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Mystical Meaning in Sacred Western Architecture

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I. Geometry as a Sacred Pursuit

Places of worship are adorned with symbols of devotion -- sculptures and other artwork designed to teach doctrine while also putting the worshipper in the proper frame of mind for worship. The temple or church should impress the worshipper as a special place, a place ideal for contemplating mysteries and offering prayers to higher powers.

Thus architects have always placed special attention on incorporating sacred principles when designing temples or churches. These principles may manifest as proportions, shapes, or symmetries considered to have special significance. For example, the geometric forms we consider basic, such as lines, squares, triangles, and circles, have carried sacred significance throughout the history of Western civilization.

Such sacred proportions or shapes indicate to worshippers of all educational levels that they are in a place of worship. This is true even when the principles included in the design are esoteric, known only to a select group of people. Innate impact on the human observer is one of the reasons these geometric principles are considered powerful.

Geometry has held a special place in mysticism throughout the ages because it not only tangibly describes the shapes of nature, and of the human body, in a way that transcends words, but also because contemplation of geometric problems helps sharpen the mind. The study of mathematics, and geometry in particular, by priests was common in ancient Egypt, Babylon, India, Israel, China, and pre-Columbian Mexico.

It is no coincidence that the same shapes, ratios, and symmetries are considered sacred by many different cultures around the world. Mystics and philosophers the world over have been drawn to the same set of interrelationships because they feel "natural" and "right." An obvious universal is the shape of the human body; though its pieces have been assigned various meanings by various cultures, its overall properties have inspired a set of "humanistic" principles which can be found in every culture. The circle, square, and triangle, objects of pure thought, have figured heavily in math and religion the world over, because of the symmetries and interrelationships they describe. Lastly, we commonly find principles derived from nature, such as the "Golden Proportion," $1:1.618$, symbolized by Φ , which is associated with the Fibonacci sequence. Numerous plant and animal forms develop in accord with this proportion, and it has been used effectively in many works of art and architecture because of its aesthetic properties.

The basic sacred geometric principles, since they are philosophically and aesthetically pleasing, provide a dimension of consistency throughout Western architecture. Though the materials, vocabularies, and engineering capabilities will change and evolve, we will find evidence of these sacred principles throughout Western architecture.

II. Sacred Geometry in Ancient Greece

Geometry was brought to Greece by Thales and Pythagoras, who had both visited Egypt and Babylon. Pythagoras, his advocate Plato, and Plato's pupils Eudoxus and Aristotle, founded the Western tradition of geometry as a religious endeavor. Plato, following Archytas, treated the pursuit of geometry, number theory ("arithmetic"), astronomy, and musical theory -- the Quadrivium -- as essentially similar. It was believed that the motions of the celestial bodies would adhere to the basic patterns of geometry (the "harmonies of the spheres"); likewise, the mechanics of musical instruments demonstrated simple harmonic properties.

Influenced by such beliefs, the architects of temples such as the Temple of Poseidon in Paestum (a Greek colony in Italy), the Theseum in Athens, and the Parthenon, have provided us with a set of architectural principles we call classical. In summary, a classical design feels human in scale and shape, while conveying stability, order, and harmony... the classical design thus illustrates the ties between humanity, nature, and the sacred.

The division of unity can be thought of as the primary sacred act. When we divide unity, represented by a square or a circle, we represent the proliferation of diversity out of the Oneness that mystics believe pervades all. The diagonal of a unit square has length $\sqrt{2}$ (an irrational number, to Pythagoras' dismay!). Also of importance, the length of a diagonal across a rectangle made from half a unit square is $(\sqrt{5})/4$. In Greek usage the division of the square, and the division of half the square, was of great importance.

This was illustrated by Tons Brunes, who in his analysis of three Greek Classical temples, shows how the placement and width of columns, the height and width of the temple, and the length of the temple, are all related to this ratio. For example, his analysis of the temple of Ceres at Paestum started with the facade. Brunes drew a square with its base at the bottom of the temple. Then he placed a circle in this square; the vertical diameter of this circle divided the main square into two rectangles. The points where the diagonals of these rectangles, drawn upward from the center of the base to each of the upper corners, intersected the circle, indicated the "facade square." Not only did this facade square mark the positions of the outermost columns, but when divided into nine strips indicated the width and positions of the inner columns as well. Further, the facade square equaled one-third the length of the temple. Three facade squares, divided into nine strips, gave 27 spaces. The outer two of these 27 indicated the space between the first step and the first column; the remaining 25 spaces gave the width and spacing of the 13 columns on each side of the temple. Similar proportions were used at the temple of Poseidon, also in Paestum, as well as the Theseum. (The Parthenon, too, incorporates the "facade square" into the width-length ratio but in a slightly different manner.) Naturally, the architects incorporated further, more complex interrelationships to determine the height and thickness of the entablature and the roof's pitch.

