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Temple, Nicholas

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Envisioning Geometry Architecture in the Grip of Perspective*

Nicholas Temple

Introduction

In the midst of the saturation of sophisticated imagery in our digital age, where it is often impossible to distinguish between reality and illusion, we remain ignorant of the origins of this uniquely modern phenomenon. This lack of awareness continues to lull the senses about what it means to represent something, and the importance that memory (history) plays in imagining and inhabiting other worlds. Such a situation is perpetuated by Hubert Damisch's observation that: "The problem of distance - distance between the point of view and the object perceived, and the distance between the eye and the picture plane, which are two different things – is to all appearances the heart of the question."¹

To examine the historical and cultural contexts of the phenomenon is to uncover something crucial and deeply mysterious about the modern world. Dalibor Vesely provides some historical background to this transformation, as it pertains to architectural representation:

"The process of uncovering those foundations leads inevitably into the depth of time, back to the generation of Leon Battista Alberti and Nicholas of Cusa and the formulation of Renaissance perspective, the first plausible anticipation of modernity. By examining Renaissance perspective against the background of the medieval philosophy of light, we can come to understand the ontology of architectural space, which is formed by light before it is structured geometrically."²

Two issues emerge from Vesely's statement that have a bearing on the present investigation: firstly that perspective is "the first plausible anticipation of modernity", and secondly that "the ontology of architectural space" was "formed by light before it is structured geometrically". Both assertions are related since the beginnings of modernity were characterised by a shift in the understanding of space as a setting revealed through 'divine' transcendent illumination to one construed in immanent terms as almost exclusively a problem of mathematics.

In this chapter I return to Vesely's arguments by examining the epistemological and ontological relationships between pictorial representation and the late medieval tradition of 'perspectivist optics', and the consequences of the transition (from one to the other) in our understanding of the representation of architecture. Through a study of the ideas of Leon Battista Alberti, Nicholas Cusanus and Filippo Brunelleschi in early 15th century Florence, I consider how this development was expressed in humanist and theological tracts and rendered spatially. Whilst a significant body of scholarship has written on the subject of linear perspective, I take a different line of approach from previous studies by considering firstly how the moment when perspective was first realised signalled a decisive historical shift, and secondly how this realisation continues to inform the representation of architecture in the modern world.³

Medieval Optics and the Resurgence of Appearance

In Dallas Denery's book, *Seeing and Being Seen in the Late Medieval World: Optics, Theology and Religious Life*, the author states:

“Theological debates, more often than not, began with ontological questions connected with the principle of singularity, moral problems involving human free will, and theological problems arising from the nature of beatific vision and God’s omnipotence. In addressing these sorts of issues, theologians exploited perspectivist ideas and resorted to visual analogies.”⁴

In essence “Knowing something is somehow analogous to seeing something.”⁵ This claim finds expression in the ideas, for example, of Robert Grosseteste, eminent medieval theologian/scientist and bishop of Lincoln Cathedral (1235-1253). His dedication to pastoral work and to Church reform drew analogies from his luminary cosmology and his theories of vision. We find evidence of this in his *Hexaëmeron*, a commentary on the creation narrative in *Genesis*, in which he examines the relationship between “aspectus” and “affectus”; between the gaze and (divine) love: “In the same way as light is understood to mean the knowledge of truth, with regard to the *glance* of the mind, in just that way it is understood as the love of the known truth in the *desire* of the mind.”⁶

From this relationship between *aspectus* and *affectus*, Grosseteste formulated what Richard Southern describes as a “maxim” of his understanding of the physical (and metaphysical) worlds, that can be traced to the very beginnings of linear perspective. Closely allied to Grosseteste’s maxim is what Vesely calls “the slow perspectivization of the culture as a whole”:

“The first manifestation of a movement toward perspectivity can be found in the new sense of space in painting, architecture, and the organization of cities. What is common to all these areas is a new coordination of space and a representation that takes into account the position of the spectator and his or her appreciation of the visible unity and beauty of the setting.”⁷

For the first time urban space was experienced as a series of ceremonially linked settings, where directional movement gave cities a new and distinct spatial orientation. This orientation, which paralleled a growing interest in the theological and cosmological perspectives of light and vision during the 13th century, even extended to the experience of liturgical space.⁸

Added to this new spatial awareness is what Denery describes as the growing importance of appearance in the Middle Ages:

“...people had come to think about themselves primarily in visual terms, in terms of a somewhat amorphous distinction between what appears and what exists...Confessional manuals, for example, are full of instructions to ensure that penitents and their sins will be fully revealed to their confessors. Not only does the confessor see the penitent, the penitent is taught to see himself through the confessor’s gaze.”⁹

The reciprocity between seeing and being seen has significant implications in our understanding of the shift from ‘perspectivist optics’, and its relationship to late Medieval orientational movement and modes of appearance, to full blown pictorial representation in the Renaissance and beyond.

