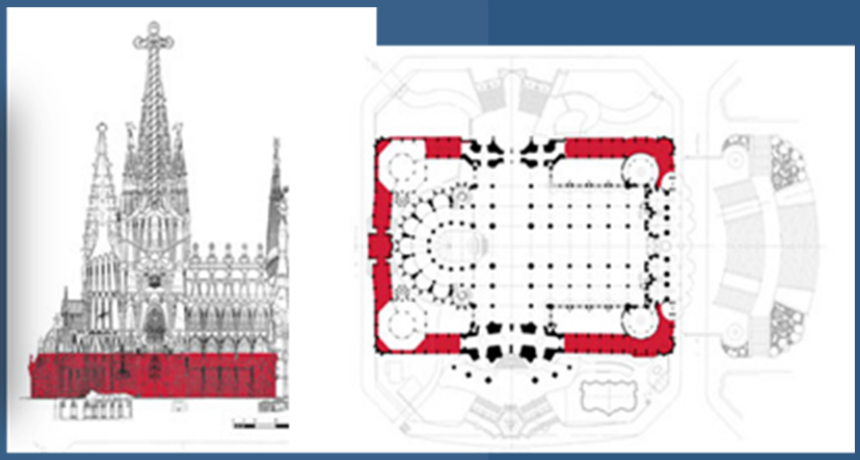


Figure 22. Sagrada Familia: Cloister. - Figure 23. Cloister Location

The cloisters of the Sagrada Familia have a completely original provision that has nothing to do with any other known construction of this type. Indeed, the cloister of the Holy Family, is arranged laterally with respect to the body of the church, but that is arranged around the temple, so that it serves as a place for walking, meditation and relaxation and also serves to insulate the temple the noise of the city that surrounds it. According Gaudí, will go to pray the Rosary in procession.

The cloisters are at the same level as the floor of the temple and pass through three gates, and articulate with the constructions with which they interact, and the Chapel of the Assumption that interrupts to restart its course and symmetrically across the sacristy, Sacramento Baptistery and Chapel.

The vaults of the cloister are of edge and generate a pediment with rosette of three warheads.

Each intersection of the cloister with the fronts crossing has a gate dedicated to

DESCRIPTION OF THE PARTS OF THE CHURCH

different invocations of the Virgin of the Nativity of the Virgin of Montserrat and the Rosary, the Passion of Our Lady of Mercy and Dolores.

The cloisters are finely decorated with various motifs surrounded by abundant sculptural representation of flowers, palms, olive branches, etc.

Being a construction that surrounds the temple, is in various stages of construction and therefore it is impossible to have an overview, but the parts built, mainly left side of the facade of Gloria and both sides of the facade Nativity, give an idea of their final appearance.

Figure 24. Cloister

DESCRIPTION OF THE PARTS OF THE CHURCH

25

CROSSING AND TRANSEPTS

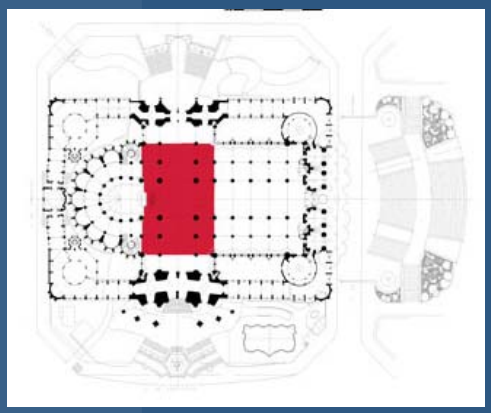


Figure 25. Sagrada Familia: Crossing. - Figure 26. Crossing and Transept Location

Just before the altar stands the cruise with a transept of three ships, which leads to each end of the two facades of the Nativity and the Passion with the mission in an understandable illustrate the mysteries of birth , passion and resurrection - glory - of Jesus Christ. The three ships of the transept have a total width of 45 meters and a length of 60 meters. This area is still at a relatively late construction.

DESCRIPTION OF THE PARTS OF THE CHURCH

CRYPT

Figure 27. Sagrada Familia: Crypt. - Figure 28. Crypt Location

It is one of the parts of the temple designed by Francesc de Paula Villar in the Gothic style, Gaudi took it as the basis of the presbytery of your project, but was one of the elements that prevented him from putting the axis of the ship crossed the block of the Eixample which it is based.

It has the same layout as the apse built over. It consists of seven chapels, an ambulatory and a central area, nearly circular (40x30 meters) above which, is the sanctuary of the church. Is supported by a set of ten pillars of that project to the roof sets small columns ending in a key vault containing a representation of the Annunciation. This dome rises two meters presbytery level. To ensure the lighting and ventilation, there is a moat around the crypt. Access is via two staircases, one on each side of the apse. These staircases have to be extended upward as the temple go growing to allow communication between different levels of galleries and choirs and reach the rooftops. Currently has installed an elevator for easy access.

DESCRIPTION OF THE PARTS OF THE CHURCH

27

GLORY FACADE

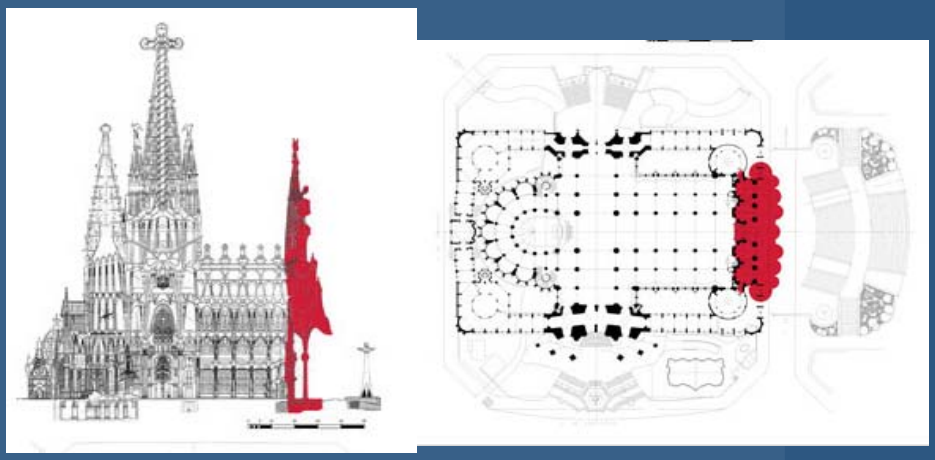


Figure 29. Glory Facade

The façade is located on Mallorca Street, is at this moment just begun, there is only the bare bones of the columns that reach a height of 10 meters and other items as called Jube.

