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CHAPTER 4

Plotting the Centre

Bramante's Drawings for the New St. Peter's Basilica

Nick Temple

Metaphysical and Material References

“... the world does not have a [fixed] circumference. For if it had a fixed center, it would also have a [fixed] circumference; and hence it would have its own beginning and end within itself, and it would be bounded in relation to something else, and beyond the world there would be something else and space (locus). But all these [consequences] are false. Therefore, since it is not possible for the world to be enclosed between [a physical] center and physical circumference, the world – of which God is the center and the circumference – is not understood. And although the world is not finite, it cannot be conceived as finite, because it lacks boundaries within which it is enclosed.”¹

Nicolas Cusanus' meditation on the nature and meaning of centre and circumference in the divine world pre-occupied not just Renaissance humanists and theologians, but also architects.² In particular, the idea that divine infinitude could somehow be 'circumscribed' as an architectural concept in religious buildings, with their bounded/enclosed spaces and

geographically/topographically defined centres, concentrated the minds and imagination of architects. The quest for spatial and geometric coherence of divine centre finds expression in the myriad of architectural drawings that have been preserved from the fifteenth and early sixteenth centuries.

The tools and techniques deployed by the Renaissance architect to communicate this Cusanian idea drew upon a complex array of references, both symbolic and practical. In particular, through the agency of the sketch and presentation drawing it is possible to witness how these multiple references were negotiated and registered as a discursive framework of relationships to give spatial definition to the received onto-theological order of the cosmos. A salient feature of this objective is the manner in which the search for geometrical and mathematical precision, in the articulation and connectivity of spaces, was informed by an equal concern for their visual coherence and persuasiveness (through the techniques of perspective and orthographic projection) and their accommodation within a pre-existing urban context and cultural milieu. The drawing served as a contemplative datum in which to reconcile these relationships here, whereby the marks on paper – with their references to certain exemplary models – provided indicators, or gestures, for more concrete relationships that were as yet undefined but nevertheless open to possibility and ultimate realization.

This chapter explores an aspect of this process through an examination of a selection of drawings for the new St. Peter's Basilica by Donato Bramante (1444–1514) and his assistants Baldassare Peruzzi (1481–1536) and Antonio da Sangallo the Younger (1484–1546). The drawings focus on the relationship between principal and secondary spaces and their supporting structural elements, highlighting how the design of St. Peter's was conceived as a constellation of spaces that emanate from the crossing of the basilica. Bramante was seeking to convey in these drawings spatial and symbolic continuity between the old and the new basilica, through their transparent and diaphanous superimposition. The

many changes and revisions made by Bramante and his assistants, in the design of the crossing and its subsidiary spaces, highlight uncertainties about the methods and processes deployed in redefining the centre(s) of the building – in both a physical and metaphysical sense. Interestingly, these methods sometimes involved recto-verso and mirrored relationships, whereby the two faces (or two halves) of a drawing convey mutual dependence.

The study considers how Bramante sought to reconcile philosophical/theological notions of centre in terms of a broadly Christian/Platonic outlook in early sixteenth century Rome, with the requirements to accommodate existing spatial and topographical conditions, as they relate to the location of the tomb of St Peter. This chapter explores how these potentially conflicting conditions were reconciled by suggesting that Bramante sought to resolve in architectural terms theological and philosophical challenges by a combination of drawing, numerical ordering and geometric reckoning.

Numerical Ordering/Geometric Reckoning

Initial clues to Bramante's treatment of the scheme for the new St. Peter's Basilica, as a discursive problem between physical and metaphysical, real and ideal, earthly and heavenly, can be found in an unexpected work; the *School of Athens* fresco in the Stanza della Segnatura in the Vatican Palace. Executed around 1509 by Raphael, the scene of discoursing philosophers, set in a monumental architectural ensemble with representations of Plato and Aristotle at its centre, forms part of a larger cycle of frescoes in the Stanza. Reference to the *School of Athens* in this study is justified in part by claims that Bramante was the author of the perspective construction of the fresco.³ For the purposes of the present argument, the investigation of the fresco will be limited to specific features that indicate a particular thinking about orientation and centring of ideal space, which I contest also informed Bramante's scheme for St. Peter's.⁴

The location of the fresco, on the east wall of the chamber and oriented towards the *Disputa* on the west wall, tells us something about a key aspect of the iconography of the fresco cycle; namely that philosophical knowledge ‘prepares the way’ for the revealed truth of divine knowledge, the principal theme underpinning the *Disputa*. The ‘destination’ of this spiritual journey, as defined by the orientation of the two frescoes, is the new St Peter’s Basilica, located to the west of the Stanza, which at the time was under construction. The investigation extends Manfredo Tafuri’s argument that the frescoes of the Stanza constitute a ‘manifesto’ of the architectural projects of Julius II in Rome.⁵¹ The *Disputa* could be said to serve in Augustinian terms as an expression of *civitas* (the community of citizens), highlighted by the dominance of pious/holy figures at the expense of conspicuous architectural elements, whereas the *School of Athens* represents *urbs* (the physical city), indicated by its more concrete reference to building (in the form of a central coffered vaulted structure redolent of Bramante’s scheme for St. Peter’s).

