Jacopo Torni l'Indaco Vecchio and the Emergence of Spanish Classical Stereotomy[1]

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A widespread conception in Spanish Renaissance architecture studies considers stonemasons and stonecutting as a reactionary force opposed to the renovation of the architectural vocabulary brought about by Italianate artists. This view, though, appears to be rather simplistic. It is certainly true that some elements of the stonemasons' lore, such as the stonecutting tools, derive from Romanesque or Antique origins; but it is also true that the adoption of classical forms in stone vaults fostered the development of new stereotomical methods. These new stonecutting techniques derive neither from the mainstream of Late Gothic stone construction nor from the brick vaults of Italian tradition.

This paper will analyze an episode that exemplifies these complex relations. Jacopo Torni, *L'Indaco vecchio*, a Florentine painter, worked with Pinturricchio in the Borgia Rooms and with Michelangelo in the Sistine ceiling. Due to unknown reasons, he went to Spain in 1520 and two years later he was made master mason of Murcia cathedral.

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Without prior architectural experience, he had to carry on a complex architectural program. In just four years he built a number of pieces that show a remarkable command of classical architecture and a complete mastery of the stonecutting technique, such as one of the first stone pendentive vaults in Europe and a singular skew passage. The construction of early Renaissance vaults at Murcia cathedral does not show, therefore, a confrontation between traditional masons and innovative artists but, quite to the contrary, stereotomical skill at the service of Renaissance architecture.

Jacopo Torni's career before his arrival in Murcia

Jacopo Torni, also called Jacopo l'Indaco vecchio or Jacobo Florentín, was born in Florence in 1476. In his youth he apprenticed in Ghirlandaio's shop; maybe he was acquainted with Michelangelo in this period, before Buonarrotti passed to the school for young talents the Medici held in the garden of San Marco. Later on, Torni worked with Pinturicchio, perhaps in the Stanze Borgia; Venturi ascribes him the *Dialettica* and the *Adorazione dei Magi*. Recently, Fiorella Sriccia Santoro has attributed him a number of paintings, such as the *Madonna del Pozzo* in the Ufizzi and the *Tempio di Ercole* in the Palazzo Davanzati (Vasari 1550, 528-529; Milanesi 1878, 3:680; Sricchia 1993:12-33)

In 1508, while staying in Florence, Michelangelo called him from Rome to collaborate in the Sistine ceiling. Twentieth-century scholars, such as De Tolnay and Wallace, have remarked the role played by the assistants in these frescoes, since Michelangelo lacked any previous experience in this technique; in particular, the architectural divisions of the vault are executed by different hands (De Tolnay 1945, 113-115; Wallace 1987, 203, 207, 208, 210). By contrast, Torni had surely gained a

mastery of the fresco technique working with Ghirlandaio and Pinturicchio, as well as sound experience in painted architecture.

In 1520, Torni arrived in Spain to work in the Royal Chapel in Granada, according to a passage in the translation of Vitruvius *De architectura libri decem* by Torni's son, Lázaro de Velasco. At this moment, the construction of the chapel was already finished and Torni undertook the paintings of the Last Supper, the Arrival of the Holy Ghost and the Meeting with the Disciples in Emaus for the Santa Cruz altarpiece, as well as the altarpiece frame, the Annunciation over the vestry door, the sacristy's drawers, an organ case and the wooden grille between the vestry and the chamber of relics. Probably he worked also in the sacristy's door, the choir stalls, the decorations of the rib vaults of the chapel and the main altarpiece. He restored also the well-known painting of the Virgen de la Antigua in Seville cathedral, probably in this period. (Velasco 1564, ff. 6v., 8r.; Gómez-Moreno 1925b, 273-275, 279; Gallego 1931, 66-67, 69, 70, 97; De Bosque 407-408; Morales 1922, 196; Pita 1994, 61; Gómez-Moreno Calera 1994, 233, 235; Calvo Castellón 1994, 218-222; Martínez 1994, 97-98).

Torni's stay in the Royal Chapel is quite significant for his later career in Spain; a fair number of Spanish and foreign artists that were playing a crucial role in the introduction of the Renaissance in Spain, such as Pedro Machuca, Domenico Fancelli, Bartolomé Ordóñez, Alonso Berruguete and Philippe Vigarny, congregated in this shop. In particular Indaco may have arrived from Italy with Machuca, and indeed had strong ties with him, since the contract for the tables of the Santa Cruz altarpiece was let to both artists. Furthermore, Fancelli also worked in the chapel of the Virgen de la Antigua, carving the funerary monument of cardinal Diego Hurtado de Mendoza.