From *perspectiva naturalis* to *perspectiva artificialis*

To understand the assimilation of perspectivist optics during the early Renaissance, and its transformation into *perspectiva artificialis*, we have to confront the difficult question of what was lost and gained in the transformation, mindful of Vesely’s claim that perspective constituted “the first plausible anticipation of modernity.” In recent scholarship this issue has tended to focus on the differing perspectives of Leon Battista Alberti and Nicholas Cusanus:

“Alberti’s *De pictura*.....helped inaugurate what Heidegger came to call “The Age of the World Picture.” “Picture” is understood here as something produced by the subject, something that has its center in and receives its measure from the subject.....To confront Alberti with Cusanus is to invite our age, this “Age of the World Picture,” to recognise the poverty that shadows its power, to become learned about its ignorance. We refuse that invitation at our peril.”¹⁰

Karsten Harries identifies a number of important distinctions between the ‘codification’ of perspective in Alberti’s *De pictura*, with its evidencing of a ‘geometrisation’ of space, and Cusanus’ ‘ontological’ treatment of perspective in which the “privileging of mathematics has its foundation not in the nature of things, but....in relation to the nature of human understanding.”¹¹ One way of examining the intersection between optics and perspective at this time is to consider the metaphorical use of optical instruments as a means of ‘corrective’ visualisation and representation, an issue that was especially relevant to Cusanus. Such an examination however requires clarification of the meaning of the term ‘instrument’. Unlike the modern definition - as a form of equipment or implement to serve largely practical ends - in medieval and early modern parlance the utility of *instrumentum* was always conditional upon its symbolic/cosmological meanings.¹²

The study of optics, and optical instruments, was very much in vogue in late 14th and early 15th century Florence, drawing upon the vast body of medieval and Arabic Aristotelian studies of light and vision which was known at the time.¹³ For a period, this interest co-existed with the earliest formulations of pictorial space, providing occasions for creative and intellectual exchange. This interest however was not just communicated through textual material and artistic production but also involved oratory, as we see in the famous sermons of Fra Antonino Pierozzi. Towards the end of his life, Fra Antonino (who became Archbishop of Florence) wrote down his sermons in a four volume work entitled *Summa theologia*:

“...the most interesting aspect of this monumental work was its emphasis on the act of seeing with the eyes, and his use throughout of optical analogies and metaphors to emphasize his spiritual and moral messages. Although he never referred to optics by its common Latin name, *perspectiva*, there is no doubt Antonino was familiar not only with the work of Peter of Limoges [*De oculo morali* (‘Concerning the Moral Eye’)] but with the basic principles of the visual pyramid as applied by Bacon to his species theory.”¹⁴

We have to remember that these sermons were delivered in basilicas and public locations, where Fra Antonino’s use of optical analogies and metaphors were conveyed in the very concrete settings of religious/civic spaces. Accordingly, his ‘theological optics’ would have been received by individual worshippers, each orientated to the altar, and also by assembled congregations in their side-by-side relationships.¹⁵ It is in this context of ‘seeing’ and ‘being seen’ (both humanly and divinely) that we can recognise Denery’s assertion of the growing importance of appearance in the middle-ages, of which prayer and confession played were central.

Among the audiences of Antonino’s sermons would have been artists, humanists and members of the clergy, many of whom contributed to the conception and codification of perspective. It is likely that Nicholas Cusanus would have attended, or known, these sermons and was influenced by Antonino’s optical analogies. Cusanus’ theology drew upon a deep tradition of Christian-Platonic cosmology, as we see for example in his interpretation of the Corpus of the Pseudo Dionysius, and at the same time promulgated radically new ideas regarding his conception of an infinitesimal cosmos that was equated with an infinite/eternal God. These two aspects of his work could be said to converge in his principle of the ‘coincidence of opposites’, in which the limits of one’s capacity to

understand divine things (through maximal and minimal relationships) are affirmed through our 'learned ignorance.'¹⁶

Cusanus communicated his theology of light and geometry in a number of treatises. Of particular interest here is a little work called *De Beryllo*, in which a beryl stone is used to convey the 'interfacial' relationships between the act of seeing and mindful vision. It is interesting to note that the choice of this precious stone as a metaphorical instrument in early Renaissance thought was not unique to Cusanus; "...in the discussion of his favourite subject, the refraction of light in semi-precious stones, Ghiberti uses the term "beryl", which does not appear in the literature to which he directly refers – but does figure prominently, as it happens, in the work of Nicholas of Cusa, who dedicated an entire treatise on the subject."¹⁷

In the case of Lorenzo Ghiberti, his 3rd Commentary is a unique study of visual experience by a Renaissance artist which draws upon an extensive literature of medieval optical sources (from Roger Bacon to John Pecham).¹⁸ Along with air, water, glass, crystals and chalcedony Ghiberti identifies the beryl stone as "diafano...per la sua transparentia e rarità."¹⁹ This attribute is reiterated by Cusanus' *De Beryllo* where he states:

"Beryl stones are bright, white, and clear. To them are given both concave and convex forms. And someone who looks out through them apprehends that which previously was invisible. If an intellectual beryl that had both maximum and a minimum form were fitted to our intellectual eyes, then through the intermediateness of this beryl the indivisible Beginning of all things would be attained."²⁰

Later Cusanus observes: "Let us apply the [intellectual] beryl to our mental eyes, and let us look out through both the maximum (than which there can be nothing greater) and the minimum (than which there can be nothing lesser), and we will see the Beginning, prior to everything great or small."²¹ Cusanus demonstrates the inter-dependency between maximal and minimal by constructing a thought experiment revealed through the beryl stone. This takes the form of a reed (of length hj), folded in the middle (i) so that one half (ij) can rotate as a separate length to form an angle in relation to the other length which is left flat (hi): "As long as the line cd constitutes one angle with ca and another angle with cb , neither angle is maximal or minimal.....And so, the one angle does not become maximal before the other becomes minimal."²²

Fig.1 (Insert here) *De Beryllo*, Nicholas Cusanus (1400-64). Demonstration of "Meditative Angles", in which a straight line (hj) is Likeness of True Being (*veritas*) (A); creation of an obtuse angle (at i) as Being (B); right angle as Living (C), and acute angle as Understanding (D).

