

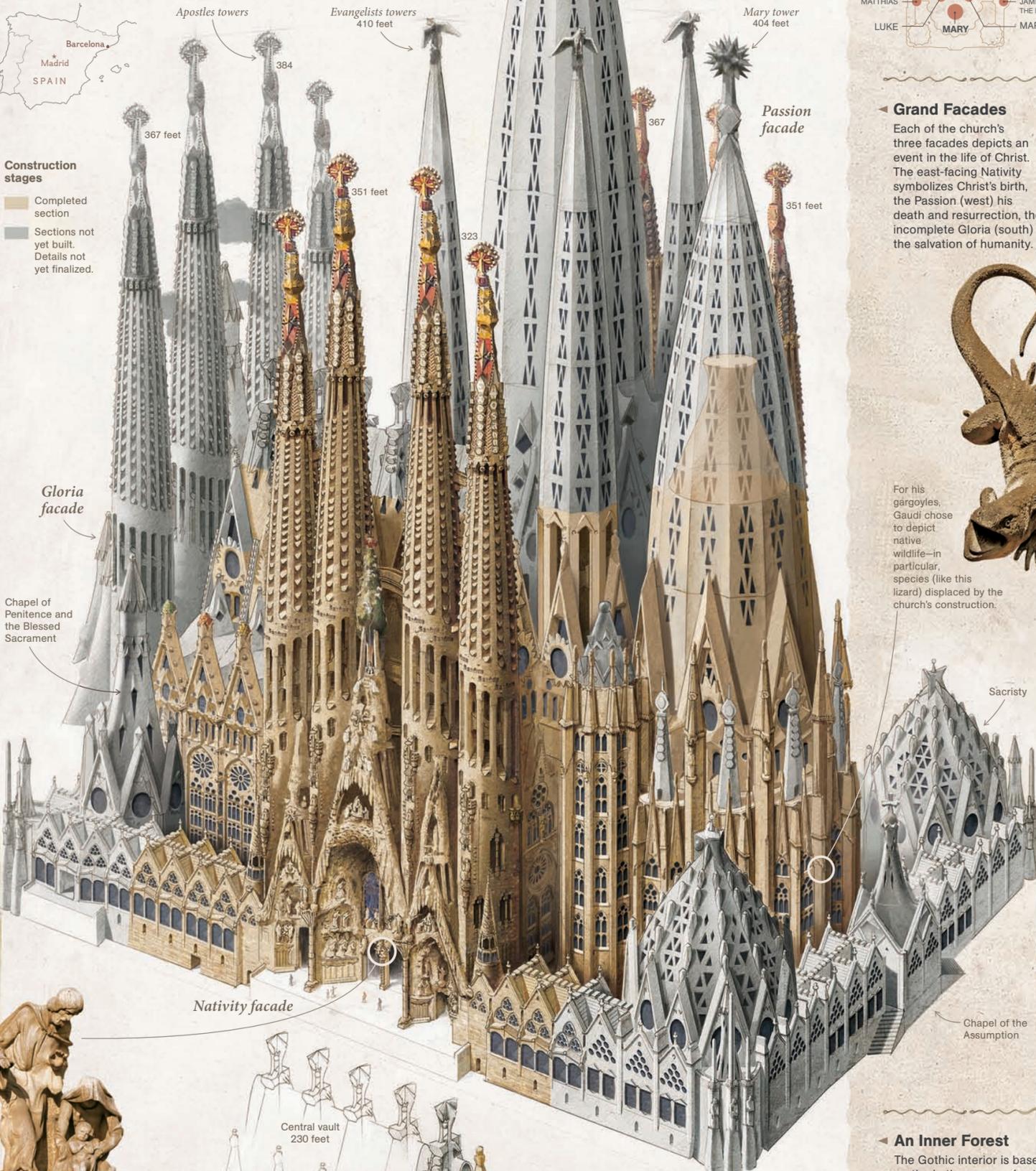
Barcelona's Natural Wonder

Financed entirely through private donations and tourist revenue, the Sagrada Familia is inching closer to completion. A look at the church's layout and design reveals a marvel of imaginative—and unprecedented—engineering.



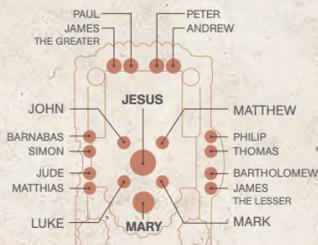
Construction stages

- Completed section
- Sections not yet built. Details not yet finalized.



Symbolic Towers

Still unconstructed, the church's primary pillars will represent some of Christianity's most important figures: Jesus, Mary, the Gospel writers.



Grand Facades

Each of the church's three facades depicts an event in the life of Christ. The east-facing Nativity symbolizes Christ's birth, the Passion (west) his death and resurrection, the incomplete Gloria (south) the salvation of humanity.



For his gargoyles, Gaudi chose to depict native wildlife—in particular, species (like this lizard) displaced by the church's construction.