This facade is oriented at noon and will be dedicated to the glory of Jesus Christ. This facade, Gaudí left only a structural study and a visual and symbolic.

Reaches the Mallorca street where the slope of the floor with respect to the street is the most important. In order to give an appropriate entry to the temple, Gaudí designed a staircase that fly over the streets of Mallorca, so that all traffic must pass under the stairs would get to the apple in front (between Mallorca and Valencia and between Sardinia and Marina (but this poses a major problem, since this block of houses is fully built and to finish the project and give it the dignity it deserves, it would demolish part or all of the buildings in this block and we can imagine the problems this could cause).

DESCRIPTION OF THE PARTS OF THE CHURCH

28

The towers or steeples:

Will, as the facades of the Nativity and the Passion, the main and most characteristic elements of the facade. But here, the importance of reserve volumes Gaudí the porch, this tape will make the towers more than in the other facades.

They will, like the others, fully accessible via spiral staircases that will leave an important central void that is placed where the tubular bells.

Each of the towers of this and the other two facades, even twelve, four for each, is dedicated to an apostle. The facade of the Gloria, it will be at St. Andrew, St. Peter, St. Paul and James. Each of them is represented in a large statue, placed at a height of approximately one third of the total length of the towers.

The Pinnacles are similar to those of the other facades but with different vertical arrangement.

The Porch:

Be covered by the four lower hyperboloid vaults steeples and a mixed set of fifteen lanterns, with a total of twenty domes. Columns rest about blackjack.

The doors will be five, one for each aisle and a central nave triple for that, like the other gantries will be devoted to the theological virtues, faith, hope and charity.

The most spectacular of all, are constructions shaped clouds that rise by following the four towers that carry flashlights and characters written on the Creed enormity "Credo in unum Deum Patrem Omnipotentem, creatorem coeli et terrae". These clouds will surround an image of God.

Gaudí wanted the whole saw this facade from the sea.

The low-level portico present a frieze with images of Purgatory and at different heights life images of men and their trades. The supernatural life is expressed by way of saints surrounding the figure of the

DESCRIPTION OF THE PARTS OF THE CHURCH

Redeemer. In the headspace would representation of Judgment.

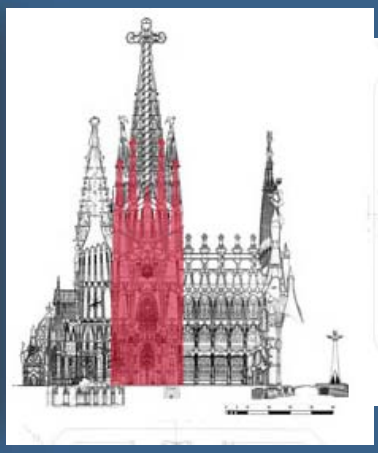
Salient porches will be the sign of the cross and the glorious Sagrada Familia with Jesus in the middle and on top of it, the Holy Spirit and God the Father.

Each of the doors, will be dedicated to a Sacrament and also one of the petitions of the Our Father.

DESCRIPTION OF THE PARTS OF THE CHURCH

30

THE NAVITY FACADE



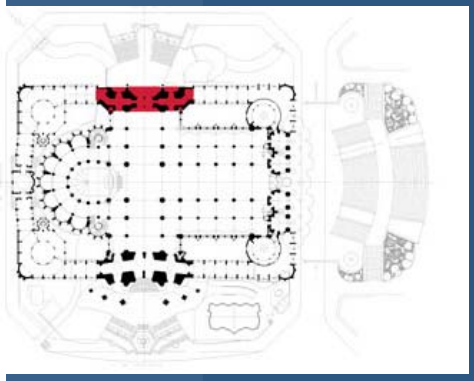


Figure 30. Sagrada Familia: Navity Façade - Figure 31. Navity Façade Location

The Nativity Facade is the only part of the temple built by Gaudí directly. It is formed as the other facades of four steeples square at its base, which becomes cylindrical when they reach the fourth of his height. Above, are adopting a parabolic profile into a pinnacle which crowns each of the towers.

The three spaces between the ridges, are occupied by three portals which together constitute the porch.

The towers or steeples:

They have a height of 107 meters both central and the outer 98 meters. They are the main and most characteristic elements of the facade. It is fully accessible via spiral staircases that leave an important central void and reaching almost to the top.

The entire length of the bell is opened by means of a kind of stone shutters allow diffusion of the sound of tubular bells provided by Gaudí.

DESCRIPTION OF THE PARTS OF THE CHURCH

The top silhouette resembles an episcopal crozier. Other symbols that can be seen, are the symbol of the ring knot of the bishops and the completion a golden cross that incorporates initial apostle whom the tower is dedicated.

Each of the towers of this and the other two facades, even twelve, four for each, is dedicated to an apostle.

Figure 32. Nativity Facade

The Porch:

Gaudí designed for this porch an impressive iconography in which besides the religious figures have been carved huge quantities of plant elements that serve as binding between different religious grounds in an imaginative explosion of life.

The porch is composed of three portals: the Fe (right), Hope (left) and Charity (center) presenting sculptural motifs in a wide and fanciful depiction of the life of Jesus.

The archivolt each portal continues upward to form a flashlight just in a pinnacle.

- The portal of Charity, which is the central one is divided into two different entries for a column that supported statues of Jesus, Mary, Joseph and angels, completed on both sides by groups of sculptures depicting the Adoration of the Magi and the shepherds. Front window eardrum composed of two warheads and a rosette see the star of Bethlehem and pedestals image of Archangel doing the

DESCRIPTION OF THE PARTS OF THE CHURCH

Annunciation to the Virgin. Above, are figures of angels musicians, all surrounded by a world of plants with flowers of various species and animals and birds, covering the entire surface of the frame giving it a stunning look to drive such a large surface. On top of this set, is a representation of the Zodiac signs as they were the night of Jesus' birth. Above and in a cave surrounded by birds, find pictures of the coronation of the Virgin. Still other images above culminate in a kind of pinnacle consisting of a cypress with white doves symbol of purity and include decorative symbols rises between the two central towers and well above the base of the ear drum.

