Winchester Palace, London - The Rose Window Geometry

Laurie SMITH

HISTORICBUILDINGGEOMETRY

Text
Geometry
Photographs
Book Design

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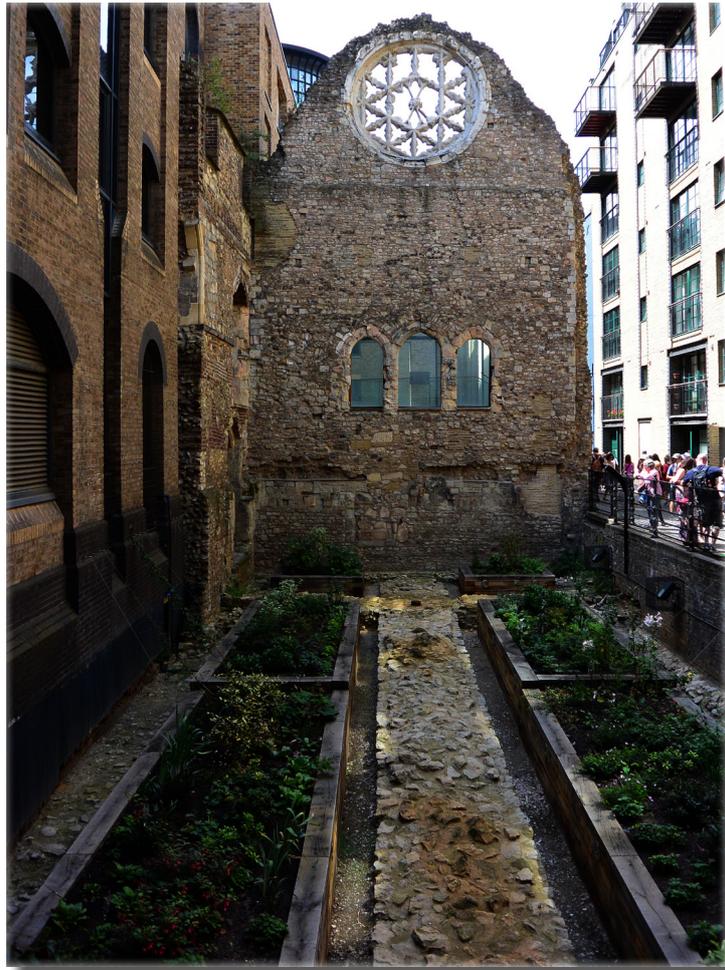LAURIE SMITH

Daisy Wheel Geometry
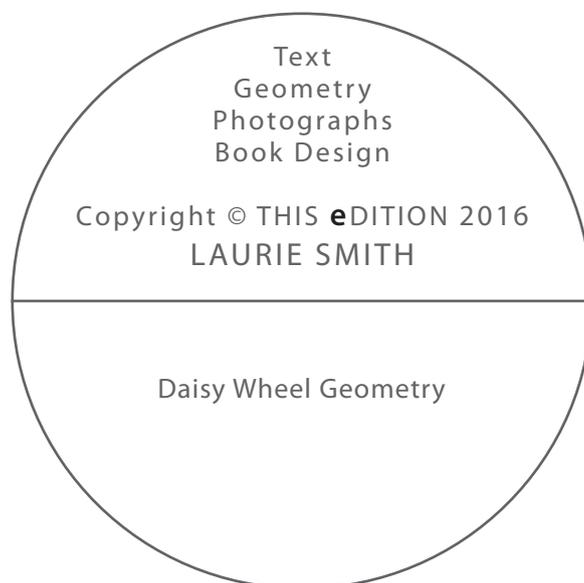
Laurie Smith is an independent early-building design researcher, specialising in geometrical design systems. Because geometry was part of the medieval educational curriculum he uses geometrical analysis to excavate and recover the design methodologies of the past, a process he thinks of as design archaeology. He lectures, writes and runs practical workshops on geometrical design and publishes his work through his website HISTORIC BUILDING GEOMETRY.

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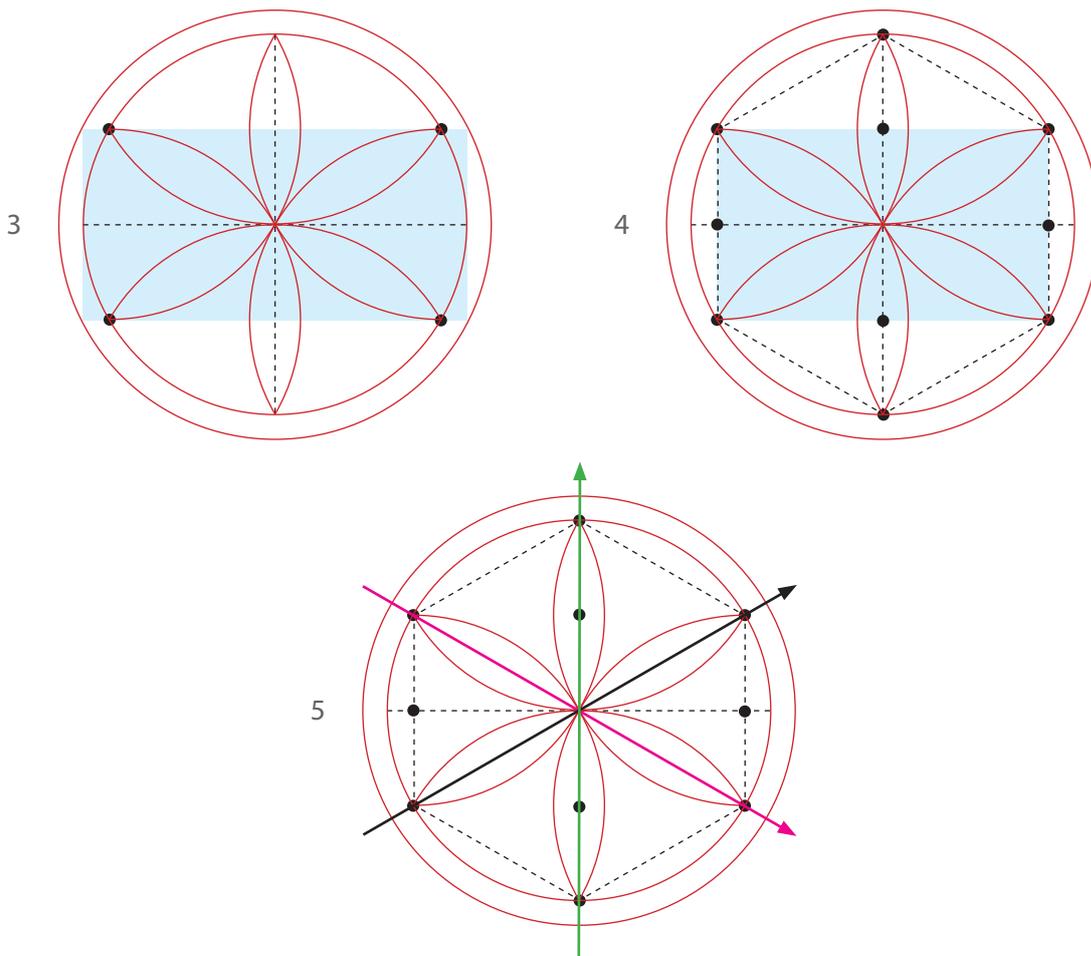### Winchester Palace, London   The Rose Window Geometry   *Introduction*

The hollow shell of Winchester Palace, a stone's throw from Southwark Cathedral, was once the London home from home of the Bishops of Winchester during their visits to the capital. The English Heritage signboard states that the palace was founded in the 12th century by Bishop Henry de Blois, brother of King Stephen.

The photograph in this text was taken from above street level but below the central axis of the Rose Window so that it has some vertical perspective variation. This shows around the circumference of the Rose where more of the upper inside of the window's rim is revealed by the angle of view than the lower rim where it is obscured by the angle of view. However, the geometrical basis of the window's design is clear and can be reconstructed using compass and straight edge daisy wheel geometry. The following pages show the developmental reconstruction of the design from the primary daisy wheel to the full rose construction.

