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Gaudí and the enigma of the modernist architectural ensemble in the gardens of the former Sant Boi Mental Hospital

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Resum. Molt a prop de Barcelona, als jardins del recinte del Parc Sanitari Sant Joan de Déu de Sant Boi de Llobregat, i on fa cent anys s'ubicava l'antic manicomi de Sant Boi, es conserva un conjunt arquitectònic modernista que ha arribat als nostres dies pràcticament com a una obra desconeguda i sense autoria reconeguda. Aquest conjunt modernista conté una sèrie d'estructures que, construïdes l'any 1906, formen un esquema complex que podria ser una anticipació de les estructures de les naus del temple de la Sagrada Família, projectades per Gaudí entre el 1915 i el 1921. Així doncs, es planteja la hipòtesi de trobar-nos davant d'una obra inèdita d'Antoni Gaudí o sorgida del seu entorn més inmediat, fet que inferiria la seva participació.

Paraules clau: Gaudí · Beatus de Girona · estructures · hiperboloide · Parc Sanitari Sant Joan de Déu de Sant Boi de Llobregat

Abstract. Very near Barcelona, in the gardens of the precinct of the Sant Joan de Déu Health Care Complex in Sant Boi de Llobregat, and where one hundred years ago the former Sant Boi Mental Hospital was located, a Modernist architectural ensemble that has survived to the present day virtually unnoticed and whose creator remains unidentified, is preserved. This Modernist ensemble contains a series of structures that, built on 1906, form a complex that could be an anticipation of the structures of the naves of the Sagrada Família Temple, projected by Gaudí between 1915 and 1921. Thus, it proposes the hypothesis that we have before us an unknown work of Gaudí or from his close social environment, which would infer his participation in it.

Keywords: Gaudí · Gerona Beatus · structures · hyperboloids · Sant Joan de Deu Health Care Complex in Sant Boi de Llobregat

Within a short distance from Barcelona, in the town of Sant Boi de Llobregat, stand the premises of the Sant Joan de Déu Health Care Complex, the site 100 years ago of the Sant Boi Mental Hospital. In the gardens of the Sant Joan de Déu center there is a Modernist architectural ensemble that has survived to the present day virtually unnoticed and whose creator remains unidentified. According to documentation and photographs, the modernist intervention in these gardens, constructed between 1903 and 1912, was larger than what remains today, encompassing fountains, benches, and small squares that no longer exist (Fig. 1).

A construction outside time and history

The Modernist architectural ensemble in the gardens of the former Sant Boi Mental Hospital includes many architectural and symbolic elements that are analogous or equivalent to some elements of the most important works constructed by Antoni Gaudí during the same period of time or immediately after the ensemble was completed. These elements include the ceilings of the naves of the Sagrada Família Temple (1915–1921), the composition of the floor plan of the Colònia Güell crypt (1908–1915), several formal aspects of Casa Milà (1906–1912), and the shape and the mosaic work (*trencadís*) of the serpentine bench of Park Güell (1911–1913).

The Modernist architectural ensemble was erected on a pre-existing English-style garden built in 1903. The garden, comprising a lake, paths, and undulant flower-beds, was built facing the valley of the Llobregat River and was demarcated by two avenues, vegetable gardens, and a perimeter wall (Fig. 1). Currently, the ensemble consists of three different architectural structures: The Cova Cascada (cascade cave) built in 1906 (Fig. 2–6), executed in stone and shaped in the form of a mountain cave crowned by a baldachin; the Capella Inundada (flooded chapel), built in 1911 (Fig. 2,3), and the Plaça dels Bancs (bench square), built at the end of 1912 (Fig. 1).

