

Geometric Evolution of Structure in the Gothic Architecture of Guillem Sagrera in Perpignan. Graphic Analysis

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Abstract

Guillem Sagrera is an essential architect during the 15th century in the Crown of Aragon. He is known for his participation in the construction of Mallorca Cathedral, first as an apprentice in the Portico del Mirador, from 1397 and later as a teacher. He was also commissioned to build the Lonja (Maritime Exchange) in Mallorca, begun in 1426. In this period his residence in Perpignan is documented, at least from 1410, but there are certain unknowns about the works in which he may have participated in Roussillon during this period, such as his part in the Lonja del Mar, in Perpignan or the chronology in the works of the chapterhouse of Saint John the Baptist. This period influenced and modified the way of conceiving the geometric layout of the structure in his buildings. This study aims to determine two aspects: 1. Through the parallels in his sculpture, to determine the works that he was able to carry out in this period in Roussillon. 2. Once his participation in the Chapterhouse of Saint John the Baptist was confirmed, to carry out a deep graphic analysis, modelling the architectural space, in which the structural and geometric experimentation is confirmed, observing how there was a change from the southern Gothic layout, eliminating capitals and corbels, to a freer layout with a mastery of the geometric layout, going beyond the canons and how this would be reflected in two of his later works, the Lonja de los Mercaderes in Palma and the Sala dei Baroni, in Castell Nuovo in Naples.

Keywords: Mediterranean Gothic, digital model, Guillem de Sagrera, Saint John the Baptist Perpignan, Lonja del Mar Perpignan.

Introduction

Guillem Sagrera was born in Felanitx, on the island of Mallorca, around 1380 and died in Naples in 1454. In 1397 he is mentioned for the first time receiving a daily wage as an apprentice in the Portal del Mirador of Mallorca Cathedral [Alomar 1970, p. 51], this beginning is important, because the influences of the masters with whom he worked are key to understanding his development and his works.

Sagrera and his work as a sculptor

In 1396, [Teres 2011, p. 174] the master Pere de Santjoan began to direct the work on the Portal del Mirador, replaced, after his death, by Pere Mora. Other masters such

as Henry the German [1] and John of Valenciennes [2] also participated. It should be noted that in these years, during the reign of John I, there is an approach to French culture due to marriage exchanges [Teres 2011, p. 150]. The influence was not surprising in Palma due to the temporary independence of the Kingdom of Mallorca from the Crown of Aragon. Sagrera's first influences come from the northernmost Gothic architecture, known as the Burgundian Gothic, from the court of the Valois in Dijon.

At that time Claus Sluter was commencing a new style with his best-known work, the Well of Moses, questioning the Flemish sculpture of the time, represented in Cathedrals such as Amiens, where the slender figures are delicate and curved imitating ivory, with soft folds.

In the Well of Moses the figures are detached from their Gothic frames, they are no longer slender, the clothes are depicted in a direct way with deep folds, concealing the entire body except for the hands and the head. The hands have movement, while the expressions of the faces become portraits.

Guillem Sagrera was the master of the Mallorcan Cathedral from 1416 to 1435 [Alomar 1970, p. 115]. During those years, the fourth and fifth sections of the naves, the chapterhouse and sculptural work were carried out. In the Portico del Mirador the figure of Saint Peter is attributed to Guillem Sagrera, in a document written around 1422 (fig. 1) where: "he has surpassed the style he learned from John of Valenciennes, working to approach the style of Sluter" [Alomar 1970, p. 94]. Due to stylistic similarity, the figure of Saint Paul is also likely to be his work, including the figure next to him of Saint Anthony, due to the Tau-shaped crozier (fig. 1). Of the 4 figures that adorn the portico, that of Saint John the Baptist is the one that seems different, it is less realistic from the point of view of the expressiveness of the face, moving away from the aesthetic principles pioneered by Claus Sluter.

Several years later, in 1426, work started on the Silk Exchange [3]. Of all the sculptural repertoire that appears in it, according to Alomar [Alomar 1970, p. 131], we can confirm that Sagrera was responsible for very few pieces, albeit very important ones, such as the angel on the façade of the square, the Saint John the Baptist on the corner, and the Madonna and Child located at the west gate of the garden, made between 1430 and 1440. Looking at the image of the Madonna (fig. 2), we can see influences from Claus Sluter. Alomar compares it to Sluter's Moses because of her clothing. Without a doubt, the expressiveness of the Madonna's face, despite the deterioration of the sculpture, is remarkable and approaches the expressiveness of the Flemish master [Alomar 1970, p. 88]. The angel above the Madonna is more original, with its upside-down position and its bare legs. Its head recalls the angel of the annunciation of the birth of Saint John to Zacharias, one of the few original plinths that are preserved of those made by John of Valenciennes in Bruges City Hall.



Fig. 1. Guillem Sagrera. Statues of Saint Peter and Saint Paul, Portal del Mirador, Mallorca Cathedral (photograph by the authors).



Fig. 2. Guillem Sagrera. Statue of the Virgin on the Garden Gate and Saint John the Baptist, Lonja de los Mercaderes (Silk Exchange), Palma de Mallorca (photograph by the authors).



Fig. 3. Guillem Sagrera. East facade, Lonja del Mar, Perpignan (photograph by the authors).

