Alberti on Perspective: Calling His Bluff

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ABSTRACT

There are lacunae in the paragraphs of De Pictura in which Leon Battista Alberti describes his method of perspective construction. Although this has been a matter of considerable discussion among Alberti scholars in recent decades, none has deconstructed the text enough to state unequivocally that the theory is both defective and circular – which it is:

- Alberti does not provide sufficient information to enable the construction to be drawn with any degree of mathematical precision, in spite of his basing its validity on mathematical proof;
- when the construction is drawn (which can only be achieved after making certain assumptions), it does not produce an array of continuous and contiguous foreshortened squares, as Alberti maintains it does;
- the 'distance point' of the viewer is irrelevant; and
- the construction is less practically useful and less technically advanced than the method or methods used by Alberti's great artist contemporaries - Ghiberti, Masaccio, Mantegna, Donatello and Piero della Francesca - rather than the reverse.

This paper maintains that Alberti does not deserve his reputation as the originator of perspective theory and that the Western academic community stands condemned for allowing this situation to occur and to continue.

Keywords: Alberti, perspective, quattrocento, painting, writers, academics

It is generally agreed that Leon Battista Alberti wrote the Latin version of his treatise on painting, *De Pictura*, in 1435, not long after his arrival in Florence for his second and most extended period of residence there (1434-46). By this time Alberti was a committed humanist with an established interest in the visual arts. Alberti himself translated the treatise into Italian soon afterwards (by mid-1436) to make it more readily available – and seem less threatening – to the city's fraternity of practising artists, to key members of which he dedicated the translation.

De Pictura/Della pittura treats a very wide range of issues concerning what Alberti took to be essential to the correct presentation of the *istoria* of a picture - according to a *piu grassa Minerva*[i] - than artists allegedly theretofore had been able to use. The representation of visual space is covered mainly in paragraphs 19 and 20 of the first book and paragraph 31 of the second. The whole discussion is grounded in the mathematical principles of the day, Alberti's aim being to guide artists towards creating a harmony based in the rational authority of classical geometry and mediaeval optics.

In paragraph 19, Alberti describes 'the art of expressing the intersection in painting' (Grayson, 1972, p.57). The intersection itself he has previously described (paragraphs 13-18) in optical terms and here he asks his artist readers to regard it as 'an open window through which the subject to be painted is seen' (Grayson, ibid., p.55). It can be regarded as a transparent vertical plane cutting the visual pyramid perpendicularly to the line of sight (the 'central ray' of vision). The picture is to be effected through the application of the properties of similar triangles to what the visual pyramid reveals to the artist's perception. The intersection, which Alberti later (paragraph 31) calls 'the veil' (*velum* (Latin)/*velo* (Italian)), is quadrilateral in shape and, to make it fit and appropriate to contain the human figures which are to play out the *istoria*, its base-line must be marked out in *bracccio*-lengths[ii] and a 'centric point' placed the height of an average human (i.e. three *braccia*) centrally above it. From this point lines are drawn back to each of the marks on the base-line and these lines become the orthogonals of a schematic pavement on which the figures of the *istoria* will be placed in a representation of visual space.

Up to this point the exposition is clear, concise and easy to follow and Alberti's intended readership would have had no difficulty in understanding him.

In paragraph 20, Alberti describes his method of establishing the 'transverse quantities' (*quantita trasverse*) - his system for representing in a picture the apparent progressive diminutions in size of figures as they stand on the notional pavement in places further and further away from the viewer. In justification of his method he describes how it may be observed in a church, for instance, that people's heads are all at the same level, but their feet seem to rise higher and higher as they move further and further from the viewer. It seems that Alberti was the first person, at least in the modern world, to describe the phenomenon of *isocephaly*.

However, there is a problem with paragraph 20 in that none of the several extant editions of the treatise, whether in Latin or Italian, conveys a method of rendering the

quantita trasverse in terms that can be followed without interpretation and extrapolations. Every published Alberti commentator has experienced real difficulties in following his instructions in this paragraph[iii] and - if the texts currently available are complete and as written - quattrocento Florentine artists would have experienced the same difficulty. Unfortunately, Alberti's autograph illustrations of his treatise for neither version have survived, so we cannot know how he would have drawn his construction.

What Alberti attempts or purports to describe in paragraph 20 is the *areolam* (Latin)/*picciolo spazio* (Italian) – a term difficult to translate but which Grayson[iv] believes to indicate a separate surface or drawing board[v]. On this, the base-line of the picture, with its *braccio* divisions, is replicated and above it is placed a point at the same height as the centric point of the picture surface (now referred to as the *quadrangolo*). Most available versions of the text do not explain how to locate this point - in spite of it being an absolutely crucial link in Alberti's system. This has resulted in various guesses as to where Alberti intended it to be located[vi], the extent of scholarly puzzlement causing it to be dubbed the *punctum dolens* (the painful point) (Grayson, 1962, p.14, note 3).

However, in 1964, Grayson discovered in some of the Latin versions of the text five extra words which clarify the situation in the following way (the words in bold being the additional, elucidating, phrase (Grayson (1972), p.57) - but here in Edgerton's translation[vii]):

'Then I place a single point above and perpendicular to one end of this line and as high as the centric point is above the base line of the quadrangle. From this point I draw single lines to the individual divisions of this same line.'

Commentators have been generally relieved to accept this as the solution to this problem[viii], and it is possible to draw the construction as it is thus described (Figure 1).