(Gómez-Moreno 1926, 118-121; Gómez-Moreno 1941, 57; Rosenthal 1988, 12; Morales 1992, 185-187; Suberbiola 1992)

These first works of Torni in Spain are more or less directly tied to the powerful Mendoza family, and in particular to Íñigo López de Mendoza, second count of Tendilla and first Marquis of Mondéjar, that had tried to reform Enrique Egas' gothic project for the Royal Chapel and commissioned Diego Hurtado de Mendoza's funerary monument to Fancelli. Until his death in 1515, five years before Torni's arrival, Tendilla had been a key figure in the introduction of Renaissance architecture in Spain. He was the patron of a small but quite significant Early Renaissance work, the monastery of San Antonio de Mondéjar, and quite probably led his uncle, Cardinal Pedro González de Mendoza, to adopt Renaissance decorations in the façade of his university college of Santa Cruz in Valladolid, begun in the gothic idiom. Italian Renaissance architecture suited perfectly the classical and aristocratic aspirations of the Mendoza; after all, Tendilla's grandfather, the Marquis of Santillana, also called Íñigo Lopez de Mendoza, was famous for his *Sonetos fechos al itálico modo*, a turning point in Spanish poetry. (Gómez-Moreno 1925a, 7-13, 23-24; Gómez-Moreno 1925b, 42-44; Gallego 1931, 43-44; Rosenthal 1974; Nader 1979, 150-178; Morales 1992, 185-187; Díez 1992, 68, 75-78)

Jacopo Torni's arrival in Murcia

Torni was appointed in 1522 master mason of Murcia cathedral. Although the post involved some sculptoric work, such as the vestry drawers and the richly sculpted sacristy doorway, it was mainly an architectural commission, since the cathedral chapter

had begun in 1519 the construction of a large bell-tower, one of the tallest in Spain. The technical difficulties of the job were made even more stringent by the nature of Murcia soil, a very soft kind of clay soaked by the nearby river Segura and the intensive irrigation of lands near Murcia, lying over a solid layer of gravel 12 m below ground. However, in 1522 the foundations were already laid by another Italian, Francisco Florentín, that had preceded Torni in the post of master mason. Apparently, Florentín did not use wooden poles in the foundation trying to reach the gravel layer, but a huge masonry block 19 m square and 4 m deep (González [1905]1997, 2:555-557; Baquero 1913, 41-46; Gutiérrez-Cortines 1987, 56-66, 112-129; Vera 1993, 100-102, 112-121).

All this poses an interesting question. Why should the cathedral chapter appoint as master mason a figurative artist without any significant building experience? To answer this question, we should turn our attention to the persons that had a say in the election of the master mason. The bishop in this period was Matthäus Lang, a diplomat in Emperor Maximilian's chancery, that was rewarded for his services with the bishoprics of Gurk and Cartagena and the archbishopric of Salzburg. He never visited Murcia; his artistic interests seem to be directed to music rather than the visual arts (Olszewsky 1992). Thus, we should look for the actual patrons of the tower between the chapter members.

The most italianate of them was Gil Rodríguez de Junterón. He had spent some years in Rome during the papacy of Julius II, that referred to him as *familiaris noster et continuus commensalis* and appointed him as *protonotario apostolico* and Palatine Count. Back in Murcia, he was appointed to the post of *fabriquero*, or chapter officer in charge of the works in the cathedral, for two crucial periods. In 1512-1513 he was surely

involved in the first Renaissance work in Murcia cathedral, the north crossing entrance or *Puerta de las Cadenas*; he was again *fabriquero* in 1519-1521 and should be held responsible for the appointment of Francisco Florentín as master mason in 1519. Furthermore, he built at his own expenses a rich funerary chapel in the cathedral; Gutiérrez-Cortines (1987, 176-178) and Villella (1998) have stressed that many traits of this chapel derive from with the first projects of Julius II' tomb. Thus, it is easy to suppose that Junterón and Torni had met in the Vatican while Indaco was working in the Sistine ceiling, that Junterón advocated the appointment of Indaco as master mason, an in turn, that Torni was responsible for the project of Junterón's funerary chapel (Villella 1998; Villella 2002). However, the picture is not so simple. Junterón had played a leading role in the insurrection of the *comuneros* against the policy of the Emperor Charles V. As a result, he was excluded from the royal amnesty and imprisoned in Madrid between September 1522 and October 1523. Furthermore, Junterón's chapel was begun in 1525 and finished around 1543, while Torni died in 1526. (Owens 1980, 60, 298; Rodríguez Llopis 1998, 225-226; Villella 1998, 89; Villella 2002, 88). Thus Torni may have furnished some basic designs for Junteron's chapel, though there is no direct documentary evidence for his involvement in this project; but he surely did not direct the construction of the inner vault, one of the most remarkable pieces of Spanish stone construction.

An important detail in a letter from the chapter to Torni, dated March 29, 1522, casts some light on his appointment as master mason. To make their job offer as attractive as possible, the chapter offers Indaco a number of additional assignements, including seven or eight funerary sculptures and many wood images in the chapel of the

Marquis of Vélez, Pedro Fajardo, and well as work in the main altar of the cathedral. The reference to the work in the main altar alludes to the Marquis attempt to hold the patronage of the presbytery of the cathedral and use it as a funerary chapel. This pretension was supported by the cathedral chapter, while the city council opposed strongly to Fajardo's plan. The controversy led to a letter from Charles V barring the Marquis to be buried in the presbytery, since it served as funerary chapel for the heart of King Alphonse X and commanding that the entrails of the king should be given an appropriate setting. What is more meaningful for our purposes is that the town hall argues that the chapter decided to assign the presbytery to Fajardo in the days of the *comunidades,* and that in this period the Marquis was in absolute command of Murcia, "in temporal matters as well as in spiritual matters". Furthermore, Fajardo sided discreetly with the *comuneros* in their clash with the city council, but was not excluded in the royal amnesty; Junterón played a more visible role, acting as a political collaborator of Fajardo, and was therefore punished by contrast with the powerful Marquis. Thus, we can assume that Fajardo, and maybe Junterón, played an indirect but essential role in the chapter's decision to appoint Torni in 1522. (Owens 1980, 109-122, 154, 159, 161-162; Rodríguez 1998, 222-227; Gutiérrez-Cortines 1987, 64-65; Torres 1990, 668; Noguera 2000).

