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Structures and Spatial Sequences in the Churches of Guarino Guarini

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ABSTRACT

The study focuses on the formal structures of the projects of churches by Guarino Guarini, identifying a series of recurring compositive operations. To understand this aggregative logic, the empty inner space of the buildings was analyzed and modeled in three dimensions. This operation, conducted reworking the method exposed by Luigi Moretti in his famous article, allowed to highlight the spatial conformation of the building, in particular the succession of the various elementary cells that composes the buildings themselves and the hierarchy between the various parts.

Highly original outcome was the formulation of four possible variants of geometric intersection, that summarize all the relationships that can be established between the elementary cells of the Guarini's buildings.

Their redraw was the moment of testing and immediate verification of the results of the theoretical study, offering, through the definition of a synoptic view, an immediate visual transposition of theoretical statements, as well as the opportunity to establish critical transverse comparisons on the projects of Guarini.

The overall outcome of the study is an attempt to systematize and integrate the rules and methods of the architectural thought of Guarini, from two points of view: the first one was the identification and rationalization of aggregative paths underlying any building; the second one, is the final resolution of the mode of contact/conflict between the cells composing each building.

As tools, was used, in the first case, the tradition of morpho-typological interpretation of the project, especially for the identification of the basic types. In the second case, the tools offered by descriptive geometry, allowed us to categorize the different ways of contact, intersection, interpenetration and connection between the different cells, by restricting the field of possible variants and arranging them on a scale of progressive and growing organicity.

We have tried to analyze and report the spatial outcome of each arrangements, especially with regard to the potential to change the aspects related to the perception and legibility of the inner space of each architecture.

KEYWORDS: Guarino Guarini, inner space, Barocco, spatial and morpho-typological analysis, geometry.

1 COMPOSITIVE METHODS OF THE SPACE OF GUARINI: AN ATTEMPT TO SYSTEMATIZATION

The common element in all projects by Guarino Guarini is the composition made by elementary cells, belonging to a small number of geometric shapes, circular, elliptical, hexagonal and octagonal. The

different modes of contact between the geometries of each cell becomes an element which strongly characterizes the projects, generating an alternation of expansions and compressions of the inner space, more or less fluid and continuous depending on the geometric shapes adopted. The complexes vaulted systems used are often the element that makes understandable the planimetric and geometrical composition of the space.

The analysis made it possible on the one hand the identification of invariant operations that constitute the core of the design method of the theatine father, on the other hand the classification of the modes of contact-conflict between the cells composing each building. The instruments used were the morpho-typological interpretation of the buildings, and the descriptive geometry, which made it possible to classify the different modes of juxtaposition, intersection, interpenetration and connection between the different cells. The spatial outcomes of each mode were analyzed, particularly regarding the issues related to the perception and legibility of the inner space.

The method of analysis resumes that shown by Luigi Moretti in his article (Moretti, 1952/53): the Roman architect turned his attention to the analysis of the internal space of a few buildings, expressed by the shape of the void. Therefore Moretti realized the plaster models which were the tangible representation of the empty space; they were obtained by considering the internal surfaces of each architecture as the negative moulds. This method has been transferred from the physical reality of the plaster model in the virtual three-dimensional CAD model. Starting from the drawings in plan and section of the Treaty (Guarini, 1737), each building has been divided into elementary component cells. Each of these was defined volumetrically through the inner surfaces of architectural structures that surround it; was thus obtained the solid transposition of the void underlying to the inner space. The aggregative patterns of each building were finally traced and the variants of the contact modes between neighboring cells were identified.

It should be noted that with the term cell shall be understood, therefore, the volume of the solid of the empty space underlying to the cell, defined by its planimetry and by its system of vaulted roofing.

2 METHOD OF CELL COMPOSITION

The geometric shapes of the main spaces (polar spaces for the central plan churches, spaces of the main nave for the longitudinal plan) are polygonal, both regular and irregular (square, pentagon, hexagon and octagon), and curvilinear, then circles and ellipses. The secondary spaces are generally circular and elliptical, or rectangular, generally terminated with an apse, or octagonal.

After this brief introduction of geometric nature, we analyze and classify the different modes of contact between the various cells, and their formal implications and spatial outcomes. The first and simplest is the juxtaposition of two elementary cells of the same geometric family. The two cells are arranged one following the other; so that the plane of tangency belongs to the geometry of both cells, containing the faces of contact themselves. Each cell retains its individuality and is perfectly readable in its entirety. In correspondence of the contact plane, or specularity plane, it generates a line of specularity, corresponding to the structural element of support of the vault. This line, which is usually highlighted by a pillar, pilaster or column, can be repeated on the vault by an arch between the two cells.