What transpires from this mental exercise is that "...it cannot be called an acute angle or a right angle or an obtuse angle, for it is not any such angle but is the most simple cause of [angles]."²³ Instead, "we know that the maximal and the minimal [angle] is the complete totality and perfection of all formable angles and is both the innermost center and the containing circumference of them all."²⁴

Accordingly, through the intellectual eye-glass we encounter not a static geometric configuration but a geometry of mediation by means of angular rotation that reveals the quiddity of angularity. Significantly geometry serves here as a similitude of mystical revelation, analogous to the efficacy

of light. There is however no mention of optical magnification in Cusanus' description (in spite of his reference to the concave and convex shapes of the beryl stone). Instead we are left with the impression of the stone as a pure lens that affords the most elevated vision of a divine order.

In one sense *De Beryllo* relates to a deep history of the analogical meanings of eye-glasses, but one that transcends empirical demonstration about optical performance. Cusanus takes advantage of the clear and white crystal of the stone to contemplate divine things through geometric relationships, as if the lens is unimpeded by its material nature. The implication of Cusanus' metaphor is that vision of divine things requires the aid of an instrument to reveal what is otherwise hidden.

What *De Beryllo* reveals ontologically, through the agency of animated geometry, is transposed in Cusanus' *De visione Dei* into a *situational* relationship among participating souls through the senses; the dynamics of the rotating angle, in which maximal is always countered by minimal movement, serves as an analogy to the intersecting (mutually dependent) perspectives of communing worshippers. This relationship is reinforced by Michel de Cereau's description of *De Visione Dei* as a "mathematical liturgy"²⁵

Unlike however most other tracts in Cusanus' *oeuvre*, in which the Cardinal deploys mathematical and geometrical similitudes to demonstrate his ideas, in *De visione Dei* he "integrates the fundamental exercises of seeing, hearing, and speaking into a praxis designed to lead his monastic audience" ...into what he calls the "ready access to mystical theology" (*facilitas mysticae theologiae*).²⁶ Significantly, Cusanus uses a religious icon of Christ to communicate this experience:

"Each monk first stands observing the [its] atemporal gaze seemingly directed to him alone. Then, each moves from his original location to the opposite side, in amazement at the "change of the unchangeable gaze" that introduces temporality and mutability into the experience. The crucial part of the experiment, however, is the transition from the visual realm to the audible, the speaking and hearing that form the believing community – that is, faith is what enables us to begin to move beyond the perspectival as particular toward a more universal viewpoint. The simultaneous omnivoyance, or infinity, of Christ's gaze begins to be revealed only when each brother asks the other as they meet simultaneously."²⁷

"Omnivoyance" typically refers to the optical illusion created by a figure painted on a flat surface, in which the eyes stare directly out of the picture at 90° to the surface. Bernard McGinn however construes the overall effect of this all-seeing presence of the icon as moving "beyond the perspectival as particular toward a more universal viewpoint." The synthesising of the human senses and oral communication provides perhaps the most far-reaching account of a *situational* understanding of the sacred. But can we reconcile Cusanus' 'model' of optical perspective with developments in pictorial representation during this time? This question prompts us to return to a comparison between Cusanian and Albertian concepts of perspective; between Cusanus' contemplative geometries (in *De Beryllo*) and Alberti's demonstrative geometries (in *De pictura*). One of the most outspoken critics of such a relationship is Clifton Olds who states:

"...the principle of one point perspective [that forms the basis of Alberti's *De pictura*] runs *absolutely* counter to Cusanus's metaphor, in that the former assumes that the viewer of a painting is always standing in front of it, his eyes on a level with the vanishing point, and at a specific distance from the image. As a demonstration of our own limited – or to use Cusanus' adjective, "contracted" –

vision, Renaissance perspective is in itself an ideal metaphor, one that Cusanus could have employed in drawing the contrast between God's all-seeing eye and own barrel vision. It is antithetical to the limitless vision of God, however; and Cusanus would have been the first to see the contradiction."²⁸

Olds makes a clear distinction between linear perspective and what he calls "aspective principles"; "looking *at* rather than looking *through*."²⁹ The distinction however is challenged by Charles Carmen who argues for a closer relationship between Albertian principles of perspective and Cusanus' 'theology' of vision:

"Cusanus is explicit in his interpretation of observing God's perspective, explaining that upon realizing the miraculous nature of God's omnivoyance, "unless he [a brother] believed, he would not apprehend that thiswas possible".....The icon's viewer must apprehend, or grasp...., must look into himself using faith and intellect. Only there will he find some explanation for what can be known beyond sense certainty. Alberti, on the other hand, is less explicit about what his infinite geometry transmits, though, as I have suggested, something similar to Cusanus's conception applies to the viewer of these Albertian spaces....Although expressed in different settings their methods indicate a common goal. Cusanus transforms the non-geometrical perspective of viewing the icon into a geometric metaphor of God's actual infinity; Alberti encloses the natural physiology of what we see within a visibly infinite geometry. Both start from simply "natural" appearance and use the metaphoric power of geometry to advance to a higher understanding of that appearance."³⁰