On the one hand, the architecture of this Modernist ensemble is rudimentary and unpolished, apparently due more to a lack of experience in the employed building procedures than a deliberate rough sense of expression, since it manifests the characteristic spontaneity of an experimental work. On the other hand, the construction includes elements of high composi-

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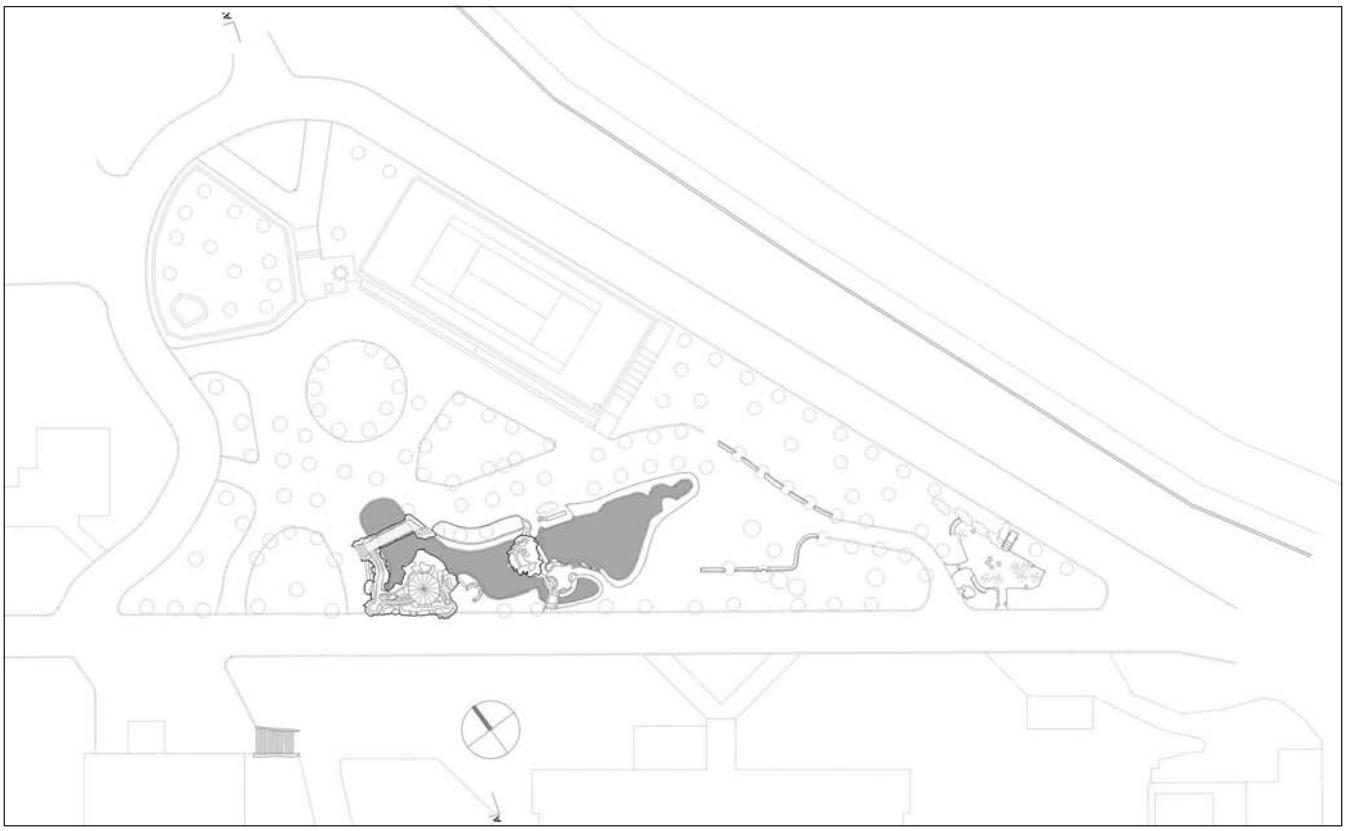

Fig. 1. Modernist architectural ensemble in the gardens of the premises of the Sant Joan de Déu Health Care Complex.