1

2
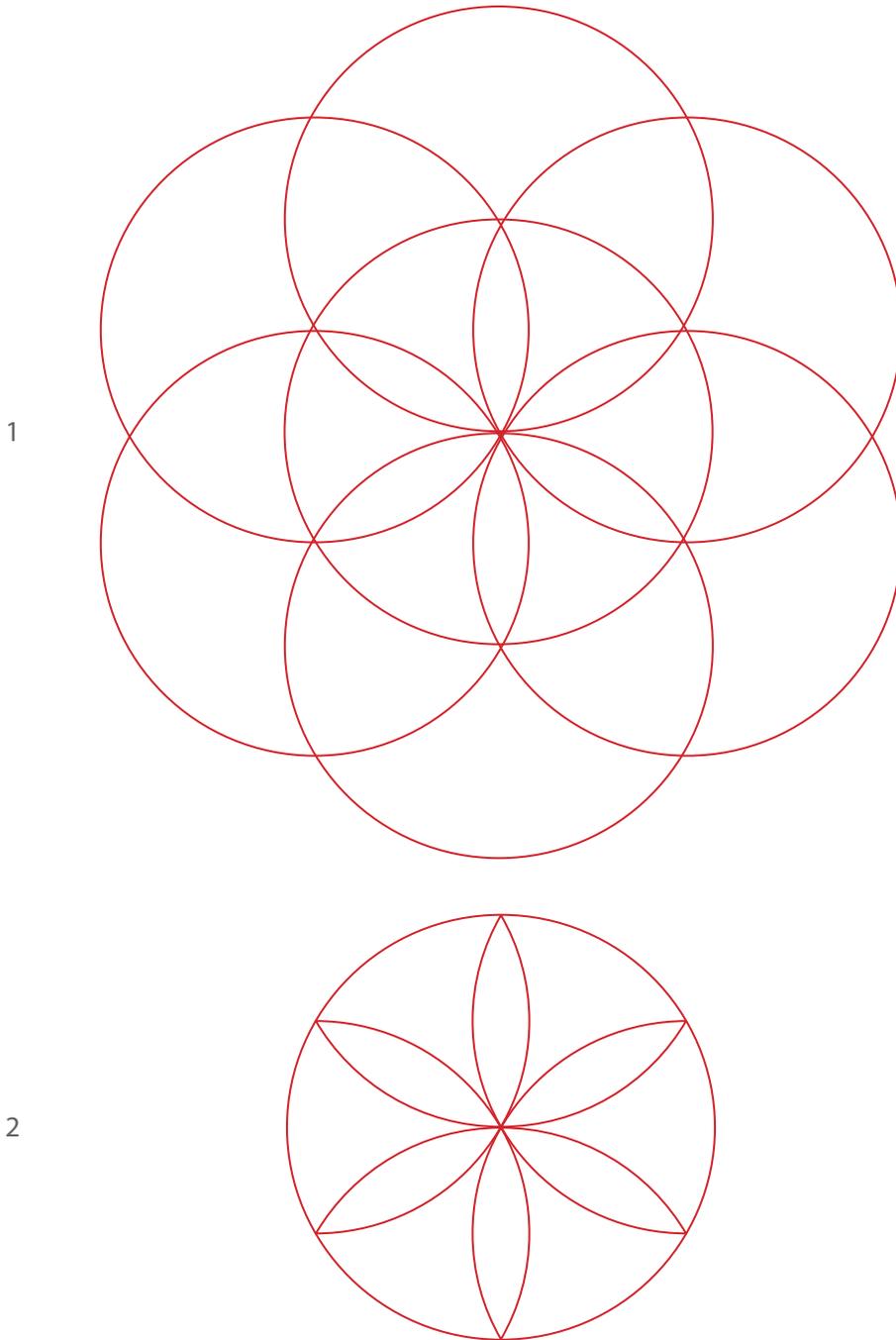
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The daisy wheel is a compass drawn construction of six circles spaced equally around the circumference of a seventh. It can be drawn either in full, drawing 1, or as a shorthand version showing only the primary (central) circle, drawing 2. The circles and arcs in both versions are drawn to a single radius. Drawing 2 is the geometrical base of the Winchester Palace Rose Window design.
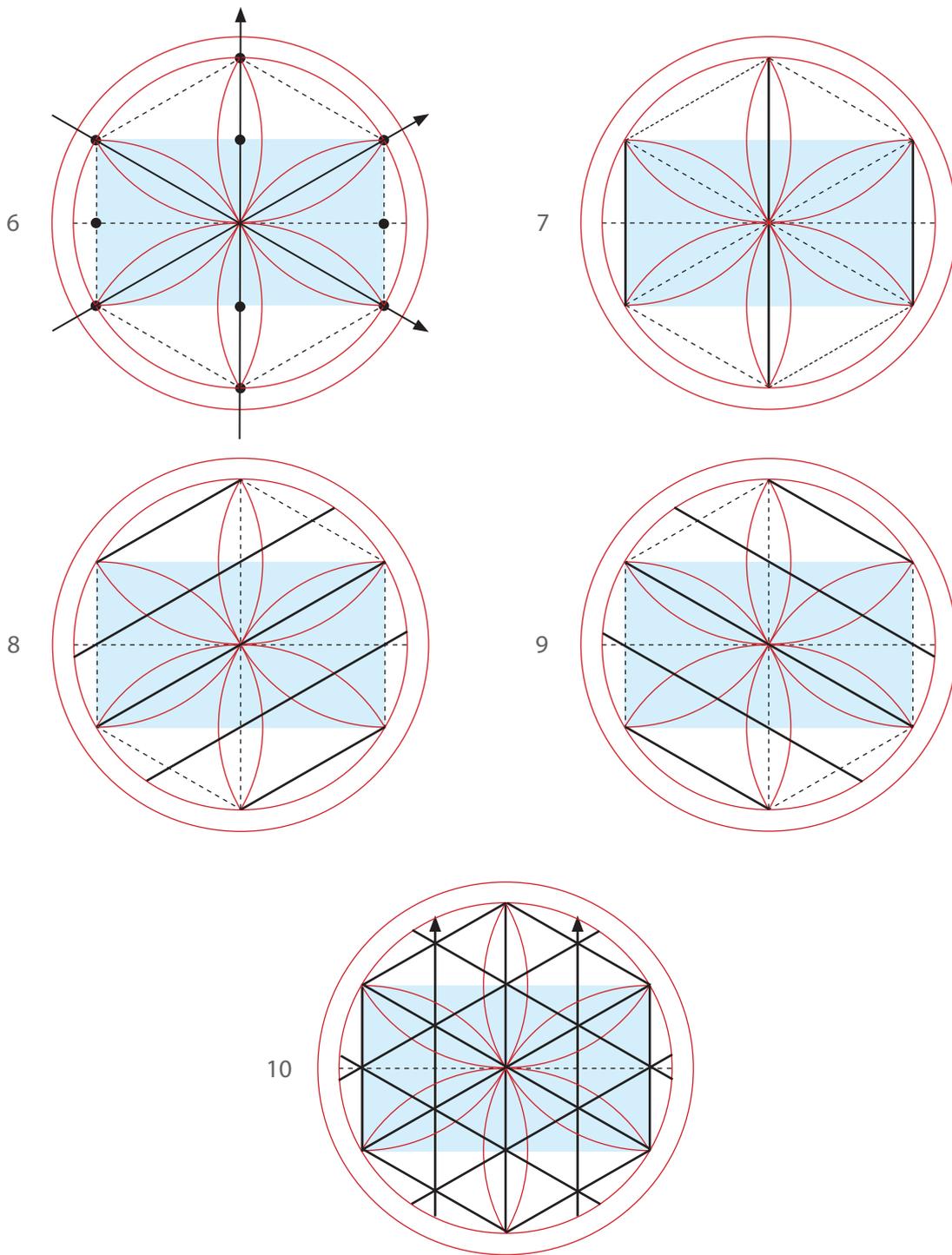
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The first stage in the design, drawing 3, is to establish the masonry boundary of the rose. Four points on the daisy wheel's rim are connected to form a rectangle which, in turn, is extended outwards until its short sides are tangents to the circumference of the primary circle. A second circle is drawn through the corners of the extended rectangle and it is the space between the primary and second circles that forms the boundary of the rose.