In Cusanus' 'contemplative' geometries, that we see in *De Beryllo*, understanding one's relationship to God is 'measured' on the basis of our capacity to seek (but ultimately not attain) knowledge of divine things through the agency of 'geometric reckoning' - hence our 'learned ignorance'. Accordingly, Cusanus deploys 'open' geometry to reveal this gap between human finitude and divine infinitude. Alberti, on the other hand (to quote Carmen), "encloses the natural physiology of what we see". The principle of enclosure - or framing the visible world - relates back to Harries' argument (quoted earlier in this chapter) that perspective is an anticipation of the Heideggerian concept of the modern "World Picture". Crucially, Harries' reasoning behind comparing the ideas of Alberti to Cusanus is that the former is "one of the founders of our modern world....whose material wealth is shadowed by spiritual poverty."³¹ The end result of Albertian perspective - "a visibly infinite geometry" as Carmen describes it - seems to counter Cusanus' geometry as a thought experiment to express the synonymy between infinite space and the infinitude of God.

This comes to a further issue underlying this comparison; namely Cusanus' abiding emphasis on direct (worldly) experience to *reveal* humanity's relationship to God, a principle that is conspicuously absent in Alberti's work.³² In this outlook Cusanus rarely considers divine matters in purely abstract terms, since his approach to mathematics and geometry is always mediated through experience in some way. To take an example, in Cusanus' *Idiota* dialogues (*Idiota de sapientia*) Harries observes:

"Having proclaimed, citing Scripture, that wisdom cries out in the streets, the layman calls the orator's attention to the activities that take place in the marketplace: money being counted, oil being measured, and produce being weighed. In each case a unit measure is applied to what is to be measured. And can we not observe something of the sort wherever there is understanding? The activities observed on the marketplace invite the thought that just insofar as he is the being

who measures, the human being transcends the beast. *Animal rationale* comes to be understood first of all as *animal mensurans*.”³³

Cusanus’ equation of ‘measure’ with human understanding, as it pertains to the everyday life of the marketplace, reminds us of Certeau’s description (referred to earlier) of the ‘visual’ encounters of communing monks in *De Visione Dei* as a form of “mathematical liturgy”. This relationship prompts us to recollect the historical connections between the ‘invention’ of perspective and architecture. Understanding such a relationship is important if we are to begin to construe how perspective became instrumentalised.

Brunelleschi’s Experiment

The importance of Brunelleschi’s famous perspective ‘experiments’ in Florence on Alberti’s codification of *perspectiva artificialis* in his *De pictura* has been extensively debated by scholars.³⁴ What is often overlooked however in these studies is the issue of the symbolic implications of Brunelleschi’s use of urban/building fabric to test his method, and his choice of sites in the city in which to construct these pictorial projections. As Martin Kemp reminds us:

“The procedures relied upon existing buildings and, inevitably, resulted in the portrayal of these buildings. Painters were not employed to paint townscapes as such, except in very unusual circumstances, and a set of existing buildings is unlikely to have provided an appropriate or adaptable setting for the religious subject-matter which predominated.”³⁵

Should we accept the principle therefore that Brunelleschi’s ‘discovery’ (or invention) of perspective was borne out of the visualization and reconstruction of the physical urban fabric of Florence, rather than formulated in purely abstract terms as an imagined geometrical construct (as we later see in Alberti’s *De pictura*)? Early in his career (in 1413) Brunelleschi was called *prespettivo ingegnoso uomo* (‘ingenius perspective man’), a term that Samuel Edgerton argues can only refer to optics (or *perspectiva naturalis*) rather than to linear perspective (*perspectiva artificialis*). This is on account of Brunelleschi’s association with the charismatic orator, Fra Antonino, referred to earlier.³⁶ Through his exposition of a “civic theology”, Antonino viewed the city of Florence as a setting for blending “experiential existence with its commitment to salvation, a *mirror image* of the heavenly Jerusalem.”³⁷

It is appropriate therefore that we draw upon this theological background to examine Brunelleschi’s famous perspective reconstruction of Florence Baptistery (San Giovanni). It is my intention here only to examine the work in the context of its topographical location. It would be helpful however to remind ourselves of Brunelleschi’s perspective methods according to his biographer, Antonio Manetti:

“He first demonstrated his system of perspective in a small panel about a half braccio square. He made a representation of the exterior of San Giovanni of Florence, encompassing as much of that temple as can be seen at a glance from the outside. In order to paint it, it seems that he stationed himself three braccia inside the central portal of Santa Maria del Fiore.....In the foreground he painted that part of the piazza encompassed by the eye....And he placed burnished silver where the sky had to be represented, that is to say, where the buildings of the painting were free in the air, so that the real air and atmosphere were reflected in it.....he made a hole in the painted panel at that point in the temple of San Giovanni which is directly opposite the eye of anyone stationed inside the central portal of Santa Maria del Fiore, for the purpose of painting it....He required that whoever wanted to look at it place his eye on the reverse side where the hole is large, and while

bringing the hole up to his eye with one hand, to hold a flat mirror with the other hand in such a way that the painting would be reflected in it. The mirror was extended by the other hand a distance that more or less approximated in small braccia the distance in regular braccia from the place he appears to have been when he painted it up to the church of San Giovanni. With the aforementioned elements of the burnished silver, the piazza, the viewpoint, etc., the spectator felt he saw the actual scene when he looked at the painting.”³⁸

Edgerton makes the case that this experiment was conducted very much under the influence of a “still medieval intellectual ambience of [Brunelleschi’s] time”, and accordingly “he would not have immediately have conceived of it as a purely abstract geometrical function.”³⁹ In the experiment Brunelleschi incorporated a combination of pictorial reconstruction (depiction) and ‘catoptric certification’ (reflection). The relationship between both is significant when we consider the differences between *perspectiva artificialis* and *perspectiva naturalis*; between the penetrative properties of projective geometry and the reflective properties of burnished silver redolent of the gold backgrounds of medieval icons.