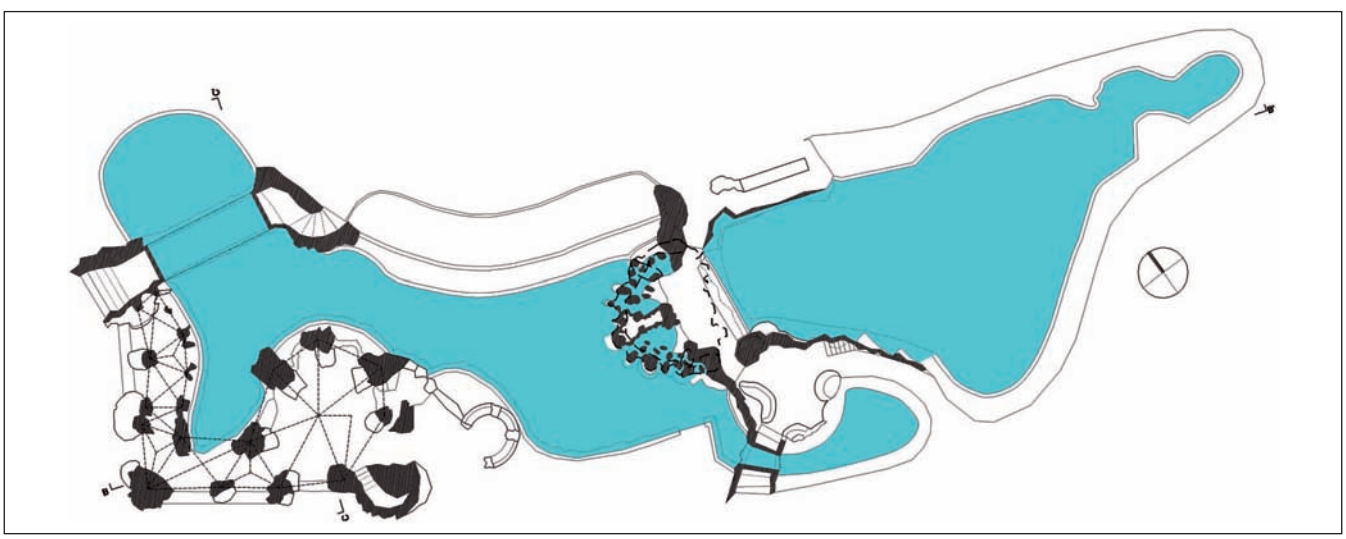

Fig. 2. Ground-plan of the Capella Inundada and the Cova Cascada in the gardens of the Sant Joan de Déu Health Care Complex.

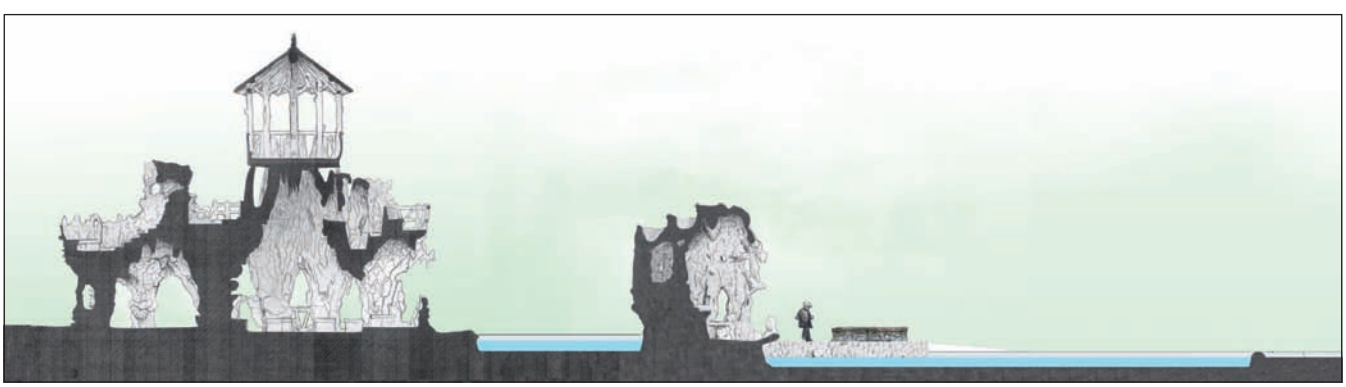

Fig. 3. Longitudinal section of the Cova Cascada and the Capella Inundada.