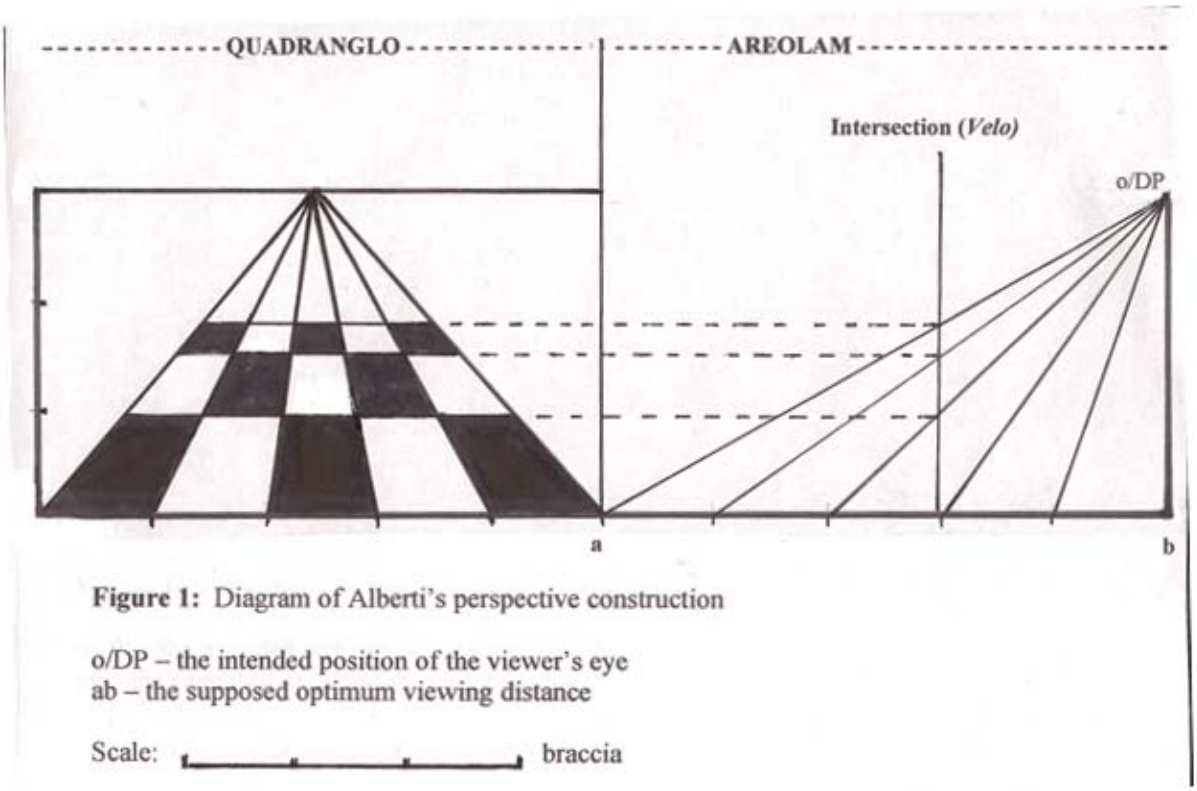

Figure 1: Diagram of Alberti's perspective construction

o/DP – the intended position of the viewer's eye
ab – the supposed optimum viewing distance

Scale: braccia

The next step in what Grayson (1964, p.22) calls the *costruzione d'aiuito* (helpful construction), and according to his translation, is

'Then I determine the distance I want between the eye of the spectator and the painting, and, having established the position of the intersection at this distance, I effect the intersection with....a perpendicular.'

But, again, Alberti gives no indication as to how the 'distance point' (as it has become known, or DP) is to be located! This deficiency is crucial because the points at which the perpendicular intersects each of the orthogonals in the construction are intended as the loci for the transverse lines of the schematic pavement and in such a way that what the viewer sees in the picture would be a convincing representation of the real scene from both the viewpoint and the viewing distance intended by the artist.

It is extremely puzzling that, in view of Alberti's continual insistence on the relevance of mathematical principles to the nature of the *istoria*, his explanation of these two key points is so imprecise – even obscure. One possible explanation is that the surviving texts may not be complete. Grayson's discovery, even if it can be substantiated as Alberti's actual words and not a later addition, still does not solve the problem because,

as Figure 1 indicates, the construction yields an array of non-congruent rectangles, rather than (congruent) squares. It is a matter of simple logical deduction that

(a) squares, being regular figures, will retain their regularity when viewed from an angle and

(b) that the effect of foreshortening will mean that the vertical height of each square on the picture plane must be less than the width.

Neither of these conditions is present in Alberti's construction.

Also, the location of the DP remains unelucidated[ix].

However, in paragraphs 21 and 22, Alberti gives rise to the suspicion that he may have actually intended to be imprecise and to withhold key facts. Even though he asserts: 'I above all wish to be understood', he - puzzlingly - goes on to say: '...I doubt if much will be understood by the reader...' Also: 'Up to this point I have said useful but brief things; I believe [they are] not completely obscure', yet they seem to be intended only for the artist 'who really understands them well both by his intellect and by his comprehension of the definition of painting.' Again: 'He who does not understand this at the first glance will scarcely learn it no matter how much effort he applies.' This, he explains, is because of both the newness of the concepts and the necessary brevity of his exposition. While this may be so, it is very confusing as stated and would have been of no help whatsoever to the artists of Florence. It may have been the realization of this that led him to state, finally: 'I usually explain these things to my friends with certain prolix geometric demonstrations....'[x].

What may be going on here is a conflict in Alberti's mind between his humanistic desire to spread rational knowledge and the remnants of a mediaeval guild mindset of retaining craft secrets as arcane knowledge. On the other hand, was he simply adopting the stance of the erudite scholar as against the unlettered (and less intelligent?) artist?[xi] Or is this an early instance of the establishment of a humanist body of esoteric knowledge such as was to lead to the establishment of the academies?[xii] Alternatively, and perhaps more cogently, Alberti may have been using the cloak of mathematics to conceal the fact that his system really depends upon rule-of-thumb dimensions and personal visual adjustment - just as others have since. Is this, perhaps, his 'prolix geometric demonstrations'? We have no way of knowing.