Fig. 2 (Insert here), View of the Baptistery of San Giovanni taken from the central portal of Florence Cathedral (courtesy akg-images/Album/Prisma)

The chosen location for Brunelleschi’s experiment is likely to have been a motivating force in the project. As the focus of the *quartiere di San Giovanni*, the Baptistery was also regarded as the oldest and most venerated building in Florence, hence Manetti’s reference to it as a ‘temple’. This symbolic and historical importance is further underpinned by the ceremonial relationship between the Baptistery and the Cathedral opposite:

“...Brunelleschi *cum* artist chose an ideal position from which to view his subject by standing just inside the Cathedral door. Positioned there he views and reproduces the space towards the eastern doors of the Baptistery, which, facing the western entrance to the Cathedral constitute the exit way of the newly baptized who would traverse this space of paradise as the literal path leading to the Eucharistic altar and union with God. His subject, in other words, was the sacred journey this space defined.”⁴⁰

Hence, the simultaneous depiction/reflection of the Baptistery and its surroundings redefined, by optical means, the liturgical connection between the rites of Baptism and the Eucharist. The space between the Baptistery and Cathedral, which had been widened after the demolition of Santa Reparata, and the construction of the larger basilica further east, allowed the whole building of the Baptistery to be visible from the cathedral portal:

“..the east doors faced directly onto the main portal of the Cathedral opposite. When both entrances were open, people in the Baptistery could view not only the newly finished west facade recently adorned with life-size sculptures of the Four Evangelists, but the main altar inside the Cathedral itself, while people in the Cathedral could in turn admire the sacred Baptistery, framed by the Cathedral doorway almost like a holy relic in a tabernacle.....”⁴¹

The religious and civic importance of the piazza between the Baptistery and Cathedral, that formed the spatial setting of Brunelleschi’s panel, is underlined by its association with ‘earthly paradise’, as described in Leonardo Bruni’s *Panegyric to The City of Florence*, written at the beginning of the

15th century.⁴² In Brunelleschi's in-situ perspectival "certification" of the Baptistery, and its surrounding piazza, we are reminded again of Certeau's interpretation of Cusanus' *De Visione Dei* as a "mathematical liturgy". Analogies between liturgical space and forms of mathematical and geometric reckoning find further resonance in Marvin Trachtenberg's argument that the Baptistery "was the first link in a single proportional chain that eventually came to structure all three buildings of the cathedral group [new Duomo, Campanile and Baptistery]."⁴³ Trachtenberg demonstrates this by highlighting the way the dimensions of both Duomo and Campanile derive from the Romanesque Baptistery, as we see in Francesco Talenti's 1357 revision; the external width of the Duomo (72 braccia) comprises the sum of the widths of the three sides of the octagonal Baptistery facing the west facade of the Cathedral and represented in Brunelleschi's perspective projection ($24+24+24=72$).⁴⁴

Fig. 3 (Insert here) Plan of Florence Cathedral and Baptistery (after Bernardo Sansone Sgrilli) showing a hypothetical reconstruction of Brunelleschi's visual angle from central portal of the Duomo to the Baptistery, with perspective view of the Baptistery (Drawn by author).

Whilst Brunelleschi's panel demonstrated the virtuosity of the new perspective technique, it seems clear that what he revealed in the process was much more; the visual trajectory linking the sites of Baptism (San Giovanni) and the Eucharist (Santa Maria del Fiore) is rendered as 'Paradise' by virtue of the site's pictorial reconstruction through optical transformation into an infinite space. In this process the vanishing point, which Olds speculates "is the perfect analogy to Cusanus' concept of the *finis sine fine*" ('endlessly end'), coincides with the position of the viewing eye (behind the tiny "lentil bean" hole of the painted panel).⁴⁵ We are reminded in this analogy of Cusanus' experiential understanding of the 'coincidence of opposites', where "impossibility coincides with necessity."⁴⁶ Significantly, Cusanus calls this encounter: "the wall of paradise whose gate is guarded by reason."⁴⁷

Brunelleschi's act of 'testing' his pictorial representation of the Baptistery, and its surroundings (the setting of 'Paradise'), both *explicitly* demonstrates what is visible in front and *implicitly* acknowledges what lies behind - the liturgical destiny of the procession of the baptised (the site of the Eucharist).⁴⁸ In this 'Janus' relationship, Brunelleschi's mirror and panel constitute as much an *ontological* as a purely *optical* instrument, echoing Fra Antonino's "moralising optics" conveyed in his animated sermons in the religious and civic spaces.