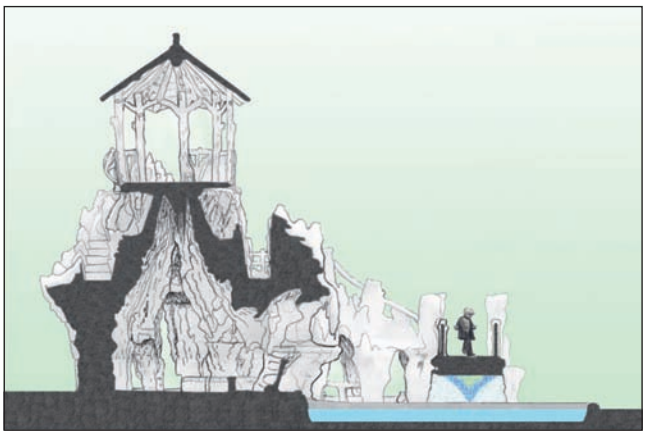

Fig. 4. Tranverse section of the Cova Cascada.

Fig. 5. Children at the Cova Cascada. Photograph taken in 1910.

tional quality and, once the plans were drawn, it became clear that the architectural scheme of the ensemble had been rigorously planned in conjunction with a structural system of great geometric complexity. Furthermore, the results of historical and artistic research have established a connection between this construction and the symbolic and narrative structure of the *Book of Revelations* and the images of the Gerona Beatus.

During the period of construction of the Modernist architectural ensemble, the former Sant Boi Mental Hospital offered workshops to its psychiatric patients in which they learned masonry skills and participated in the different remodeling and expansion works that were taking place at the institution. The compiled documentation, together with the rough character of the construction, suggests that some psychiatric patients participated in the building process of the Modernist ensemble, following the guidelines of a complex project drawn up and directed by an anonymous architect.

Fig. 6. The Cova Cascada.

Fig. 7. Perimeter pillars of the Cova Cascada.

The Cova Cascada of the Modernist architectural ensemble of the former Sant Boi Mental Hospital

The Modernist architectural ensemble of the former Sant Boi Mental Hospital comprises a series of structures resembling ruled surfaces. These are described by second-degree equations, in which for every point of a surface passes at least one straight line that lies on that surface. The most common ruled surface found in the architectural ensemble is the hyperboloid of revolution of one sheet, a surface generated by rotating a straight line (generatrix) around another straight line (directrix) that neither intersects the generatrix nor is parallel to it. Another method to generate a hyperboloid of one sheet is to rotate a branch of a hyperbola around its conjugate axis. An example of a hyperbolic surface is the open end of a trumpet.

Some of the structures of this Modernist architectural ensemble were erected by placing rough blocks of stone on top of one another, using a minimum amount of mortar. This generated nerve-like and tree-shaped surfaces. Some blocks were placed such that they followed the geometric principles of ruled surfaces; indeed, there are traces of straight and curved lines (generatrix, directrix, and hyperbolas) similar to the ones that generate ruled surfaces. Given the positions of the blocks making up some of the structures, it seems probable that the architect who built them was well acquainted with the geometric and mathematical principles of ruled surfaces and, by way of experimentation, used this knowledge to create primitive or embryonic forms of them (Fig. 7).

These forms would have originated in a “concordant” conceptual scheme of ruled surfaces which, during the construction process, would become intentionally blurred, distorted, and fractured. Nevertheless, it remained possible to build complex structures of great formal quality, with countless variants, nuances, and textures, out of “rude” materials and “rough” construction procedures. Furthermore, the relationship between the existing structural elements resulted in forms of tremendous structural and mechanical complexity.

The Cova Cascada, built in 1906 (Figs. 2–4,6), includes a main structure composed of a vault that is similar to a half-concave hyperboloid of one sheet and which widens from top to bottom, such that its main ring rests on seven pillars linked to each other. The pillars resemble half-convex hyperboloids of one sheet and become wider from bottom to top. In the inner perimeter of the vault, these pillars generate a series of curved nerve-like surfaces that rise up towards the crown of the vault (Figs. 10,11). The nerves resemble hyperbolas and they grow from each of the pillars–except from one that is displaced toward the adjacent pilar due to the presence of an oculus–extending as far as the keystone of the vault and forming its framework.