The figure of Saint John the Baptist (fig. 3) is reminiscent of the figure of Isaiah in Sluter's Moses' well, not only because he frees himself from the niche on which he stands, but also because he has similar features, while the depth of his clothes is reminiscent of the Flemish master, especially that of the sleeve that leaves the arm bare with great naturalism.

Sagrera in Perpignan

Sagrera's first years in Perpignan

Sagrera is documented for the first time in Perpignan, in 1410, credited together with Rotli Vautier [4], for the pulpit that has now disappeared from the church of the Franciscans, a document made known by Pierre

Vidal [Alomar 1970, p. 86]. That same year, he appears as executor of the will of a stonemason and appears as "architect, Peyrer, from the city of Mallorca, living in Perpignan" [Alomar 1970, p. 90]. In 1411 he appears in a professional document together with Rotli Vautier, Jean de Liho, from Brussels and the carpenter Leonart Raholf [Alomar 1970, p. 90]. This confirms his relationship with Flemish masters in this period.

In 1416, Guillem Sagrera was consulted about the change of plan for the Cathedral of Girona [5] in his capacity as master builder of Saint Jean le Neuf de Perpignan, so it is certain that in that year he was the master builder of the latter Cathedral [Alomar 1970, p. 90].

It is not known on what date he left Mallorca to travel to Roussillon; it has been suggested that it could have been around 1410, because his presence in Perpignan that year

is documented [Alomar 1970, p. 90]. One hypothesis may be that it was together with Pere Santjoan, whose presence in Elna 1404 and in Perpignan in 1406 is documented [Sabater 2010, p. 301], and there is evidence that they worked together on the Portal del Mirador.

Alomar says that around 1416 his trips to the court of Dijon, ruled by the Dukes of Burgundy, must have been continuous in order to learn from the Flemish masters and follow in the footsteps of Claus Sluter [Alomar 1970, p. 92]. There seems to be no doubt about Sagrera's trips to Dijon, due to the influence on his pieces from the second decade of the 15th century, the question is when he was able to make these trips. If we accept the hypothesis that Sagrera resided in Roussillon from around 1405, it is possible to argue that these trips to the North intensified in these early years of the 15th century, a period in which his activity is also unknown.

Sagrera's relationship with Rotli Vautier is also unknown. His presence in Perpignan between 1410 and 1432 is documented [Catafau 2018, p. 201], Alomar states that he may have acted as Sagrera's deputy in his works in Roussillon, during that period in which Sagrera alternated his residence between Mallorca and Roussillon, as well as making his own works [Alomar 1970, p. 90] [6]. It is important to determine until what year he carried out these tasks, Alomar, as has been said, says it was until 1432 but also states that between 1427 and 1430 Vautier worked as a teacher in Girona Cathedral. Later it is known that he worked in Barcelona in the cloister of the Cathedral, so at least in 1432 he was in Barcelona. Finally, from 1436 until he died in 1441 he worked on Lleida Cathedral. So it seems that it is likely to have been until 1427 or until 1430, given the proximity of Girona, when Rotli Vautier could have worked as Sagrera's deputy.

The Loge de Mer in Perpignan and its sculptural ensembles

Una orden real de 1397 autorizó la construcción de la A royal order in 1397 authorized the construction of the Loge de Mer; [7] by the Consulate of the Sea, founded in 1388, as a commercial institution attached to the town council [Poisson 2011, p. 87]. The work began in 1402, and was completed in the first quarter of the 15th century. In 1540, the building was enlarged due to the importance of the ports of Collioure and Canet. The extension with two other sections in 1540 gave rise to certain doubts on the north façade about the treatment of the decoration of the original project and its extension [8]. The researcher Tina Sabater raises



Fig. 4. Guillem Sagrera. Saint Bartholomew (left window, East façade) and Prophet (left window, North façade), Lonja del Mar, Perpignan (photograph by the authors).

the possibility that Sagrera and Vautier worked on it, apart from the chronological coincidences, both masters worked with the stone of Fonts, a type of stone used in the medieval section [Sabater 2010, p. 302].

Sagrera's work on the Loge would be carried out in the period between 1410 and 1415, so this relates to the eastern façade and occasionally to the north. This building has undergone several renovations, also with regard to decoration, as indicated [Poisson 2020, pp. 142-144]. On the eastern façade, in addition to the figure of Saint John located between the two arches, the right window is preserved, while in the case of the left window only the outside of the wall is preserved, the plant decoration of the edge of the waterspout that is topped off with two sculptures at the height of the capitals and the lower decoration of the sill. In the two windows of the north façade, only the lower decoration of the sill is preserved.

The four sculptures on the eastern façade that top the plant decoration of the waterspout rim are the most unique items of the sculpture of this building, where the Burgundian style for the folds and hair suggests a general connection with Sagrera [Poisson 2020, pp. 142-144] (fig. 4). The sculpture located to the right of the left window depicting Saint Bartholomew [Sabater 2010, p. 298] (fig. 5) should be highlighted for its quality and state of conservation. The serene expressiveness of his face and the delicacy of his hands, as well as the depth of relief of his garments, are reminiscent of Sagrera. The treatment of the sleeve of the right arm is reminiscent of that of the same arm of Saint John of the Mallorca Maritime Exchange.