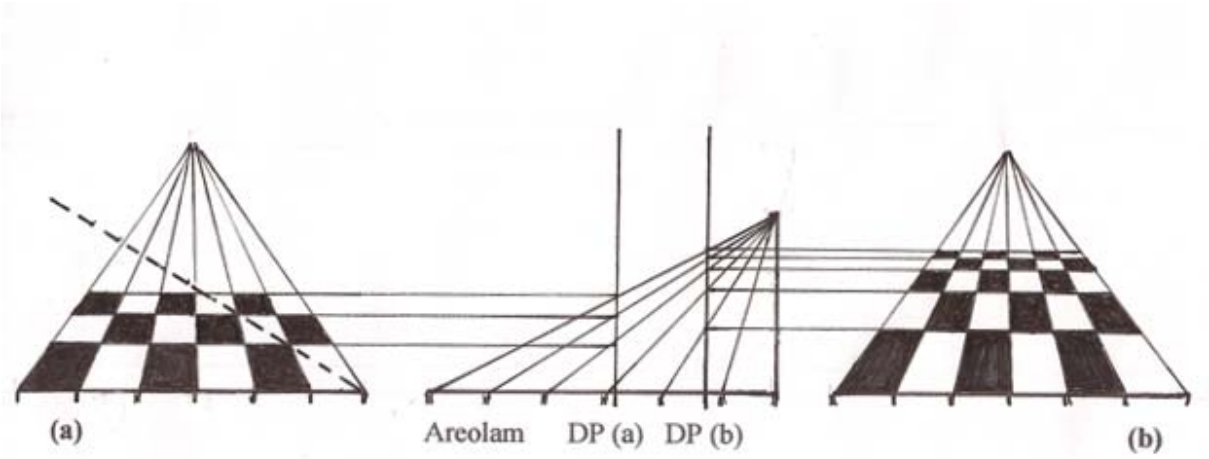

Figure 2: Effect of different placement of the distance point

But it may be that Alberti suspected, or was told, that the proof of his system is geometrically and empirically unsound. He insists that its mathematical validity is proven by drawing a single diagonal line through the adjacent 'squares' on the drawn pavement (Grayson, 1972, p.57). But, although it is possible to do this (Figure 2), the resulting quadrangles are not congruent and not squares in perspective! This is very obvious in the first (lowest) line of rectangles, which are clearly longer vertically on the picture plane than they are wide and the vertical-to-horizontal ratios of each figurechange from more rectangular to more square-like as they ascend. This is nothing like what Alberti claims would happen!

A comparison of Figure 1 and Figure 3 illustrates the deficiency. Figure 3 has been drawn by the present writer from monocular observation of a checker-board 250x250mm lying horizontally about 400mm from the eye, measuring the apparent vertical and horizontal lengths and distances on a ruler held at a constant distance from the eye[xiii]: the receding foreshortened squares are congruent, their vertical heights on the picture plane are less than their widths and it is possible to draw a single diagonal through them.

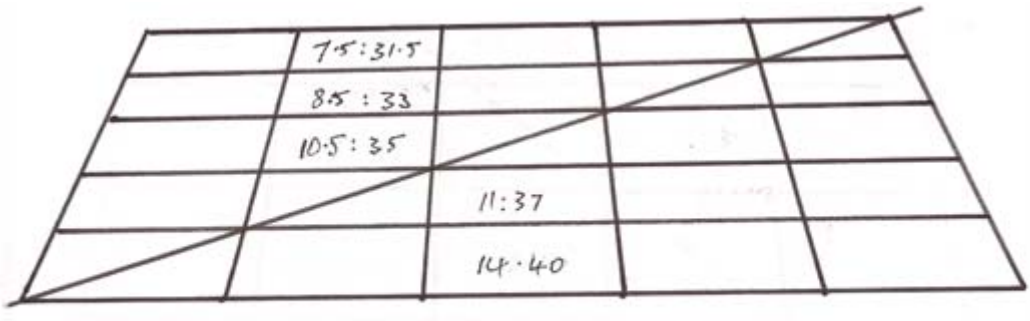

Figure 3: Checker-board drawn from observation

One thing we can be certain of is that Alberti was not – as some have assumed[xiv] – simply codifying the existing practice of his great artists contemporaries[xv]. We shall see below that at least Ghiberti, Masaccio and Donatello were using a superior system (or systems) well before *De Pictura* was published.

But it is remarkable that no commentator has ever discussed the matter fully[xvi]. In fact, Spencer in his drawings of the theory, indicates (1956, pp.110-111) that he has no idea of its deficiencies, insouciantly representing in the foreground very long rectangles, not foreshortened squares[xvii]. Similarly Gadol (1969, p.43), Grayson (1972, pp.112-113) and Edgerton (1975, pp.45-46). Massey (2003), on the other hand, discusses the difficulty of the distance point concept. The one writer to call Alberti's mathematics into question is Field (1997, pp.25-28).

The lack of congruence is readily evident in Grayson's drawing of the construction, although he has not noticed it![xviii] This is a truly amazing drawing for amajor Alberti scholar. 'For convenience of demonstration', Grayson says, he has shown 'the *areola* immediately below the painting surface' and it is shown as a square - but no reason is given for either deviation from Alberti's specifics[xix]. Further, it is clear that the transverse lines have not been calculated by any system, and it is not possible to draw a diagonal through the construction. So Grayson - apparently unwittingly - represents precisely Alberti's criticism of earlier perspective formulae and not what he claimed for his construction!

One must express surprise and disappointment that the lack of clear definition of these two key elements of Alberti's system has not hitherto led his major commentators to question his putative position in the history of perspective theory[xx]. Ivins (1973, p.26) attributes Alberti's 'obscurity' to communication difficulties. Panofsky, apparently embarrassed by the omissions, 'formulate(s) it more liberally by dropping the condition of the rigorously maintained single point of view' entirely (1991, p.77, n.5). And Harries (2001, p.75) actually commends Alberti for 'the arbitrariness of the adopted point of view' as an indication of his advanced, scientific thinking – i.e., his belief that the universe is infinite and that the human - not god - is its referent. On the other hand, White (1972, p.122) questions commentators' neglect of alternative theories while Frangenberg (1986) discusses some of them.