The pillars supporting the main vault have different shapes in both their outer and inner perimeters according to the load borne by each one. As the pillars widen from bottom to top, resembling a half-convex hyperboloid of one sheet, they generate curved organic shapes in the inner perimeter of the vault, creating a formal continuity with the vault by means of a nerve-network-like construction.

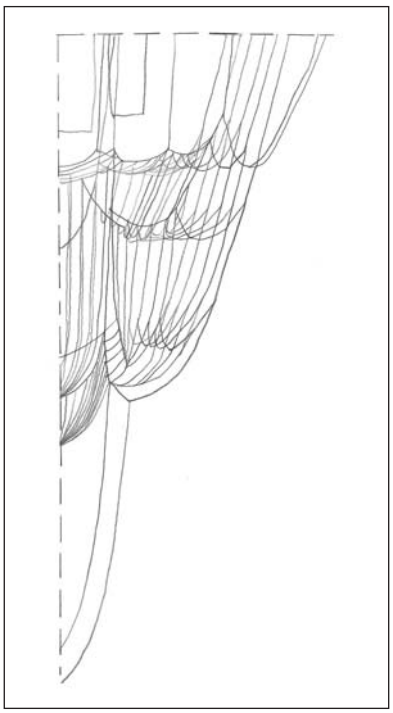

Fig. 8. Funicular model of the crypt of the Colònia Güell.

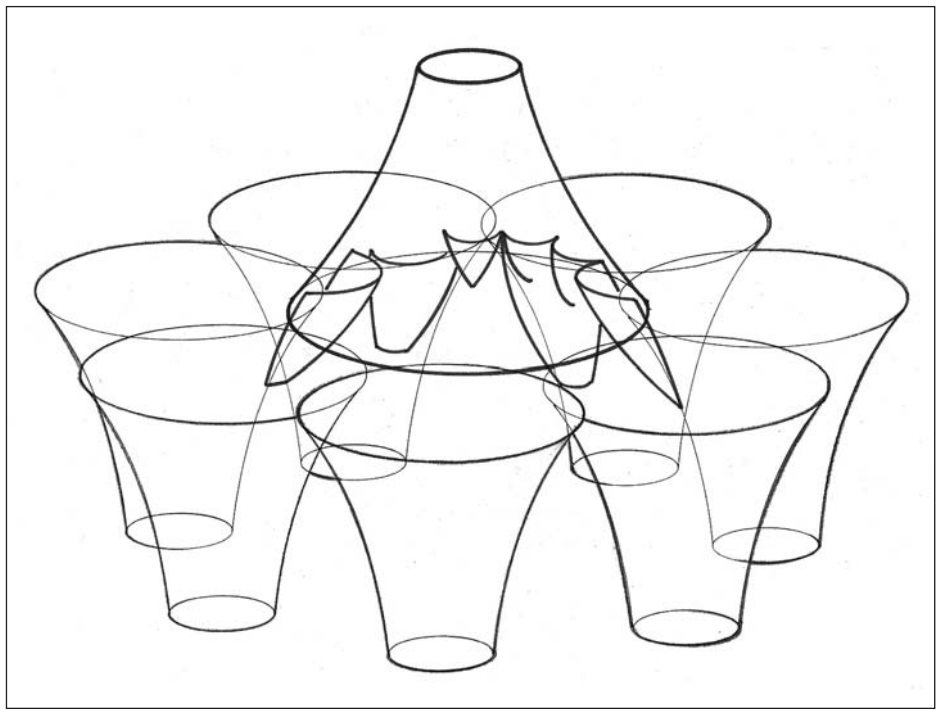

Fig. 9. Hypothetical conceptual scheme of the central structure of the Cova Cascada.

Regarding the outer perimeter, at the northern facade the pillars support a cantilever structure of fountains and balconies with the use of iron beams to counteract the traction forces. These pillars approximate half-convex hyperboloids of one sheet and some of them generate nerve-like structures which follow the direction of the hyperbolas that would form a ruled surface. As for the southern facade, there are supports, thinner than pillars, that also present shapes approximating half-convex hyperboloids of one sheet. At their upper end, they generate a large planter virtually without bearing any perimeter weight, unlike the pillars of the northern facade. In addition, the supports generate conoidal vaults and pointed arches stabilized with a keystone.