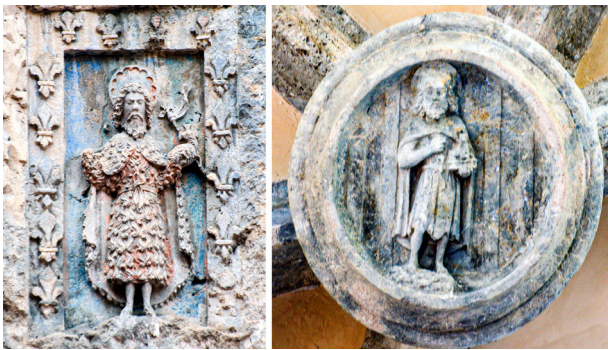


Fig. 5. Vautier. Saint John the Baptist, East façade of the Lonja del Mar; Keystone, Chapter House, Cathedral of Saint-Jean-Baptiste, Perpignan (photograph by the authors).

In the first section of the north façade there are also sculptures called "Sagrarian", that is, of marked expressiveness like those of the Burgundian school [Sabater 2010, p. 302]. Two pieces of the ends stand out, in the lower part of the sill of the first window of the north façade, where a prophet and an angel can be seen (fig. 5).

The expressiveness of these figures is remarkable, despite their size. The prophet, again, by the expressiveness of his face, is reminiscent of Saint John of the Lonja de Mallorca. This was probably the work that led Sagrera to become the master builder of Perpignan Cathedral and participate in the Girona consultation.

As has been shown, in the sculpture of Guillem de Sagrera a significant influence can be identified of the artists of the Burgundian court, which would modify and develop his style. In the same regard, it is intended to establish the evolution that his way of conceiving space and its architectural traces would undergo during his stay in Roussillon and which, as will be seen, comes from the same influences as sculpture, emphasizing the originality of the author as he received influences that were significantly different from the rest of the builders who worked in the lands of the Crown of Aragon. This learning, with a great personal contribution, will be experienced in the Chapterhouse of the Cathedral of Saint John the Baptist. A small room, low in comparison with the building and of relative importance on the whole, located beyond the buttresses of the apse. Without a doubt, the right place to experience a different way of conceiving the Gothic structure. The result is a magnificent room, where the ribs of the vaults merge with the column and the pre-existing buttresses, eliminating capitals, fasciculated columns with mini-columns and corbels, facilitating freedom of design and lending dynamism to the result. The experiences gained were transferred and developed in his later works: the Lonja de Mercaderes (Maritime Trade Exchange) in Mallorca and the Sala dei Baroni in Castelnuovo in Naples. This would influence other architects such as Pere Comte in the Silk Exchange in Valencia or much later Antoni Gaudí in Park Güell.

Methodology of the analysis

A graphic survey was necessary to carry out the analysis. "Surveying must be fundamentally a method of analysis and its final goal has to do fundamentally with the knowledge of the building" [Almagro 2004, p. 14]. To carry