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The transformation, moreover, from painted scenes to actual building (the new basilica) is unleashed through the properties of number and geometry – the ‘building blocks’ of the Christian/Platonic cosmology. This connection, as I will demonstrate, entailed a translation from Pythagorean number and Euclidean geometry to the perspective construction of pictorial space. Initial clues to this relationship can be found in two *tabulae* (chalk-boards) located in the foreground of the *School of Athens*; on the extreme right and left hand sides that face the *Disputa* opposite. Rather like Bramante’s preparatory sketches for the new basilica, these tablets could be said to serve as a conceptual ‘record’ of the project. To the left, we see the tablet represented in the form of an abacus, with various numerical symbols highlighted on its black surface. The meaning of these symbols is easy to determine; the triangular configuration of the *Tetractys* in Roman numerals is superimposed on a representation of the musical ratios (*diatessaron*, *diapente*, *diapason*) highlighted in Greek

letters. The tablet, which is held by an admiring youth in the fresco, is partly inclined and oriented within the perspectival grid of the paved floor. On his left is an elderly bearded figure with open book and pen in hand, and shown recording information from the abacus. Identified as a representation of Pythagoras, the figure provides a further clue to the symbolic meaning of this part of the fresco.

[Fig. 1 Raphael, *School of Athens* (c.1509). Vatican, Stanza della Segnatura, showing Euclid's diagram (from the right-hand tablet in fresco) superimposed, © 1990, Photo Scala, Florence.]

Balancing this arrangement is the other tablet, on the right hand side and laid flat on the pavement, with a figure shown bending over with dividers in hand and measuring its contents. Like the inclined tablet opposite, the identity of the figure (most probably Euclid) is informed by the contents of the tablet – two interlocking triangles in the form of a six-pointed star. It seems likely that this configuration is intended to complement the numerical representations on the other tablet, by invoking geometric reckoning. The precise meaning of the two triangles, however, is less certain given that its configuration is not completely accounted for in the propositions of Euclid's *Elements*. The uncertainty centres on whether the geometric figure is an equilateral hexagram (or six-pointed star), as some have argued, or some other 'hybrid' configuration.⁶ For Simonetta Valtieri, the ratios of the intersecting sides of the superimposed triangles (with the inclusion of the diagonal chords) match the Pythagorean numbers recorded on the Tetractys on the other tablet.⁷ Valtieri further argues that the geometry may have been used to map the architectural background of the fresco. Further, Robert Haas has demonstrated that the foreshortening of the geometric figure on the 'Euclidean' tablet is more exaggerated than one would expect within the perspective

projection of the fresco.⁸ What is important however to recognise in this configuration is what Enrico Guidi describes as ‘... a knowledge of irrational, i.e. immeasurable numbers: numbers which cannot be measured by mathematics, but only by geometry.’⁹

It seems therefore that Raphael was trying to communicate a double meaning in the relationship between both *tabulae*: firstly to reconstruct the shift from Pythagorean whole numbers, and their cosmic associations, to the status of irrational numbers in Euclidean geometry, and consequentially the ‘perspectival’ transformation of geometry itself. Indeed, the content and pictorial relationships between both tablets in the fresco conveys this translation; from the virtual uprightness of Pythagoras’ tablet, of ‘elemental’ whole numbers, to the exaggerated foreshortened tablet of Euclid (laid flat on the gridded floor) invoking ‘optical’ geometry, and finally to the larger perspective of the whole fresco. This translation is further amplified by the likelihood that the figure representing Euclid, shown holding dividers in hand over the right hand tablet, is a portrait of Bramante himself (*‘Prospettico melanese depictere’*).¹⁰ Given Bramante’s probable authorship of the background architectural ensemble of the fresco, this double identity is compelling evidence of an intentional connection between Greek philosophical thought and humanism.¹¹

The question of how number and geometry (and by implication Greek thought and humanism) were intended to be understood in the *School of Athens* finds a useful precedent in Leonardo da Vinci’s *Last Supper*, as examined by Leo Steinberg.¹² In his argument, Steinberg makes the case that both number and geometry are conceived not as competing or conflicting systems, but “rather as expressions of the same unified cosmological order, albeit revealed through different modes of understanding.”¹³ He uses the term “duplexity” to explain how perspective provides the visual armature for disclosing this dialogue between the traditions of numerical ordering and geometric reckoning.¹⁴ We will see shortly how this understanding informed Bramante’s drawings for the new St. Peter’s Basilica. It seems

Comment [AB2]: If appropriate, could a sentence or two be added to further clarify how you see this occurring?

evident that by the early part of the 16th century, as the *School of Athens* demonstrates, this duplexity takes on more explicit terms of reference, reflecting a conscious attempt to conceive humanism (and Julius II's Pontificate in particular) as the inheritor Greek learning.

