Carlo Crivelli’s *Annunciation* (1486)  
A Computer Investigation into  
Renaissance Painted Perspective  

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This article examines the manipulation of the rules of perspective to create variations in human scale within the scene in Carlo Crivelli’s masterpiece, the *Annunciation* of 1486. To carry out this analysis it is necessary to construct a model of the space represented in the painting. Such a model is made possible for the first time through the new technology of computer aided design software (CAD). Crivelli emerges from this analysis as a figure at once knowledgeable in the optical science of perspective but fully prepared to manipulate its rules to achieve scenographic effects.  

**KEY WORDS** Crivelli, perspective, CAD  

Carlo Crivelli’s famous *Annunciation* was commissioned as an altarpiece for the church of SS. Annunziata in Ascoli Piceno, to celebrate the new self-governing status granted to the town by Pope Sixtus IV in 1482.¹ Ascoli had instigated an annual procession to the church which was held on the feast of the Annunciation, when news of the agreement had first reached the town. Both events had thus become bound together. A phrase was coined to describe the new arrangement with the Papal authorities, ‘Libertas ecclesiastica’ (‘Freedom under the Church’), and this motto reappears at the base of Crivelli’s painting. The base also contains a series of coats of arms which, reading from the left, belong to the town’s bishop Prospero Caffarelli, to Pope Innocent VIII and to Ascoli. The scene itself interprets the appearance of the Archangel Gabriel before the Virgin Mary as described in the gospel of St. Luke (I. 26–38). According to the gospel, the angel predicts that the Virgin will conceive a son through the intervention of the Holy Spirit, and that the child would be the son of the Most Holy and be called Jesus. Unusually for a scene depicting the Annunciation, Crivelli’s mas-
terpiece includes other figures together with the Archangel and the Virgin, although the event itself is symbolised following convention with a dove descending along a shaft of light. The Pope is portrayed as an angel, on the left of the painting, whilst to his right is the patron saint of Ascoli, St. Emidius (Emygdius), who is carrying a small model of the town.²

I. Crivelli and the Development of Perspective Theory

The rules of one-point perspective were ‘invented’ by Brunelleschi, and codified by Piero della Francesca and Leon Battista Alberti. By the date of the Annunciation, 1486, both Alberti and Piero had written treatises on one-point perspective, and it would have been unusual for a Venetian artist of Crivelli’s importance not to have encountered their writings.³ Within the single-point perspective system, which Crivelli appears to be applying in the Annunciation, parallel lines must converge at a vanishing point somewhere along the horizon. Since diagonals across similar flat rectangles are parallel, these diagonals must also converge on this horizon, at points described as ‘distance points’. In Il Beato Gabriele Ferretti in estasi (possibly dated 1489),⁴ Crivelli naïvely represents the receding sides of the background buildings dropping to a vanishing point below the horizon. This, together with other earlier examples of crudely drawn perspective in Crivelli’s work, suggests at first glance that his use of perspective was restricted by his understanding of the mathematical system behind it. However his rigorous use of a single vanishing point in the Annunciation suggests that, on the contrary, he is prepared to manipulate the rules of perspective to create particular spatial effects.

The Annunciation is divided vertically into two equal parts: the right-hand (internal) side depicts the Virgin in an intimate setting whilst the left-hand (external) side is again split into two around the vanishing point. Thomas Tolley has recently observed that the painting is ‘notable for its spectacular perspectival scheme, based on a composition in Jacopo Bellini’s sketchbook, and is Crivelli’s most ambitious attempt at integrating figures and architectural setting’.⁵ The computer has facilitated the hitherto impossible reconstruction of this painted space, necessary to compare the painting’s perspective scheme with what were by Crivelli’s time well enough understood – if not always followed – optical rules of
single point perspective (as established by Alberti). Moreover the relative sizes and positions of the elements as rendered within the painting can now be compared: the following analysis proposes the 'ideal' sightline as coincident with the vanishing point, rather than assuming any particular point of view in front of the altar within the church.

II. The Computer Model of Crivelli's Scene

The primary grid, and hence fundamental starting point for this reconstruction, is the scene's tiled floor (Figure 1). In order to construct a model, an element which represents a regular geometric shape is required within any given scene, and it was therefore assumed that the tiles in the front row of Crivelli's picture are true squares. Since the purpose of the model was limited to a spatial analysis, the geometry of the scene was simplified. Small details within the painting were not modelled unless they were of importance spatially or they appeared to be 'wrong'. Certain areas which were hidden within the painting were completed in the computer model, however, such as the base of the left-hand building beyond the flight of steps obscured by the wings of the Archangel; by taking an identical viewing position within the computer model to that opposite the vanishing point in the painting, the depth of this building was 'tried-and-tested' until it matched the evident parts in the painting.