It should not be underestimated the significance of the translation of Brunelleschi's perspective rendering to the largely abstract codification of pictorial space expressed in Alberti's *De pictura*. As Kemp makes clear, "What was needed was a means of adapting Brunelleschi's procedures to the creation of an imagined space [Alberti's *costruzione leggitima*] which could act as the servant to the artist's needs. Without such a means, the potential of the invention would remain dormant."⁴⁹

The term 'dormant' is perhaps unwarranted here as an indication of some expected - but ultimately unfulfilled - potential. It is probable that Brunelleschi was unaware of the full implications of his 'invention', given what was to follow in the progressive 'grip' of perspective on both imagined (ideal) and actual (physical) settings.⁵⁰ His experiment therefore should not be construed as a conscious demonstration of *perspectiva artificialis* as some have argued, given the lack of supporting geometric procedures, but rather as an affirmation of the still pervasive late medieval

tradition of perspectivist optics and catoptrics. The decisive turning point takes place in Alberti's codified rules, in which "A God-centred art gives way to a subject centred art."⁵¹

'Perspectivising' Photography

In this investigation I have attempted to situate Brunelleschi's famous perspective experiment in the context of the philosophical, theological and scientific developments of the late middle ages, and how these developments set in place the eventual establishment of an autonomous 'world picture'. I would like to conclude with a brief investigation of the impact of perspective on photography, with specific focus on an image taken by Le Corbusier. The intention of this study, digressing as it does from specifically 15th century investigations of *costruzione leggitima*, is to argue that the instrumentalisation of perspective, inaugurated by Alberti's codification and resulting in the complete geometrisation of space in Cartesianism, did not signal the complete demise of 'embodied' meanings and associations of pictorial space. Indeed, even in the most mechanised form of visual reproduction – photography – we can trace what Vesely describes as a 'latent continuity' of traditions in the ontological paradigms of pictorial space.

Le Corbusier's early career as a photographer may well have been influenced by the ideas of Frédéric Dillaye, who at the beginning of the 20th century published a journal on photography.⁵² Dillaye compared photography to the fine arts, in particular how the construction of the image relates to, or deviates from, the rules of linear perspective. Through his principle of "perspective d'accommodation", Dillaye warned against the distorting effects of wide-angled lenses: "The photographer has a very limited palate of tones and a set of inexorable laws of perspective to deal with. The effective photograph is typically one in which the geometry imposed by perspective and the grouping of tones work together to create a relatively simple but memorable impact."⁵³

It is easy to see how the play of light and geometry in Dillaye's photographic 'constructions' influenced Le Corbusier, and were accommodated within the Purist sensibilities of his early building projects and photographic studies.⁵⁴ Taken from *L'Oeuvre Complète*, the photograph chosen for this study comes from a later period, and shows the interior of Le Corbusier's studio at 24 rue Nungesser et Coli. An important aspect of the 'staging' of this photograph (which incidentally is captioned "towards unity") is what Peter Carl calls "the fusion of opposites". This consists of: "(in the vault) tent and cave...of rustic building (rubble party wall) and aeroplane (the V-strut and wing vault)."⁵⁵

Fig. 4 (Insert here) Diagram showing structure of the principal intersecting axes of the photograph of Le Corbusier's Painting Studio at 24 rue Nungesser et Coli (Drawn by author after Peter Carl).

Carl argues that like the *Le Poème de l'Angle Droit*, the photograph of Le Corbusier's studio invokes a "conciliation" of contrasting themes (light/dark, terrestrial/celestial etc).⁵⁶ In this relationship we can see how Le Corbusier articulates a geometric relationship of elements through the camera lens; the 'horizon' (eye height) of the athletic fields, visible outside across the street from the window, is extended into the interior and coincides with the top of a picture positioned upright on the floor, whilst the curved vault above is framed by both vertical and sloping (projecting) axes that intersect. At the same time, the perspective diminution of the base of the window, through which the outside landscape comes into view, is projected into the centre of the room. The resulting right-angled triangle and its notional vanishing point, created by these intersecting axes,

anchors the spatial matrix of ground, rear rubble wall, window and vaulted ceiling into a union of contrary elements. Significantly, as Carl observes, the photograph was shot “from a recess off the studio designated the ‘library’.....to which the mess on the table [visible in the foreground of the photograph] conforms.”⁵⁷ Accordingly, Le Corbusier was seeking to register what lies hidden behind the viewer, reminding us of the ‘Janus’ image implicit in Brunelleschi’s experiment.

In this arrangement it becomes apparent how Le Corbusier applied optical methods to bring the multitude of different elements, in the depth of the space, into visual coherence, and at the same time to underline the continuity of the scene with respect to places and locations that lie beyond/behind its immediate frame. One can draw some interesting comparisons between Le Corbusier’s photographic methods and the beginnings of *costruzione leggitima*, by revealing what is both different and similar between modernity and the early modern world views. To briefly speculate on such a relationship the following statement by Carl about Le Corbusier’s photograph is instructive:

‘The image presents the studio as a cosmic theatre of creation establishing the nature of creativity itself, and justifying the enigmatic caption [‘towards unity’]; but it is important to recognise that the photograph elaborates upon a very laconic setting, which is articulated only enough to awaken what is always already there.’⁵⁸

The “laconic setting” that Carl refers to could in one sense be likened to Brunelleschi’s pictorial/catoptric experiment. Once the privileged status of religious and civic spaces in the medieval and early modern worlds, as we see for example in the *quartiere di San Giovanni* as ‘earthly paradise’, claims of cosmological meanings of spaces in the modern age tend to focus on the ‘problem of the room’ - or more generally the dwelling.⁵⁹ Paralleling this ontological shift from piazza to room - from public (civic/religious) space to private (ontological) interior - is the status of modern public space as denuded of ritual/ceremonial purpose. In the process of photographing his studio, Le Corbusier was in one sense re-inventing an architectural order by rendering domestic space with cosmological significance, eviscerated elsewhere in the modern city. Carl’s argument of an affiliation between the symbolism of the interior and the *Le Poème de l’Angle Droit* clearly underlines this enterprise.