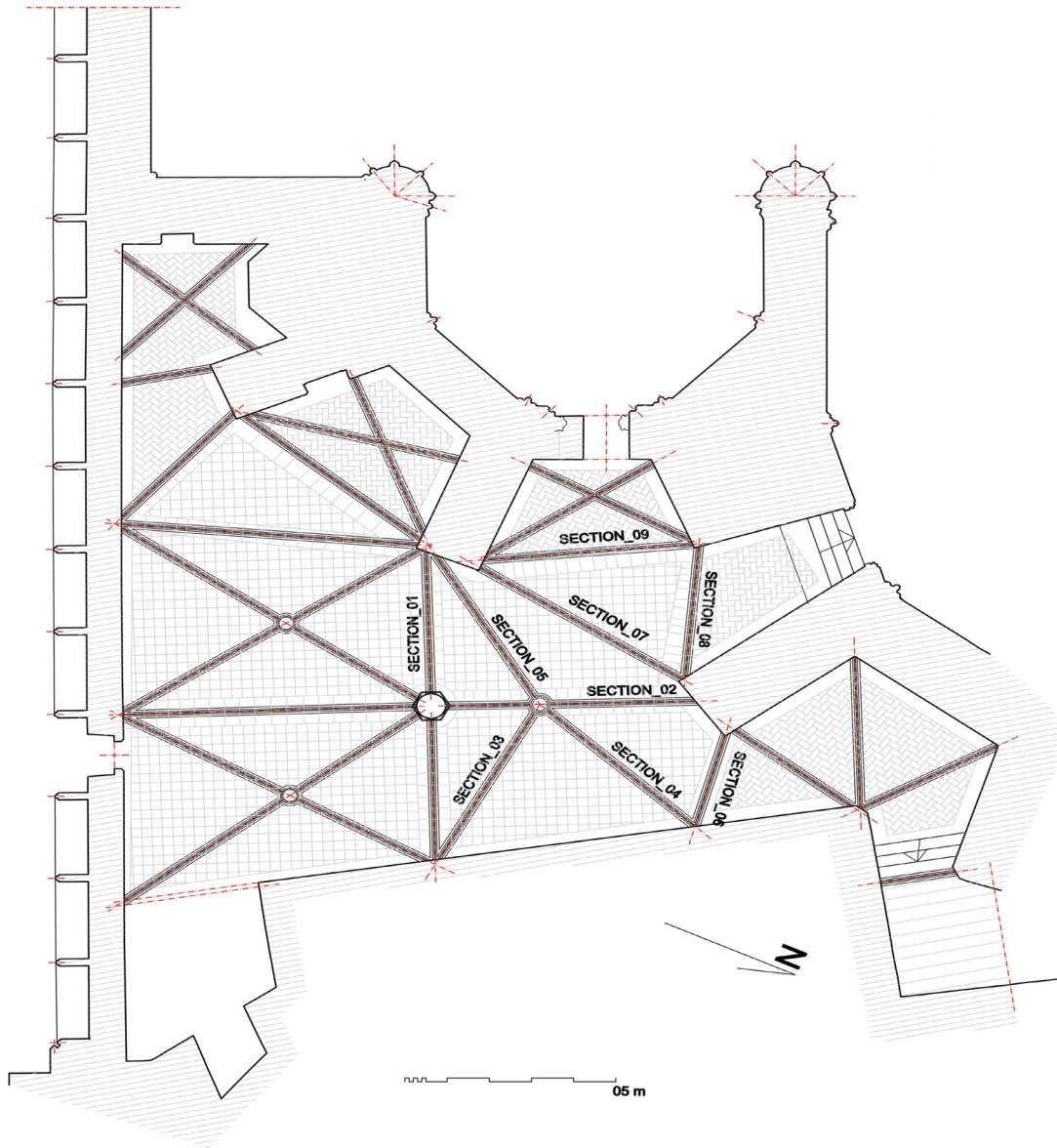


Fig. 6. Guillem Sagrera. Floor plan of the Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (graphic elaboration by the authors).



Fig. 7. Guillem Sagrera. Central column, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (photograph by the authors).

out this work and to be able to show the structural experimentation, a graphic analysis of the whole ensemble was carried out, firstly, a point cloud was made, with millimetric precision, using a laser scanner (LS), with which great accuracy is guaranteed, it is a very suitable technique for spatial analysis.

The tool used was a Faro Focus S70 laser scanner, measuring between 0.6 m and 70 m, with sensors: GPS,

compass, altimeter, dual-axis compensator, and distance accuracy of up to ± 1 mm, including HDR photographic overlay. With the point cloud obtained, the analysis was performed using 2D CAD software, Autocad from Autodesk and BIM software ArchiCAD from Graphisoft. "The graphic survey of the heritage site necessarily involves obtaining a three-dimensional digital replica of the highest precision and graphic quality. We will obtain this three-dimensional model by means of SfM (Structure from Motion) photogrammetry and/or 3D laser scanner" [Rodríguez-Navarro, Gil-Piqueras 2024, p. 557].

Study of the chapterhouse

Chronology and designers of the chapterhouse

Ponsich identifies Sagrera for the first time as the architect of the chapterhouse of the 'future' Cathedral of Saint John the Baptist and claims that it was probably built between 1433 and 1447, without providing data [9]. Alomar says that if the historical reasons for this attribution are satisfactory, the stylistic ones are decisive [Alomar 1970, p. 110]. Sabater disagrees with this date and says that it would have been logical for Sagrera to take on this commission between 1410 and 1415 [Sabater 2010, p. 305]. This would justify his presence in Girona in 1416 as master builder of the Cathedral, and provides further evidence in sculptural terms, namely the similarity between the Saint John the Baptist on the façade of the Lonja del Maritime Exchange in Perpignan by Rotli Vautier and the Saint John the Baptist on the keystones of the chapterhouse (fig. 6).

The keystone of the most exceptional vault, with 5 ribs, has a figure of Saint John the Baptist, against a background with the bars of the Crown of Aragon, with a facial expression reminiscent of that of the Maritime Exchange. If it is assumed that Vautier worked as Sagrera's deputy in his works in Roussillon and that he designed this keystone, he must have done so before 1427 or 1432, dates on which it has been indicated that he left Roussillon, therefore questioning Alomar's theory that the Chapterhouse was built from 1433 onwards. In no case does any author cast any doubt on Sagrera as the designer.

The chapterhouse from the perspective of its architectural lines

The space of the chapterhouse is unique due to the geometry of its floor plan (fig. 7) Sagrera tackles a complex problem, resolving the covering of a room, adapting



Fig. 8. Guillem Sagrera. Zenithal view, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (graphic elaboration by the authors).

the curved geometry of the apse of the Cathedral and its buttresses, with the straight geometry of the boundary with the cemetery, also respecting a background that was narrowly constrained by the property, also with a straight geometry. The solution is a brilliant one, in contrast with a more homogeneous and patterned geometry, such as the chapterhouse that he himself built those same years in Mallorca Cathedral.

To resolve the geometry of the structure, he placed a single column at approximately at the centre of the space, from which he projected ribs to the irregular edges that delimit the room, forming pointed arches of different lengths, as detailed in the study of the vaults, but with an approximately constant curvature in practically all its arches.

The column, an essential element of the space, has a base of hexagonal section. In his later designs this base would

be lost, with an approximately cylindrical shaft travelled by the vertical prolongation of the ribs of the arches, located in general in the projection of the centre from the sides of the hexagon, although in other cases it also coincides with its vertices, maintaining a sound respect for proportion and geometry. The most outstanding thing about this column is that it lacks a capital, this absence is not only for aesthetic reasons; it has a geometric justification (fig. 8).