The main vault supports a baldachin with a folded octagonal roof, which is perimetrically supported by eight posts built into a circular framework (Figs. 3,4,6). This framework is a metal radial structure and it rests directly on the small ring of the main vault. The framework's outer perimeter is indirectly maintained by rough stone blocks–the shapes of some of which resemble helicoids–and rests on the large ring of the main vault, thus transferring the weight to the supporting pillars (Figs. 3,4). There is also a secondary structure formed by four arches–a few of which are reminiscent of parabolic arches–built out of rough stone. This structure contributes to stabilizing and pointing the framework of the baldachin. The load is transferred by the framework to the small ring of the main vault and substitutes the load of its keystone; as the latter is an aesthetical element with virtually no weight, it constitutes an empty volume.

The weight transferred by the baldachin and the arches to the supports in which the main vault rests counteracts the lateral pushing forces produced by the main vault, displacing and reconducting the isostatic lines towards the core of the supports (a similar weight transfer can be seen in Park Güell, with the large planters and masses of stone of the walls and viaducts). In this construction, the mass is responsible for ensuring that the whole structure as well as its sections work in compression and remain in balance. Furthermore, the inherited principle of the "Catalan vault" is adopted, by which the construction procedures are intended to achieve the cohesion of materials such as iron and stone.

Consequently, it is possible to formulate the hypothesis that the structures of the Cova Cascada originated in a conceptual scheme of great geometric complexity based on ruled surfaces (Fig. 9).

The relationship between the research and the architectural work of Gaudí

> "I previously tested the future structure of the Sagrada Família at the Colònia Güell. Without this preliminary trial, I would not have dared to adopt the structure for the temple."
> Antoni Gaudí

Gaudí worked on the project of the Colònia Güell church beginning in the year 1898, with its construction started in 1908. He visited the building site more than 300 times between 1910 and 1912. In the year 1914, Gaudí abandoned the project, and work on the building stopped in 1916. The Cova Cascada was erected in 1906, and the Capella Inundada and the Plaça dels Bancs were constructed between 1911 and 1912.

The Colònia Güell church, which was going to be erected above the crypt, was designed using a funicular model of hanging chains, forming parabolas and thrust lines, weighed with

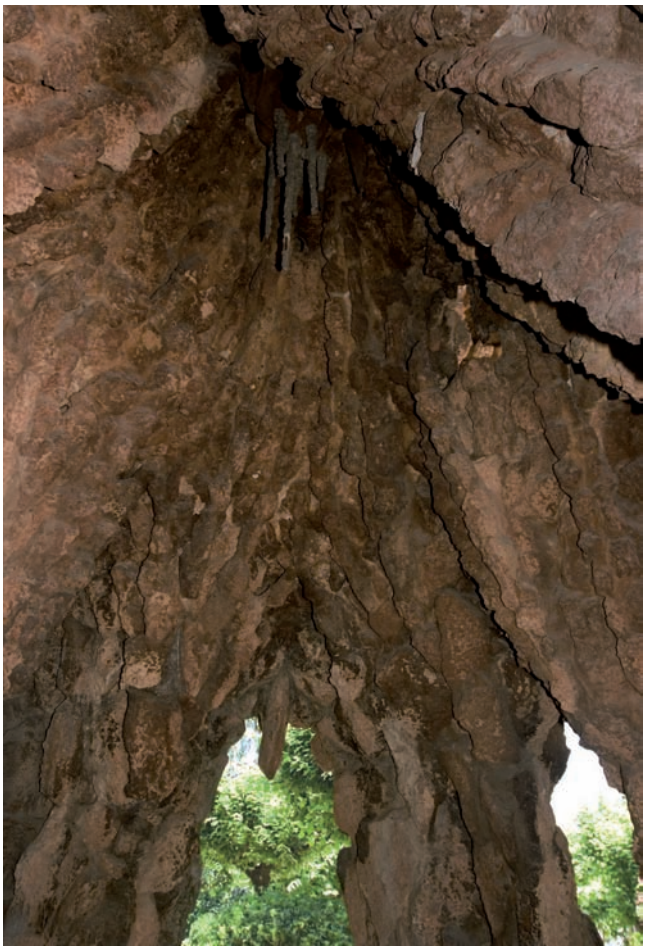

Fig. 10. Main vault of the Cova Cascada.