Fajardo had been educated by a Milanese humanist, Pietro Martire d'Angheria, that had arrived in Spain under the protection of the second count of Tendilla. Furthermore, Fajardo strenghtened his ties with the Mendozas by marrying Mencía de la Cueva y Toledo, daughter of the Duke of Alburquerque, a prominent member of the family. Of course, Fajardo was also an important patron of Renaissance architecture. He carried on

the funerary chapel begun by his father in the cathedral deambulatory in a very rich Gothic; however, he appended Renaissance details in the last phases of decoration, such as in the vestry doors. Furthermore, he begun his own palace-castle, in Vélez-Blanco, as an irregular mediaeval fortress, but later on he added a number of rich *grotteschi* decorations in the doors and windows of the patio, nowadays in the Metropolitan Museum in New York; at the same time, he commissioned ten large wooden friezes for two of the palace rooms, those of the *Triumph of Caesar* and the *Labors of Hercules*, now in the Museé des Arts Décoratifs in Paris (Torres 1990, 665; Raggio 1968; Blanc 1997).

All this explains the successive appointment of two Italian artists to the post of master mason of Murcia cathedral. The chapter, influenced by Fajardo and Junterón, looked for artisans with a sound mastery of the decorative language of antiquity; in particular *grotteschi* with trophies, shields and swords suited the aristocratic ambitions of Fajardo, victor of the uprising Moorish minority. However, Torni did not build his vaults in Murcia cathedral in brick, as Brunelleschi or Giuliano da Sangallo, but in ashlar. Again, the election of this material seems to have been imposed by his patrons. Simply put, in sixteenth-century Spain, aristocratic ideals and classical culture added up to magnificence, as Rosario Díez del Corral (1992) has remarked; and the idea of magnificence in architecture was closely associated with the use of cut stone. At the same time, magnificence, wealth and power were linked to the difficult, the rare and even the exotic. All that adds up to the fascination that stereotomical tracings must have exerted in this reduced Murcian elite; for, as I shall explain, the stereotomical procedures needed to construct this vaults were as distant from Gothic construction techniques as from the Italian brick-vaulting tradition.

The pendentive vault in the sacristy of Murcia cathedral

The stereotomical work in the cathedral of Murcia that can be most clearly ascribed to Torni is the pendentive vault of the vestry, Figure 1, in the inner part of the first story of the bell-tower. An entablature below the vault springing carries a Latin inscription that includes the phrase "ANNO DOMINI MCCCCCXXV DIE XV NOVEMBRIS", making reference to the dedication of the vestry. Thus, it is unanimously accepted that the vault was finished in this date. Furthermore, it cannot have begun much earlier, since another inscription, in the exterior façade of the tower states that the tower was started on October 18th, 1521. Therefore, the vault (fig. 1) can be safely ascribed to Jacopo Torni term as master mason. (Baquero 1913, 41-42; Gómez Piñol 1970, 18-19).

From a formal point of view, the vault is neatly divided in two sections by a big round garland that ties together the keystones of the wall arches. Below this garland, the pendentives are treated as four naked spherical triangles. However, the top section of the vault is decorated with narrow ribs, converging in a big roundel in the vault keystone. In this formal understanding of the vault, it is clear it derives from Florentine sources, such as the vaults at the Sacrestia Vecchia in San Lorenzo or the one in Capella Pazzi, although the spaces between the ribs are much narrower in the Murcian vault, more akin to Bramante's choir in Santa Maria del Popolo in Rome. The fruits and vegetables of the garland and the roundel are quite similar to those of contemporary works by Giovanni della Robbia (Gutiérrez-Cortines 1987, 135-136), such as the *Labavo* in Santa Maria Novella.

However, the recent topographical and photogrammetrical survey by Miguel Ángel Alonso has proved that the surfaces of the four pendentives and the outer surface of the ribs are actually parts of the same spherical surface. This suggests quite a different understanding of the vault. From a formal point of view, the vault is an assembly of two clearly different parts, the pendentives and the round vault. From a constructive standpoint, however, the vault is a seamless unit, that can be described as a spherical vault cut by four vertical planes that stem from the sides of a square. Thus, the vault is a perfect example of a building type fairly common in Spanish and French stonecutting treatises and manuscripts, the pendentive vault, *Capilla cuadrada* or *Capilla vaída*. (L'Orme 1567, 111 v.- 113 r.; Vandelvira 1580, 81 v. ; Palacios 1987, 60-63; Palacios [1990] 2003, 254-259; Rabasa 2003, 1679)

These treatises and manuscripts explain three different solutions to this problem. The vault can be divided by horizontal planes and by planes that pass by a vertical axis stemming from the center of the sphere; in this way the divisions are akin to the parallels and meridians of the globe. This *Capilla cuadrada en vuelta redonda* is the easiest and more frequent solution to the problem, and Vandelvira explains it in the first place. By contrast, Philibert de L'Orme, in his usual phony manner, eschews this relatively simple solution and presents directly a sphere cut by two sets of vertical planes that are parallel to the diagonals of the square of the vault springing, called in Spanish *Capilla por hiladas atravesadas* or *enrejada*. Vandelvira explains yet another solution, the *Capilla cuadrada por hiladas cuadradas*; here, the spherical surface is divided by two sets of vertical planes, parallel to the sides of the springing square (L'Orme 1567, 111 v. –

133 r.; Vandelvira 1580, 89 v., 83 v., 99 v.; Palacios [1990] 2003, 264-267, 278-281; Potié 1996, 114-123).