Figure 33. Portal of Charity

- The portal of Hope, to the left, is much smaller than the central and stands just under the facade has a single door, also contains a lush aquatic in this case, since in this website are represented scenes the escape from Egypt and the slaughter of the holy innocents. At the bottom of the pedestals, we find aquatic fauna geese.

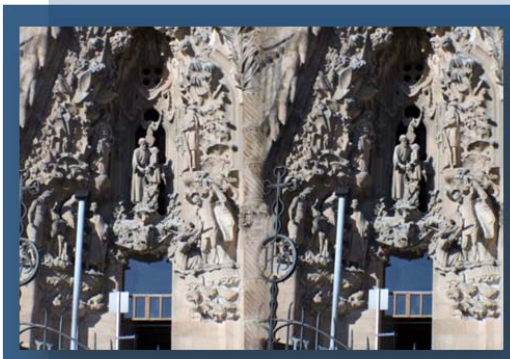


Figure 34. Portal of Hope

DESCRIPTION OF THE PARTS OF THE CHURCH

-The portal of the Faith, to the right of center, is similar to the previous dimensions. With a single door, find pedestals with poultry and vegetables with a frieze of arabesque. Above and to the right, a picture of Jesus working on a workbench and Joseph and Mary seeking Jesus in the temple. On the left, the Visitation of Mary to her cousin Elizabeth and above Zechariah, father of John the Baptist. Above in a niche, an image of the saint. Above the doorway and chairing the portal, an image of Jesus seated at the age of twelve. The eardrum has a window of warhead and a rosette. The archivolt is decorated with lush vegetation with branches of apple, angels left trumpeters among other decorations

-

Figure 35. Portal of the Faith

DESCRIPTION OF THE PARTS OF THE CHURCH

THE PASSION FACADE

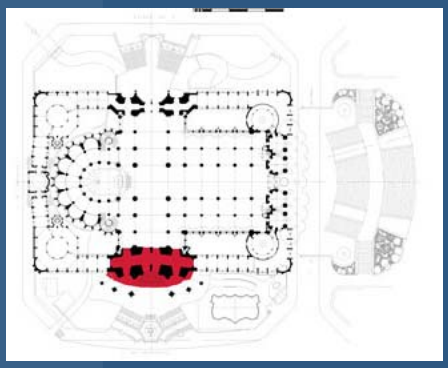


Figure 36. Sagrada Familia: Passion Façade - Figure 37. Passion Façade Location

The Passion façade is of recent construction. It is located on the street Sardenya and is oriented to the west. It represents the passion and death of Jesus Christ. Consistent with this function looks extremely bare and austere, geometric shaped edge. The forms a six-column porch with three entrances, of which the center is divided in two by a mullion signs with Alpha and Omega, located between the four towers. As the facade of the Nativity and the Gloria, the three portals of the Passion are dedicated to the three theological virtues. The sobriety of the facade is also manifested by the presence of bone-shaped columns and sober sculptures were made by Josep Maria Subirachs deliberately adding drama to the already sad Gaudí design.

The project complies with the initial set of Gaudí with respect to their general, but the details are obviously adapted to modern aesthetics.

DESCRIPTION OF THE PARTS OF THE CHURCH

35

THE MAIN NAVE

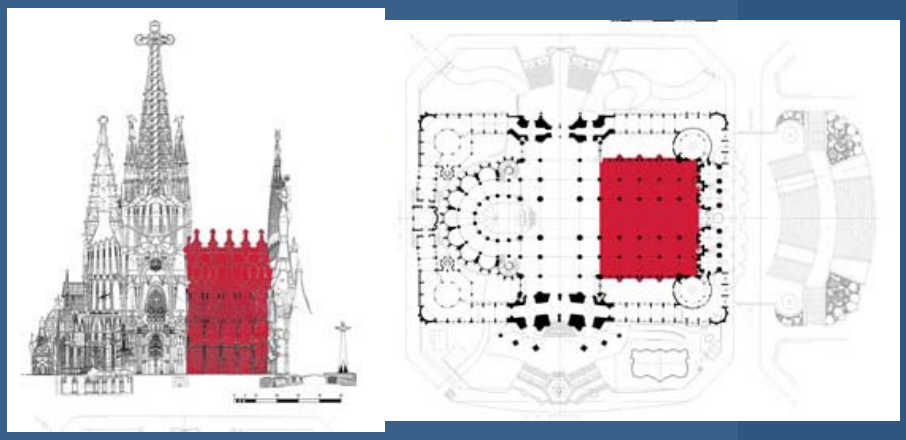


Figure 38. Main Nave Location

The church has a basilical ground plan and five naves, the central one rising to a height of 45 m and the side ones to 29 m. The central nave and side naves are supported by a system of columns which is completely new in the history of architecture. In the eyes of the observer, the interior looks like a forest of trees with beautiful alignments, of which we can see the trunk, the branches and a cluster of leaves. In this forest of columns, the light filtered through the windows will give a bucolic appearance and give a feeling of undergrowth.

The ceilings of the central nave, seen from the interior, will be crowned by aedicules that will provide support for lights with the initials of the Holy Family. Five thick parabolic shields, placed on either side, will have "Amen" and the words of praise "Al", "le", "lu", "ia", broken up into syllables, written on them. The large columns that support the vaults and the roofs also represent the apostles and the churches of the whole world. The columns dedicated

DESCRIPTION OF THE PARTS OF THE CHURCH

to the apostles St Peter and St Paul are outstanding; they are situated between the crossing and the apse, joining the triumphal arch with the Calvary.

On the exterior, the water from the roofs runs down drainpipes which at half height are fixed to the walls at half height with the following allegories and captions: a flask with the inscription "myrra (myrrh)-sacrifice", an incense burner with the inscription "thur (incense) – prayer" and a box with the inscription "aurum (gold)-alms. Beside and on the windows are images of the saints who founded religious orders, such as St John Bosco, St Joachim Vedruna or St Joseph Oriol.