small sacks containing lead. This technique allowed Gaudí to reproduce the different uneven curved-surfaces of the building; when inverted 180°, the model revealed an optimal method to work in compression. By experimenting with this inverted model of funicular arches, Gaudí obtained shapes that later evolved into the forms of the towers and domes, as well as the inclination of the branching columns, of the naves of the Sagrada Família.

Regarding the Cova Cascada, the morphology of the ensemble of curved nerve-like surfaces generated by the pillars supporting the main vault can be seen as a conceptual reference to the model of funicular arches conceived for the Colònia Güell church (Figs. 8–11).

> "The existence of both a concave surface and a convex surface creates concordance. Therefore, in order for it to exist, both elements, positive and negative, should be present."
> Antoni Gaudí

In the last creative stage of his life, while constructing the Sagrada Família and the crypt of the Colònia Güell, Gaudí rationalized and synthesized, using ruled surfaces (i.e.,the hyperboloid, hyperbolic paraboloid, helicoid, and conoid), the most significant aesthetic formal aspects of his work. Consequently, he planned to cover the naves of the Sagrada Família with structural systems as yet unknown in the history of architecture; naves would be covered with a net of helicoidal tree-

Fig. 11. Pillar of the main vault of the Cova Cascada.

shaped columns in which each half-hyperboloid would form the capitals and, in its turn, would be linked to a surface generated by an ensemble of star shapes. The latter would be formed by the intersections of other hyperboloids of one sheet linked with hyperbolic paraboloids and planes.

In the lateral vaults of the naves of the Sagrada Família, the capitals of the tree-shaped columns, formed by half-convex hyperboloids, support each of the fourth parts of four hyperboloids of one sheet with a more developed concave part (Fig. 12). Each of these hyperboloids are supported by four branches crowned by solid hyperbolic capitals of one, two, or four different tree-shaped columns. In the main vault of the Cova Cascada, seven pillars with a shape similar to a half-concave hyperboloid of one sheet support a vault shaped as a half-convex hyperboloid of one sheet (Fig. 9).

In the Sagrada Família, the hyperbolic capitals have elongated bevels in order to shorten the small cantilever formed between the capitals and the hyperbolic ceiling. The bevels are linked to the hyperboloid vaults, generating a palm-shaped

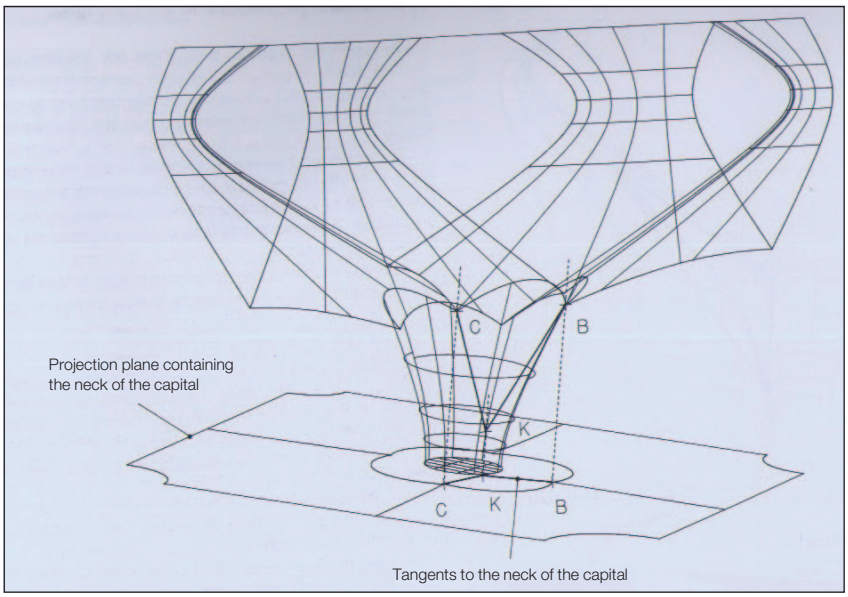

Fig. 12. Digital modeling of the hyperbolic capital and vaults of the naves of the Sagrada Família by Jordi Coll, architect of the Sagrada Familia.