THE RELEVANCE OF THE 'DISTANCE POINT'

Alberti asserted (Spencer, 1966, p.57) that 'a painted thing can never appear truthful where there is not a definite distance for seeing it.' Yet he declines to give a calculation for this distance point, saying simply that he places it 'as I wish' (ibid., p.57) - a distinctly un-mathematical attitude to be sure! In spite of this, most commentators have assumed that it is an essential feature of any convincing visual representation of space. However, few commentators have related the principle to any actual picture[xxi].

In Figure 1, the placement of the DP (the intersection) has been arbitrary, as Alberti clearly recommends. But it is completely unclear whether the distance which a viewer should stand from the picture is the length to the left or the right of the DP in the diagram[xxii]. The lack of specificity here borders on the ludicrous.

However, in fact, the effect of any picture on a viewer has nothing whatever to do with any putative or hypothesized distance point. It is a matter of simple observation that one can 'read' a picture almost as well from a postcard-sized photograph of it as from the original, even though the actual measurements - including distances - are entirely different. And this applies, too, when a picture of whatever size is viewed from a more or less acute angle of deviation from perpendicular to the picture-plane (Alberti's 'centric point'). Our visual system automatically makes appropriate corrections in both cases[xxiii]. This must have been realised by Michelangelo because a distance point would have been no use in designing his Sistine Chapel ceiling – a curved horizontal surface, to be viewed *di sotto in su* from indeterminate angles, and containing a number of separate pictures, each with its own individual representation of space.

What, then, can be the relevance of Alberti's distance point? In Figure 2[xxiv], two alternative DPs have been drawn, each at a different distance[xxv] from the vertical construction line. These yield two different arrays of the notional pavement, both equally useless: in (a) it is impossible to draw many more transverse lines closer to the horizon (and, therefore, represent objects in the top half of the picture accurately) and, in (b), a large part of the bottom of the picture is non-functional as it contains no transversals at all.

In (a), one's eye seems to be closer to the ground, whereas, in (b), one seems to be viewing from an elevated position because the horizon-line is higher[xxvi] - but viewing distance above the ground is not what the DP is alleged to indicate. In comparing (a) and (b) one has no sense of being closer to or further away from the picture's surface.

Figure 4 is drawn after the well-known Figure XV.a from Piero della Francesca's *De prospectiva pingendi* (ca.1474). It represents two checker-boards in plan bisected by a diagonal and, above each, the same checker-board in perspective with orthogonals drawn to central vanishing points. The diagonal from each plan-view is continued in the projection to DPs which are placed, without calculation, at different heights. It will be obvious that the higher the diagonal is placed the higher will be the view-point[xxvii]. Herein lies the only significance of the distance point – which, consequently, is mis-named.

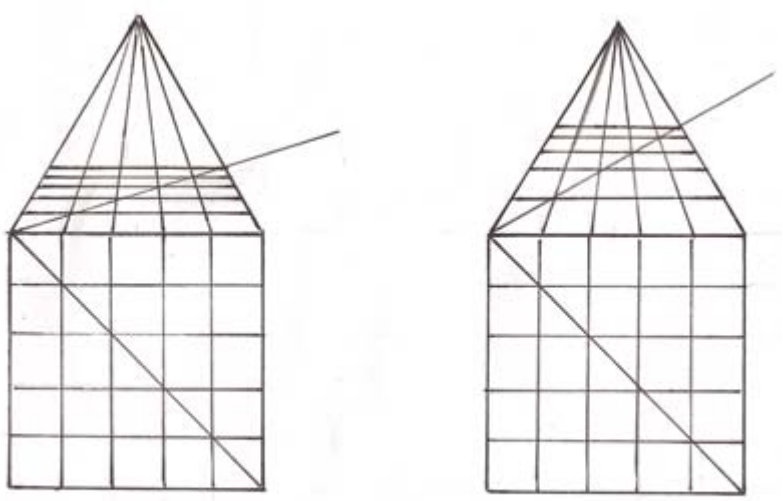

Figure 4: Two projections based on Piero della Francesca's Figure XV.a

If Piero's system is derived from Alberti, it is both more rational and more flexible[xxviii]. It follows an extremely simple, but logical, rule - so, can it be that Alberti's writing has been complicated (and contaminated) by some scribe or translator who intended, ingenuously, to clarify it? More likely Alberti's error is due to the grounding of his theory in mediaeval optics, which regarded vision as a mechanical or geometrical process and the eye as its site, neither of which is factual.

From the foregoing, it would appear that the interminable learned discussion about the exact location and function of the DP has been no more than a scholastic word-game, for it is an empty concept. One must ask why this has never been faced fully and frankly by the academic community: Damisch (ibid., p.446) says that the function of the distance point is 'decisive' and that he will 'demonstrate [it] elsewhere' - but enlightens us no further. Borsi (1989, p.199) and Klein (1979, pp.110-116) simply reproduce drawings made by others, without critical analysis or comment. Maynard (1994, p.25) does remind us that Panofsky (1991, p.77, n.5), taking his lead from Wolfflin, drops altogether 'the condition of the rigorously maintained single point of view'. He points out that photography has provided us with innumerable examples of perspective rendered without

construction and designates it 'a clearly false conception' (1996, p.30), but carries on his discussion regardless. White (1972, p.204) notes that Uccello did not use Alberti's system[xxix] and (p.275) expresses doubts about it as one of the 'present problems' of perspective theory. Vero (1980, p.40) admits that 'the real decision must be made with your eye'. In this sense, at least, Alberti's tradition lives on!

When one views a picture, one does not ask (however intuitively) where the DP is. Empirically, the optimum viewing distance of a picture is attained byinspection until a point of balance is reached between a minimum of eye movements and the ability to focus[xxx].