In later designs such as the Mallorca Maritime Exchange, they were threaded around the column, eliminating not only the capitals but also the bases. In the same way that the capital disappears, the corbels disappear at the point where the arch and the wall meet, embedding themselves in it, except in one case, which will be studied later as it is so different. This innovative solution may have been inspired by the cloister of the unfinished Narbonne

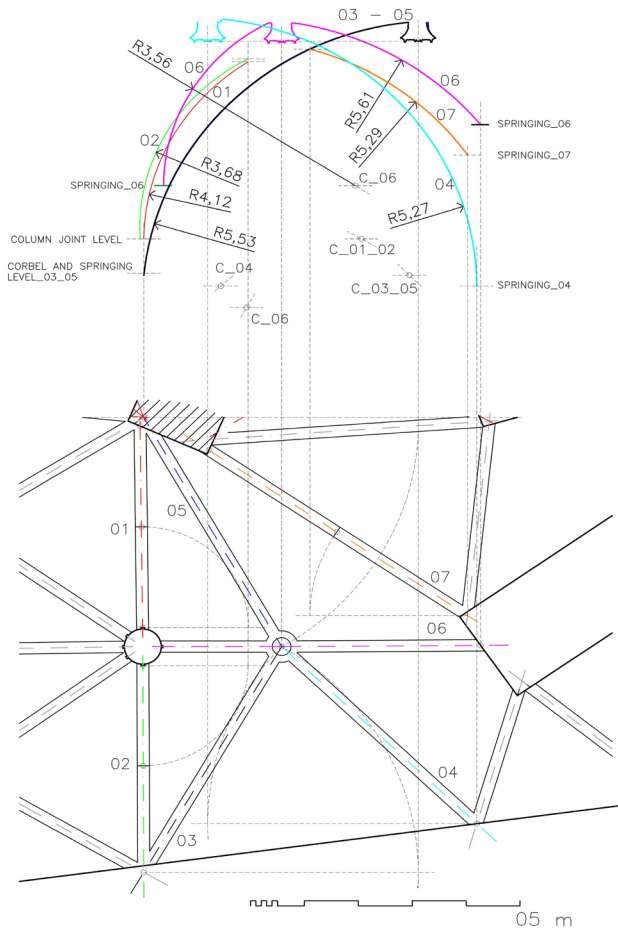


Fig. 9. Guillem Sagrera. Tracery of the irregular pentagonal vault, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan. Fold-out of the arch tracery onto a vertical plane for true magnitude projection, based on Viollet-le-Duc's interpretation of Villard de Honnecourt's drawings and disseminated by Enrique Rabasa and José Carlos Palacios, among others (graphic elaboration by the authors).

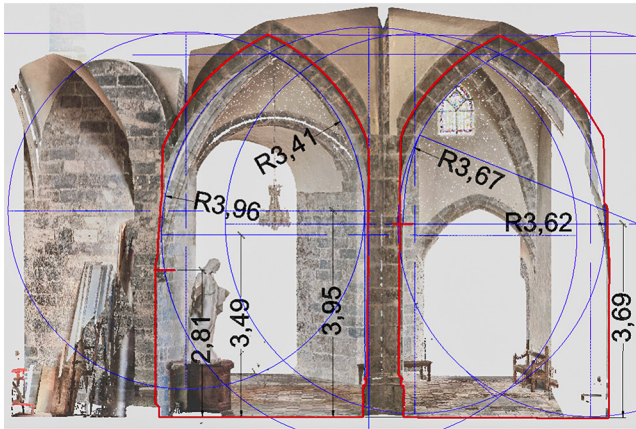
Cathedral, whose construction began around 1360, or in the Theology Room of the Palace of the Popes in Avignon, or the Palace of the Dukes of Burgundy in Dijon, which, as has been shown with the influence on his sculptural work, he must have known about during his stay in Roussillon, but in the case in hand he gives this solution a greater structural sense.

To cover this space leaning on the central column, he devised three coverings, two classical vaults supported on the wall of the cemetery and the column, a regular solution, geometrically parallel and with the predominant curvature in the room of approximately 5.50 m, three trapezoidal, with considerable symmetry in the openings of the buttresses of the Cathedral, with different curvatures and an irregular pentagonal vault, which will allow it to resolve geometric disagreements and the main object of the study, due to its uniqueness (fig. 9).

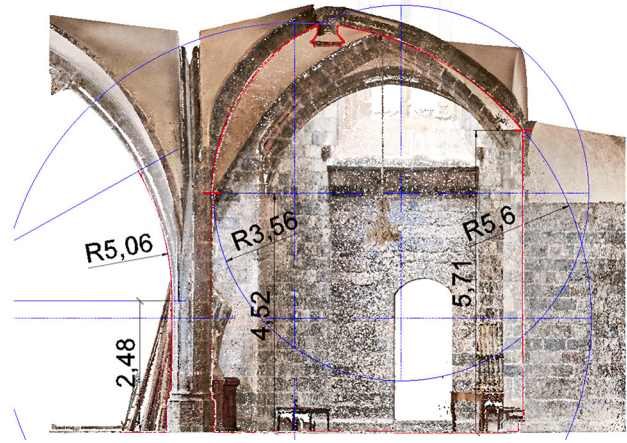
This vault features varying spans and a consistent curvature—approximately 5.50 m—for the arches meeting at the keystone, with the exception of the shortest arch, which has a radius of 3.56 m. In contrast, the arches springing from the pier that do not reach the keystone (formerets 1 and 2 in fig. 9) exhibit different curvatures, measuring 4.21 m and 3.68 m, respectively. The arches that form this vault must have different heights; as they must be joined in a keystone of fixed height, the starting level of the arch must be lowered, which rules out having capitals or corbels at the same level. Despite the aesthetic disadvantage, it could be done from a structural point of view, but when they converge on a pillar, as is the case of Saint John the Baptist, it is not feasible (fig. 9).