We can see how Brunelleschi’s optical ‘certification’ of San Giovanni, and its intervening space, finds a modern equivalent (if there can ever be one) in the photographic ‘certification’ of Le Corbusier’s staged image of his studio. Through this process Le Corbusier’s “conciliation of opposites”, observed in the camera lens as mediated geometric relationships, serves as a tragic echo of Cusanus’ “coincidence of opposites” revealed in the metaphorical instrument of the beryl stone.

ENDNOTES

¹ Hubert Damisch, *The Origin of Perspective* (Cambridge, Mass: MIT Press, 1995), 107.

² Dalibor Vesely, *Architecture in the Age of Divided Representation: The Question of Creativity in the Shadow of Production* (Cambridge, Mass: MIT Press, 2004), 6.

³ This chapter is a further development of an earlier study, *Disclosing Horizons: Architecture, Perspective and Redemptive Space* (London: Routledge, 2007).

⁴ Dallas G. Denery II, *Seeing and Being Seen in the Late Medieval World: Optics, Theology and Religious Life* (Cambridge: Cambridge University Press, 2005), 4-5.

⁵ *Ibid.*, 5.

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- ⁶ C.F.J. Martin (trans.), *Robert Grosseteste: On the Six Days of Creation: A Translation of the Hexaëmeron* (Oxford: Oxford University Press, 1996), Part II, ch. IX, 2.
- ⁷ Vesely, *Architecture in the Age of Divided Representation*, 110.
- ⁸ See *Bishop Robert Grosseteste and Lincoln Cathedral: Tracing Relationships Between Medieval Concepts of Order and Built Form*, edited by Nicholas Temple, John Shannon Hendrix and Christian Frost (Farnham, Surrey: Ashgate, 2014)
- ⁹ Denery, *Seeing and Being Seen in the Late Medieval World*, 7.
- ¹⁰ Karsten Harries, 'On the Power and Poverty of Perspective: Cusanus and Alberti', in *Cusanus: The Legacy of Learned Ignorance* (Washington, D.C.: The Catholic University of America Press, 2006), 105-126, (108). See also Charles H. Carman, *Leon Battista Alberti and Nicholas Cusanus: Towards an Epistemology of Vision for Italian Renaissance Art and Culture* (Farnham, Surrey: 2014).
- ¹¹ Harries, 'On the Power and Poverty of Perspective' 109. See also Ronald Godzinski, '(En)Framing Heidegger's Philosophy of Technology', *Essays in Philosophy* (January, 2005), 6 (1).
- ¹² Donald G. Bates, 'Machina Ex Deo : William Harvey and the Meaning of Instrument', *Journal of the History of Ideas* (October 200), Volume 61, Number 4, 577-593.
- ¹³ Samuel Y. Edgerton, *The Mirror, the Window, and the Telescope: How Renaissance Linear Perspective Changed Our Vision of the Universe* (Ithaca, NY: Cornell University Press, 2009), 30.
- ¹⁴ *Ibid.*, 32.
- ¹⁵ For further discussion on this see Nicholas Temple 'Architecture as the Receptacle of *Mitsein*', in *Intersections of Space and Ethos*, Edited by Kyriaki Tsoukala, Nikolaos-Ion Terzoglou and Charikleia Pantelidou (London: Routledge, 2015) 138-149.
- ¹⁶ *Nicholas of Cusa On learned ignorance: A translation and an appraisal of De docta ignorantia*, Translated by Jasper Hopkins, (Minneapolis, Minnesota: The Arthur J Banning Press, 1985).
- ¹⁷ Vesely, *Architecture in the Age of Divided Representation*, 161.
- ¹⁸ Some have dismissed Ghiberti's 3rd Commentary as regressive, on account of the lack of discussion of linear perspective. *Ibid.*, 160.
- ¹⁹ "diaphanous ... for its transparency and rarity." Alberto Ambrozini, *Immaginazione visiva e conoscenza: Theoria della Visione e Practica Figurativa nei Trattati di Leon Battista Alberti, Lorenzo Ghiberti, Leonardo da Vinci* (Pisa, Edizioni plus – Pisa University Press, 2008), 158.
- ²⁰ Nicholas Cusanus, 'On [Intellectual] Eyeglasses' (De Beryllo), in *Nicholas of Cusa: Metaphysical Speculations*, Trans. By Jasper Hopkins (Minneapolis, Minnesota: The Arthur J. Banning Press, 1998), 35-72, 36 (3)
- ²¹ *Ibid.*, 37 (8)
- ²² *Ibid.*, 39 (10)
- ²³ *Ibid.*, 40 (12)
- ²⁴ *Ibid.*, 41 (15)
- ²⁵ Michel de Certeau, 'The Gaze of Nicholas of Cusa,' in *Diacritics: A Review of Contemporary Criticism* 3 (1987): 2-38, (14).
- ²⁶ Bernard McGinn, 'Seeing and Not Seeing: Nicholas of Cusa's De Visione Dei in the History of Western Mysticism', in Peter J. Casarella (ed.), *Cusanus: The Legacy of Learned Ignorance* (Washington, D.C., The Catholic University of America Press, 2006), 26-53 (38).
- ²⁷ *Ibid.*, 39.
- ²⁸ Clifton Olds, 'Aspect and Perspective in Renaissance Thought: Nicholas of Cusa and Jan van Eyck,' in *Nicholas of Cusa on Christ and the Church: Essays in Memory of Chandler McCuskey Brooks for the American Cusanus Society*, edited by Gerald Christianson and Thomas M. Izbicki (Leiden: Brill, 1996), 251-264, (254).
- ²⁹ *Ibid.*, 255.
- ³⁰ Carmen, *Leon Battista Alberti and Nicholas Cusanus*, 91.
- ³¹ Harries, 'On the Power and Poverty of Perspective', 108.
- ³² This is most clearly highlighted in Cusanus' account of the inspiration for his concept of learned ignorance. Harries, 'On the Power and Poverty of Perspective', 112.
- ³³ Harries, 'On the Power and Poverty of Perspective', 119.
- ³⁴ See in particular Damisch, *The Origin of Perspective*; Martin Kemp, *The Science of Art: Optical themes in western art from Brunelleschi to Seurat* (New Haven: Yale University Press, 1990) & Samuel Y. Edgerton, *The Renaissance Rediscovery of Linear Perspective* (New York: Harper Icon, 1976).
- ³⁵ Kemp, *The Science of Art*, 15.
- ³⁶ Edgerton, *The Mirror, the Window, and the Telescope*, 40.
- ³⁷ Carmen, *Leon Battista Alberti and Nicholas Cusanus*, 125-126.
- ³⁸ Howard Saalman, ed., *The Life of Brunelleschi by Antonio di Tuccio Manetti*, Translated from the Italian by Catharine Enggass (University Park: Pennsylvania State University Press, 1970), 42-44.
- ³⁹ Edgerton, *The Mirror, the Window and the Telescope*, 48.