This is obviously the simplest case, since this conformation is present in any longitudinal building, obtained by addition by linear spans; the complication introduced by Guarini is given by the adoption of cells with octagonal plan instead of square ones or rectangular.

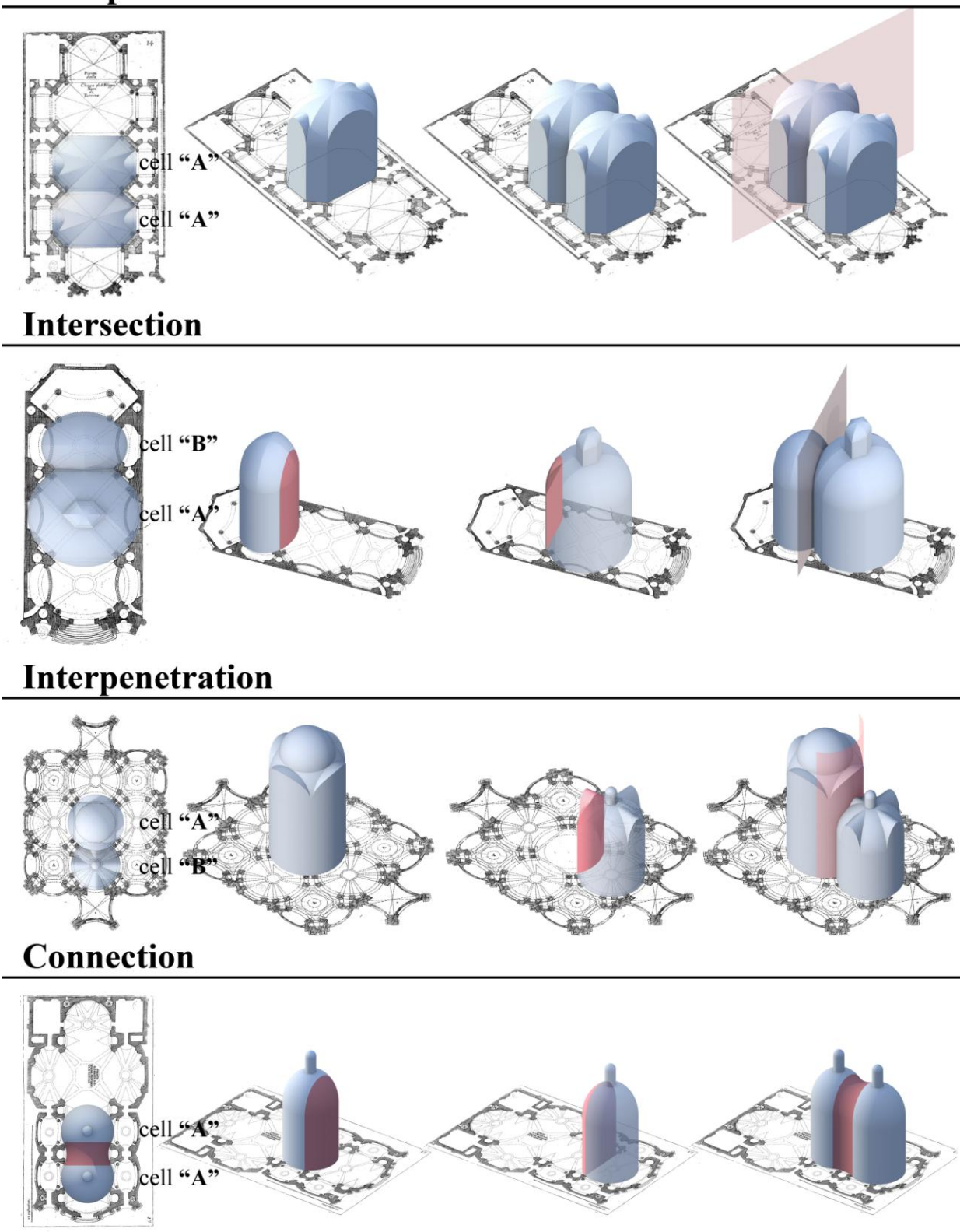

Figure 1: Method of cell composition

The second possibility, in progression of integration, is that of the intersection: both cells are intersected and partialized by a plan that does not belong to their geometry. Although each cell maintains its individuality and recognizability, they will not be readable in their entirety. Similarly to the above, the cut-off plan will introduce a line of specularity in the structure.