It is here, at this time, where the capital and, by symbiosis, the corbels disappear, starting the arch directly from the walls. This solution, from a structural point of view, is more straightforward: the capital, in traditional lintelled architecture and semicircular arches has the task of centring loads on the pillar; whereas in Gothic architecture with pointed arches it would not perform this function because the lateral thrusts are much lower and the load is practically vertical, the capital behaving as a stylistic ornament.

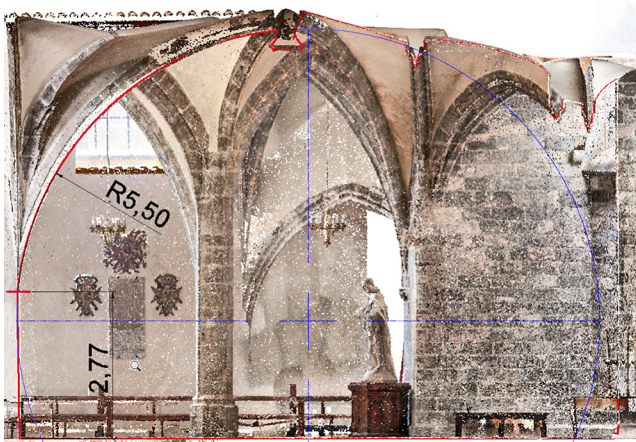
For the study of the pentagonal vault, a graphic analysis was carried out on the 3D model, with flat sections, observing curvatures, the arch starting point, the centre of each arch and the geometry itself (fig. 10); where it can be observed through drawing, why the geometric decisions of the layout of arches were made, which might seem



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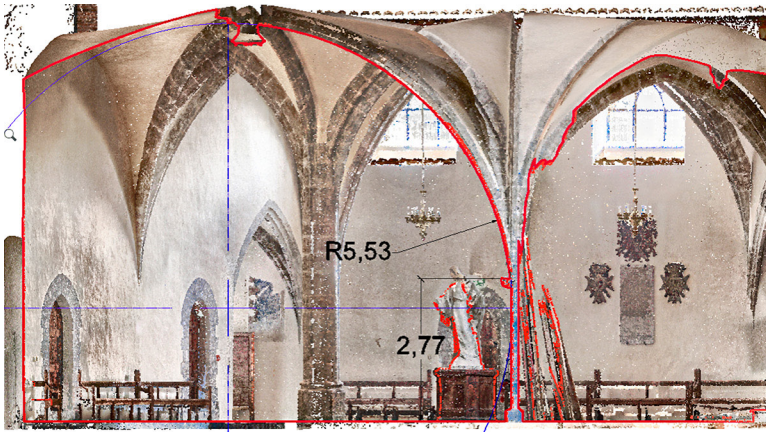


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Fig. 10a. Guillem Sagrera. Cross-sections of the pentagonal vault arches, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (graphic elaboration by the authors).



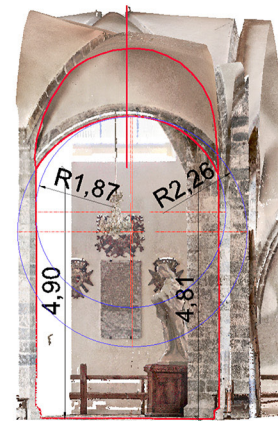
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Fig. 10b. Guillem Sagrera. Cross-sections of the pentagonal vault arches, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (graphic elaboration by the authors).