The second stage, drawing 4, highlights ten cardinal points that are crucial to the design: six daisy wheel circumference petal tips and four points at the centre of each of the rectangle's sides. The rectangle is drawn between four of the circumference petal tips.

The third stage, drawing 5, is not drawn as part of the rose window design but serves to draw attantion to a characteristic of the daisy wheel that will influence the design. It shows that if the daisy wheel's six radial petals are bisected they generate three diametric alignments across the wheel (in green, black and magenta). Commencing at one side of the circumference and passing through the wheel's axis to the opposite side of the circumference links three cardinal points in each of the three alignments and this can be read as a Trinity reference or even triple Trinity reference in the ecclesiastical rose window design. The daisy wheel is also the source of numerous equilateral triangles, for example linking any two consecutive petal tips with the wheel's axis, which can also be considered as a Trinity symbol.
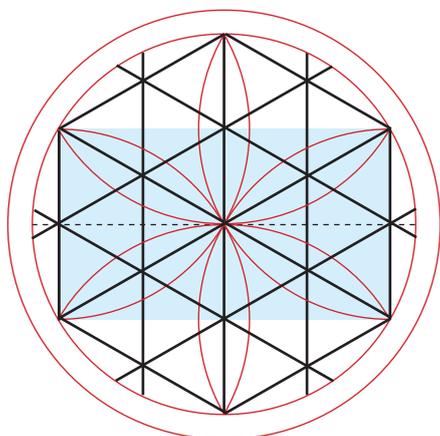
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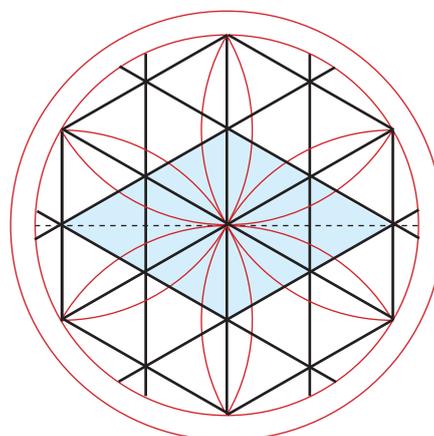## Winchester Palace, London   The Rose Window Geometry

Drawing 6 is for reference and indicates the three diametric alignments in the daisy wheel. Drawing 7 shows how three verticals can be drawn between the cardinal points in drawing 6. Drawings 8 and 9 show how five parallel lines can be drawn at mirror image angles through the cardinal points marked in drawing 6. Drawing 10 shows the three sets of parallel lines amalgamated into a grid which then allows the construction of two more vertical lines that pass through numerous points of intersection. The full grid comprises 24 equal equilateral triangles, the underlying geometrical matrix of the rose window's design.
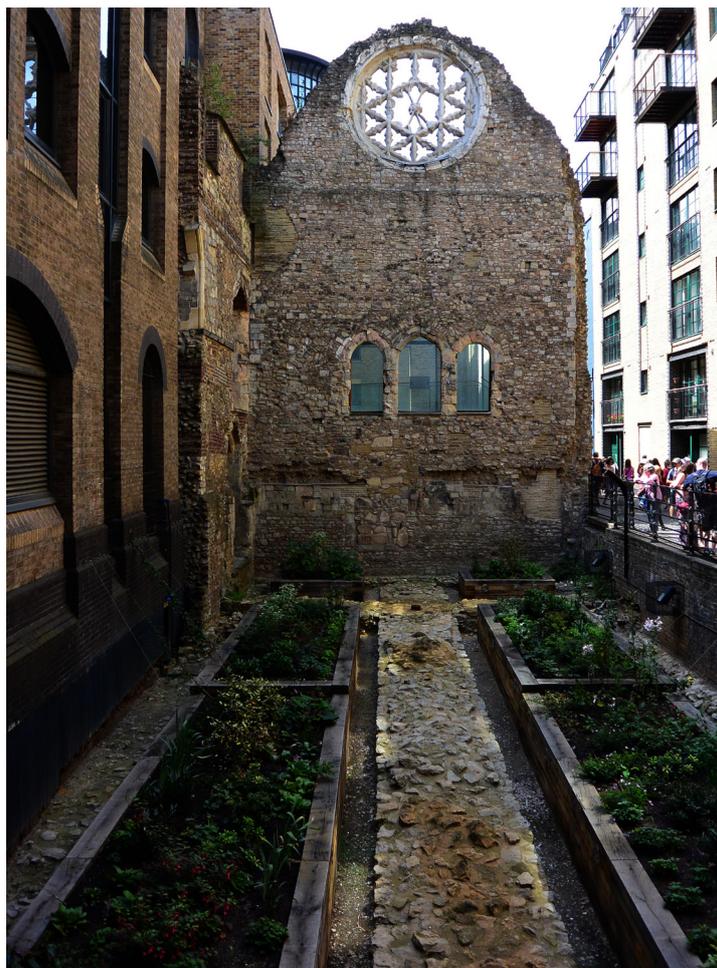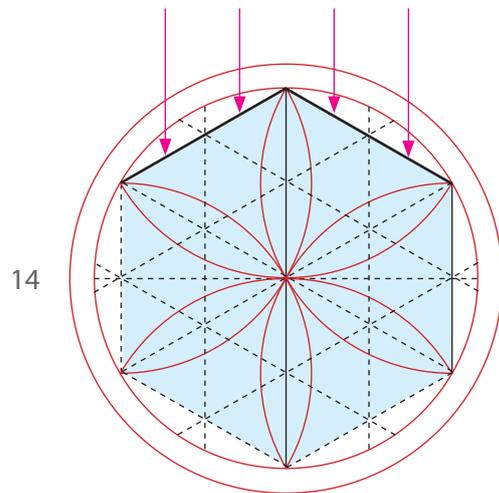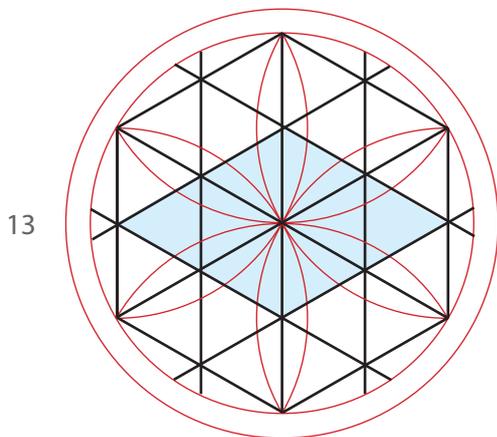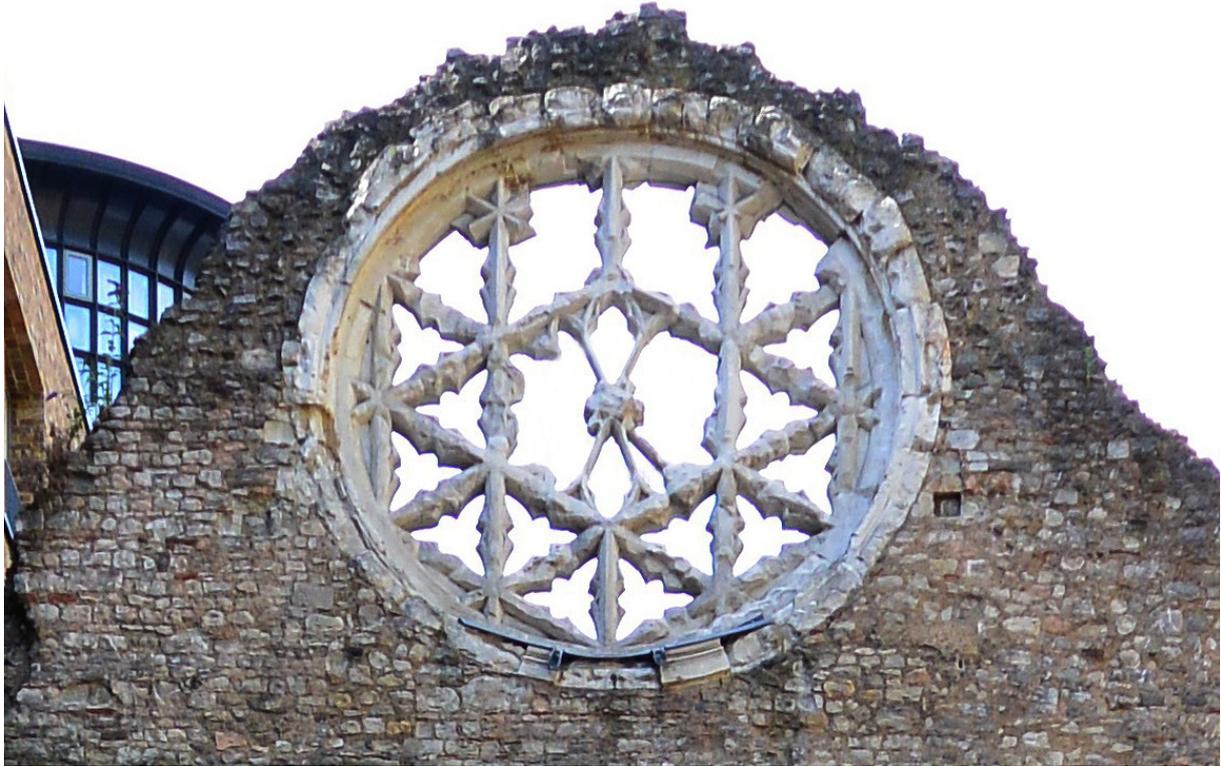
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12