On constructing the model, it became obvious almost immediately that the floor grid does not correspond to the rules of single point perspective construction. As noted earlier, the diagonals of a flat tiled floor should cross the horizon at fixed distance points. In accordance with this, the diagonals of the foreground tiles (zone A: Figure 3) converge to distance points on the horizon. However, the tiles in the mid-ground (zone B), partially obstructed by the painting's main characters, converge to points below the horizon, whilst the diagonals of the furthest tiles (zone C) converge to distance points above the horizon. This inconsistency could, of course, be purely accidental; alternatively it might reasonably be explained as a deliberate 'system' of distortion, with the overall aim of shortening the perceived depth of the scene. According to this view, Crivelli would have first established his perspective grid by correctly constructing the tiles in the foreground of the painting.
Figure 1  Detail of Annunciation showing the tiled floor overlaid as a starting point for the construction of the computer model.

(zone A: Figure 2): he would then draw the furthest tiles deeper than their width in plan, making them seem larger and hence closer to the viewer (zone C). However, as we have seen these do not in fact occupy all the remaining space since the presence of the middle
Figure 2  Plan view of Crivelli's distorted tiles. Zones A, B, and C denote square, shallow and deep tiles.
zone of tiles (zone B) which are shallower than their width in plan suggests that Crivelli was also attempting to maintain the overall proportions of a correctly constructed (square) gridded floor. In fact, if we construct a floor of an identical number of undistorted tiles, its depth exactly coincides with that of the ‘distorted’ floor (Figure 2). This indicates that although Crivelli manipulated the scene’s distance points, he understood perfectly well how to paint a tiled floor ‘correctly’ in perspective. Indeed his concern to maintain the overall ‘correctness’ of the tiled floor is demonstrated by the fact that the deeper tiles are exactly offset with shallower ones, with the painting’s two main figures neatly concealing the changes in tile proportion.

Crivelli’s manipulation of the painting’s perspective is further demonstrated by the coffered ceiling to the upper room, in which

![Diagram of perspective and distance points](image)

**Figure 3** The various distance points used in the painting. The tiled area is shown separated into zones, A, B, and C, denoting square, shallow and deep tiles respectively.
the diagonals of the panels again recede to a distance point above the horizon (Figure 3). This has the effect of making the ceiling panels appear shallower than their width, lengthening the perceived depth of the room. However, an overlay on the painting shows clearly enough the distorted, elongated appearance of these ceiling panels if Crivelli had constructed them to correct distance points on the horizon (Figure 3 illustrates the distorted squares). In the lower room, the diagonals of the ceiling panels now focus below the horizon, giving the reverse effect in making the room

Figure 4  Part section of the computer model showing the depths of the upper and lower rooms.
appear shallower and creating a more intimate setting for the Virgin. Further, using the computer model the relative positions of the back walls of the upper and lower rooms can be easily compared to show the extent of Crivelli’s illusion. For whilst the upper room appears to be a lot deeper than the lower room in the painting, the computer model demonstrates that the upper room is in fact half the depth of that below (Figure 4). The arch on the side of the building (seen obliquely in the painting) further assists the illusion of depth in the upper room, for whilst it appears to be as wide as those on the front it is in fact dramatically reduced (and distorted) due to the lack of space (Figures 4 and 5).

The point at which the divine light touches the Virgin’s head can also be easily plotted within the computer model, as can the roundel in the wall through which the light passes. Using these two points, the direction and point of origin of the ray can be established in three dimensions. Although the light appears to emanate from the heavens, it in fact originates between the Archangel and St. Emidius at a height which is coincident with the springing point of the arch (Figure 5).

If the Archangel is taken to be an ‘ideal’ figure, whose height if measured according to convention would be three braccia (which we will equate with five feet nine inches), then using the model the other characters within the composition can be given relative heights (Figure 6). Since the kneeling figures in the foreground occupy a similar depth within the scene, their relative heights do not vary to any great extent. However, surprisingly enough the characters on the landing directly behind the front group are almost seven feet tall: this once again has the effect of bringing their perceived depth within the painting closer to the viewer. Moving back, the two figures near the arch appear to be at a similar depth within the scene and of a similar height. But the character at the base of the steps measures six and a half feet whilst the figure scrutinising the sky is in fact nearly a foot taller. The first figure beyond the arch, a woman to the left-hand side of the vanishing point, is a surprising nine and a half feet tall. The two furthest characters are even taller than this, measuring approximately eleven feet six inches. This is exactly double the height of the nearest figure, the Archangel used here as a datum and scale. Hence a pattern emerges: the figures get progressively taller the further back they are within the scene. Indeed, the positioning of these characters relative to the viewing axis of the scene also follows a simple rule,
Figure 5  Plan and front view showing the position of the divine light.
Figure 6  Scaled plan and longitudinal section showing the relative heights of the painting's main figures.
with the Archangel positioned to the left, St. Emidius to the right, the next character to the left and so on: this zigzagging continues down the axis of the scene to the back wall and has the effect of transporting the eye to the depths of the painting (Figure 7).
The appearance of the scene with the characters now scaled to an identical (standard human) height can be modelled (Figure 8, overleaf, left). The figures beyond the arch are obviously those most noticeably reduced in size and importance within the scene. Alternatively, if these standardised figures are to appear as represented in the painting then they must all be brought closer to the viewer and the building elements must also be compressed (the front floor tiles now become shallower in depth, and are no longer square as originally assumed) (Figure 8, right). The view loses the qualities of depth achieved by Crivelli. He is obviously manipu-
lating the heights of the characters rather than the depths of the buildings. Indeed, unlike the progressive increase in the figures' heights, elements such as doors and windows are clearly unaltered throughout the scene (with the exception of the side arch, the distortion of which is dictated by the perspectoidal manipulation of the upper room) (Figure 6).