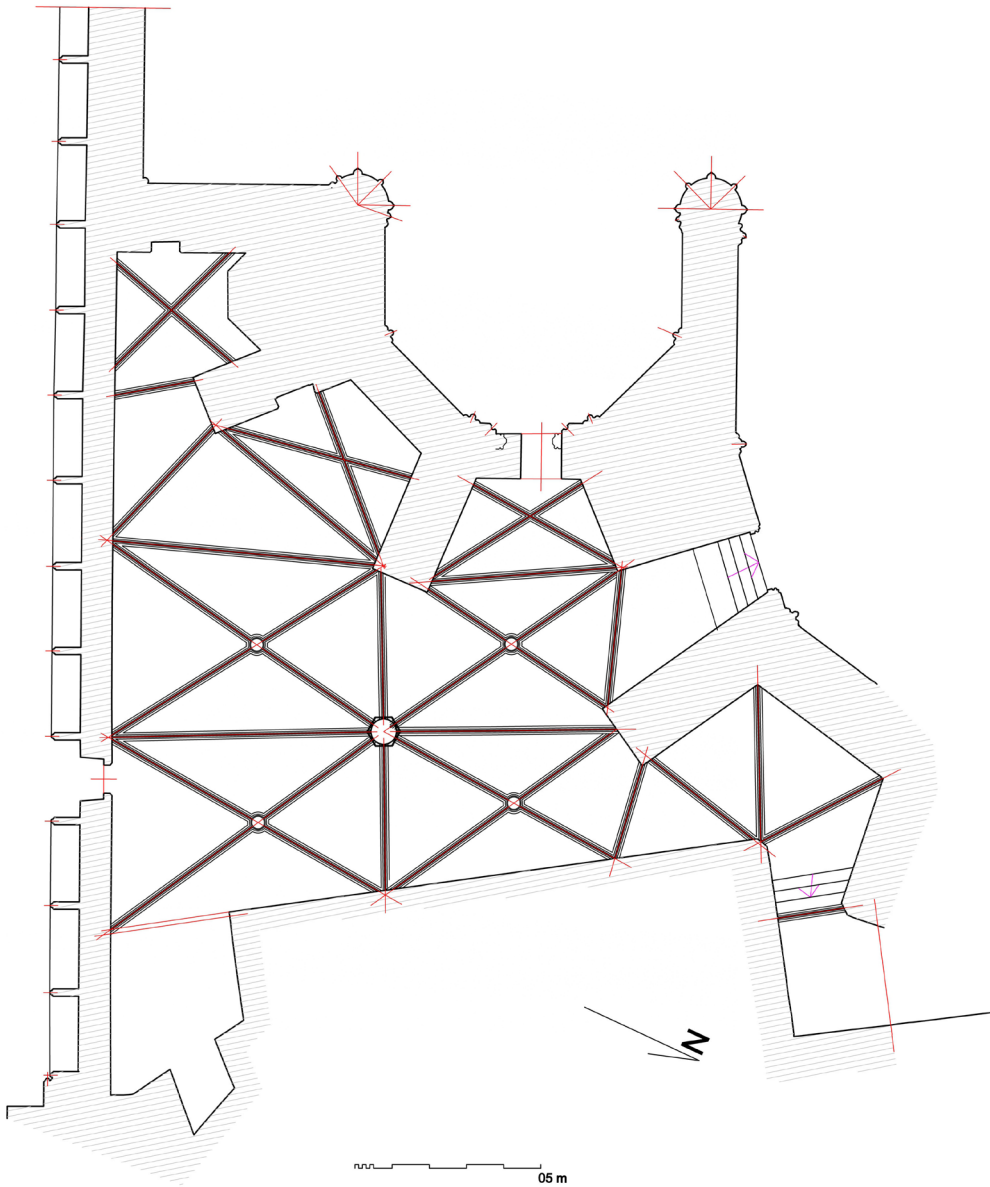


Fig. 11. Guillem Sagrera. Final plan of the three-vault solution and conventional four-vault layout, Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (graphic elaboration by the authors).



Fig. 12. Guillem Sagrera. Chapter House, Cathedral of Saint Jean Baptiste, Perpignan (photograph by the authors).

to us stylistic concessions, but are in fact structural and constructive: "The design, control and construction of the vault are carried out by means of only three elements: the plan of the ribs, the elevation of each rib and its section" [Senent Domínguez et al. 2012, p. 79].

When observing the vault, the first question that arises is why he made these lines of three vaults, instead of covering the space with four vaults from the central column (fig. 11), which would be the solution used when a double ambulatory appears, with the difference that in these cases the ribs follow the radial direction. In Perpignan, being a triangular portion with two clear directions, he discarded the idea of radial lines. In our opinion, the reason is twofold. On the one hand, the solution executed is more efficient from a structural point of view, since it resolves the covering of the same space with three vaults instead of four. On the other hand, the motif is also aesthetic, it achieves an organic effect on the spine, with the starts of the ribs at different heights, thanks to the size of the arches.

The corbel of the Chapterhouse

Llama la atención en este espacio la única ménsula existente. The only existing corbel in this space is striking, appearing on the edge of one of the buttresses (fig. 12). A floral corbel that is the only decoration of the ensemble in addition to the three keystones. "Its origin is not clear, but it seems strange that only one appears in the whole ensemble" [Senent Domínguez et al. 2012, p. 77] looks at this corbel and concludes that it is not an error [Senent Domínguez et al. 2012, p. 80], hypothesizing that if it were not present, this corbel would have forced the dismantling of three more rows of the buttress, about 77 cm, to embed this rib, due to the *tas-de-charge* construction system [10], since this corbel receives the longest rib, whose elevation is determined by the height of the keystone. He also believes that the pillar is not located in the centre between the buttress and the wall, but is slightly offset towards the wall [Senent Domínguez et al. 2012, p. 80]. Using the digital model it can be seen that the pillar is indeed slightly displaced, but this displacement is 24 mm, which we consider negligible in a length covered by the arch of 8,000 mm, so Sagrera's intention was to place that pillar in the centre of the space and he did so.

To avoid the corbel without having to dismantle the buttress, there are two possible solutions: one solution would have been to change the position of the pillar, to reduce that span, but this solution would contradict the idea of a central pillar, which seems clear in Sagrera, so it can clearly be ruled out. The second would be that the longest rib should not rest on the edge of the buttress, but on the buttress's vertical surface, thus reducing its length. But aesthetically it would not be such a refined solution, so it is also ruled out. On the other hand, placing the corbel to avoid dismantling three more rows of the buttress, up to a height of 1.84 m from the ground, while in the area on the left there is a buttress that is dismantled up to a height of 1.64 cm, does not seem definitive either.

Sagrera places the pillar in the centre enhancing the only symmetrical arches of the assembly, with a double deep edge [11], the vertical edge. As for these arches on the corbel, he could have done it to emphasise not only the idea of the corbel, but also the idea of the two symmetrical arches. What other meaning could it have than this edge protrudes 8 cm from the buttress, when the arch is only 2.5 cm longer than its symmetrical, where it is not emphasised in this way.



Fig. 13. Guillem Sagrera. Detail of the rib-to-wall junction, Lonja de los Mercaderes, Palma de Mallorca (photograph by the authors).

Fig. 14. Guillem Sagrera. Detail of the rib-to-wall junction, Sala dei Baroni, Castel Nuovo, Naples (graphic elaboration by the authors).