DESCRIPTION OF THE PARTS OF THE CHURCH

SACRISTIES

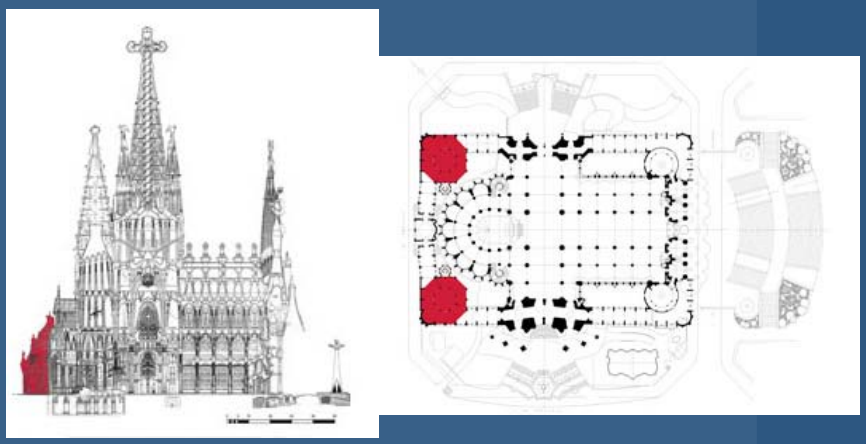


Figure 39. Sacristies Location

Still have not started building, shall be sized on the basis of 18x18 meters and a height of 46 meters. The cover will be domed twelve-sided and be positioned at the corners of the cloister behind the cruiser.

The twelve sides of the dome will be that hyperbolic paraboloids level cloister covers, will be cut by eight vertical planes twelve gables originate uneven corners being larger than the walls.

The bevel angle to give the street there will be a kind of tower topped by three obelisks and a flashlight. At the opposite end, a staircase linking the three floors of the basis of which, the main floor will have a height of 14.5 meters and will be partially prepared as a tiered gallery. The light will enter through the twelve rosettes triangular pediments.

The dome consists of four levels, and all of it will be pierced by triangular windows in order to ensure good lighting. The whole system of vaults that cover different levels will be based on hyperbolic paraboloids and hyperboloids.

DESCRIPTION OF THE PARTS OF THE CHURCH

38

The domes of the two vestries are put together harmoniously with the series of gables, pinnacles and lanterns that are part of the apse who will be next.

GEOMETRY

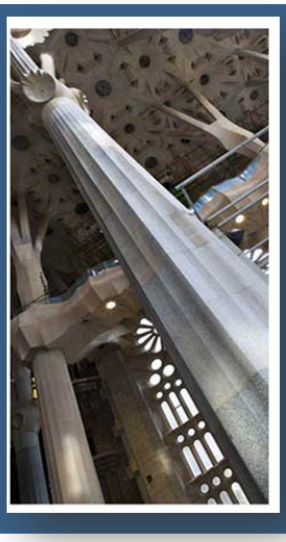


Figure 40. Double Twist Column

During the last fifteen years of his life, Gaudí planned many parts of the church so that they could be built in the future. He did so combining geometrical forms, chosen for their formal, structural, luminous, acoustic and constructive qualities: hyperboloids, paraboloids, helicoids, conoids and ellipsoids.

Many of these surfaces are ruled, which makes the construction easier. He assigned one of these forms to each type of the elements that make up the naves. With helicoids he invented a new column in the history of architecture: the double twisted column. He used hyperboloids for the openings of the windows and the vaults. With paraboloids he created linking surfaces on the vaults, the roofs and the columns of the Passion façade. He generated the knots or capitals of the main columns with ellipsoids. And earlier he had planned the building of the parish schools with conoids.

> *"I geometer, i.e. synthetic, I calculate everything, the geometry in the execution of complicated surfaces, but also simplifies the construction"* by Antoni Gaudi

GEOMETRY

40

DOBLE TWIST COLUMN

In plaster, Gaudí's double twisted column is generated by engraving a helicoidal groove on a cylindrical base by means of a star-shaped template. By making this movement twice, in the two opposite directions of the twist, the result is the common solid of the two barley sugar columns, the two that would have the helicoidal engraving of the grooves, one twisting to the right and the other to the left. In that way the number of arrises created by the initial star-shaped polygon multiplies as the column becomes higher, until practically reaching the circle.

Gaudí was searching for a new column, one that would excel the earlier ones but would fit into the history of the column. And, in that history, he saw three great basic models:

1. The Greek Doric column has vertical grooves.
2. The Corinthian order column, which is cylindrical, is generated by the extrusion of the circle from the base following a slightly curved profile.
3) The barley sugar column, typical of the Baroque, with the torus shape, marks an ascending helicoidal movement following the helix that surrounds the cylinder of the nucleus.

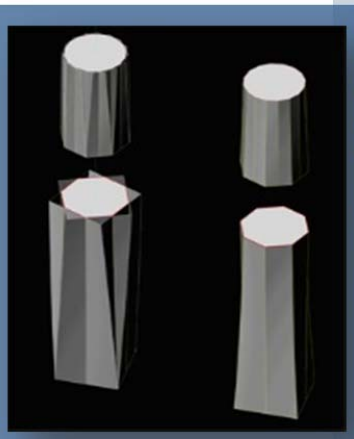


Figure 34. Doble Twist Column

GEOMETRY

RULED SURFACE

One of the great contributions to modern architecture Gaudi has been the use constructive ruled surfaces

Ruled surfaces, as their name suggests, are surfaces that contain straight lines, or rather that can be generated by the movement of one straight line that follows a particular route.

Ruled surfaces allowed him to expand the repertoire of forms and get solutions hitherto unpublished, both on the walls and the vaults or covers.

> *"The use of ruled surfaces is logical for their superior ease plastic and constructive."* by Antoni Gaudí

There are two ways that led to Gaudi to work with regulated space geometry: one is the analysis since childhood had made of natural forms (tree trunks, bones, crustaceans, etc.), and the other his domain the geometry of space and the need I had to experiment with the three dimensions.