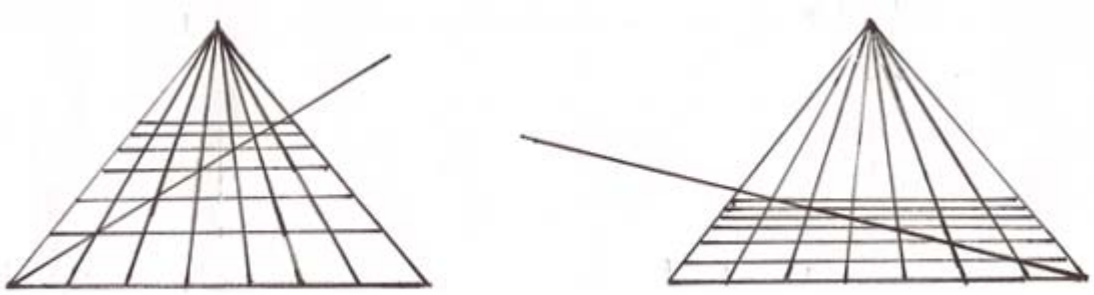

Figure 5: Constructions drawn from randomly-placed diagonals

THE DIAGONAL 'PROOF'

Alberti rejects on geometric grounds a practice by some artists of constructing a pavement in perspective based on a 1/3 reduction of the gaps between successive receding parallel horizontals (Figure 6) because it is not possible to prove mathematically by drawing a continuous diagonal line through the tiles[xxxi] (which is the case in a plan-view of a checker-board and, therefore, should also hold for one drawn in perspective)[xxxii].

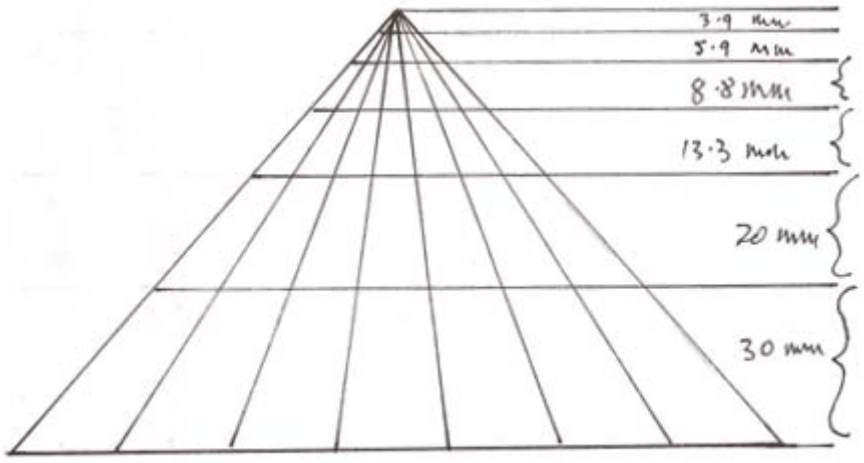

Figure 6: 2/3 reduction construction

The concept of 'squareness' is central to Alberti's theory in spite of the fact that the word 'square' is carefully avoided in Grayson's translation of paragraph 20[xxxiii]. Pure geometric shapes were considered significant by the Neo-Platonists, and Alberti was of this persuasion[xxxiv]. In any case, most commentators have assumed that Alberti meant his method to draw squares in perspective, not rectangles. It is crucial, therefore, that when (in paragraph 20)[xxxv] Alberti relies for the proof of his system upon the fact that a diagonal line can be drawn through the adjacent figures of his constructed pavement, this can be demonstrated. Well, as Figure 2 shows, a diagonal can be drawn, but this is through what are actually various non-congruent quadrilaterals, not squares[xxxvi]. In fact, being able to draw diagonal though adjacent quadrilaterals is not a proof of 'squareness' at all.

This is an indication that Alberti's 'proof' is circular because it is no more than the reverse of the construction[xxxvii]. In Figure 5, the rendering of the two pavements started with the diagonals, randomly-placed, without any construction, so the 'proof' is the construction.

The weakness of Alberti's diagonal proof is alluded to, but not completely understood by, Field (1997, p.91) and Wright (1983, pp.67-70).

Because a diagonal can be drawn through the square-tiled pavements of Ghiberti, Donatello and Masaccio, discussed below, it is probable that they worked in the way the author drew Figure 3 – not using Alberti's system. This is common studio practice, and may have been so since Masaccio and Donatello first used it.

Actually, the construction of a squared pavement is not essential to an objective representation of space (see Figure 7).

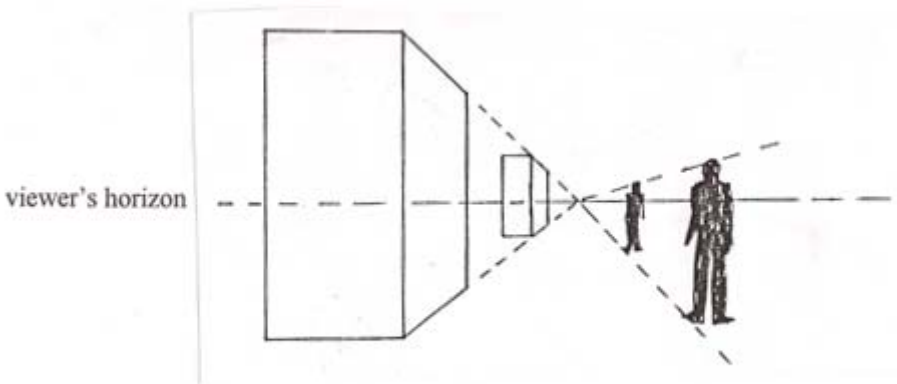

Figure 7: locating figures and buildings in pictorial space without transversals

THE HORIZON

Even though some commentators have assumed that the top horizontal of Alberti's construction represents the horizon[xxxviii], the concept of horizon is not found in Alberti's theory at all[xxxix]. This being so, we can only assume that the necessary connection between view-point and the perceived height of the horizon was unknown to him[xl]. However, the concept is an absolutely indispensable factor of our homeostasis. It embodies a rule that governs our perception both of the world and of a representational picture – i.e., (whether it is obscured or not) the location of the horizon is a fact personally evident - at each moment in time - to each individual when he/she looks straight ahead (i.e., 'horizontally')[xli]. And a corollary of this is that 50% of our personal visual space is sky – a fact that Alberti's system totally ignores. Thus, the concept is basic to any system of visual representation. Given this, and orthogonal lines drawn from it to the top and bottom of objects in the foreground, it is a relatively simple matter to place figures and objects in a landscape (Figure 7).