As I have suggested elsewhere, the relationships between number and geometry, in the two *tabulae*, are ultimately reconciled by the presence of Plato in the fresco.¹⁵ In particular, Plato's left hand, which holds a copy of the *Timaeus*, coincides with the vanishing point of the perspective, from which the paved floor radiates out to 'meet' the groups of figures gathered around the two *tabulae*.¹⁶ Here, visual coherence conveys, in rhetorical terms, continuity between ancient Greek philosophy and Renaissance humanism.

Seen in this context, the iconography of the *School of Athens* could be said to reveal, at one level, a form of 'handing down' of philosophical principles, which in turn present the first glimmerings of Christian Trinitarian symbolism. The triad of classical thinkers (Pythagoras, Plato and Euclid) provides therefore the basis for conceiving a humanistic rendering of the mystery of the Trinity variously prophesied through numerical ordering and geometric reckoning, and culminating in the representation of the Host at the vanishing point of the *Disputa* opposite.

This rather compressed (and simplistic) interpretation of the symbolism of the *School of Athens* I believe provides a useful backdrop to Bramante's design for the new St Peter's Basilica, in the way the fresco articulates a transmission from Christian-Platonic cosmology to pictorial space, from metaphysics to the representations of practical life. If we accept Valtieri's argument, then this transmission is effectively codified in the two *tabulae*; their inscribed configurations constitute the recto (Pythagorean number) and verso (Euclidean geometry) of a unified cosmological system. At the same time, they communicate in symbolic terms the orientation and 'centring' of the *School of Athens* in relation to the *Disputa*, the expression of divine knowledge.

The Ideal in the Real

By the time Raphael executed the *School of Athens*, in 1509, the construction of the new basilica was already underway. The ground was broken on 18th April 1506 for the foundation stone and construction of the first corner piers of the crossing. Most of the drawings to be examined here probably predate the construction of the new basilica.

Two works that have a particular bearing on the original design and foundation of the basilica will serve as a starting point here. The first is the famous parchment plan of the basilica which gives us a picture of Bramante's vision for the building. The second is the foundation horoscope for the new basilica, which was thought to register the planetary positions on the day of the basilica's foundation. The layout of the new St Peter's Basilica, as indicated in the parchment plan, has been the subject of intense debate.¹⁷ It was almost certainly used as a presentation drawing to Julius II and his court in early 1506. It is likely that the drawing was accompanied by models, as was usual practice for design projects during the Renaissance.¹⁸ The significance of the plan lies in its description of only half of the basilica. This arrangement is likely to reflect in part uncertainty at the time about whether the new building should be centralised or longitudinal. The drawing further demonstrates Bramante's focus on resolving the crossing as the principal generator of the whole scheme, reinforced by the fact that the construction of the new basilica actually began in this area. In most modern reconstructions of Bramante's original design, the parchment plan is handed to convey a centralised scheme. Recognising the ambiguity of the plan, was it intended to be seen as a working drawing, to relay practical information, or an 'iconic' work endowed with specific symbolic meanings? It seems plausible that it served both purposes, given the probable expectations of such a drawing of a revered building to explain the layout of spaces,

Comment [AB3]: Would it be useful to clarify by who?

and at the same time to convey a sense of the symbolic significance of the site of St. Peter's burial.

[Fig. 2 Donato Bramante, Parchment Plan of New St. Peter's Basilica (Summer, 1505?), Florence, Galleria degli Uffizi, Gabinetto Disegni e Stampe, Uff.1A.]

The idea of mirroring the half-plan, to reveal its complete form, tells us something about the role of drawing at this time, as a form of revelation; parallel to the recto-verso relationship (as seen for example in numismatics), the mirrored image renders the idea of representation as being in possession of a hidden counterpart (or 'other'), redolent of the two faces of Janus – an analogy moreover that has a particular bearing on the possible symbolism of Bramante's scheme.¹⁹

The question of how the form and layout of the new St. Peter's Basilica would have been understood by Julius II and his court would no doubt have been influenced by the revised interest in Platonic thought during the Renaissance.²⁰ This assumption, however, has recently received some criticism, on the basis that it ignores a broader understanding of the reception of antiquity in the Renaissance.²¹ Notwithstanding these disputes, Rudolf Wittkower's interpretation will serve as an initial reference in this examination of Bramante's drawings for the new St. Peter's, recognising also the evident importance of this tradition in the *School of Athens*. One of the more common geometric configurations, associated with the Pythagorean/Platonic tradition in architecture, is the rotational square (the so-called 'quadrature' or 'Roriczer' series) as we see in ecclesiastical buildings and in the design of urban spaces from the Late Middle Ages. Examined recently in Marvin Trachtenberg's *Dominion of the Eye*, the quadrature can also be traced in Bramante's plan for the new St. Peter's Basilica, whereby major and minor spaces are informed by this rotating geometry.²²

Probably derived from the famous problem posed by Socrates to the slave boy in Plato's dialogue, the *Meno*, the rotational technique conveys not just the proportional relationships between spaces, in the plan of the new St. Peter's, but also their translation into the three dimensional volumes of the whole building – a feature that would probably have been highlighted in the supporting models of the building presented to the Pope.²³

Comment [AB4]: Is it possible to add a citation or other reference to support this suggestion?