Gloria facade

Chapel of Penitence and the Blessed Sacrament

Nativity facade

Sacristy

Chapel of the Assumption

The only facade with sculptures designed by Gaudi himself, the Nativity focuses on the church's namesake: the Holy Family.

An Inner Forest

The Gothic interior is based on the Latin cross and set by initial architect Francisco del Villar. But Gaudi wanted the space to feel like a sylvan canopy. Columns rise like tree trunks before branching. Light is captured and reflected through a double roof.



Gaudi designed mosaics bearing the stylized initials of Jesus, Mary, and Joseph to mark the church's crossing and apse.

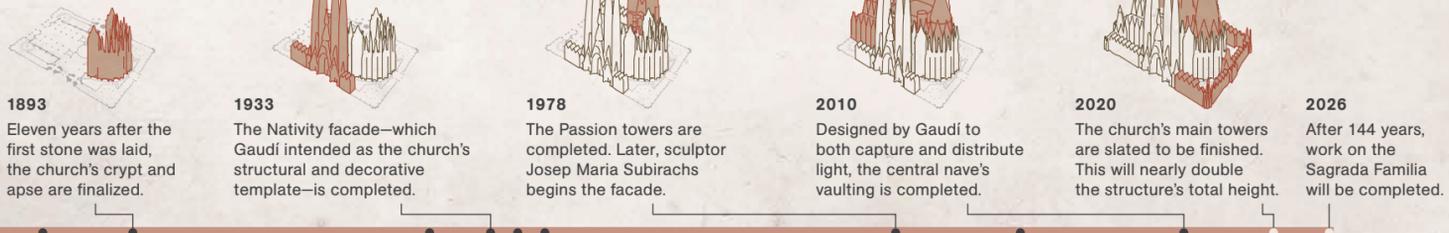
The total interior surface area of the church is 48,438 square feet and has room to seat 8,000 people.



ART: FERNANDO G. BAPTISTA, SHIZUKA AOKI
 DESIGN: FERNANDO G. BAPTISTA AND OLIVER LIBERTI
 RESEARCH: KAITLIN M. YARNALL. TEXT: JEREMY BERLIN
 MAP: SAM PEPPLE. TIME LINE ART: HIRAM HENRIQUEZ
 CONSULTANTS: JUNTA CONSTRUCTORA DEL TEMPLE EXPIATORI DE LA SAGRADA FAMILIA, JORDI CUSSO ANGLES, JOAN BASSEGODA, ANDREW D. CIFERNI. PHOTOS: DOS DE ARTE (LIZARD AND NATIVITY FACADE), JUNTA CONSTRUCTORA DEL TEMPLE EXPIATORI DE LA SAGRADA FAMILIA (MOSAIC)
 OPPOSITE SIDE: ARCHIVE OF THE TEMPLE DE LA SAGRADA FAMILIA (GAUDI PORTRAIT), REBECCA HALE, NG STAFF (VINE), DOS DE ARTE (PINNACLES), STEPHEN CHAO (NAVE INTERIOR)
 COPYRIGHT © DECEMBER 2010 NATIONAL GEOGRAPHIC SOCIETY

A Work in Progress

Here are some key steps in the church's slow march to completion.



1883 Gaudi becomes chief architect of the church.

1926 Gaudi dies in Barcelona.

1936 The Spanish Civil War begins. Many of Gaudi's 3-D models are burned.

1939 The civil war ends. Construction begins again based on remaining models.

1992 Barcelona hosts the Summer Olympics, boosting church revenue via tourism.

2010 Pope Benedict XVI consecrates the basilica.

1893 Eleven years after the first stone was laid, the church's crypt and apse are finalized.

1933 The Nativity facade—which Gaudi intended as the church's structural and decorative template—is completed.

1978 The Passion towers are completed. Later, sculptor Josep Maria Subirachs begins the facade.

2010 Designed by Gaudi to both capture and distribute light, the central nave's vaulting is completed.

2020 The church's main towers are slated to be finished. This will nearly double the structure's total height.

2026 After 144 years, work on the Sagrada Familia will be completed.

Design by Nature

Gaudí pioneered an architecture based on nature's geometric forms. Structural and ornamental, they reflect his native region—and ingenuity.



Structures

Having observed their functional perfection in nature, Gaudí used twisted surfaces and curved planes as the organic bases of his buildings. His columns, arches, and stairways all stem from this notion of natural design.

Columns

In his quest for a perfect column, Gaudí studied the helicoid growth of many plants—patterns that let leaves receive sunlight and lend structural strength.



Chinese abelia grows in a helicoid pattern.

How It Works

Gaudí's columns follow the natural weight-distribution pattern of trees. Beginning with an eight-sided polygon and following the logic of a double-twisting helicoid, columns gain sides and strength with height.