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Drawing 11 is for reference and indicates the equilateral grid within the daisy wheel. Drawing 12 shows how a horizontal diamond can be observed within the equilateral grid matrix and how this is also visible in the photograph. With this diamond held in mind it can also be seen that the central sector of the rose has a different structure to the ring of equilateral triangles surrounding it.

13

14

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Drawing 13 is for reference and indicates the rose window's equilateral grid. Drawing 14 shows the pattern of equilateral triangulation within the window's overall grid and how four upper sectors of the window's masonry (marked by magenta arrows) are missing. These are indicated by the bold solid lines and mark the two upper sides of the hexagon boundary around the equilateral triangles. Like the diamond in drawing 13, the hexagon in drawing 14 can also be observed in the rose window.

15

16
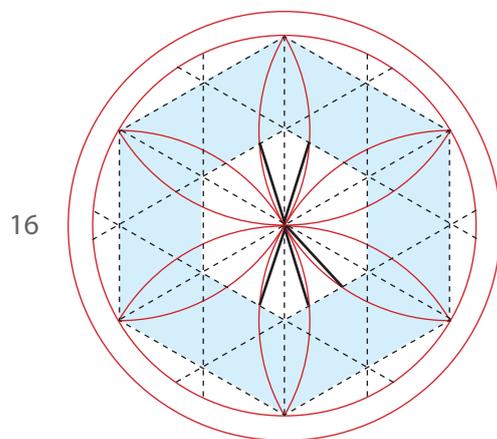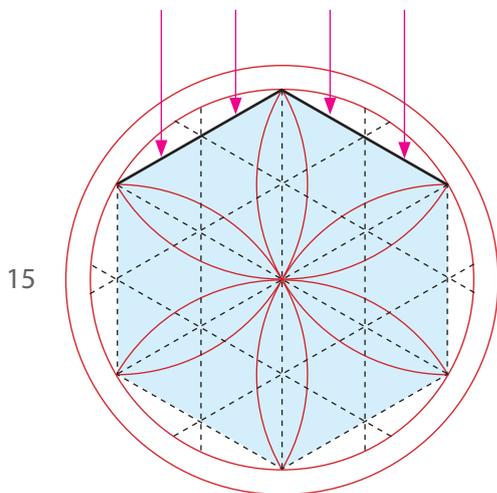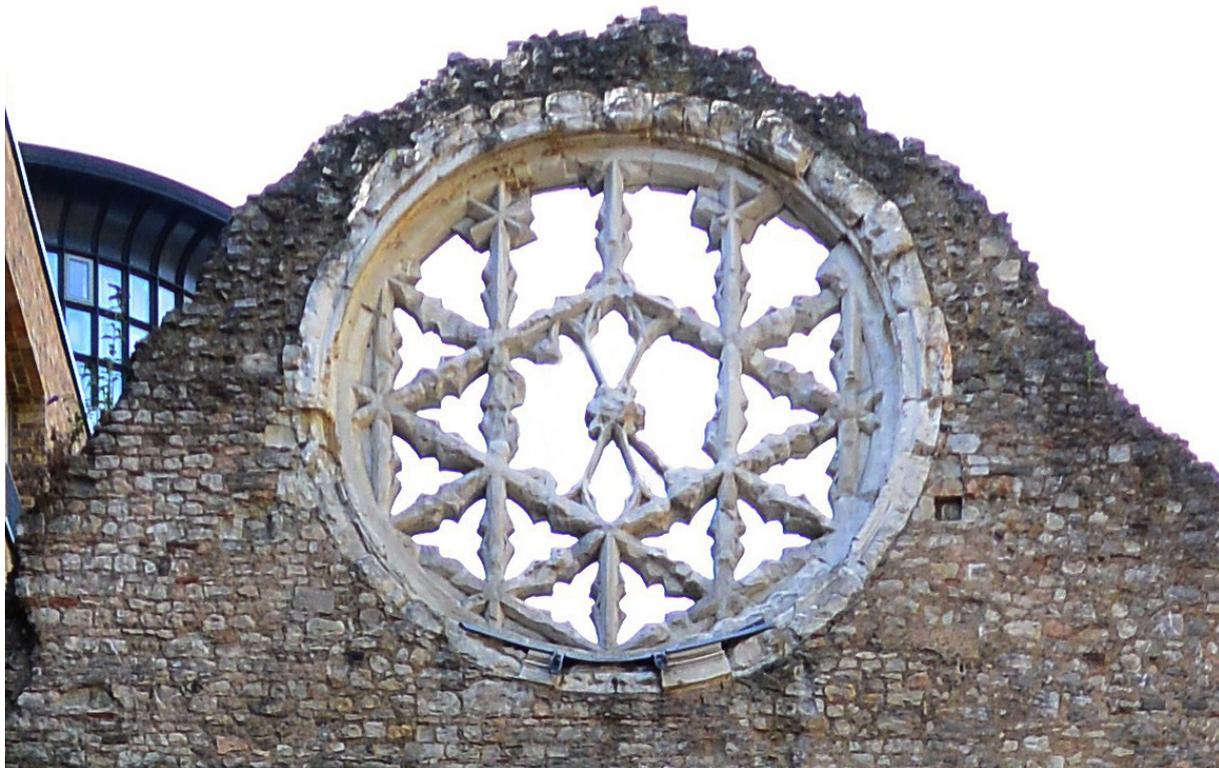
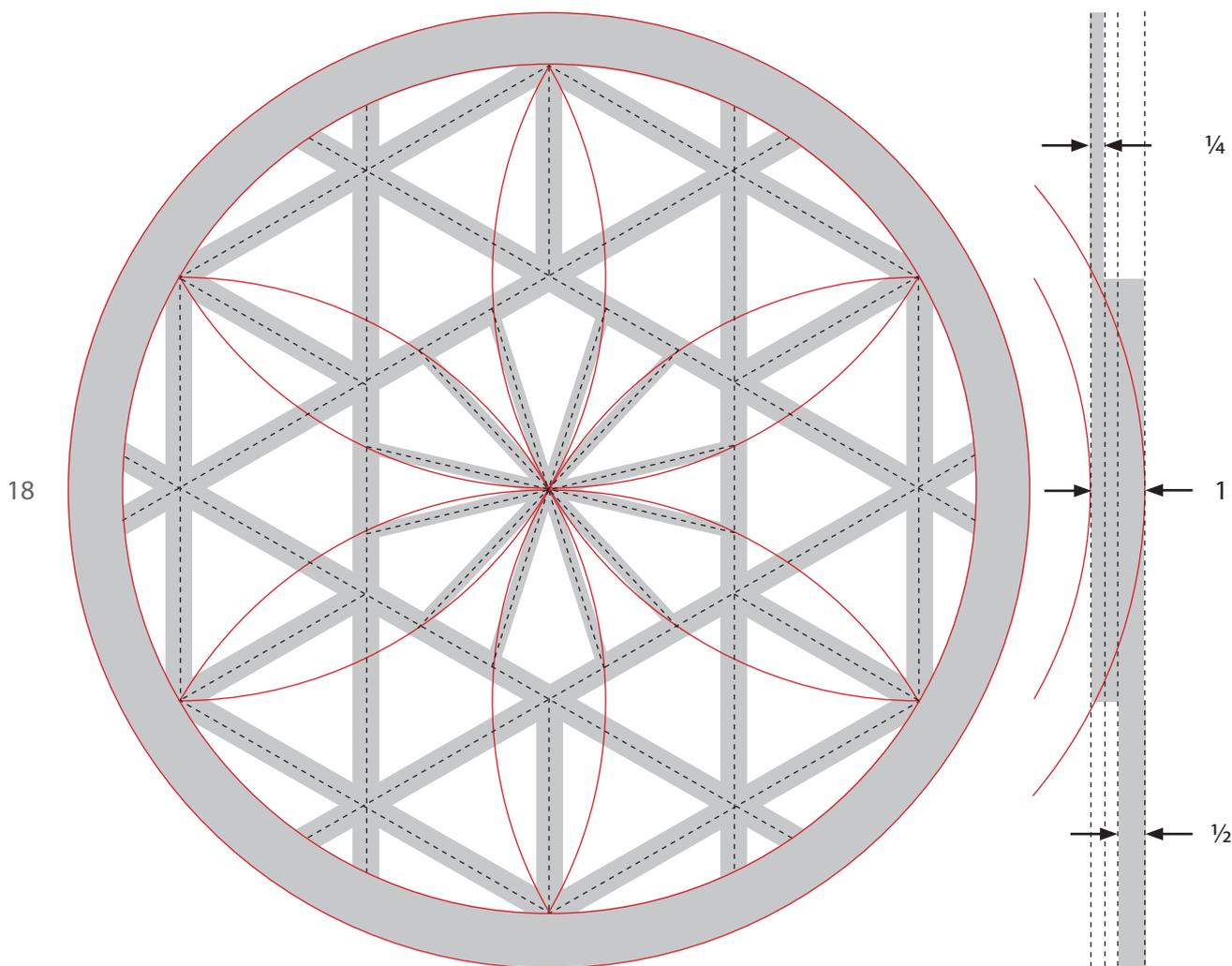**Winchester Palace, London**   The Rose Window Geometry