With the use of those twisted ruled surfaces (hyperboloids, paraboloids, helicoids and conoids), as well as creating a rich architecture and a characteristic and expressive visual quality, thanks to their double curve they achieve a structural efficiency which is by no means to be despised, since the double curve, often reversed, provides great rigidity and a great capacity for transmission of the mechanical actions to the edges or the support points.

GEOMETRY

HYPERBOLOIDS

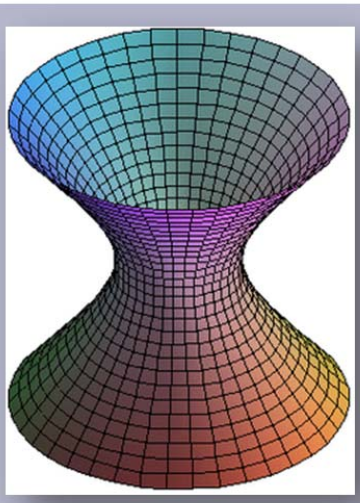


Figure 42. Shape of Hyperboloid

These surfaces are formed by lines that rest between two equal and parallel ellipses, and combines a focused set of corresponding points between the two ellipses. They have two generating lines, nails in one direction and the other in the hand, and represent a special case among elliptical cones and elliptical cylinders.

We find hyperboloids of one sheet in some temple vaults and windows.

And so we can find hyperboloids on the windows, circular or elliptical hyperboloids, the latter easily identifiable from the elliptical rose window.

The light from the attics has to pass into the nave through the vaults, and that is why the vaults are pierced with hyperboloids of revolution

Figure 43. Example of hyperboloid in Sagrada Familia

GEOMETRY

HYPERBOLIC PARABOLOID

The hyperbolic paraboloid surfaces of the most important and original used by Gaudí, a ruled surface is formed by straight lines that are supported by two lines that intersect in space in an orderly fashion, i.e, establishing a objective correspondence between points related support

One of the first examples of the temple is found in the side windows. A second case form the basis of the great columns, creating a smooth transition between the ground and the plane.

Also at the base of the pinnacles of the Nativity façade. The culmination of the use of hyperbolic paraboloid is located on the upper deck of the ships and the sacristy

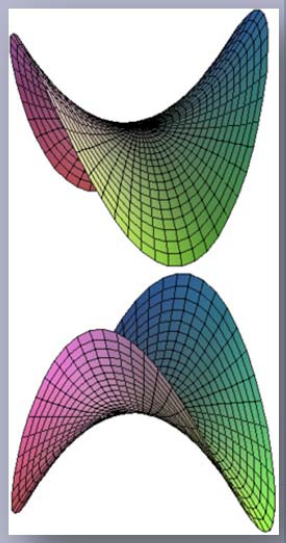


Figure 44. Shape of Hyperbolic and Paraboloid

Figure 45. Base: Example of Hyperbolic and Paraboloide in Sagrada Famila

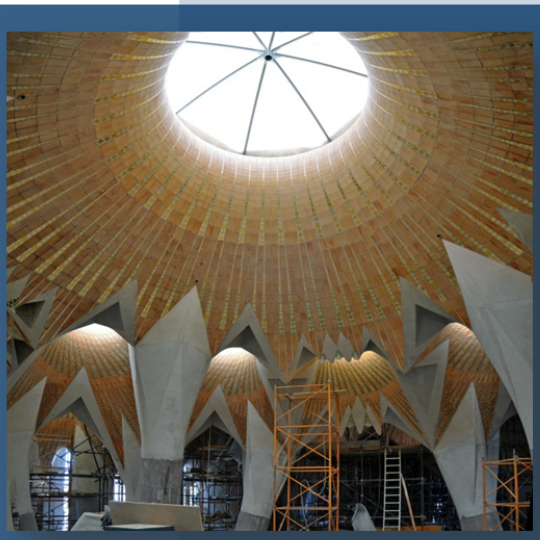


Figure 46. Vault: Example of Hyperbolic and Paraboloide in Sagrada Familia

GEOMETRY

HELICOIDS AND CONOIDS

A helicoid is a surface generated by moving a straight which moves parallel to a plane and rests on a straight line perpendicular to this and a helix associated with a cylinder perpendicular to the plane and whose central axis the straight set. Thus originates to cause helical movement (rotation, around the shaft composite translational direction parallel to it).

The helicoid is the ruled surface we can see on the skeleton of a spiral staircase (before the steps or seen from below if left smooth). It is a ruled surface because there is always a set of horizontal straight lines which afterwards will serve to mark the directions of the radial steps, which follow the route of a spiral of the exterior cylinder of the space occupied by the stairs, and at the same time those radials rest on a central vertical straight line, the imaginary axis inside the nucleus of the staircase.

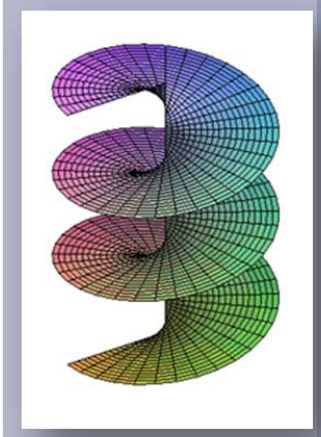


Figure 47. Shape of Helicoids

Figure 48. Staricase: example of Helicoid in Sagrada Familia

GEOMETRY

HELICOIDS AND CONOIDS

The conoid is determined by a line, a curve and a perpendicular plane in space, and formed by all straight lines based on the given and the corresponding points of the curve set, and all these lines are parallel to the given plane.

The surface of the conoid is also ruled. A sinusoidal guideline is traced on the ground and a straight bar placed at a certain height as a second guideline. Resting on these two guidelines, one a straight line and one a curve, are the straight lines that generate the surface, which are the whole group of tensed strings linked to the upper bar that seek the line marked below to act as a guideline for raising the undulating wall.

THE AUXILIARY RESOURCES TODAY

The Sagrada Familia has built for over a century (since 1882). Although it has evolved and finished sculptures level, follows the principles underlying the original structural design Gaudí. During its construction have been using the construction methods of the times, all influenced by material, type of construction, aids, etc..