Cologne Cathedral, Germany

THE STATUS QUO

In Gothic cathedrals, lateral loads are supported by flying buttresses. Gaudí disliked the aesthetics of this system and considered buttresses to be "crutches."

199 psi 356 psi 142 psi

Pressure on the columns in pounds per square inch

Top view

Area of detail

Sagrada Familia, Spain

GAUDÍ'S RESPONSE

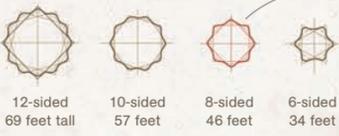
Gaudí strayed from the Gothic tradition in part by shifting the lateral load of the Sagrada Familia onto the nave columns—an engineering feat made possible due to the column systems' unique load-bearing capabilities.

1,138 psi 569 psi 159 psi

Top view

Area of detail

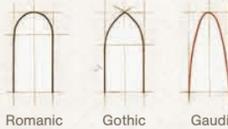
The main columns of the Sagrada Familia come in four sizes and shapes, all of which finish in a circle. The diameter and number of sides depend on the load the column needs to bear.



Other Structures

Arches Follow Gravity

All of Gaudí's works feature catenary arches, which form naturally via gravity and are visible when a rope is hung. To determine the load capabilities of the church's arches, Gaudí hung proportionally measured sacks of lead.



Gaudí's ingenious three-dimensional arch models were photographed and used in lieu of building plans.

Double Roof

A unique feature of the church's roof, quadric surfaces called hyperboloids reflect and filter natural light.

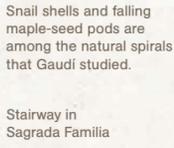


Spiral Stairways

Found in plants, animals, and planetary systems, spirals are a recurring shape and theme in Gaudí's works.



Garden snail



Stairway in Sagrada Familia

Leaflike Roofs

Taken from the structure of a leaf and applied to a roof design, a curved plane called a conoid bears great weight and can channel rainwater.



Magnolia leaf



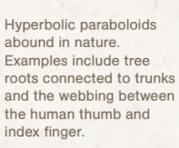
School designed by Gaudí

Tree Structures

To create the church's inner "forest," Gaudí etched tree features into his columns. The crown of the column in the central nave represents the transition between the trunk and branches of a great tree.



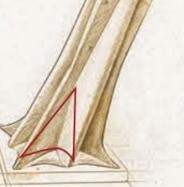
Designed to house artificial lights, Gaudí's columns copy the scars that form naturally when a tree branch is cut.



Kapok tree

Hyperbolic paraboloid

Hyperbolic paraboloids abound in nature. Examples include tree roots connected to trunks and the webbing between the human thumb and index finger.



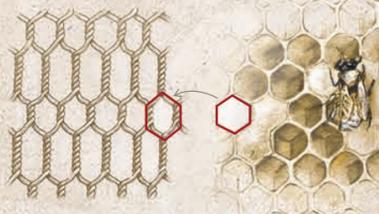
Column base from the Passion facade

Ornaments

Gaudí's sense of aesthetic beauty was directly tied to physical utility. If perfect practicality arises in the natural world, he concluded, so too must sublime decoration.

Honeycomb Gates

The patterns of honeycombs and palm fronds are etched on the gates, walls, and floors of many of Gaudí's early architectural works.



Iron railing on the Nativity facade

Vine Lines

Gaudí often incorporated naturally spiraling helices. Passion fruit tendrils, for instance, adorn the side walls of the Nativity facade.

Passion fruit vine



Frieze on the Nativity facade

Organic Windows

Following the patterns found on natural objects, like those on a marine diatom, Gaudí designed windows to allow for greater passage of natural light.



Marine diatom



Windows on the cloister

Pinnacles of Detail

The tower tops of the Sagrada Familia are modeled on the architect's study of crystals, cereal grain spikes, and grasses growing in and around Barcelona.



Pyrite

Gaudí looked at the geometry of crystallization in minerals such as pyrite, fluorite, and galena and incorporated them in many of his works.

Lavender, wheat, and grasses were some of the plants Gaudí studied as he designed his pinnacles.



Lavender



Pinnacle on the Apse



Rappelling workers lend a sense of scale to the church's central nave vaulting.



Gaudí's Works

- 1 Sagrada Família
- 2 Casa Vicens
- 3 Finca Güell
- 4 Palau Güell
- 5 Col·legi de les Teresianes
- 6 Casa Calvet
- 7 Cripta de la Colònia Güell
- 8 Bellesguard
- 9 Parc Güell
- 10 Finca Miralles
- 11 Casa Batlló
- 12 Casa Milà (La Pedrera)
- 13 El Capricho de Comillas
- 14 Palácio Episcopal de Astorga
- 15 Casa de los Botines de León
- 16 Celler Güell
- 17 Primer Misteri de Glòria a Montserrat
- 18 Catedral de Palma de Mallorca



Barcelona's Architect Most of Gaudí's works are found in or around Barcelona. They have become symbols of both the city and the region of Catalonia.