The photograph and drawing 15 are for reference and indicate the rose window's missing upper masonry sectors. Drawing 16 shows that, as well as an outer hexagon encompassing the grid of equilateral triangles, there is a smaller hexagon at the centre of the rose. This smaller hexagon was constructed more delicately than the surrounding grid of equilaterals as a twelve-spoked wheel, only five of which survive. It can be seen clearly that the spokes owe their location to the underlying daisy wheel geometry and specifically to the intersections where the small hexagon cuts the daisy wheel's petals. This is shown on a larger scale in drawing 17.

17
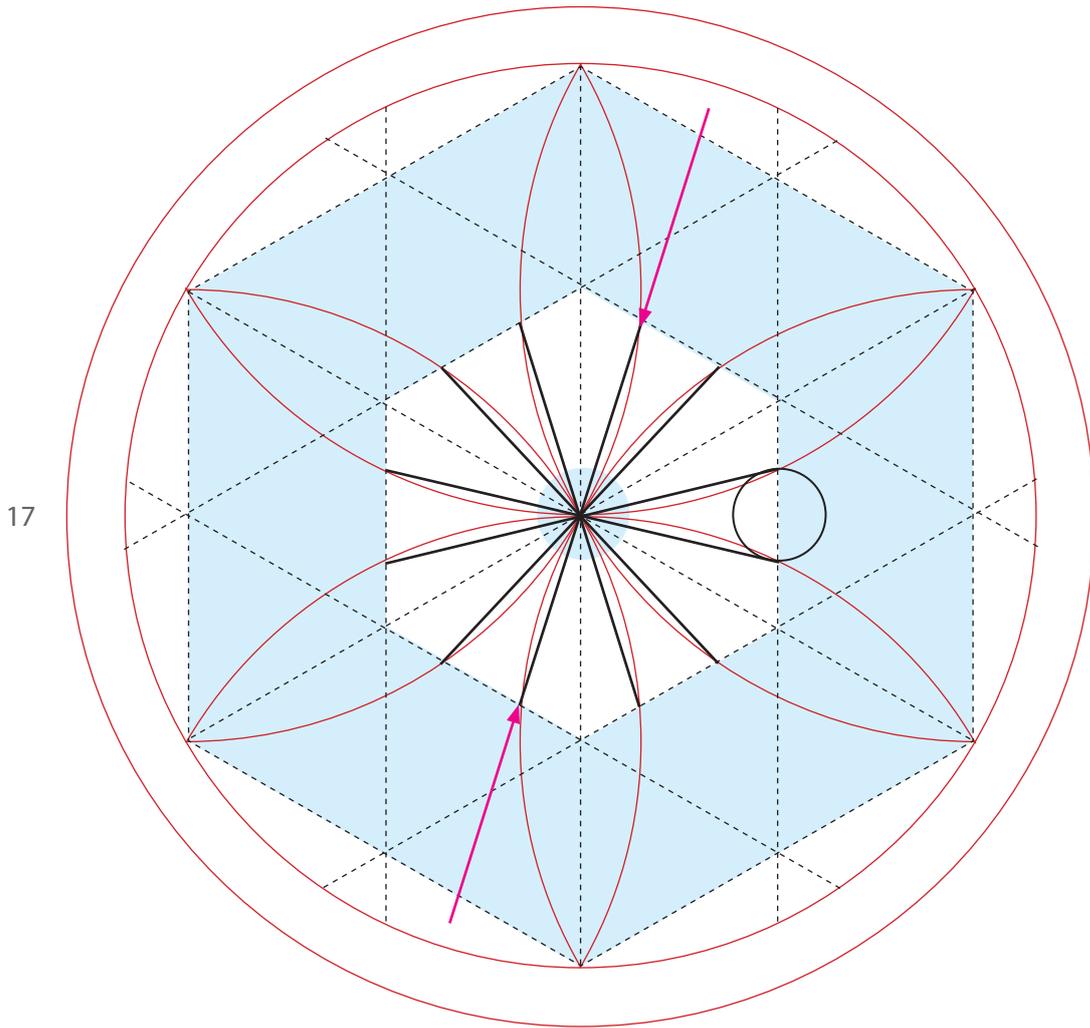
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Drawing 17 shows the geometry of the twelve-spoked wheel at the rose window's centre. The geometry can be drawn in two ways: from the edges of the central hexagon where the daisy wheel petals cut it to the axis of the circle or as lines spanning the central hexagon through the circle's axis (as indicated by the magenta arrows). The construction generates alternating wider and narrower spaces between the spokes and this characteristic is confirmed in the lower three spokes in the photograph

Another practical aspect of the design is that where the twelve spokes meet at the centre of the rose they need a central masonry support and this, in order to maintain the symmetry of the design, needs to be derived from the existing geometry. The drawing shows a potential solution, derived from the distance between the spokes where they meet the boundary of the smaall central hexagon. This is shown in black line on the right and as a solid blue tone at the window's axis.