This brings us to the second work to be considered here; the foundation horoscope of the new Basilica, where we see the same geometry applied.²⁴ Whilst the use of the rotational square in horoscopes, to highlight the twelve zodiacal signs, is not without precedent, its appearance here may have been a conscious acknowledgement of the layout and symbolism of the new basilica. Traditionally, as Rachel Ann Seely states, 'The temple is oriented toward the four world regions, or cardinal directions, and to various celestial bodies such as the polar star.'²⁵ We can see how this principle was enthusiastically adopted by Bramante in his scheme for St Peter's, in part to emulate the Temple of Jerusalem. At one level the mirrored plan of the parchment drawing reveals Bramante's Greek cross plan, set on the cardinal points, with the east-west axis as the primary orientation to the tomb of St. Peter and the altar. This beautifully echoes the alignments of the horoscope, organised around each rotating square quadrant. One can see how the horoscope could be construed as a celestial 'mirror' of Bramante's plan of the basilica, in the way the hierarchy of constellations is reflected in the spatial treatment of primary and secondary zones. The mirroring between the spatial footprint of the building (articulated in the handed parchment plan) and its 'reflected' cosmological diagram (the geometrized horoscope) could be further understood as a recto-verso relationship, in the way actual and ideal, terrestrial and celestial, visual and metaphysical are inextricably paired and oriented either earthbound or skyward. We will probably never know for certain if the author of the horoscope directly drew inspiration from Bramante's scheme, nor indeed to what extent Bramante was consciously alluding to the

cosmological meanings and astrological associations of the *quadrature* in his design. It would seem unlikely however that such connections were not an underlying factor in the intended symbolism of the new basilica; the ‘fulcrum’ of the Roman Catholic Church.

[Fig. 3 Foundation Horoscope for New St. Peter’s Basilica, 1506 (published 1552), Luca Gaurico (redrawn by Stephen Calcutt).]

Notwithstanding the importance of this geometry, in the conception of the design, it is a general misunderstanding that proportional and geometric principles were applied as readymade systems in the design process; that architecture was effectively ‘generated’ from these arrangements. James Ackerman alludes to this when he states: ‘Perhaps the character of Renaissance architecture owes much to the fact that its monuments started, not from a complete idea, fixed in the symbolism of the blueprint, but from the flexible impressions constantly susceptible to change.’²⁶ This misunderstanding, moreover, also has much to do with a misreading of the role of architectural drawing, as Marco Frascari argues: ‘Architectural lines create a *graphesis*, a course of actions based on factures by which architects actualize future and past architecture into representations. Architectural drawings must not be understood as visualizations of building, but as essential architectural factures.’²⁷ Frascari’s notion of ‘facture’ lies, I believe, at the heart of Bramante’s design process for the new St. Peter’s Basilica; the drawings are not technical or instrumental recordings, in the modern sense, but are rather heuristic expressions of possible (albeit incomplete) scenarios of the scheme. This attribution of drawing is especially revealing when we consider the issue of whether Bramante envisaged the new basilica to be centralised or longitudinal in plan. As Meg Licht argues: whilst ‘some attention is paid to both the outer perimeters of the building and its internal spatial divisions’, the question of the overall configuration of the building is

largely ‘left in suspense.’²⁸ This ambiguity should not be viewed as indicative of indecisiveness, on the part of the architect and his patron, but rather as reflecting an implicit recognition of the temporality of architecture (and by implication of the design process), whereby the memory of the old St. Peter’s Basilica is permanently embedded in the emergence of the new. To put it another way, architectural drawing at this time was guided by a sense of the symbolic meanings of spaces, in which design (*disegno*) constituted a form of creative ‘re-enactment’ of a pre-existing onto-theological order. We can see this for example in Uffizi A 20r where Bramante superimposes a version of the plan of new St. Peter’s over the layout of the old Constantinian basilica; as if the old and the new co-exist. This idea permeated the design and construction of the new basilica for almost a hundred years, most clearly exemplified in Tiberio Alfarano’s famous 1571 drawing of St Peter’s.²⁹

[Fig. 4 Plan of New St. Peter’s Basilica, indicating application of the ‘Rotating Square’ (drawn by author).]

[Fig. 5 Plan of New St. Peter’s Basilica, indicating sequence of 60 degree angles of vision, Gretta Tritch (redrawn by author).]