In the case of interpenetration, the two cells overlap, but one is to prevail over the other. The first presents itself whole, the second partialized. The surface of interpenetration belongs entirely to the prevalent cell and is, also in this case, identified by a line of specularity. If the penetrated cells are cylindrical in shape, the arch that marks the penetration will be a three-dimensional arch, or an arch for which the keystone and the skewback does not lie on the same vertical plane. In all the listed cases, if found in axial longitudinal buildings, is generated along the nave an alternation of contractions of the space in the points of contact or interpenetration of the cells, and expansion on the centerline of the same. Such expansion can be further amplified by the insertion of the side chapels, which expand the space transverse to the axis.

Finally, the relationship between two adjacent cells can be solved through the interposition of a connection space between the two elements. This can be accomplished by different methods. The joint may be limited exclusively to the vaulted roofing system: the junction vault connects the different geometries of the roofing that precede and follow it, giving the vaulted system a wavy pattern, fluid and continuous. The connection space does not acquire a value in the planimetric articulation of the building on the lower level, where there is once again the presence of a line of specularity. In this part of the building the cells appear to be intersected, as previously described. The impression of continuity remains confined to the coverage systems and does not extend to the articulation of the nave. Conversely, it may happen that even at the planimetric level it registers the inclusion of an readable joint area, perhaps amplified by the inclusion of a lower transverse axiality, strongly subject to greater axiality (entrance-presbytery). Depending on the shape of the walls that define this space, the waving movement is extended to the whole building. The last possible variant implies that the joint space acquires a strong planimetric value, conferred both by a dimensional increase both by the introduction of a transverse axiality strongly pronounced; underscore that occurs through the insertion of major lateral chapels or the creation of a real transept.

In order to clarify each contact modes between cells, we analyze the individual study-cases.

2.1 San Filippo Neri in Turin

The plan is longitudinal, multi-axial with orthogonal not equivalent axes. The nave is composed by three identical cells of irregular octagonal shape, elongated orthogonally to the axis entrance-presbytery, with vaults composed by four diagonal panels and four groins. Two rectangular chapels with apsidal endings are added at each head of the transverse axes. Two identical and symmetrical spaces serve as entrance vestibule and as presbytery. All the relationships between cells are resolved according to the procedures of the juxtaposition. Two elements reinforce the individuality of cells: the first is due to the fact that the specularity line generated by the contact plane does not find a bearing element common to the two cells, but an edge wall. At the sides of this edge, symmetrically, are located two free columns, surmounted by independent sections of trabeation, which connect them to another column placed on the same side of the octagon of the cell. The second element is constituted by the absence of an separation arch between the vaults, replaced by two separate parallel arches.

The space of the nave is perceived as an alternation of compressions and expansions: the first occurring in correspondence of the tangency plans; the latter are generated by transverse secondary axiality of the side chapels. This alternation does not occur according to a fluid movement, but in a broken line. The oblique arrangement of pairs of columns reinforces the perception of this broken line and, at the entrance of the church, offers the viewer a sequence of independent elements (Passanti, 1963).

2.2 Santa Maria Ettinga in Prague

As in the previous case, the plan is longitudinal, but is introduced both a hierarchy of the cells components the nave, both a hierarchy of the transverse axiality orthogonal to the principal one. The nave is composed of three cells: the first and the third are elliptical, with elliptical dome with groins and diagonal ribs; the central one, larger, is complex shaped, elliptical with rectified diagonal strokes. A fourth hexagonal cell serves as a presbytery and closes the composition longitudinally. The greater cell intersects the lower of the nave and the latter interpenetrate the side chapels and the chancel. The nave is characterized by three subsequent transverse axiality: two of this are in smaller cells, one in the main room, generated by the insertion of the side chapels. The central one prevail over the other due to the greater extension of the axis, generated the breadth of the central compartment, that expands with respect to contiguous. In the intersection point of the cells occurs a space narrowing, with an edge wall. At the level of the vault, the plane of intersection is not marked by an arc but from a cusp generated by the combination of the vault, countered by a band for the side.