According to Vandelvira's manuscript, each of these vaults can be solved by two quite different methods. The vaults *por cruceros* employ a grid of ribs that are later filled by coffers. This method resembles gothic construction, but the final appearance can be as classical as the Pantheon coffers, the surbased vaults in Chambord halls or the tunnels between the presbytery and the deambulatory in Granada cathedral. The other method, without an special appellation, is more innovative, since it makes no difference between ribs and panels; a number of recent Spanish studies refer to this vaults as made by *piezas enterizas*, whole pieces.

The vault in the Murcia vestry is divided by meridians and parallels and constructed without any difference between ribs and coffers. Therefore, it is a perfect antecedent of Vandelvira's *Capilla cuadrada en vuelta redonda*; so, we will follow Vandelvira's text to explain its construction. This poses the problem of a possible anachronism, since Vandelvira's manuscript is at least fifty years posterior to the vault in the Murcia vestry. However, I shall explain that there is evidence for the use of the methods explained by Vandelvira as early as 1534; so we can assume it is fairly possible that the Murcia vault was constructed according to Vandelvira's method, except some specific details.

Vandelvira instructs the reader to construct a plan and cross-section of the vault, dividing the section in the appropriate number of courses and bringing lines from these divisions to the plan to trace the parallels or horizontal joints of the vault. At this point, Vandelvira refers the reader to the *Capilla redonda en vuelta redonda* or hemispherical vault, that he has explained before; in fact, the voussoirs above the garland in the vault

of the Murcia vestry are equivalent to the voussoirs of a hemispherical vault (Vandelvira 1580, 81 v.). Vandelvira solves the problem of this vault inscribing a set of cones in the intrados of the vault, so that each cone passes by two successive horizontal joints or *lechos*. All these cones have their vertices in the vertical line that passes by the center of the sphere, or axis of the vault. Since the meridians are sections of the cone by vertical planes that pass by the axis of the vault, he can take the chord of a section of the meridian between two consecutive horizontal joints and extend it until it meets the axis of the vault. Furthermore, the extended chord is a generatrix of one of the cones that are inscribed in the hemisphere, and Vandelvira can easily develop the cone tracing two arcs with center in the cone vertex and passing by the edges of the chord; afterwards, he will use this developed cone as a flexible template for the intrados of the voussoirs of the vault.

Of course, this template will not be an exact development of the spherical surface, that is not developable; as a matter of fact, it will adjust exactly to the horizontal joints, while the edges of the template will coincide with the chords of the joint between voussoirs in the same course or *juntas*. This poses a difficult problem, since it involves the rectification of the circumference, and Vandelvira avoids it saying that "las cuales cerchas cerrarás por do quisieres", that is to say, the mason can trace at will a second *junta*, as long as it passes by the vertex of the cone. Of course, this does not allow exact control of the length of the voussoirs; the mason can dress a set of identical voussoirs, but nothing assures that the last voussoir of a course will fit exactly against the first one. However, in many occasions the mason would adapt the length of the voussoir to the dimensions of the available blocks. (Rabasa, 2000, 172). It is quite noticeable that the

hemispherical vault of the main dome of the Escorial basilica is built with voussoirs of variable lengths. Furthermore, Ruiz de la Rosa and Rodríguez Estévez have recently found a full-size stereotomical tracing in the rooftops of Seville cathedral, most likely made in 1534, that follows closely Vandelvira's procedure and even leaves the *cerchas* open. (Ruiz de la Rosa, 2002). However, the method of the Seville tracing and Vandelvira's manuscript cannot be applied literally to the vault in the Murcia vestry, since in Murcia each voussoir spans one or two grooves. Thus, exact control of the length of the voussoirs is essential, and the masons that dressed the stones for the Murcia vault must have employed a somewhat different procedure, as we shall see.

Rabasa (1996, 429; 2000, 172-174) has remarked that Vandelvira does not describe accurately the dressing of the voussoir, but the somewhat later manuscripts of Guardia and Gelabert are more precise. The stonemason would carve a spherical surface in a block, using a *cercha*, that is, a curved, single-sided template with the same radius as the intrados hemisphere; of course, that is possible because the sphere presents the same curvature in all directions. Afterwards, he should mark the flexible template in this spherical surface; the round edges of the template, corresponding to the parallels of the vault and the cross-sections of the cone, will adjust exactly to the spherical surface, while the generatrices will not. However, it must be stressesed that in a vault of a sizable span and a fair number of voussoirs, such as the one in Murcia vestry, the difference in lengths between arc and chord in the *junta* is quite negligible – in fact it amounts to half a millimeter.