The materials used in these early years were mostly stone and traditional building techniques were basically. So far the great buildings were made of stone as in antiquity and more normal brick buildings.

After the discovery of Portland cement, began rehearsing with reinforced concrete. The first results applicable to beams and other structural elements were exploited from patents. Gradually the concrete was gaining importance, to the point where he got to be the main material used in the construction of the Sagrada Familia.

The use of concrete has conditioned building methods and consequently aids to accomplish:

-Cranes: Over the construction have been needing a larger number of cranes, up to the number 6. Its use means faster construction and great coverage of all the areas of the basilica.

-Concrete making pant: Concrete is the most important material in the construction of the basilica. Five different types of concrete are used, so that the concrete making plant gives speed to construction.

-Template machine: This makes it possible to produce templates of all kinds with different materials. It receives its order directly from a sketch done by computer. The diversity is necessary to produce pieces of stone in the workshop, plaster models, new designs on site... It can also make three-dimensional models up to certain sizes.

-Good lift: It supplements the crane. It was invented for the building of the

THE AUXILIARY RESOURCES TODAY

cathedral and is used when an item is difficult placement.

-Special scaffolding system for the columns of the church: This consists of a metal structure, made up of two joined and connected platforms, which enable work on two levels of the column simultaneously.

-Elevator scaffolding and different machinery for the different workshops.

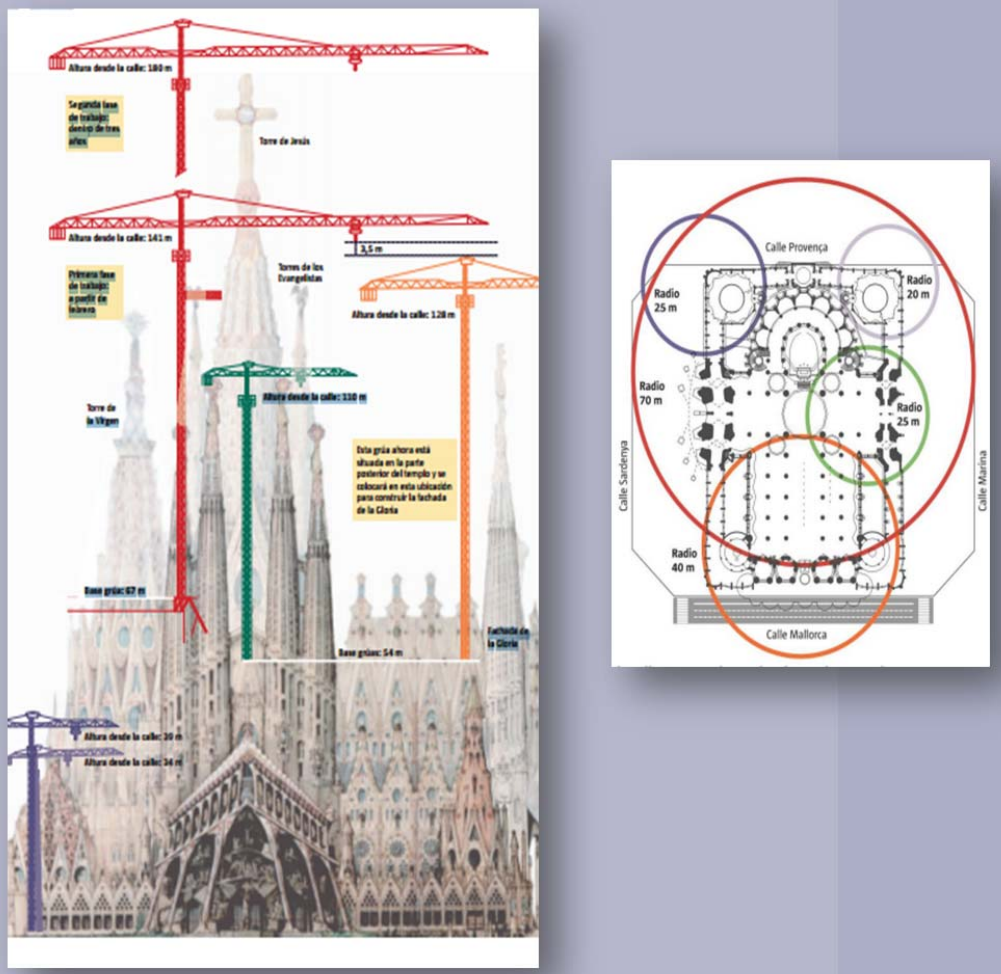


Figure 49. Distribution of cranes in the Sagrada Familia

TRENCADÍS

The trencadís is an artistic ceramic mosaic type whose peculiarity that the parts used for manufacturing tiles come cleaved. The key to a quality trencadís is in choosing pieces with similar sizes, arranged so they seem a puzzle that all fit leaving a small space between pieces to grouting.

The surface coating with trencadís played a major role in modernism, especially in the work of Antoni Gaudí.

The manufacturing process of traditional trencadís can be divided into several phases:

Selection of materials: The most suitable materials are flat pieces of ceramic tiles, but also uses glass, marble or stone. It is desirable that the surface of the rough parts is not as difficult subsequent cleaning mortar residues and may be smeared surface tarnishing final result.

Figure 50. “Pinaculos” of the towers with “Trencadís”

Rupture of the ceramic pieces:The skill of the operator to perform the pieces break is essential when getting a good trencadís ceramic. It is important to obtain a good ability pieces with uniform sizes, especially when the trencadís be performed with pieces of sizes larger than 8 or 10 cm and thus a smaller amount of wasted material. At the time of breaking the parts must use protective gear for the eyes and hands. Sometimes placed a newspaper or cloth over the pieces to break not jump when small sharp splinters of enamel.

Size of pieces: The size of the pieces is to be suited to the characteristics of the

TRENCADÍS

the drawings may have. This way you can get an optimal outcome.

Fitting the pieces: The pieces are placed on the wet mortar with a small vibration, making sure to leave enough space between the boards so that once the mortar is dry and well set pieces can be grouted. The grout has to do with a rubber or similar. Before the material is dry grout used to have to clean the remains of mortar from the surface of the tiles with a damp sponge.