Perspectivising Centre

Bramante’s pre-occupation with the plan, as the principal mode of representation in the design process, was accompanied by a new innovation, the supporting perspective sketch. As Ann C. Huppert argues, Bramante’s drawings for the new St. Peter’s Basilica reveal for the first time an attempt to combine the practices of orthographic projection – principally the plan – with perspective renderings of parts of the building.³⁰ This is demonstrated in Uffizi A20r, 20v and A7945v, where thumb-nail perspective sketches are used to convey parts of

the interior, notably the transition from supporting piers to the spandrels and domed vaulting above. In each case the sketch is located alongside – or within – the plan (to which it directly refers), and serves as a quick approximation of the architectural conjunctions. In these supporting sketches, however, there is no evidence that Bramante was particularly concerned with the detailed application of the architectural orders, and their relationship to the ornamental treatment of surfaces. Instead we are presented with perspective renderings that express the broad geometric volumes of the spaces, in which classical architectural elements are only sparsely represented as abbreviated references. We have to wait until Antonio da Sangallo the Younger to find examples of drawings for the new St. Peter's (such as Uffizi A 70r) that more systematically explore the full vocabulary of classical architecture through sectional details and elevations.³¹

What is evident in Bramante's drawings is a sense in which the geometric layout of the plan, and its proportional arrangement of spaces, was consciously translated into three-dimensional foreshortened snap-shorts, by means of the techniques of freehand perspective. The combination moreover of perspective sketch and measured plan is especially revealing since the inscribed spaces attempt in various ways to redefine relationships between centre and periphery; between void and supporting structure. Interestingly, this process often entailed retracing building outlines through the use of recto-verso drawings. We can see this for example in Uff.107, which shows different solutions for the south-east corner of the basilica.³² Bramante's attempt to define these peripheral zones, as 'satellite' spaces of the nucleus of the Basilica, is demonstrated in the way he includes on the recto an outline of the circular dome above (no doubt to serve as a microcosm of the principal dome of the basilica) and the inclusion of a supplementary perspective view of part of the internal elevation of the space (to echo the articulation of the main crossing). Through the visible trace of the

drawings on both recto and verso sides, which registers the thickness and porosity of the paper, we are given a greater visceral sense of the spatial/volumetric features of the plan.

Bramante's adoption of perspective drawing, to explore elements of the scheme, may have had a more direct bearing on the design of the building. This idea relates to an assertion made by Gretta Tritch that Bramante's design for St. Peter's was more indebted to Aristotelian principles, since the plan of the Basilica was conceived with the experiences of the spaces more in mind than their metaphysical properties.³³ Tritch argues that the layout was partly conceived perspectivally, using the 60 (rather than the 90) degree field of vision. This, she suggests, is indicated by the progression through the spaces (from east to west), where the locations of supporting piers (many of which are recorded in Bramante's perspective sketches) frame a sequence of 60 degree views.³⁴ This argument, however, should be treated with some caution, given that, as Alberto Pérez-Gómez states: 'It was impossible for the Renaissance architect to conceive that the truth of the world could be reduced to its visual representation, a two-dimensional diaphanous section of the pyramid of vision.'³⁵

Considered in the context of the translation from number and geometry to perspective, it seems clear that the 'altering' (or reconstructing) of reality through perspective formed part of a still pervasive onto-theological (transcendent) order, in which pictorial space represented a more perfect – other-worldly – domain. But can we speak of perspective in the same symbolic terms when comparing Bramante's thumb-nail sketches for the new St. Peter's with his likely authorship of the design of the architectural background of the *School of Athens*? More generally, can the representational techniques adopted in painting and architectural design at this time be treated in the same way? This touches on a more extensive debate, beyond the scope of this present study, concerning the principles of perspective codified in Alberti's famous *de pictura* and their relevance to architecture.³⁶

[Fig. 6 Donato Bramante, Sketch (plans and perspectives) of New St. Peter's Basilica (Summer, 1505?), Florence, Galleria degli Uffizi, Gabinetto Disegni e Stampe, Uff.107A. (recto & verso).]

We know that by the early sixteenth century perspective drawing becomes much more integrated in architectural design, evidenced in the various schemes for St. Peter's Basilica from Bramante onwards. My comparison between the *School of Athens* and Bramante's designs for the St. Peter's touches on the more specific issue of centring and orientating of both real and imaged space, and the manner in which perspective was deployed to achieve this goal. Steinberg's term duplexity, as applied to Leonardo da Vinci's *Last Supper* described earlier, comes to mind here in the way perspective is deployed to bring into dialogue the real and the ideal, number and geometry. Departing from Albertian principles of perspective as an independent and codified form of pictorial representation, we can see how it served a 'supplementary' role in Bramante's design of the new St. Peter's. This is demonstrated in Uff.107 A (referred to earlier) and Uff.7945 A. In the first, the sectional perspective sketch (on the recto side), with the shadowed opening of the oculus clearly visible, is drawn within the central domed space, so that it extends between the perimeter structure and the domed centre of the plan. In a rather different vein, Bramante used the verso side Uff.7945 to explore the main crossing of the basilica, by highlighting through a combination of plan, perspective and outline geometries, the relation between the volume of the new basilica and the location of the apse and altar of the old. In both drawings therefore, plan and perspective are intended to be read together as a single composite drawing to redefine spatially the idea of centre through its vertical and horizontal alignments.