Isocephaly is really no more than the observation that, for people of a similar height, standing, the horizon appears to be at the same phenomenal height (i.e., their common eye-level). Again, there is no evidence that Alberti was aware of this[xlii]. Whether Ghiberti, Masaccio and Donatello were cannot be established but, from an inspection of their works, it is likely that they were. However, Figure XLI of Piero della Francesca's *De prospectiva pingendi* (ca.1474) clearly represents orthogonals receding to a vanishing point on the horizon, so the horizon's pictorial relevance may have been Piero's discovery. Its is also evident in later treatises - Serlio (published in 1537-47)[xliii], Pozzo (published 1693 and 1700) and in Vredeman de Vries (published in 1604-5), where the author clearly labels it *orisen* in many of his drawings.

Of course all the perspective projections that have been discussed in this paper are what we today know as single-point systems – i.e., there is only one, centrally-placed 'vanishing-point'. One of the several deficiencies in such systems is that the front faces of objects away to the left or right appear distorted, but there is no need to go into this in this paper[xliv].

QUATTROCENTO ARTISTS' PERSPECTIVE

It is instructive in this context to examine the use of perspective in the works of artists who were Alberti's contemporaries[xlv].

Lorenzo Ghiberti, 26 years older than Alberti, was an established master when *De Pictura* was published. His relief, *Isaac*[xlvi], from 'The Gates of Paradise' (the second set of doors

he made for the Florence Baptistery, in 1425-52) includes a large expanse of square-paved ground which appears to be in perfect perspective. A number of factors result in this set of doors exhibiting a mature Italian Renaissance style much more than his first set (of 1401-24) does. Krautheimer (1970, p.250) analyses this relief diagrammatically and claims that 'all the elements of construction used by Ghiberti in the Isaac panel' are contained in *De Pictura*. But, this is specious scholasticism: it is a matter of simple observation that Ghiberti's pavement can in no way have been derived from Alberti's construction because all the squares are shorter vertically than horizontally[xlvii]. Krautheimer is somewhat undecided about Ghiberti's own contribution to theory, quoting from his own book, *I Commentari*, 'I strove to observe with all the scale and proportion (*misura*) and to endeavour to imitate Nature in them as much as I might be capable...' (Krautheimer, ibid., p.232) but, from the evidence of the *Isaac* relief, it seems that this is just what Ghiberti did – i.e., observe and imitate, rather than read Alberti.

Ghiberti began writing *I Commentari* about the same time as Alberti was writing *De Pictura*, and was still working on it 1452, but it actually says almost nothing about the theory of perspective.

Donatello, too, was older than Alberti - by 18 years - and had worked with Ghiberti on his first doors for the Florence Baptistery until about 1406, during which time he would no doubt have been party to his master's deliberations on perspective[xlviii]. The relief of the *Slaying of the Dragon* from the base of his St George, on Or San Michele, Florence, was made in 1412, thirteen years before the publication of *De Pictura*. Although it does not include a squared pavement, various commentators[xlix] have noted that it is represented in convincing perspective. His *Feast of Herod* (c.1425), from the font of Siena cathedral, was made about a decade before the publication of *De Pictura* and is perfectly constructed in perspective - including a square-paved base. And, in his *Ascension* (Victoria and Albert Museum), he completely reverses Alberti's principle of *isocephaly*, the figures' feet being located on the base horizontal while their heads descend as they move further back.

The immaculate perspective of Masaccio's *Trinity*, painted in S. Maria Novella, in Florence, in 1427, predates *De Pictura* by 18 years. In fact, Masaccio was dead before Alberti wrote his book. Alberti's system would certainly have been of no assistance with this mural's *di sotto in su* view, even if it were possible to replicate it – inverted – in the coffered ceiling[l].

Piero della Francesca was younger than Alberti, being born ca.1420 or, perhaps, a decade earlier. His *Flagellation of Christ* (ca.1460), in the Galleria Nazionale della Marche, Urbino, is universally admired for its representation of space. Although there are some minor inconsistencies in its perspective scheme, the representation of the pavement is immaculate and exhibits nothing of the deficiency of Alberti's system[li]. The same can be said of his *Ideal City* in the same museum[lii]. Piero, of course, was a considerable mathematician as well as a painter and developed his own perspectivesystem.

Lefaire (1994) notes that Andrea Mantegna was an associate of Alberti in the ducal court of Mantua, the former arriving there in 1459 and the latter a year later. But an analysis of the squared pavement in the younger man's *Circumcision of Christ* (Uffizi) indicates no reference to Alberti's theory: the tiles are all shorter vertically than horizontally (although, oddly, the entire seven rows are a constant, non-diminishing, ratio of 1:5, leaving the orthogonals to carry the perspective alone). Mantegna rarely relied on linear perspective to achieve his very convincing representations of space, the most remarkable being the heavily foreshortened *Dead Christ* (Brera, Milan). This seems to indicate that he drew from observation rather than using any theoretical perspective scheme. Leonardo's preference for working from perception, rather than using Alberti's formula, is detailed in Farago (1994).