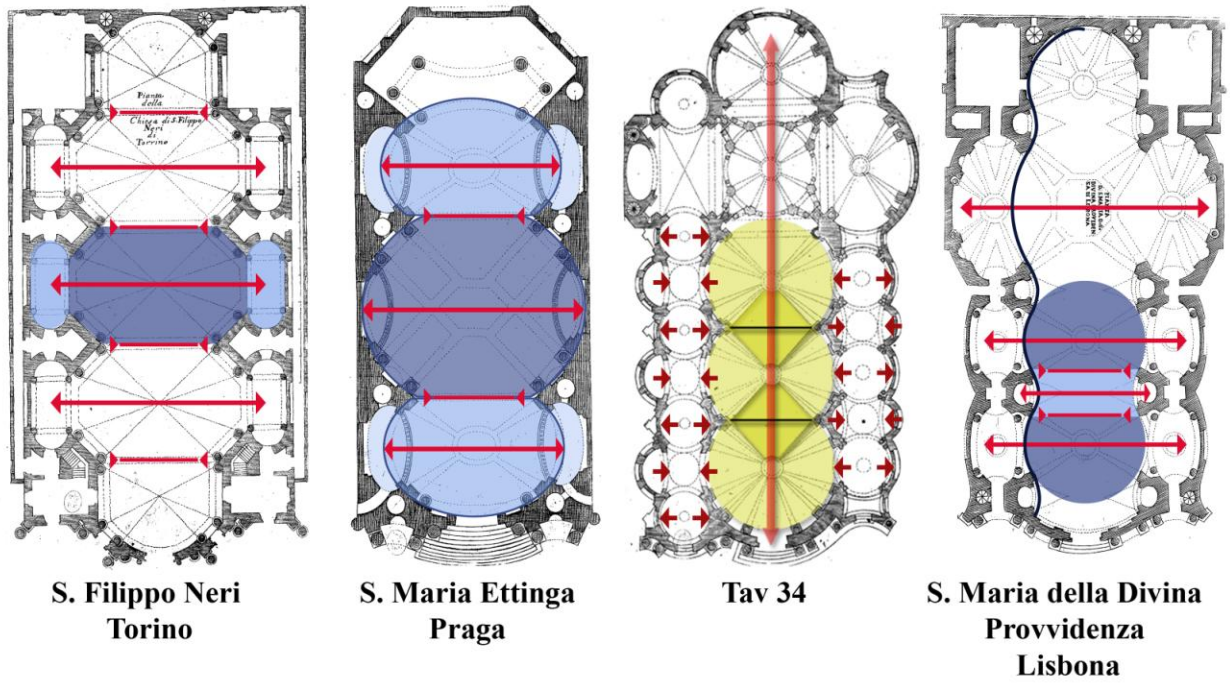

Figure 2: Analysis of longitudinal project

2.3 Santa Maria della Concezione in Turin

The building has a longitudinal multi-axial scheme, which in many ways shows a reversal of the characters and relationships of the church in Prague. In fact, at planimetric level, the central cell is compressed by the two lateral circular. In addition it is distinguished by its smaller vertical development and for the presence of side chapels, larger than those that overlook the adjacent rooms. The three spaces are intersected: this intersection is objectively planimetrically not very visible, while it seems clearer if you look at the longitudinal section of all the vaults. The two cells are covered with vaults with groins on the longitudinal axis, while the vault of the central one is made up of four groins with, on the longitudinal axis of the church, the same reference line of the of vaults of the greater spaces. The junction of the vaults creates a cusp. Looking at the vaults, you get the impression that those of the greater spaces are smoothly filleted, also due to the decoration which attenuates the different profile of the curves. The space is

divided by three cross axiality, one of whom, prevalent, generates a central transept; the remaining two are originated from minor chapels arranged at the sides of the circular rooms. To be precise, they do not generate a transverse axiality, due to their lack of alignment: in fact, they are symmetrically rotated with respect to the center of the cell of about 8 ° and therefore generate two separate axis.

2.4 Santa Maria della Divina Provvidenza in Lisbon

The space and the relationships between the parties that generate, will complicate the design of the church for the Portuguese capital, where is introduced the mode of connection between adjacent cells. The nave consists of four circular cells: the first two are exactly alike and identify the nave, the third largest, in correspondence of the transept; the last one, smaller, generates the presbytery. The first two are flanked by elliptical chapels, the largest by chapels also elliptic, larger than the previous ones, which form a shallow deep transept.