18

¼

1

½

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Drawing 18 shows the geometry of the rose window's masonry web shown in dashed black line. The masonry, shown as grey tone, is scaled from the circular boundary, the width of which is divided into half and then into quarters, as shown on the right. The half width defines the outer area of the web while the quarter width defines the twelve spokes at the web's centre. The masonry widths are aligned over the dashed lines of the geometrical grid so that the geometrical grid's alignments run through the centre of each masonry element.

The scaling of the masonry web from a full width outer circle to half width web and, at the rose centre, quarter width web follows the classical rule of diminishing but aesthetically related elements within a building. Usually this rule is applied vertically from a building's ground level, through it's floors, to it's eaves and on to the roof ridge. Because the rose window is circular and has circular symmetry, the rule is applied from circumference to centre.
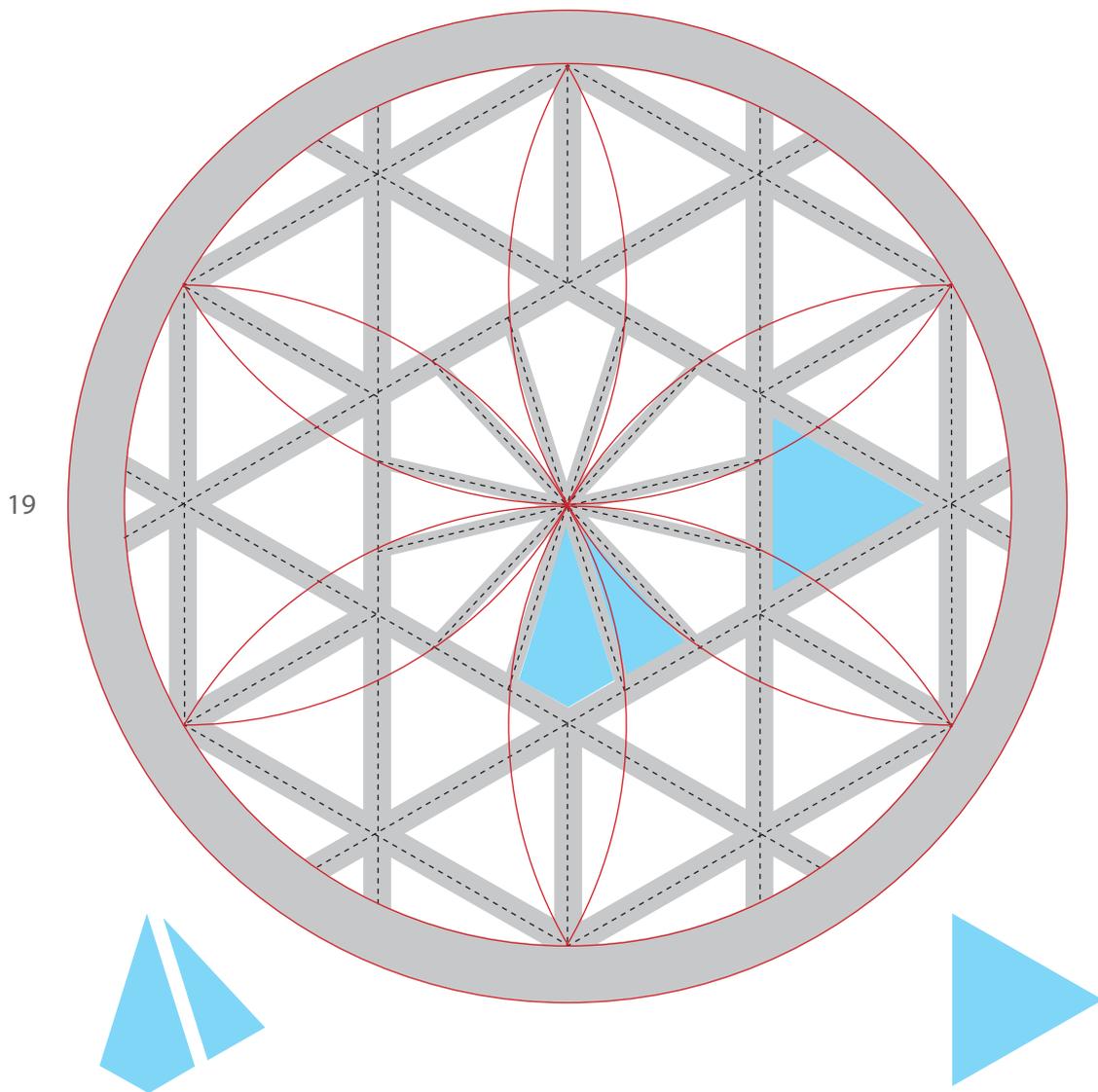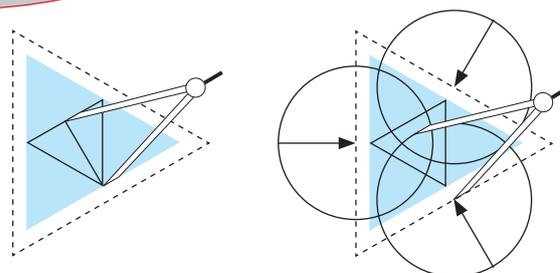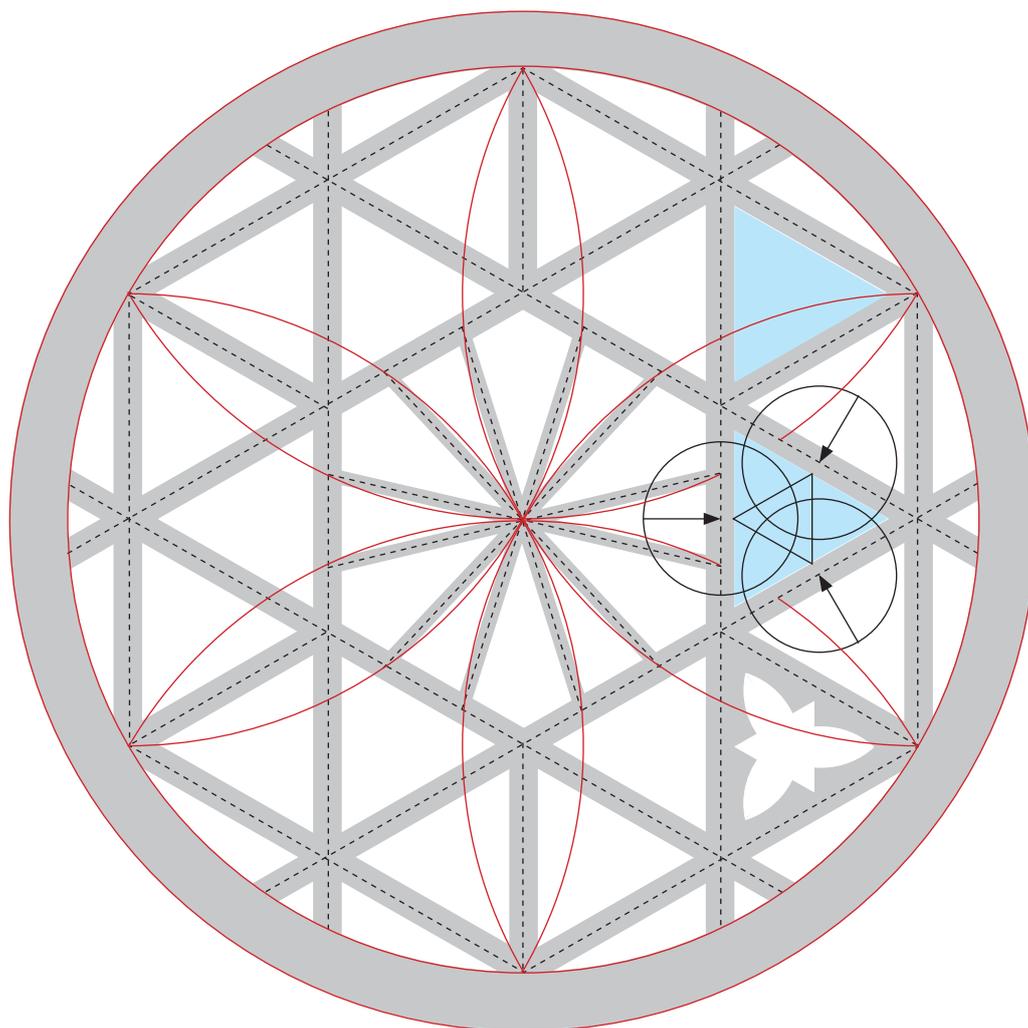
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Drawing 19 shows the basic geometrical configuration of the Winchester Oalace window with an outer hexagonal ring of eighteen equilateral triangles around an inner eye composed of twelve alternating narrow triangles and kite shapes (all of which radiate from the central axis of the rose). The three shapes are shown in tone above, the two narrow shapes occupying surviving locations in the rose.