Of course, the stonemason cannot trace exactly the second *junta* by means of the template, as I have said. However, he can easily trace the *juntas* in the plan, take the

distance between two edges of the voussoir from the plan, since the two edges are at the same level and their distance is shown in true size in the plan, mark it in the *cercha* and transfer it to the spherical surface, repeating this operation for both horizontal joints; that allows him to close the template directly on the dressed surface of the stone easily and exactly.

All this allows the dressing of the voussoirs above the garland. The pendentives or *pechinas* pose an additional problem, since the voussoirs that rest on the wall arches meet the vertical plane of the wall and must be cut by an oblique line. Once again, Vandelvira's explanation is quite obscure. However, comparing Vandelvira with the later manuscripts of Guardia and Juan de Portor y Castro, it seems clear that all three authors take the length of a chord of a horizontal joint, draw an arc with the radius of this chord and center in the intersection of this chord and the developed horizontal joint; where this arc meets the horizontal joint, the stonemason can place an edge of the voussoir template. Of course, this method underestimates the length of the template. However, this difference can be negligible in most occasions, since it can be absorbed by the thickness of the mortar joints.

The skew vault in the entrance passage to the sacristy of Murcia Cathedral

Another piece that can be safely ascribed to Torni is the skew vault in the entrance passage to the cathedral vestry, (fig. 2). González ([1905] 1997, 2:167-168) argued that the sacristy could not have been dedicated if the access was not properly solved. Thus, the passage vault should have been built at least some months after October 1521, when the tower walls rose above ground, and before November 1525, when the vestry was

dedicated. Furthermore, we can assume that the fourth bay of the entrance ramps to the tower, that is above the passage vault, was already built by November 1525, since the tower walls must have risen higher to allow the construction of the sacristy vault. All this places the passage construction between 1522 and 1525, in Torni's term as master mason.

The passage is quite singular. Its walls are curved, maybe to avoid the tower ramp, but more probably to gain privacy in the vestry. The vault, however, is not a torical vault, like the one in the courtyard of the palace of Charles V in Granada; it is rather a translation surface generated by a semicircle that moves while keeping its edges in two springing arcs. The vault is divided in nine courses; in turn, each course is divided in nine coffers, each one decorated with a rose. The front of the passage near the sacristy vestibule is treated with a skew *arrière-voussure* with nine voussoirs decorated with *candelieri*, neatly integrated in the vault. The opposite front, that of the sacristy, is solved with an arch in the Florentine tradition, akin to those in the lateral chapels of San Lorenzo or Santo Spirito, or those around the *finestre inginocchiate* in the Palazzo Medici; this adds up to the attribution of the passage to Torni (Vera 1993, 107, fig. 77).

At first sight, no sixteenth-century treatise or manuscript offers a solution to this strange vault. However, Vera (1993, 107) has pointed out that the vault resembles the *Decenda de cava que guarda por lechos torre cavada y redonda* from Alonso de Vandelvira's manuscript. Of course, the resemblance is not literal, since the characteristic trait of the *decenda de cava*, akin to the French *descente de cave*, lies in its sloping springing, while the springing of the vault in the Murcia passage is horizontal. Notwithstanding that, Vera's suggestion casts light on the problem, since in the *Decenda de cava que guarda* ...,

Vandelvira refers the reader to the simple *decenda de cava* for the basic constructions and, once this is solved, deals with the problem of the curved springing. In turn, in the *Decenda de cava*, Vandelvira refers the reader once again to the *Viaje contra viaje*, a skew arch. (Vandelvira, 1580, 30 r., 29 r., 28 r.; Palacios, [1990] 2003, 109-113, 102-105). Thus, we can reconstruct a possible procedure to construct the vault in the Murcia passage starting from the skew arch, dealing afterwards with the problem of the curvature of the joints, and leaving aside the procedures to deal with the sloping springing.

The mason should prepare a full-size tracing with the plan and the elevation of the vault, dividing the front arch in nine parts and tracing the horizontal joints in the plan. In the Murcia vault, each voussoir spans two coffers. This is not a general rule, but we can assume this irregularities are the product of posterior repairs an leave them aside. Thus, we can assimilate the vault to a succession of nine skew arches, each one two coffers deep. In the first arch, we should take the first, third, fifth, seventh and ninth voussoirs; in the second arch, we should take the second, fourth, sixth and eight voussoirs; again, in the third arch, we should take first, third, fifth, seventh and ninth voussoirs, and so on till the ninth arch.

Taking all this into account, we can apply Vandelvira's procedure for the *Viaje contra viaje* to each of this arches. To construct the intrados template, Vandelvira computes the length of both diagonals of the intrados face, constructing a triangle with the horizontal projection of the diagonal and the difference in heights between its edges. Once this is done, Vandelvira can construct two arcs with their centers in both edges of the lower intrados joint of the voussoir. The radius of one of this arcs should be

the length of the diagonal of the intrados face of the voussoir, while the radius of the other arc should be the length of the chord of the arc that corresponds to the voussoir, taken from the elevation. Where these two arcs intersect, Vandelvira can place one edge of the upper intrados joint. Repeating this procedure for the other diagonal, he can place the other edge and construct the intrados template. Vandelvira applies a similar method for the faces of contact between voussoirs or *lechos*, computing the diagonal length, but does not construct the full template; he limits himself to trace the face joint, calling it *saltarregla*, since it allows to determine the angle between intrados joint and face joint, which is transferred to the stone with a protractor called *saltaregla* or *sauterelle* (Vandelvira 1580, 28 r.; Palacios, [1990] 2003, 102-105).