⁴⁰ Carmen, *Leon Battista Alberti and Nicholas Cusanus*, 126.

⁴¹ *Ibid.*, 127. Brunelleschi stood approximately 60 braccia away from the east facade of the Baptistery.

⁴² 'Leonardo Bruni: Panegyric to the City of Florence,' in *The Earthly Republic: Italian Humanists on Government and Society*, ed. Benjamin G. Kohl, Ronald G. Witt and Elizabeth B. Welles (University Park: University of Pennsylvania Press, 1978), 141-2. Richard Krautheimer states that the east entrance to San Giovanni was the "focus, as it were, for the entire body of sacred buildings on the border between the old and the new parts of the town." Richard Krautheimer and Trude Krautheimer-Hess, *Lorenzo Ghiberti* (Princeton: Princeton University Press, 1970) Vol.1, p34. Quoted in Edgerton, *The Mirror, the Window and the Telescope*, p47.

⁴³ Marvin Trachtenberg, 'Architecture and Music Reunited: A New Reading of Dufay's "Nuper Rosarum Flores" and the Cathedral of Florence', *Renaissance Quarterly*, Vol.54, No.3 (Autumn, 2001), 740-775 (749). Trachtenberg makes a compelling argument for a numerical correspondence between Guillaume Dufay's motet, Nuper Rosarum Flores, commissioned for the dedication of the new cathedral in 1436, and the proportions of the Duomo, that in turn derive from the Baptistery.

⁴⁴ *Ibid.*, 750.

⁴⁵ Old, 'Aspect and Perspective in Renaissance Thought', 254. Olds asserts however that this is his interpretation, not Cusanus'.

⁴⁶ McGinn, 'Seeing and Not Seeing', 46.

⁴⁷ *Ibid.*

⁴⁸ As Edgerton states, "In our mortal world, just as in my mirror, you see the Baptistery only enigmatically. Not until you are in heaven face to face with God, will you at last behold its true reality." *The Mirror, the Window and the Telescope*, 53.

⁴⁹ Kemp, *The Science of Art*, 15.

⁵⁰ See my *Disclosing Horizons: Architecture, Perspective and Redemptive Space* (London: Routledge, 2007).

⁵¹ Harries, 'On the Power and Poverty of Perspective', 111.

⁵² Tim Benton, *Le Corbusier Secret Photographer* (Zürich: Lars Müller Publishers, 2013), 42.

⁵³ *Ibid.*, 44-45.

⁵⁴ Perhaps the best evidence of this combination of Purist sensibilities and perspective technique can be seen in the famous photograph of the studio in the Maison Ozenfant (1922).

⁵⁵ Peter Carl, 'Le Corbusier's Painting Studio', *Scroope: Cambridge Architecture Journal* (1993/4), Issue 5, 36-37 (36).

⁵⁶ *Ibid.*, 37.

⁵⁷ *Ibid.*, 36.

⁵⁸ *Ibid.*, 37.

⁵⁹ For discussion on this, in the context of the Chapel of Notre-Dame du Haut in Ronchamp, see Peter Carl, 'Architecture and Time: A Prolegomena', *AA Files*, No.22 (Autumn 1991), pp. 48-65.

* This chapter is dedicated to the memory of Dalibor Vesely (1934-2015), teacher, colleague and mentor.