The direction of light within the painting can also be studied using the computer model. The angle of the sun is quite low, as can be seen from the shadow cast by the peacock on the upper storey of the foremost building. For Italy, this shadow could indicate midday in early spring or late autumn. Indeed since the celebrations of the
Figure 9 Plan and part section showing the angles of light in the painting.

town's new self-governmental status were held on the twenty-fifth of March, this time of year approximately agrees with the shadows we see in the painting. The angle of the light can be calculated with the computer, using the shadow cast by St. Emidius's head on the wall of the main building and the sharply angled shadow in the Virgin's doorway. Assuming the view is due north, the light comes from an angle of forty-one degrees south-west and an elevation of twenty-one degrees from the horizontal (Figure 9). However, these shadows are not consistent with those cast onto the back wall by
the furthest figures and which indicate a much lower lighting angle in this part of the painting but their effect strengthens Crivelli’s illusion of reduced depth.

As well as proportional analysis in two dimensions on the picture plane, the computer model thus enables us to make spatial comparisons in three dimensions. It was noted that the furthest figure measures six braccia, exactly twice the height of the nearest figure. The canvas, or picture plane, is eight tiles wide which also turns out to be twice the height of the Archangel, that is six braccia; this is also the width of the opening of the triumphal arch. These similarities along with the manipulation of characters’ heights suggest that a coherent proportional system lies behind Crivelli’s perspective composition.

III. Conclusion: Crivelli’s Search for ‘Depth with Intimacy’

Crivelli’s one-point perspective scene is one of the most dramatic of the examples which date from this period. The painting prefigures the fixed one-point perspective stage scenery developed by Baldassare Peruzzi and Bramante in which, rather than the individual characters increasing in height relative to the scene as here, figures remain consistent and the scene diminishes as it converges on the vanishing point. Crivelli subtly manipulates the elements in the scene to balance depth with ‘intimacy’ whilst retaining apparent ‘realism’. As a result of the progressive enlargement of human scale throughout the depth of the painting, the figures do not appear to be lost within the perspective from the ‘ideal’ viewpoint opposite the vanishing point: their independence from the (mathematically defined) setting is emphasised, which adds to the ethereal quality of the scene as a whole. Crivelli’s complex management of the scene’s distance points and vanishing point, together with his alteration of the proportions of individual characters, demonstrate that by 1486 he had mastered perspective theory to such an advanced level he was able to adapt it to his own scenographic objectives. Indeed paintings which are dated later than this (according to the standard chronology of Crivelli’s work) frequently distort the rules of perspective more obviously. The Annunciation represents an imaginative application of, rather than a slavish adherence to, the emerging rules of perspective.
References


2. Ascoli has over forty towers, many of them dating from the time of the painting: these are visible on St. Emidius' model, aiding the town's identification. However, there is no obvious part of the model with which the scene can be identified. The model is probably changed (or 'idealised') beyond recognition.

3. Alberti's Della Pittura was written in 1436, and Piero's De Prospectiva pingendi was written by ca. 1474. Although Crivelli left Venice early in his career, he was keen to refer to his Venetian training.

4. The date of Il Beato Gabriele Ferretti in estasi is recorded as 1489 by the National Gallery in London, where it hangs; however it should be noted that Crivelli's use of perspective in the Annunciation (of 1486) is apparently far more consistent in its convergence towards a single vanishing point than in this (possibly) later painting, suggesting that either the paintings were produced in the reverse order, consistent with a sense of technical development, or that in both paintings the perspective rules are manipulated.


6. Since the painting is a simple one-point perspective, verticals are painted parallel with no foreshortening along any given vertical.

7. A sloping tiled floor would create a similar effect, but the brick courses of the adjacent buildings show that the floor is flat.

8. According to perspective convention, the length between the vanishing point and either distance point is equal to the separation of the ideal viewing position, or eye point, from the picture plane. In the Annunciation, this ideal viewing distance is twice the width of the painting, nine feet seven inches. The eye point (opposite the vanishing point) is at a height of six feet two inches, which accounts for the slightly elevated feeling when observing the painting.


10. These distorted tiles were modelled by a process of 'trial-and-error'; the result is accurate since it originates from a direct overlay on the painting.

11. The ceiling panels are consistent in their convergence to vanishing and distance points, although the furthest row of panels abutting the wall are shallower than the others.

12. A Florentine braccio was 58.36 cm (twenty-three inches).

13. The two figures are in fact separated by a depth of twelve feet within the model, the same width as the steps.