Once this is done, the stonemason must deal with the curvature of the horizontal joints. According to Vandelvira (1580, 30 r.), "los lechos en cercha [...] se extienden después de sacadas las plantas a regla y por la manera que parece en la traza que se han de extender en las plantas las cerchas que hacen por sus plomos, como dije en las trazas pasadas, especialmente en la pechina". That is, the stonemason should take the distance between the horizontal projection of the intrados joint and its chord and transfer it to the intrados template to construct a *cercha*. However, such a construction method poses a number of problems. This *cercha* should not be applied to the intrados face, since the *lecho* or face of contact between the springer and the impost must be flat. By contrast, the *lecho* of ordinary voussoirs should be an oblique cylinder, since it is generated by the front joint as it moves along the intrados joint. All this suggests these voussoirs were in fact carved by squaring, while templates and *cerchas* were reduced to a secondary role as verifying instruments.

The role of Jacopo Torni in the emergence of classical stereotomy

This two examples of classical stereotomy in Murcia cathedral are quite remarkable for the precision in the stonecutting methods, as the division of the voussoirs in the sacristy vault makes clear; or either for the complexity of the tracing methods in the passage vault, where forty-one different voussoirs are to be constructed independently. These experiences become even more outstanding if we consider the early date of this singular pieces, around 1525. We should take into account that the *Pendentif de Valence*, the archetype of French pendentive vaults, dates from 1548, more than twenty years after the vault in Murcia sacristy, or that the first written explanation of skew arches, in Philibert de L'Orme's *Le premier tome de l'architecture,* belongs to 1567. Furthermore, most classical stereotomy pieces in the beginning of the sixteenth-century, such as the surbased vaults in Chambord or in Seville town hall, are built *por cruceros*, that is, with a framework of ribs filled with coffers. By contrast, both pieces in Murcia cathedral are built with *piezas enterizas*, and play a significant role in the diffusion of this stereotomical line, that was to dominate the evolution of stereotomy, since construction *por cruceros* fades slowly along the sixteenth-century and is irrelevant around 1600.

The innovative character and high constructive quality of this pieces is more striking if we take into account that Jacopo Torni had little or no experience in actual building before his appointment as master mason in 1522. Of course, we can imagine Torni as a figurative artist, deeply involved with garlands, *candelieri* and roses, and leaving to assistants the practical aspects of stonecutting and template construction, and of course the tiresome task of tracing full-size stereotomic diagrams in the floor.

However, these assistants have left no trace in the cathedral documents, at least during Torni's term as master mason. Gutiérrez-Cortines (1987, 61, 95) has remarked that Juan de Marquina, a first-rate stonemason, was inscribed as resident in Murcia in 1523, and that he and Jacopo Torni bought slaves the same day, but up to this date no document has been found to tie Marquina to the cathedral works.

At the same time, we should take into account Torni's mastery in stone sculpture, attested by the *Annunciation* in the Royal Chapel. Thus, we can assume Indaco had at least a thorough command of some stonecutting instruments. He may have lacked a deep understanding of tracing procedures at the first moment, but we must stress again the innovative nature of the stonecutting methods employed in these pieces, utterly strange to the Gothic tradition. Thus, rather than a figurative artist leaving to his assistants the painstaking tasks of stonecutting, we should think about a team of artisans, facing a difficult task, that of building classical stone vaults, quite different to Italian brick vaults, but also strange to the Gothic method of rib and groin construction.

All this does not mean that Torni and his assistants were starting from the ground up. There is a line of late-mediaeval ribless construction, that plays a marginal role in the wider streams of Gothic architecture; but one of the most important centers of ribless construction lies in Valencia, 250 km north of Murcia (Zaragozá 1992, 1997). Furthermore, there is some evidence of contacts between the masons of both cities, as I hope that another contribution to this seminar, by Eliana de Nichilo and myself, will make clear. Thus, I will not discuss this matter here; it will suffice to say that, very likely, the experiences in ribless construction in fifteenth-century Valencia provided a starting point for the classical stereotomy in Murcia cathedral.

However, most fifteenth-century and early sixteenth-century pieces in Valencia cannot be ascribed to classical stereotomy. For example, the vaults in the present-day entrance to Valencia cathedral bell-tower, the well-known *Micalet*, can be described as groin vaults with lunettes, but this description would be misleading, since groin vaults with lunettes are very rarely found together in classical architecture; it will be more clarifying to describe them as ribless tierceron vaults. Therefore, there was a long way from this brilliant late-mediaeval school to classical stereotomy. Part of this task was carried on in Valencia; the small groin vault in a niche in the church of Saint Nicholas or the skew arches in the Resurrection chapel in the back of the cathedral choir attest the early appearance of Renaissance stereotomy in Valencia. However, these pieces are quite small; it will be more appropriate to describe the Resurrection chapel as a work of anti-stereotomy, since the small size of the arches permitted to build each one with a single stone.