In the next stage of the design, each of the three shapes is the subject of further geometrical development that converts its simple linear boundary into one that is more complex but arguably more aesthetically pleasing.

The fact that becomes clear is that the design is iterative and has a number of stages that commence from the simplicity of the circle and gradually increase in complexity as the design evolves.
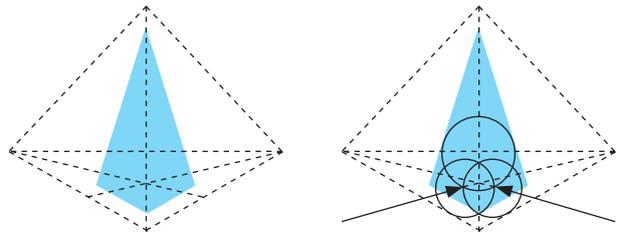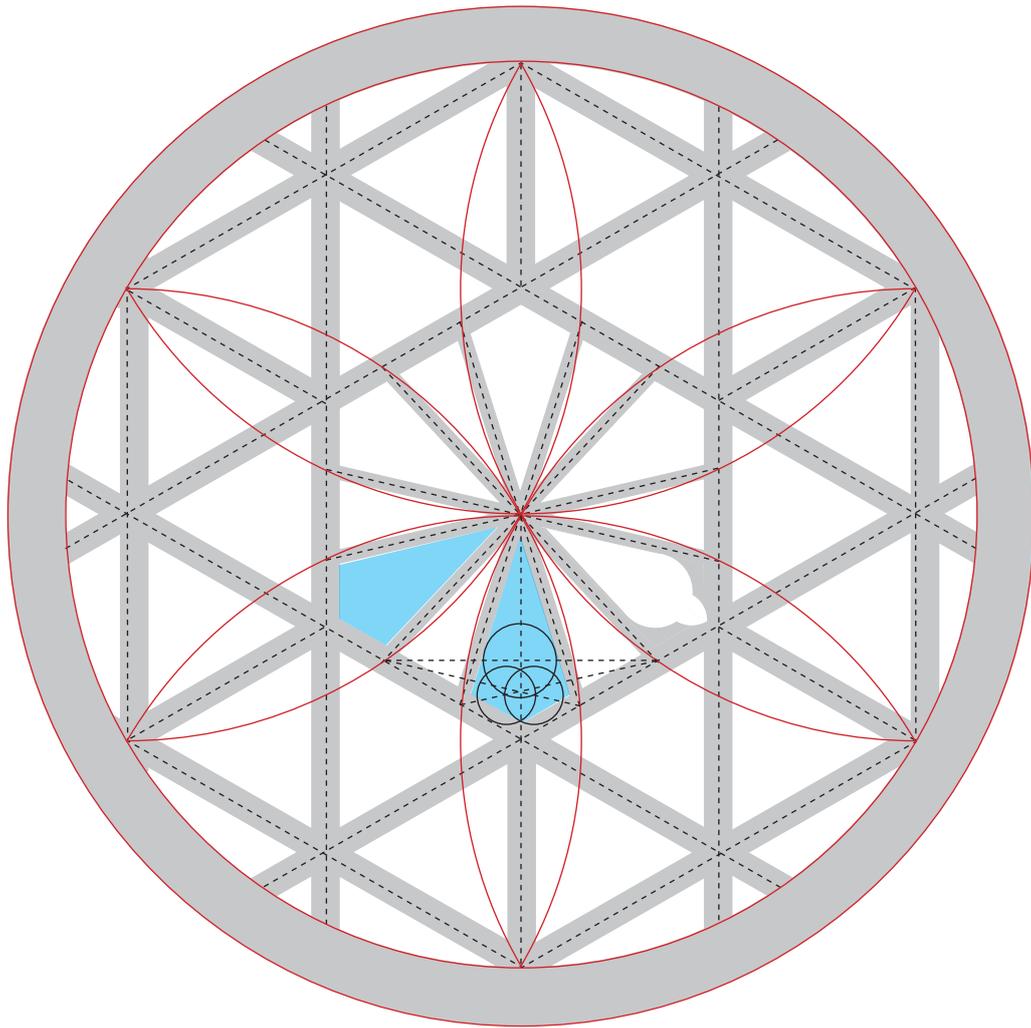
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Drawing 20 shows the geometrical development of the masonry within the equilateral triangulation of the rose window's matrix. The development is shown in three stages on the right of the rose: the upper triangle in blue tone identifies a typical area, the central drawing in black line show the specific geometrical construction and the lower drawing shows the resulting space within the matrix (the space to be infilled with stained glass).

The lower drawings show, left, how the height of the small triangle gives the radius for three identical circles and, right, how the circles are drawn from axes on the dashed line matrix boundary. The geometry expresses the Trinity in the central equilateral triangle and, more emphatically, in the triple circles.

21

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Within the rose window's central eye there are twelve radial elements composed of two repetitive shapes that alternate as they rotate around the window's axis. Drawing 21 shows the construction of the larger kite-shape form. The construction is shown in three stages: first the kite-shape in blue tone on the left. The second stage is to construct lines linking existing points of intersection in the window's matrix where they meet the arcs of the daisy wheel (shown as dashed black line). The third stage is to draw a circlesat the centre of the horizontal line and then two further circles from where the first cuts the angled lines (these stages are shown separately in the lower drawings). The final stage shows the resulting space within the matrix (the space to be filled with stained glass) in white on the right. The lower right drawing marks the centres of the two lower circles.