On the other hand, a number of lesser painters seem to have applied Alberti's scheme, representing pavements in rectangles, not squares. Some well-known examples: The painting by an unknown artist of *The Burning of Savonarola* (dated '15th-16th century')[liii]; Giovanni di Paolo's *Annunciation* (ca.1440-1445)[liv]; and Carlo Crivelli's*Annunciation* (1486)[lv]. Many others are illustrated in the literature although, in no case does the author indicate recognition of their deficiency.

It would seem that this is empirical evidence that perspective was developed in the artists' workshops - possibly from Brunelleschi through Donatello and Masaccio - rather than by Alberti. Clark (1944) and Ackerman (1991) recognise this, the latter somewhat reluctantly (ibid, p. 76).

CONCLUSION

Alberti's system of perspective is impossible to draw without making certain arbitrary and unmathematical assumptions, and it would have been of no practical use to the artists of quattrocento Florence – the alleged beneficiaries of his treatise. Rational evaluation of his contribution to the theory of perspective construction does not support its current

position of honour in the field; nor does it speak well of the successive generations of academics who have uncritically accepted his vague and unscientific assertions and not attempted to render them graphically or test them practically.

And it must be a significant fact that, of all those who have written perspective theory over the centuries, it seems that only Filarete acknowledged Alberti as a predecessor[lvi].

The available evidence supports the view that the principles of perspective were developed in the workshops of the artists of quattrocento Italy, not by Alberti[lvii].

In his reluctance (or inability?) to reveal how to complete the construction of the *areolam* and to calculate the distance point, together with the impotence of his cherished diagonal proof, Alberti should have condemned himself to oblivion. That he did not do so is, without doubt, the fault of the scholasticism of the academic community[lviii].

We can, perhaps, be more charitable to Alberti himself and recognize that he may not have been so much the rational and scientific Renaissance man commentators have considered him to be[lix]. In criticising him for taking an arithmetical approach when a geometric one was called for, Giusti (1999) notes that, although he said he was writing *De Pictura* as a painter, Alberti was not a painter; he was - in fact - writing as a scholar, which explains his privileging line over colour and the fixed viewpoint (which is the one the reader of a page takes) over how we actually perceive the world.

Also, we must acknowledge that his system does, however roughly and loosely, approximate how humans perceive the world and realist artists represent it[lx]. And, of course, nothing can detract from the fact that Alberti's perspective theory contributed to the development of humanist thought generally – a fact which Panofsky (1991, p.65) summarizes as: 'this perspectival achievement is nothing other than a concrete expression of a contemporary advance in epistemology or natural philosophy'[lxi].

NOTES

[i] The usual English translation of which is 'more sensate wisdom', although Elizabeth G Holt (1957) uses 'grosser method'. The English translation of this phrase remains debatable; however, it is clear that Alberti was at pains to distance his thesis from mathematical theory and address the application of perspective to the art of painting.

[ii] A *braccio*, the notional length of a forearm with fingers outstretched, was a common measure in 15th century Florence (equal to approx. 58cm).

[iii] See, for example, Grayson (1964), pp.18-19).

[iv] 1972, p.57 and p.116. Others interpret it variously, although to no practical effect.

[v] Apparently *picciolo* is an archaic form of *piccolo* (small) as is *areolam* of *areola* (a little bed or quarter in a garden). The *Encyclopaedia of World Art* translates it as 'a small space' (CVX, col., 206)

[vi] Listed in Grayson (1964), pp.18-19, n.13.

[vii] Edgerton (1975/76), p.44. See also Grayson's slightly different version (1964), p.17.

[viii] Although Grayson's discovery has been accepted by other commentators, it is unclear as to whether, and to what extent, they checked his sources.

[ix] Salgado (1998) lists the many assumptions Alberti interpreters have had to make to validate his theory. Borsi (1989, p. 204) wonders if Alberti really fully understood his theory, but fails to enlarge on this. The relevance of the DP is discussed further below.

[x] Spencer (1956) translations.

[xi] '*Artefici*' (artisans) was the term used by Alberti, according to Damisch ibid., p.59.

[xii] On this point, see Clark (1944), p.292.

[xiii] A time-honoured method of the artist that may be replicated readily. Alternatively, a photograph of a checker-board may be used, standard camera lenses being ground to simulate naive human monocular perception.

[xiv] Panofsky (1970, p.124ff) credits Alberti with '...organizing...a scheme employed by progressive Italian painters from ca.1340...' Filarete's position does not need considering as he simply follows Alberti (Book XXIII, Folio 177v).

[xv] About whom, incidentally, he was exceedingly condescending in his dedication.

[xvi] Ackerman (1991) mentions this historical fact in a footnote (p.92, #50).

[xvii] Inexplicably, in Diagram 1, he places the central point four *braccia* high, not three as Alberti specified – a clear indication of defective scholarship.

[xviii] *Op.cit.*, 1972, p.116, Figure 3.

[xix] Actually, this construction is anachronistic, being that of Piero della Francesca - not Alberti - but without Piero's essential diagonal construction (see Figure 4)!

[xx] Maynard (1996) ably summarizes the position and characterizes it as 'entrenched confusion'.

[xxi] An exception is Krautheimer (1956) who, in his discussion of Masolino's frescoes in the Branda Chapel, S. Clemente, Rome (pp.241-243), observes that, in *The Death of St Ambrose*, the foot-board and head-board of the bed in which the saint lies appear to be of different widths. As they are placed orthogonally to the picture surface, he assumes that each must have been constructed from a different (vertical) 'distance point', although he takes the discussion no further.
Harries (2001) alludes to 'Every painting with a pavement painted in accord with Alberti's construction...', but declines to identify any - which is not surprising, since none of the artists of the day would have been more able to follow Alberti's writing than the present author is!

[xxii] I owe this observation to Donald Leslie Johnson.

[xxiii] Psychologists know this as perceptual constancy (see English and English, 1958, p.114).

[xxiv] Which is drawn strictly from Alberti's instructions, unlike Grayson's, Spencer's or Panofsky's.