Thus, the experiences in Murcia cathedral, involving much bigger pieces, play a crucial role in the emergence of Renaissance stereotomy and in particular in the technique of building by *piezas enterizas*. Later on, Juan de Marquina was to hold an important position in the works of the palace of Charles V in Granada, and was likely in charge of the lunette vault under the chapel, although he died before the construction of the torus-shaped vault in the courtyard. Andrés de Vandelvira, father of Alonso and builder of such steretomical masterpieces such as the corner arch in the entrance to the vestry of El Salvador in Ubeda and the archetypal *Ochavo de La Guardia*, was in contact more than once with Jerónimo Quijano, appointed master mason of Murcia cathedral after Torni's death; this can explain the presence in Alonso's manuscrips of a number of

solutions that derive from Murcian pieces, such as the *Bóveda de Murcia*, named after the funerary chapel of Gil Rodríguez de Junterón, or the *Bóveda en vuelta capazo*, that resembles closely the vault in the sacristy anteroom in Murcia cathedral. Maybe the influence of this Murcia examples also extend to France, since Philibert de L'Orme's *Vôute en forme d'une coquille de limaçon* resembles the somewhat earlier vault in the sacristy vestibule, although there are significant differences in the tracing methods, as Rabasa (2003, 1682-1683) has pointed out.

In any case, this early episode in Spanish stereotomy challenges the conception of stonecutting practices as a force opposed to introduction of the Renaissance in Spanish architecture. Rather, we have seen an group of Italianate patrons attracted to classical architecture, but unwilling to renounce the aristocratic connotations of stone vaulting. This group of patrons attracted two Italian artists to Murcia, and posed before one of them, Jacopo l'Indaco, the difficult task of building in stone a number of classical vaults. Rather than following the technique of construction *por cruceros*, as in Chambord or in Seville town hall, he constructed massive ribless vaults, as different from the Italian brick vaults as from the rib and groin system of mainstream Gothic construction. This difficult stereotomical problem was carried on in a most precise manner, particularly visible in the pendentive vault of the sacristy, for the skew vault in the entrance passage has been affected by the movements of the tower. Thus, this episode does not show a confrontation between traditional stonecutters and Italianate artists but, quite to the contrary, fine stonecutting at the service of classical architecture.

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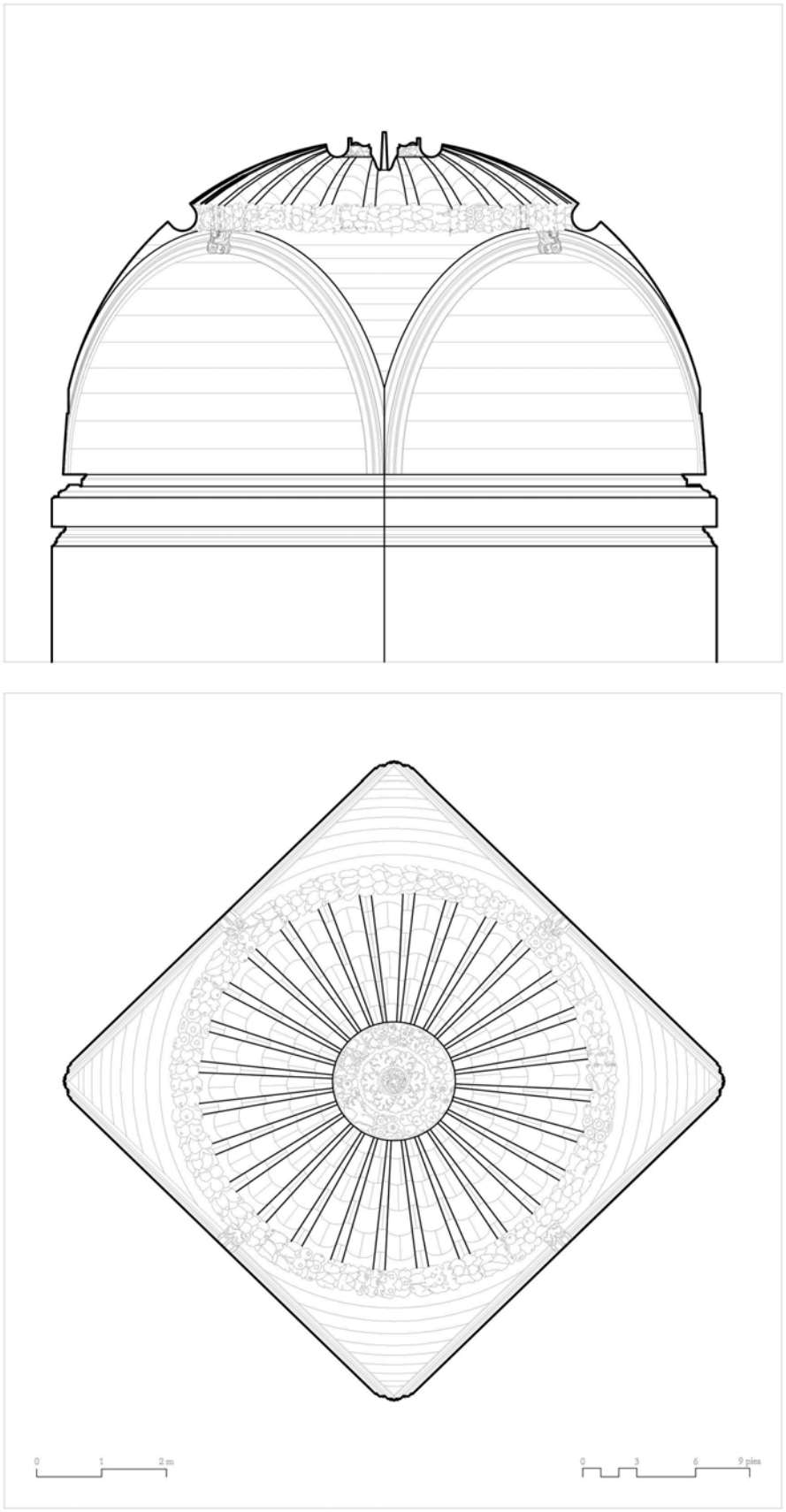