22
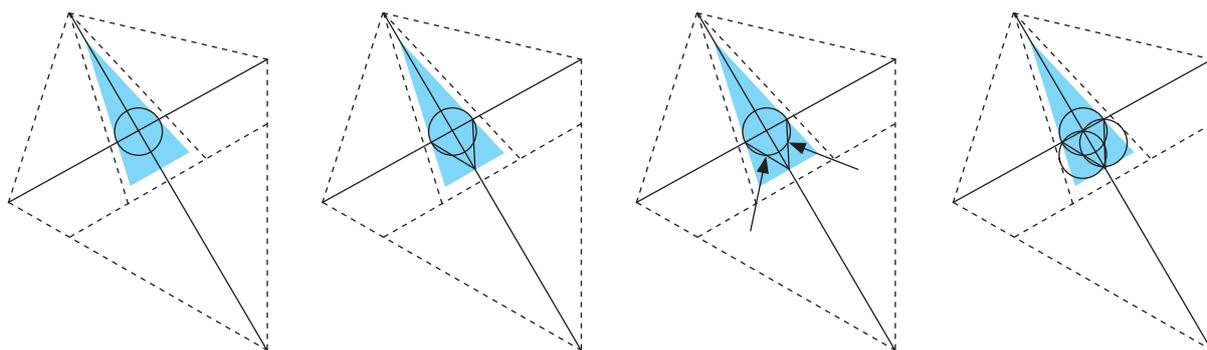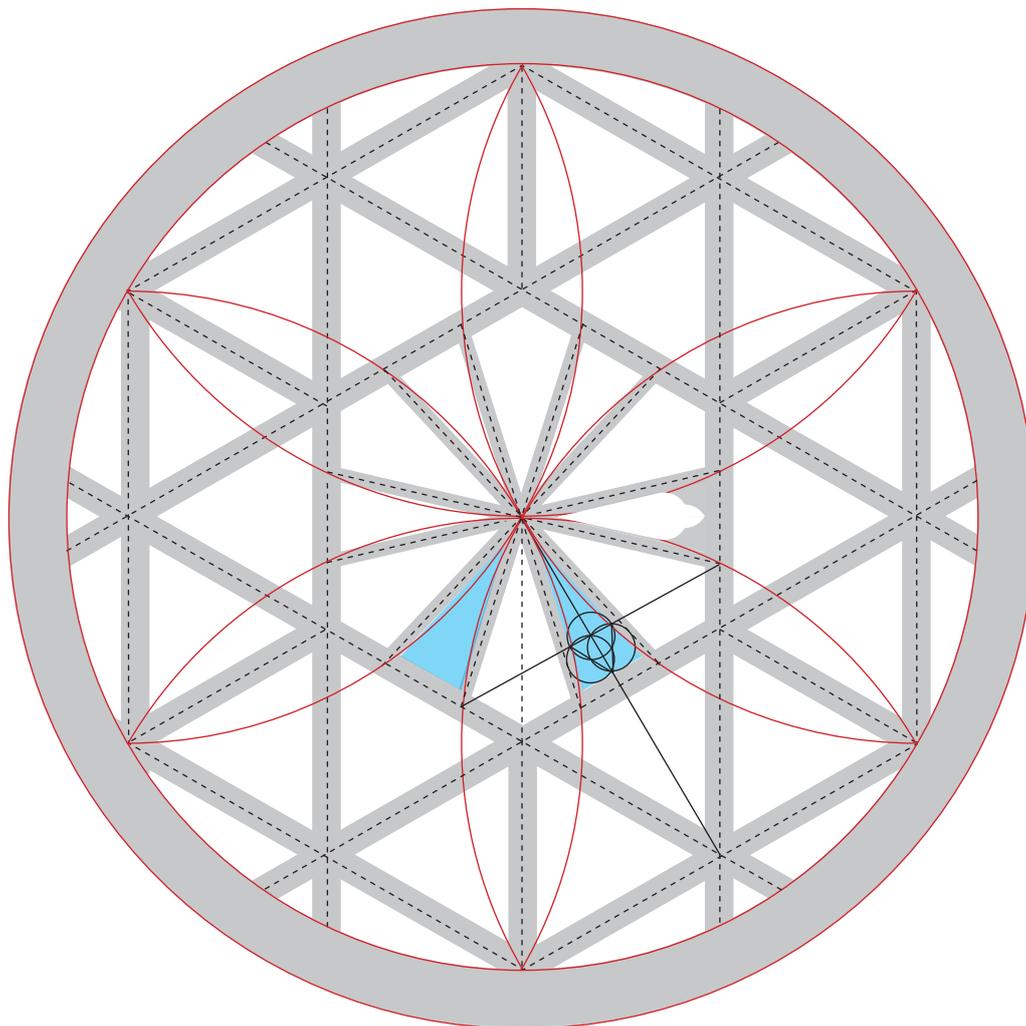
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Drawing 22 shows development of the smaller shape within the grid at the centre
of the rose: the basic triangle on the left, the shape geometry in the centre and
the resulting shape on the right. The lower drawings show, left, the construction of
a circle, centre left, a triangle based on the diameter of the circle, centre right, two
points of intersection between the circle and triangle (marked by the black arrows)
and, right, two further circles drawn from their axes at the points of intersection.
The construction therefore generates a triple circle, a Trinity reference.
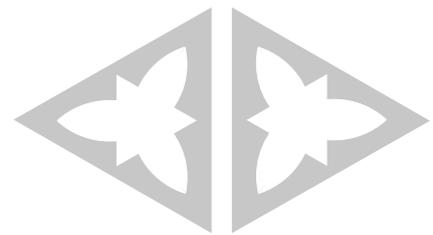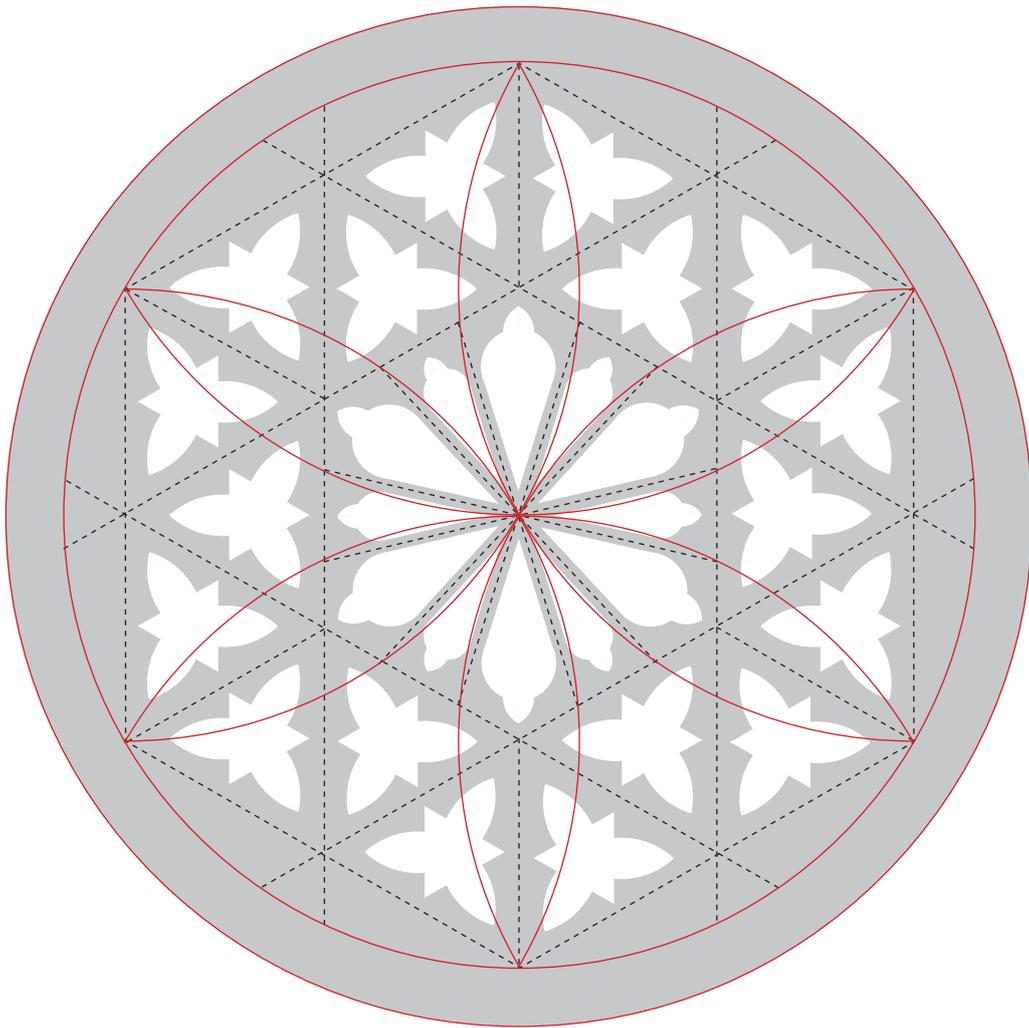
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In drawing 23 the three individual pattern components of the design are brought together to form the rose window's unified composition. Because the design arose from the daisy wheel and because all subsequent developments have arisen from it's triangular symmetries the window design is inevitably symmetrical but the specific iamgery results from the master mason's geometrical acumen and preferences. He understood that geometrical constructions often generate mirror imagery, as shown in the lower drawings, and that this characteristic brings a visual dynamic to the outer sectors of the window, carrying the eye vertically, diagonally and around the central radial flower at the heart of the design. It is, of course, a mandala: a meditational focus that leads the eye from the solidity of the surrounding wall, through a parterre of glass inhabited space to a delicate central focal point, from great to small, from reality to infinity.

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