The famous continuous undulating movement of the inner space is due to the relationship that is established between the cells of the nave, all connected to each other by the interposition of special spatial items. At the level of the nave, the connection spaces are highlighted by the doubling of the supports and by the insertion of niches on the lower level and choruses on the upper one. The corresponding entablature is convex toward the nave and joins to that of the side chapels describing a sinusoid. At the level of vaulted system, a vault with sinusoidal section bring back on the roof the same fluid, undulating profile. The relationship between the cells of the nave and the side ones is more varied: the chapels which form the transept seem to relate to the dome of the transept in a manner similar to those of the vaults of the Chiesa di S. Maria della Concezione in Turin. The inner space, as well as characterized by the undulation of the walls, is animated by an alternation of different shades of transverse axiality. There are three types: that of the transept of greater length, those of the side chapels of length slightly less, and finally, those smaller of the connection spaces. Respectively called A, B and C, the rhythm that is generated is of the type C-B-C-B-C-A-C.

2.5 Church of the table 34 of the Treaty “Architettura Civile”

The church of the table 34 of the Treaty “Architettura Civile” (Civil Architecture), depicts two possible variants of a religious building with three naves with a transept, side by side along the main axis. The project is represented exclusively in plan: due to the absence of the section, the assumptions regarding roofing systems are obtainable only by deduction by the way of representation in plan and by comparison with other analog drawings of Guarini.

The relationship that is established between the three cells of the circular nave is the same in both versions, which we denote the right and left with respect to the longitudinal axis of the building. The three circumferences, in plan, intersect each other; the junction point is highlighted by three quarters columns placed on sections of the wall that follow the curvilinear shape of the individual cells, drawing it near to a broken line. Even in this case, it generates a space narrowing at that point, which gives the nave the same undulating rhythm of expansions and contractions. In the plan, at the junction point, the projection of separation elements between the vaults is not shown; on the contrary happens, however, between the nave and the transept, and between the latter one and the choir, where the dotted lines indicate an arch of caesura. It can be assumed that a connection vault is present between the domes, similar to the one introduced in the church of Lisbon. If so, the connection space, differently from the Portuguese church, would be limited solely to the roofing system, without having a value in planimetric configuration of the building. Undoubtedly the lateral naves appear more clearly: in both variants, they are composed of a succession of circular interpenetrated cells. These are the only elements common to both variants. For the rest, each one represents a reversal of the compositive logic expressed by the other one. The first difference is drawn in relation to the nave, which interpenetrates the left side, while on the right side is interpenetrated. In addition, in the left variant, the cell of the aisle that overlooks the main space, it is also

interpenetrated by the cells that precede and follow them, hidden by the wall sections that support the vaults.

Consequently, an observer placed at the center of one of these cells, would see a compressed space on all sides. In summary, in the left variant, the spaces of the main nave prevail over those of the side aisle also because they maintain their entire geometry. The main spaces of the side aisle are not visible from the central one, as opposed to secondary connection spaces. On the right, as already mentioned, the relationship is reversed: the greater chapels of the side aisle are visible from the nave and interpenetrate the nave itself. These chapels are then perceived as spaces that expand into contiguous, prevailing over them. This time, the connection spaces are hidden from view with respect to the nave. The transverse axiality find their visual conclusion on the rear walls of the greater chapels, distinguishing then to the lower linear extension.