[xxv] As Alberti declined to publish any clear indication as to where the DP is to be properly located, there can be no objection to taking this experimental approach.

[xxvi] See below for further discussion of the horizon.

[xxvii] See Panofsky (1991, p.131).

[xxviii] White (1972, p.122) notes Alberti's ignorance of a simpler method of construction used in Northern Europe, which may be the source of Piero's system.

[xxix] This is not, however, surprising since Uccello was a mature artist in 1435.

[xxx] This is discussed in Frangenberg (1986). On the other hand, White naively refers to 'the psychological effect of the artist's own distance from his work while creating it' (1972, p 194).

[xxxi] This model does, however, produce a representation of a receding pavement, although not of square elements – but neither does Alberti's.

[xxxii] I am indebted to Dr Alan Lee for his informative comments on this.

[xxxiii] '*E a questo modo mi trouvo descritto tutti e' paraleli, cioe le braccia quadrate del pavimento nella dipintura*...' only as 'In this way I have all the parallels of the pavement drawn'. Spencer (1966), p.57, on the other hand, translates '*le braccia quadrate*' as 'the square[d] braccia'. This is reasonable because paved surfaces are usually of square tiles.

[xxxiv] See Panofsky, 1968, p.58

[xxxv] Grayson (1973), p.57, line 17ff. Spencer (1966), p.57.

[xxxvi] It is odd that Edgerton, given his discussion of this point (op.cit., pp.46-47), failed to notice that his Diagram III-4 does not draw squares in perspective. This can be established by calculating the height-to-width ratios on the picture plane of the first and

last represented quadrilaterals: they are (as far as can be calculated) respectively 1:2 and 1:5. (Cf Figure 3. The proportions indicated are the vertical height:length of lowest horizontal.)

[xxxvii] This is denied by Ivins (1973, p.25), who, however, reveals that he is unaware of Piero's important contribution.

[xxxviii] One of whom is Panofsky who states (1970, p.125) that Alberti 'assumed...a central vanishing point (which determines the "horizon" of the picture...)'. Another is Salgado (1998).

[xxxix] Noted by Grayson (1964) and Ivins (1973, pp.21. 26). Neither does he use the term 'vanishing point', which follows.

[xl] He had, after all, the ideal opportunity to dilate upon it when he discussed *isocephaly* in paragraph 20.

The phenomenon being referred to here is the observable fact that the horizon appears to be 'higher' when viewed from a tall building than when viewed, for example, from the beach.

[xli] Actually, it is a corollary of our autonomic and somatic sense of the vertical (and physical balance). See Gibson (1968) and Gregory (1970).

[xlii] This also applies to his follower, Filarete (published in ca.1461-64) and to Viator (published in 1505).

[xliii] The English translation of 1611 is specific in the fourth paragraph of Book II, Chapter 2: 'The second line is that....which some call sight....But the horison is the right name thereof, for the horison is in every place wheresoever sight endeth.'

[xliv] It is illustrated in many of the drawings in Vredeman de Vries (1968). Goodman (1976, p.10ff) gives a cogent critique of the value of a fixed monocular system of perspective. On this, see 'Curved Perspective: Cracking the Nut' by the present author (published on his web-site).

[xlv] He dedicated *De Pictura* to Brunelleschi and also mentioned Masaccio, Donatello and Lucca della Robbia in the dedication. Maynard (1996, pp.30-31) demonstrates the German, Durer's, mastery.

[xlvi] Also known as *The Story of Jacob and Esau*.

[xlvii] Krautheimer, op. cit., discusses the relationship between Brunelleschi, Alberti and Ghiberti in Chapters XVI and XXI.

[xlviii] But we also should remember that Manetti tells us that Donatello helped Brunelleschi draw the Roman ruins (mentioned in Kuhn (1990), p.120).

[xlix] For instance Pope-Hennessy (1949). The author of the entry 'Perspective' in The Encyclopaedia of World Art believes that the perspective in this relief derives directly

from Brunelleschi. Kuhn (1990) has the same opinion about Masaccio. This may well be so, considering that - as younger men – all three studied together in Rome.

[l] Kuhn (1990) instructively points out Masaccio's dependence upon Brunelleschi, stating our 'need to read *De Pictura* in the light of the *Trinity*, rather than the other way about', (pp.128-129). Aiken (1998) is equivocal in the matter.

Hills' (1987, p.139) admission that 'Brunelleschi and Masaccio are likely to have anticipated Alberti's formulation of the laws of linear perspective…' damns Masaccio with faint praise. In fact, as we have shown, Masaccio in no way depended upon Alberti for his method. And Hills proffers no evidence for including Brunelleschi in this strange statement.

[li] In spite of this, Panofsky (1970, p.123, n.2) implies – anachronistically - that Alberti wrote because systems like Piero's were 'much too unwieldy' for painters.

[lii] Attribution of this work to Piero is in doubt (see Damisch, 1994, p.169 ff) but, if it is not his work, this would likely increase the number of painters who knew more about perspective than Alberti.

[liii] Plate 91 in Volume II of *The Encyclopaedia of World Art*.

[liv] Plate 218 in E H Gombrich's *Art and Illusion*

[lv] Plate 3 in R E Gregory and E H Gombrich's *Illusion in Nature and Art.*

[lvi] That Leonardo da Vinci had a copy of *De Pictura* in his library is recorded in the *Codex Urbinas*.

[lvii] Acknowledged by Klein (1979).

[lviii] Perhaps we can exempt late 20th-century writers on visual perception – such as Gregory, Kaufman, Gibson, Goodman and Pirenne (who simply ignore Alberti) – from this stricture.

[lix] Recognised by Gadol (1969, p.18ff).

[lx] That he was the first to do so is acknowledged by most commentators and is not challenged here.

[lxi] Ackerman notes that this was Alberti's 'most influential and revolutionary contribution to the history of art' (1991, p.76). See also White (1972, pp.121-126).

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