The resulting tension between the reality of built form and its exemplary model pervaded Bramante's design for the new basilica. At one level we are given an impression of this tension in the celebrated parchment plan, where the search for both symbolic and aesthetic expression, in the articulation of spaces, resulted in compromises in the structural integrity of the building, in particular the insufficient size of the four piers at the crossing to bear the significant loads of the superstructure above.³⁷

Conclusion

Implicit in Bramante's drawings for the new St. Peter's Basilica is a sense that the 'entire project, at every stage, unfolds from its nucleus.'³⁸ This point is reinforced by Ackerman in reference to both the drawings of the new St. Peter's and the competition entries for San Giovanni dei Fiorentini (executed under Julius II's successor, Leo X), in which he states: 'In churches the great trend toward the central plan was accompanied by a method of design that can be described only as centrifugal. The architect starts drawing in the centre and works outwards, and it is not until he has reached a final solution that he begins to consider what the outer face should be.'³⁹ It seems that this pre-occupation with centre pervaded architectural thinking during this period and reflected a desire to 'situate' actual (sacred) spaces within a pre-ordained Christian-Platonic cosmological order.

The resulting progression from centre to periphery in the design process meant that many subsidiary spaces of churches were treated as constellations of the principal centre, namely the crossing. Through drawing we can see how this progression entailed an on-going negotiation between figure-ground, geometric and proportional relationships and perspective reconstructions, of which the sheet of paper or parchment provided a physical datum for redefining the notion of the 'ideal in the real' as it pertains to the techniques of reflective or recto-verso relationships.

Notes

1. Nicholas Cusanus (Nicholas of Cusa), *On Learned Ignorance*, trans. Jasper Hopkins (Minneapolis: Banning, 1981), Ch. II of Book 2, p. 114. Quoted in Karsten Harries, *Infinity and Perspective* (Cambridge, Mass: MIT Press, 2001), p. 47.
2. Rudolf Wittkower is quite explicit about the importance of the Cusanian geometric model in Renaissance concepts of centre: ‘The most perfect geometrical figure is the circle and to it was given special significance. To understand fully this new emphasis we must turn for a moment to Nicholas of Cusa who had transformed the scholastic hierarchy of static spheres, of spheres immovably related to one centre, the earth, into a universe uniform in substance and without a physical or ideal centre. In this new world of infinite relations the incorruptible certitude of mathematics assumed unprecedented importance. Mathematics is for Cusanus a necessary vehicle for penetrating to the knowledge of God, who must be envisaged through the mathematical symbol. Cusanus, developing a pseudo-hermetic formula, visualises Him as the least tangible and at the same time the most perfect geometrical figure, the centre and circumference of the circle.’ Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (London: Academy Editions, 1977), p. 28.
3. The claim largely derives from Vasari (1568); Giorgio Vasari, *Lives of the Painters, Sculptors and Architects*, trans. A. B. Hinds (New York: Dutton, 1963), Vol. 2, p. 187. Ralph E. Lieberman however argues the contrary, since Bramante’s extensive and laborious design of the crossing piers of the new St. Peter’s Basilica could not compare with ‘so unconvincing and irrational a passage as the one we see [in the fresco].’ ‘The Architectural Background’, in Marcia Hall (ed.), *Raphael’s School of Athens* (Cambridge: Cambridge University Press, 1997), pp. 64–84, p. 73.

4. Literature on the *School of Athens*, and the fresco cycle in the Stanza della Segnatura in general, is extensive. Recent studies include: Christiane L. Joost-Gaugier, *Raphael's Stanza della Segnatura: Meaning and Invention* (Cambridge: Cambridge University Press, 2002); Marcia Hall (ed.), *Raphael's School of Athens* (Cambridge: Cambridge University Press, 1997), Nicholas Temple, *renovatio urbis: Architecture, Urbanism and Ceremony in the Rome of Julius II* (London: Routledge, 2011), pp. 214–63.
5. Manfredo Tafuri, 'Roma Instaurata', in C.L. Frommel, S. Ray and M. Tafuri, *Raffaello Architetto* (Milan: Electa Editrice, 1984), pp. 59–106, p. 63. See also, Temple, *renovatio urbis*, pp. 214–63.
6. For a detailed investigation of the various theories, relating to the identity and meaning of the geometry, see Robert Haas, 'Raphael's *School of Athens*: A Theorem in a Painting?', *Journal of Humanistic Mathematics*, Vol. 2, No. 2 (July 2012), pp. 2–26. The case for the hexagram is based on both geometric integrity and symbolic meaning (Magen David), the latter alluded to by the presence of hexagrams in the floor mosaics in the Stanza.
7. Simonetta Valtieri, 'La Scuola di Atene', *Mitteilungen des Kunsthistorischen Institutes in Florence*, XVI (1972), pp. 63–72.
8. Haas, 'Raphael's *School of Athens*', pp. 12–15.
9. Arnold Nesselrath, *Raphael's School of Athens: Recent Restorations, Vatican Museums*, Vol. 1 (Vatican City State: Edizioni Musei Vaticani, 1997), p. 29.
10. On Bramante as the 'Prospettico melanese depicatore', see: Ingrid Rowland, *The Culture of the High Renaissance: Ancients and Moderns in Sixteenth Century Rome* (Cambridge: Cambridge University Press, 2001), pp. 105–08.