Trencadís found work in the elements that decorate the facade of the Nativity, among them are the pinnacles of the towers.

BEYOND THE GOTHIC

Antoni Gaudi took structurally gothic ideas, but he went further, based on principles of the Gothic, natural forms and his own inspiration, came to what is called "the beyond the Gothic", introducing new elements, such as being:

Parabolic arch: this arch is the formal expression of the pressure line that defines the natural decline in cargo space and solution of continuity with the lancet, which proposes a model for the new architecture.

Inclined columns: it is a direct consequence of the use of absorption systems efforts seeking identification of load-bearing geometric lines with pressures caused by the lowering of loads. The vertical line is the simplest expression of the gravitational action. But in most cases does not happen naturally, and that the composition of the forces that originate in a resulting construction is not a vertical line. It is similar to nature, we find completely unsupported vertical structures, like a tree under strong wind efforts supported by the leg of an animal in motion.

Remove flying buttress and buttress: Working with completely vertical pillars necessary to use an auxiliary structure as were the buttresses and flying buttresses. With the introduction of inclined elements, these accessories obsolete.

FUTURE

Antoni Gaudi suffered an untimely death, this did not prevent left an important legacy to new generations. His wit, skill and a different way of looking at architecture, has inspired several new architects of the 21st century.

Among them are, another Catalan architect Enric Miralles. With a premature dead like Gaudi, it was said that had it not been so, had come to project works like those of Gaudi.

Some of his most important works, rehabilitation of Santa Caterina Market, the cemetery of the city of Igualada and the Scottish Parliament.

Using a similarity with one of them, we can speak of the cemetery, with the fusion of stone, steel and concrete with the hardness of the natural earth transforms the essence of nature, like Antoni.

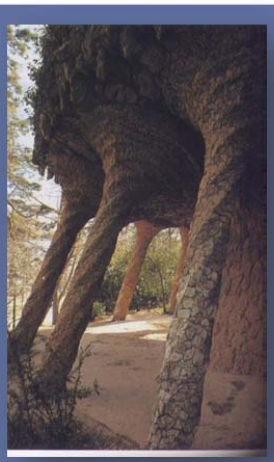


Figure 51. Cementery in Igualada city - Figure 52. Parc Güell

Another architect who was influenced by Gaudi, has been the Valencian Santiago Calatrava, famous for works such as The City of Arts and Ciencas, the Turning Torso or Jerusalem Chords Bridge.

Most works of Santiago Calatrava noted for its curved forms (parables, helical, conoid) and the use of Trencadis, having a difference in the color of Trencadis as Gaudi used colors and Calatrava uses only white.

The following pictures are a example between the Gaudi's architecture and Calatrava´s architecture:

FUTURE

The left picture belongs “Casa Milà” in Barcelona by Antoni Gaudi, It can be see an Inverted Catenary like a spinal column. And the right picture belongs “Sala Municipal Subterranea” in Alcoy(Alicante) by Santiago Calatrava, it´s an obvious similarity between the two constructions.

Figure 53. Casa Milà - Figure 54. Sala Municipal Subterránea

This other two picture are other example between the similarity. The up picture is “Escuela Sagrada Familia” by Gaudi and the down picture is “Bodegas Ysios” in Rioja Alavesa by Santiago Calatrava

Figure 55. Escuela Sagrada Familia - Figure 56. Bodegas Ysios

FUTURE

Antoni Gaudi has also influenced architects such as Norman Foster who said "Gaudí has been one of my heroes. It came at a time that produced heroic figures like Gustav Eiffel, Louis Sullivan and Frank Lloyd Wright. In the eyes of some critics, the creativity of Gaudi suffered from over-expression but Gaudí was an extraordinary poetic power architecture with a group of artisans dumps in his works " .

Finally, other artists have been influenced by Gaudi: Frank O.Ghery, Zaha Hadid, Herzog & de Meuron, Jean Nouvel, Benedetta Tagliabue, Richard Rogers o Toyo Ito.

CONCLUSION

Hard to believe that a basilica begun to build in 1882 and still under construction even more so without his principal architect without a legacy of plans to follow the construction.

But such is the ingenuity, diversity and originality that shows the basilica, which would be foolish not to end the project.

La Sagrada Familia, is more than a building, it is a work of art. It can be found from columns entirely new to an unseen ornamentation.

The basilica has under construction 130 years, what has made you have gone through the techniques, influences and problems of each period.

The knowledge and techniques have evolved in a way that is logical as unthinkable that are reflected in the materials and construction solutions used.

The studies for the construction of the remaining parts are facing labor following the innovative spirit that has always had the Temple and not rule out the possibility of using new materials. The progress of the works of the Sagrada Familia has been brought up over the new years covered needs with available resources. As seen, the Concrete has solved some of these problems, but it is possible that future requirements arising introducing materials not yet used. For example, the construction of the tower over the crossing of Jesus Christ must necessarily make with a lighter material otherwise it would strengthen the current foundation under the crypt built by Gaudí.

Gaudí was essentially an architect, an architect who was well aware of the trade resources, able to use all forms of planar and spatial geometries, passionate about building. As a result, of the impossible into constructible.

True, Gaudí was inspired by organic forms in natural patterns and, above all, in the spirit of synthesis, but so is that behind the most symbolic of his work there is a structural support, functional approach, the economy is based on experience and observation of facts.

CONCLUSION

His originality is not based on new materials and new ways strange, but new solutions with extraordinary ingenuity resolved constructively analyze arising problems forever, but at the root, from the origin.

This end point was the consecration of the Sagrada Familia, which has become a symbol for and a symbol for Barcelona. It has become an inspiration for many artists, has become an icon, something to admire.

The most important and emblematic Gaudi not only display their elaborate conception of architecture, but also will reflect different times along which have built.

the construction of the Sagrada Família (Bonet, 2000) is a challenge for the technology and architecture of XXI century.

The Sagrada Familia and Antoni Gaudi have marked a before and after.