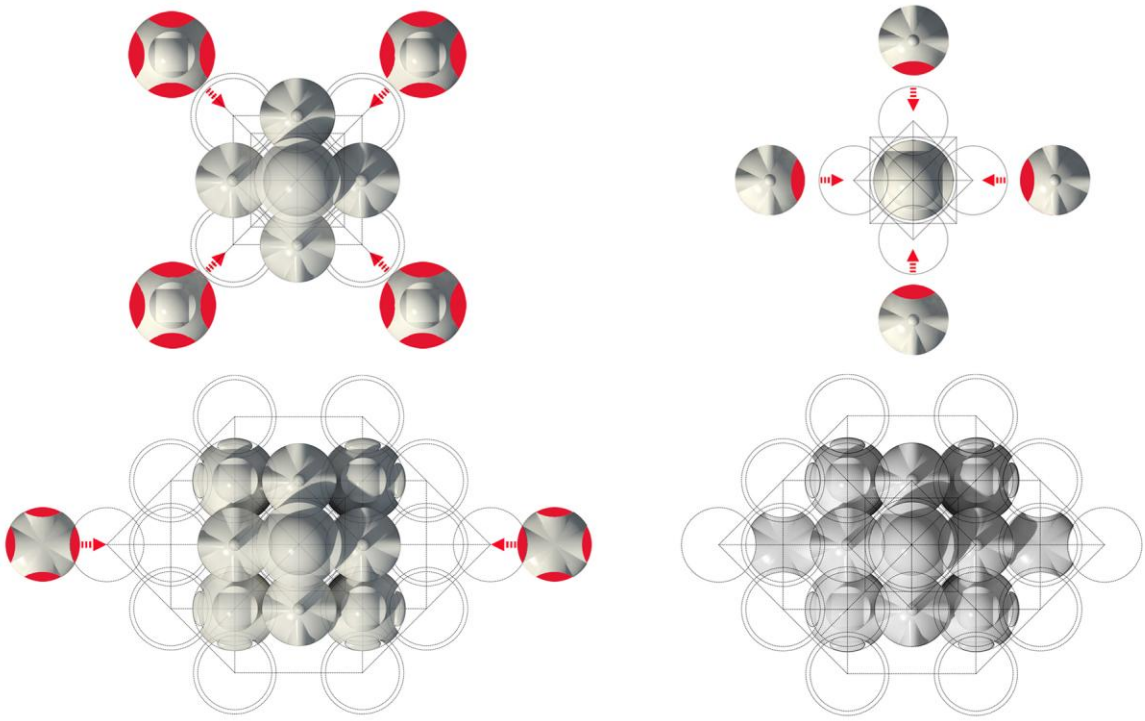

Figure 3: three dimensional model of the void inner space of S. Filippo in Casale Monferrato. Aggregative pattern of the elementary cells.

2.6 S. Gaetano in Vicenza

The design for the church in Vicenza, such as the following, is a variation on the theme of the central plan with Greek cross, enriched through the inclusion of smaller chapels on the diagonal. The pattern is generated by a central circumference and four ellipses, which constitute the arms of the Greek cross; diagonals chapels are also of a circular shape. Among those adopted by Guarini, the plan is as open as possible, virtually upgradeable along every direction by mirroring each cell with respect to each other. It may ultimately be generated an isotropic scheme that alternates between ellipses and circles, the latter of the two possible dimensions. The central cell is penetrated by the four ellipses arranged on orthogonal arms of the cross. This device generates an unprecedented spatial effect that alters the perception of the dome from below: the four three-dimensional arches, generated by the interpenetration of cells, identify the spherical surface of the pendentives. The latter do not support the dome but a balustrade ring that hide

the impost of the dome. The dome is constituted by a double shell: the first spherical, open by a large oculus that gives a glimpse of the second, elliptical. The observer at the center, in correspondence of the keystone of the dome, perceives a space compressed by the neighbors ones. This feeling is confirmed by the balustrade that closes the space over the observer himself, hiding the impost of the dome, preventing you from understanding its real size. He obtained an effect of expansion and vault suspension, amplified by the second shell.

2.7 S. Filippo Neri in Casale Monferrato

As anticipated, San Filippo repeats the principles of the Venetian church, applied to a plan generated exclusively by the interpenetration of cells of circular shape. A complication with respect to the project of Vicenza, is obtained by the insertion of a cell, that serves as a chancel, geometrically similar to those placed on the diagonals. On the Treaty, the plan is depicted only half: assuming that it is perfectly symmetric, a space similar to presbyterial one, on the opposite side, would act as an entrance vestibule, providing a predominantly axiality to the space. By inverting the relationship with respect to San Gaetano, the main compartment pervades and prevails on the side ones: so this space expands itself, compressing the bordering spaces.

The minor diagonal cells, circular in shape, are interpenetrated on two sides by greater ones; on the remaining sides, they replicate the partialized profile of the first sides, suggesting a virtual interpenetration with identical cells, in size and shape, to those of the arms of the cross. To replace the latter, are placed small elliptical chapels.

3 CONCLUSIONS

In conclusion, the article, after classifying the mode of contact between cells, shows that the latter, together with the geometry used for the layout of the buildings of Guarino Guarini, greatly influence the internal space of the churches and the perception of space itself. The vaulted systems often allow you to make legible the compositive logic and the geometric patterns. Together with the typological interpretation of the buildings, allow to objectively highlight the main feature of the projects of Guarini, namely the alternation of expansions and compressions that generates the pulsation of the space.

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