11. Underlying this connection however is a controversy during the Renaissance, concerning the relationship between Platonic/Pythagorean number and Euclidean geometry. Michele Sbacchi makes the case that the relationship was never resolved, but instead resulted in a dichotomy that has its roots in an “epistemological difference” evidenced in Plato’s *Meno*. (M. Sbacchi, ‘Euclidism and Theory of Architecture’, *Nexus Network Journal*, Vol.3, Issue 2, (September 2001), pp 25-38, p.3). Sbacchi argues that the Quattrocento saw the primacy of numerical ratios over geometrical relationships in architectural theory and practice, an assertion largely echoed by Wittkower (*Architectural Principles*, pp.101-16). Sbacchi highlights Alberti’s predilection for numerical relationships to support his argument (Sbacchi, ‘Euclidism and Theory of Architecture’, p.3). Both Richard Padovan and Lionel March however take a very different stance on this point; the former by some evidence of the use of irrational numbers by Alberti, and later Palladio (Richard Padovan, *Proportion: Science, Philosophy, Architecture* (London: Spon Press, 1999), p.183), and in the latter by an argument that Alberti’s treatment of *lineamenti* was an attempt to “fuse the irrationals of the *ad triangulatum* with the whole number ratios of *ad quadratum*.” (Nicholas Temple, *Disclosing Horizons: Architecture, Perspective and Redemptive Space* (London: Routledge, 2007), p.43; L. March, *Architectonics of Humanism: Essays on Number in Architecture* (Chichester: Academy Editions, 1998), p.200).
12. L. Steinberg, *Leonardo’s Incessant Last Supper* (New York: Zone Books, 2001), pp.56-7.
13. Temple, *Disclosing Horizons*, p.43.
14. Steinberg, *Leonardo’s Incessant Last Supper*, pp.56-7.
15. Temple, *renovatio urbis*, pp. 214–63.

16. As arguably the most venerated ancient philosophical text in the early modern world, Plato's *Timaeus* was also considered by some, such as Marsilio Ficino, to be prophetic of Christian cosmology, an attribution underlined by the fact that Plato was nick-named the 'Attic Moses' (a title not even the nearby figure of Aristotle was given). One can see how Renaissance humanists would have interpreting the *Timaeus* as both building upon the numerological principles of Pythagoras (Plato's 'predecessor') and anticipating the geometric ideas of Euclid (Plato's 'successor').
17. Christoph Luitpold Frommel, 'St. Peter's: The Early History', in Henry A. Millon and Vittorio Magnago Lampugnani (eds.), *The Renaissance from Brunelleschi to Michelangelo: The Representation of Architecture* (Milan: Bompiani, 1994), pp. 399–423.
18. On Renaissance architectural models see Henry A. Millon, 'Models in Renaissance Architecture', in Millon & Lampugnani, *The Renaissance from Brunelleschi to Michelangelo*, pp. 19–73.
19. This relates to my argument that Bramante's design for St. Peter's was partly inspired by the Janus Quadrifrons. Temple, *renovatio urbis*, pp. 201–07.
20. Wittkower's interpretation of Bramante's centralised scheme for the new St Peter's is based on the assumption that 'The Renaissance conception of the perfect church is rooted in Plato's cosmology.' *Architectural Principles*, p. 23. On Platonism in the Renaissance see in particular, James Hankins, *Plato in the Italian Renaissance* (Leiden: E.J. Brill, 1990), Vols. 1 & 2.
21. Manfredo Tafuri, *La ricerca del rinascimento* (Turin: Einaudi, 1992), pp. 3–32; Paul Davies, 'La Madonna delle Carceri in Prato,' *Architectural History* 36 (1993), pp. 1–18.