BIBLIOGRAPHY

1. www.sagradafamilia.cat
2. http://en.wikipedia.org/wiki/Sagrada_Fam%C3%ADlia
3. http://www.guardian.co.uk/artanddesign/2011/apr/24/gaudi-sagrada-familia-rowan-moorehttp://etsamtallerjmsanzjuliominguito.blogspot.dk/2010/03/extracto-de-presentacion-para.html
4. http://arquitecturamashistoria.blogspot.dk/2008/09/sc-76-gaud-y-calatrava-en-las.html
5. http://es.wikipedia.org/wiki/Antoni_Gaud%C3%AD
6. http://www.antonigaudi.org/
7. http://www.rtve.es/television/20091109/gaudiana/300028.shtml
8. http://www.lanacion.com.ar/922238-la-influencia-de-gaudi-brilla-en-dos-edificios-portenos
9. http://cvc.cervantes.es/actcult/gaudi/
10. http://www.monografias.com/trabajos21/antoni-gaudi/antoni-gaudi.shtml
11. http://www.guardian.co.uk/artanddesign/2006/jan/16/architecture.spain
12. http://es.wikipedia.org/wiki/Santiago_Calatrava
13. http://es.wikipedia.org/wiki/Enric_Miralles
14. http://blogs.elpais.com/del-tirador-a-la-ciudad/2010/07/diez-a%C3%B1os-sin-enric-miralles.html
15. http://elfenomenogaudi.blogspot.dk/2010/02/la-edad-de-oro-de-los-discipulos.html
16. Book: Antoni Gaudi by Rainer Zerbst
17. Book: Gaudi by Ignasi de Solà-Morales
18. Book: Simbologia del Templo de la Sagrada Familia by
19. Article: Gaudi, l'obra
20. Article: Gaudi y la arquitectura orgánica
21. Newspaper La Vanguardia
22. Dissertation: Gaudi, Philosophy, Influences and Statics from the genius

PICTURES REFERENCES

PICTURES REFERENCES

Figure 11. Bone	http://www.google.es/imgres?q=femur&start=102&num=10&hl=es&biw=1366&bih=624&addh=36&tbm=isch&tbnid=uWkVkAUjychhEM:&imgrefurl=http://www.sciencephoto.com/media/98690/view&docid=NsyJPRCZEaC_yM&imgurl=http://www.sciencephoto.com/image/98690/350wm/C0034464-Human_Femur-SPL.jpg&w=234&h=350&ei=iN5yUMGaO4jntQa49YHwAg&zoom=1&iact=hc&vpx=498&vpy=89&dur=869&hovh=275&hovw=183&tx=79&ty=163&sig=104305906407509407249&page=4&tbnh=138&tbnw=90&ndsp=35&ved=1t:429,r:11,s:102,i:156	13
Figure 12. Casa Batlló	http://www.casabatllo.es/content/imgsxml/es/galerias/texto/154/img-5006.jpg	13
Figure 13. Tendons	http://4.bp.blogspot.com/_wQKn3C3xRQY/TFXalvJ26gI/AAAAAAAAAEc/2zuZVlLB8Aw/s320/8.jpg	13
Figure 14. Colonia Güell	http://m1.11870.com/multimedia/imagenes/cripta-la-colonia-guell_pxl_7f761a6d248770372b9e1ae37d13dfc3.jpeg	15
Figure 15. Trencadís	http://static.flickr.com/121/302325904_0c7321d4ec_o.jpg	15
Figure 15. Trencadís	http://2.bp.blogspot.com/_BWXh-5GBWTA/TFwpEt5hm7I/AAAAAAAACbY/Eqayequ6nhI/s1600/Salamandra_Gaud%C3%AD.jpg	15
Figure 16. Sagrada Familia	http://farm4.static.flickr.com/3032/2953501825_fb3e3dd711.jpg	20
Figure 17. Abside location	www.sagradafamilia.cat	20
Figure 18. Gargoyles	http://lh4.ggpht.com/_aGZfY4CLu-c/SpQafzcIaII/AAAAAAAAEVg/nE6_WjHsSs4/Mallorca	20

PICTURES REFERENCES

PICTURES REFERENCES

PICTURES REFERENCES

Figure 43. Example of hyperboloid in Sagrada Familia	http://topologia.wordpress.com/2011/06/03/edicion-2-5-del-carnaval-de-matematicas/	42
Figure 44. Shape of Hyperbolic and Paraboloid	http://enciclopedia.us.es/images/thumb/f/f8/Paraboloide_hiperb%C3%B3lico.png/250px-Paraboloide_hiperb%C3%B3lico.png	43
Figura 45. Base: Example of Hyperbolic and Paraboloide in Sagrada Familia	http://www.sagradafamilia.cat/sf-cast/docs_instit/geometria4.php	43
Figure 46. Example of Hyperbolic and Paraboloide in Sagrada Familia	http://static.panoramio.com/photos/original/44746678.jpg	43
Figure 47. Shape of Helicoids	http://www.cabalaytarot.com/03/Helicoide.png	44
Figure 48. Staircase: example of Helicoid in Sagrada Familia	http://www.sagradafamilia.cat/imgs/imgs_inst/arq2/geo_0502.jpg	44
Figure 49. Distribution of crane in the Sagrada Familia	Newpaper La Vanguardia	47
Figure 50. "Pinaculos" of the towers with "Trencadís"	http://2.bp.blogspot.com/-cy4W3yBZCsI/TtvUC3NJjAI/AAAAAAAAAK4/nAyjLhkZH0Q/s1600/basi_arte3_p153_f5.jpg	48
Figure 51. Cementery in Igualada City	http://etsamtallerjmsanzjuliominguito.blogspot.dk/2010/03/extracto-de-presentacion-para.html	51
Figure 52. Parc Güell	http://etsamtallerjmsanzjuliominguito.blogspot.dk/2010/03/extracto-de-presentacion-para.html	51
Figure 53. Casa Milà	http://arquitecturamashistoria.blogspot.dk/2008/09/sc-76-gaud-y-calatrava-en-las.html	52
Figure 54. Sala Municipal Subterranea	http://arquitecturamashistoria.blogspot.dk/2008/09/sc-76-gaud-y-calatrava-en-las.html	52

PICTURES REFERENCES