In our opinion, this corbel appears projected from the outset, it is not a mistake, nor a cost-driven revision, but indicates the desire to experiment structurally and aesthetically, where, from structural sincerity, we can place a corbel so as not to dismantle a buttress, when in the rest of the building it is not necessary to do so. This knowledge was applied in the Mallorca Maritime Exchange around 1426, so chronologically it must have been applied in the chapterhouse earlier than Alomar claims.

Conclusions

Studying Sagrera's work from a graphic point of view, data is provided on the result of the three-dimensional analysis, with respect to his least known period between 1400 and 1416, during which time he lived in Roussillon, with frequent trips to the North and the South. Parallels are established between his sculpture, with a clear influence from Burgundy, to suggest that he could have participated together with Vaulter in the construction of the Perpignan Maritime Exchange, and that this work could have facilitated his access as a master builder to the future Cathedral of Saint John the Baptist, as evidenced in the Girona consultation of 1416. This same sculptural influence was also architectural. It materialised in his first great architectural work, the chapterhouse of the future cathedral of Perpignan. The usual road between Perpignan and Dijon passes through Narbonne

and Avignon, in these places he probably knew the cloister of Narbonne Cathedral, where there are no corbels or the Palace of the Dukes of Dijon and the Popes of Avignon, where you can see examples where a central pillar also lacks a capital.

The claim that the chapterhouse of the Cathedral was built between 1433 and 1447 is refuted, indicating that it must have been at least before 1427. We base this conclusion on this sculptural influence, which has an equivalence in his architectural work, and which would mark a notable stylistic change, simplifying the lines and giving aesthetic importance to the structural elements. This learning process would be reflected in the chapterhouse of the Cathedral, which he would use to experiment with formal solutions. For this analysis of the room, a 3D model with millimetric precision was obtained and as a result of the use of this tool it was

verified when, where and why the capitals and corbels disappear in Sagrera's architecture.

The consequence of this experimentation in the small room, almost residual from Perpignan Cathedral, would be reflected in his two most important later works: the Mallorca Maritime Exchange (fig. 13) and the Sala dei Baroni (fig. 14). In the first, "in order to achieve the desired interior space, Sagrera had to resolve some construction elements through unique solutions, which would not have been possible by using modulation alone" [Cifuentes Utrero 2015, p. 459]. In other words, Sagrera transgresses the module he learned in the chapterhouse of Perpignan. In the second case, the Sala dei Baroni in Castelnuovo in Naples, as Ricardo Filangieri points out: "A report signed in May 1458 clarifies that Sagrera—with his collaborators—was responsible for the construction of the great Hall" [Domenge 2007, p. 78].

Credits

This article is part of the research line of the GRAHyC research group, Historical and Contemporary Architectural Representation Group.

Notes

[1] Known as Rich Alamant, a Flemish master who had previously worked on Barcelona Cathedral [Teres 2011, p. 174].

[2] It may be that this sculptor is the same one known as John of Valenciennes, documented in Bruges between 1379 and 1386 in charge of the sculptural decoration of Bruges City Hall [Teres 2011, p. 174]. This master belongs to the circle of artists of the pre-Burgundian style, along with Sluter [Alomar 1970, p. 94].

[3] The contract, dated 11 March 1426, contains a contract price of 22,000 Mallorcan pounds and stipulates the form of payments, so that, in this commission, he was not only going to carry out the work of architect and sculptor, but also that of contractor and coordinator [Alomar 1970, p. 124].

[4] Everything seems to indicate that Rotlino or Raoul or Rotlli Vautier or Vaulter or Gaultier was a native of Normandy and had a brother who was also a master builder named Carli, who worked on the designs of Seville Cathedral and Lleida Cathedral.

[5] Girona Cathedral was initially designed with three naves, after the construction of the apses, a single nave was chosen. Ten master builders of the Crown of Aragon were consulted on the technical and stylistic feasibility. All endorsed the technical possibility, although only four supported it stylistically. Sagrera advocated the option of a single nave.

[6] Such as the construction of the three pointed arches, which are preserved today, belonging to a loggia in the Palace of the Courts of

Perpignan made between 1424 and 1427.

[7] The Lonja (Exchange) is a cubic volume with two floors: the lower one, porticoed, opens onto carrer dels Mercaders and the Plaza de la Lonja. The façade to Mercaders, the first to be executed, has two ogival porticoes without ornamentation on the ground floor and two windows on the upper floor.

[8] There is a panel preserved in the Rigaud Museum, painted 1488, belonging to the altarpiece of the Trinity where a building can be seen that may be the Lonja del Mar (Maritime Exchange).

[9] These dates coincide with the appointment of Galceran Albert as bishop of Elna in 1430, after having been bishop of Mallorca (1426-1429), where he developed the cathedral with Sagrera as master builder [Alomar 1970, p. 106]. In Roussillon he promoted the renovation of Saint John the Baptist with new designs, in accordance with those proposed in Girona and adapted to the new functions of the building after the loss of the capital of Perpignan.

[10] The French term, '*Tas-de-charge*' (springing block), is applied to refer to the lower rows of ribs in a vault, which are arranged horizontally and receive the vertical load. They generally rise about one-third the height of the vault and, when projected forward, reduce the span to be vaulted.

[11] Sagrera only distinguishes three arches with double edges, the two symmetrical and the one from the access from the church, although the latter is narrower than the other two.

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