22. Marvin Trachtenberg, *Dominion of the Eye* (Cambridge: Cambridge University Press, 1997) pp.118-19. See also my *Disclosing Horizons: Architecture, Perspective and Redemptive Space* (London: Routledge, 2007), pp. 112–22.
23. This expression of the proportional relationships of volumes, in the model of buildings, is inferred in Alberti's assertion that models should "exclude decoration,... show plainly and simply the parts to be considered...[and] focus attention on certain calculated standards of architecture rather than on the ingenuity of the fabricator of the model." Millon, 'Models in Renaissance Architecture', p.22
24. Mary Quinlan-McGrath, 'The Foundation Horoscope(s) for St. Peter's Basilica, Rome, 1506: Choosing a Time, Changing the *Storia*', *Isis* Vol. 92, No. 4 (Dec. 2001), pp. 716–41. The study is based on a horoscope published in 1552, which Quinlan-McGrath claims is actually a rectified version of the original produced in 1506.
25. Rachel Ann Seely, 'St. Peter's Basilica as *Templum Dei*: Continuation of the Ancient Near Eastern Temple Tradition in the Christian Cathedral', *Studia Antiqua* Vol.4, No.1 (Winter, 2005), pp. 63–80, p. 66.
26. James S. Ackerman, 'Architectural Practice in the Italian Renaissance', *Journal of the Society of Architectural Historians* Vol. 13, No. 3 (Oct. 1954), pp. 3–11, p. 9.
27. Marco Frascari, 'Lines as Architectural Thinking', *Architectural Theory Review*, Vol. 14, No. 3 (2009), pp. 200–12, p. 200.
28. Meg Licht, 'I Ragionamenti – Visualising St. Peter's', *Journal of the Society of Architectural Historians* Vol. 44, No. 2 (May, 1985), pp. 111–28, p. 111.
29. Federica Goffi, 'Drawing Imagination and Imagination of Drawing: The Case of Tiberio Alfarano's Drawing of St. Peter's Basilica', *Interstices: A Journal of Architecture and Related Arts: The Traction of Drawing* Vol. 11, (2010), pp. 20–30.
30. Frascari, 'Lines as Architectural Thinking', p. 201.

31. Ann C. Hubbert, 'Envisioning New St. Peter's: Perspectival Drawings and the Process of Design', *Journal of the Society of Architectural Historians* Vol. 68, No. 2 (2009), pp. 158–77.
32. Ackerman mistakenly identifies the recto drawing as a plan of the crossing, which is clearly not the case given the representation of the east entrance portico at the bottom. 'Architectural Practice', p. 7, Fig. 8.
33. Greta Tritch, 'Questioning the Philosophical Influence of Beauty and Perception in Bramante's First Scheme for St. Peter's', *Inquiry* Vol. 6 (2005), pp. 1–23. Tritch's assumption however of a direct (and exclusive) correlation between perspective renderings of space and Aristotelian thought is simplistic, given that perspective at this time was not a 'reconstruction' of reality, and humanity's experience of it. See Alberto Pérez-Gómez, 'Questions of Representation: The Poetic Origin of Architecture', *Architectural Research Quarterly (arq)* Vol. 9, Nos. 3/4 (2005), pp. 217–25.
34. One implication of this argument, which Tritch does not highlight, is that the conscious use of perspective, to define the arrangement of the physical spaces, was informed in some way by the 'optical' correction of building elements (such as the profile of the supporting piers at the crossing). This argument, however, challenges the view of most historians that the techniques of optical correction in design only became fully established in the seventeenth century, thanks to the development of stereotomy. Michele Sbacchi, 'Projective Architecture', *Nexus Network Journal* Vol. 11 (2009), pp. 441–54, p. 447.
35. Pérez-Gómez, 'Questions of Representation', p. 220. In addition: '... the symmetrical correspondence between the elements of real objects and those of their images was not recognized. Objects, as rendered in perspective, were considered altered

(*digradati* was the term frequently used). Attention was indeed paid to what was changed by projection.’ Sbacchi, ‘Projective Architecture’, pp. 446–47.

36. As Pérez-Gómez states, ‘The opening pages of *De Re Aedificatoria* contend that design consists “in a right and exact adapting and joining together the lines and angles which compose and form the face of the building.” The role of design was “to appoint the edifice and all its parts their proper places, determine number, just proportion and beautiful order.” Design, however, was in Alberti’s mind “inseparable from matter”, so that drawing was perceived as the embodiment of architectural ideas, distinct from perspectives that represented (in painting), the reality of a building.’ ‘Architecture as Drawing’, *Journal of Architectural Education* Vol. 36, No. 2 (Winter, 1982), pp. 2–7.
37. ‘... the St. Peter’s crossing piers had to be flattened, much to the detriment of the handsome profile. This lack of technical discipline may explain in part why the High Renaissance is one of the few great eras in architectural history in which a new style emerges without the assistance of any remarkable structural innovation.’ Ackerman, ‘Architectural Practice’, p. 4.
38. Licht, ‘*I Ragionamenti*’, p. 112.
39. Ackerman, ‘Architectural Practice’, p. 9.

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