structure that emerges from the capital of each column and expands towards the rings of each of the four hyperboloids surrounding it (Fig. 12). Regarding the Cova Cascada, the nerves that shape the framework of the main vault, along with the ensemble of curved surfaces–which have been compared to the funicular model of chains and bags–are linked to the pillars supporting the main vault, generating a structure of pointed elongations that would have the same function, from a formal perspective, as the bevels of the capitals in the Sagrada Familia, thereby creating a formal continuity between the pillars and the main vault (Figs. 9-11).

The structure of Sagrada Família's crossing vaults, at 196 feet high (Fig. 13) and currently under construction, is formed by a large hollow vault generated by a large hyperboloid of one sheet that has a more developed concave part. The hyperboloid rests its perimetric ring on the four branches of the four main porphyry columns crowned by solid capitals shaped as half-convex hyperboloids of one sheet; these form a series of bevels, creating a formal continuity between the pillars and the main vault. This structure concentrically generates two rings arising from a series of hollow hyperbolic vaults of different sizes that rest on the branches and the hyperbolic capitals of the central porphyry columns. Above this structure, the branches of the main columns perimetrically support the central dome, the main feature of the construction. The dome's windows allow light to enter into the crossing, filtered by the crossing vaults. An almost exact repetition of this structural scheme is present in the main vault of the Cova Cascada (Figs. 3, 4, 9, 10). In a single space, a form analogous to a hollow half-hyperboloid concentrically rests on solid forms in a position inverted to this one, and an ensemble of curved forms joins them together. Furthermore, above the main vault perimetrically rests the baldachin. The perimetrical arrangement allows light to filter through, illuminating the outer surface of the main vault (Figs. 3, 4).

In 1906 an anonymous architect completed the Cova Cascada; this construction includes structures that are extremely similar–in terms of the compositional relationship between the

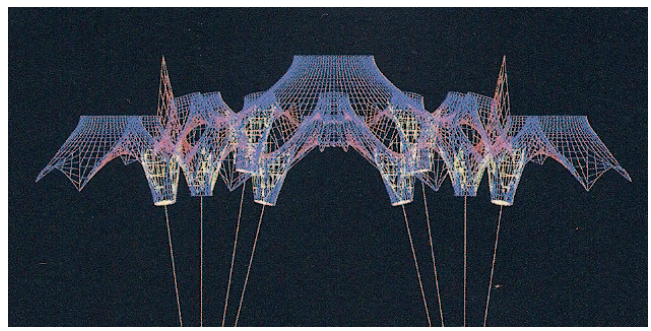

Fig. 13. Digital modeling of the crossing vaults, 196 feet high, by Jordi Coll, architect of the Sagrada Família.

different geometric elements–to the vaults of the naves of Antoni Gaudí's Sagrada Família. The structural systems for this still uncompleted church were, at the time, unique in the history of architecture and were proposed 10 years after the completion of the Cova Cascada.

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About the author

David Agulló-Galilea graduated in architecture from the Superior Technical School of Architecture of Vallès (ETSAV) of the Technical University of Catalonia (UPC). He has undertaken different architectural and urban development projects as well as museography projects. In the year 2001, architect David Agulló, geologist Daniel Barbé, and artist Jordi Martí Aladern started a research based, mainly, on establishing analogies between the works of Antoni Gaudí and Josep Maria Jujol, and the Modernist architectural ensemble located at the Sant Joan de Déu Health Care Complex in Sant Boi de Llobregat. In addition, he drew the architectural plans of this architectural ensemble. The first stage of the research was supported by the Association of Architects of Catalonia. He has worked as an autonomous researcher studying the technical, structural, and architectural aspects of the Modernist Architectural ensemble of Sant Boi. He currently carries out a historic and artistic study on the identification of the symbolic contents of the Modernist ensemble and their relationship with the Gerona Beatus.