Figure 1. Pendentive vault in the vestry of Murcia cathedral. Plan and diagonal section. Survey by Miguel Ángel Alonso Rodríguez.

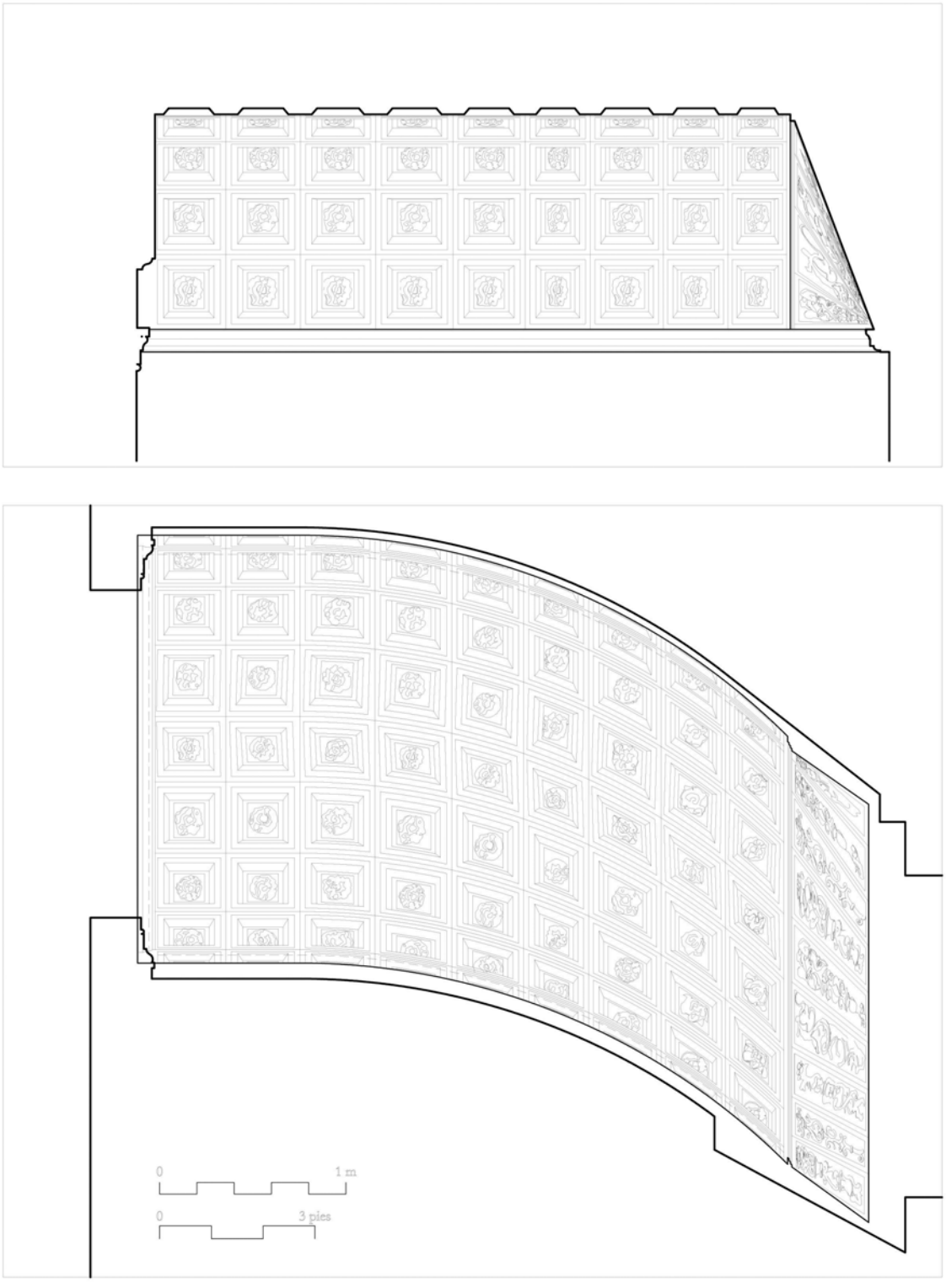

Figure 2. Skew vault in the entrance passage to the vestry in Murcia cathedral. Plan and longitudinal section. Survey by Miguel Ángel Alonso Rodríguez.