III. Sacred Geometry and Medieval Mysticism

The Christian church usually has the layout of a Latin cross. This echoes the Crucifix, but more abstractly it mirrors the human form, that of a man with his arms stretched out. The presence of symmetry along only a central axis is also reminiscent of the human form. At the crossing usually is a dome, capped by a tower; this would indicate, intuitively, the human heart reaching for heaven.

Romanesque churches favored the use of simple, modular dimensions, and a strong feeling of rhythm. Rhythm, naturally, is reminiscent of the cycles of life as well as of music. The use of sacred geometric shapes and proportions during the Medieval period reached its pinnacle in Gothic design. The architects of the Gothic period focused their attention away from the obvious stability and simple modular structure of the Romanesque designs and concentrated instead on ingenuity of design and engineering to create an unworldly feel. The substance of the Gothic church is de-emphasized in favor of spiritual atmosphere.

The wisdom of Greek sacred geometry had been successfully absorbed into Christianity. Arab advances in mathematics made their way into the schools of Europe, giving architects powerful tools. Using diagonal arches and flying buttresses, instead of thick walls of masonry, to counter the force of gravity, Gothic architects could create structures of tremendous vertical height. In the Medieval scheme, the vertical dimension was holy, so every aspect of the design, especially in the interior of the church and on the church's facade, directed the viewer's eyes upward.

Gothic churches also incorporate very strongly the dimensions used in the Greek temples. Rob Krier analyzed the Cathedral of St. Etienne, in Auxerre, and found numerous instances. For example, the

ratio of depth of the chapels to that of the aisle, on the cross-section, is $1:\sqrt{2}$, and the ratio of the depth of aisle to nave is 1:2. Krier further notes that:

The angle projected from the centre of the crossing point and inscribing the width of the interior church space is 30 degrees.... We can assert... that the interior space can be inscribed in a circle with twelve segments. (p. 236).

Krier also finds evidence of the Golden Proportion Φ , both in the dimensions of the floorplan and in the dimensions of the facade. The crossing divides the nave into two halves, the ratio of width to length of each roughly equal to 1:1.618. The crossing itself can be divided into two rectangles of the same proportion. The facade as a whole is a rectangle of this proportion and contains several rectangles also proportional.

IV. Mystical Geometry during the Renaissance

The Renaissance saw a resurgence of Roman design and with it, Greek and Roman humanism. Leonardo da Vinci, Albrecht Durer and Caesar Cesariano offered intensely detailed descriptions of the human form, proposing new interrelationships between the circle, square, and human body. During this period the Golden Proportion was understood to a much greater extent (due to the work of Fibonacci); Leonardo da Vinci and Durer, in their Vitruvian illustrations, depicted a man who was halved at the crotch, two being the number of sexuality, of propagation of life. In these figures, if the height of the man is taken as 1, the height from feet to navel is $1/\Phi$, and the height from navel to head is $1/\Phi^2$.

The works of Plato and Pythagoras, among others, gave three sets of sequences that were of crucial importance to geometry, arithmetic, and, much later, Renaissance architectural theory. They were:

arithmetic sequence	1, 2, 3, 4, ...
geometric sequence	1, 2, 4, 8, ...
harmonic sequence	3, 6, 12, 24, ...

Andrea Palladio, in his Four Books on Architecture, proposed the use of these sequences for room dimensions, especially the relation of height to width and length.

Some churches of the time were built with a centralized design, rather than a Latin Cross. Designs were used that incorporated square, pentagonal, hexagonal, or even octagonal radial symmetry. While pleasing philosophically, the centralized design proved impractical for ritual reasons. Most Renaissance churches, while different in vocabulary, contained many of the engineering features first used in Gothic churches, especially those with the familiar Latin Cross floorplan. Krier analyzed the Michaelskirche, church of St. Michael in Munich, and found that, as at St. Etienne, "the central spine of the barrel vault also forms the apex of an equilateral triangle that has the cross-section as its base line." The ratio of the width of the nave to its length is $1:\Phi$. The facade of the church is riddled with instances of proportions that equal $1:\Phi$.

V. The Geometry of Baroque Design

Baroque design was intentionally complex and deliberately superhuman in scale. Illusions, meant to trick the observer's impression of the shape of the architecture, were common. This was architecture for emotion, for artistic expression.

As such it shied away from the geometry and philosophy of the past, especially that of the Renaissance. Floorplans of Baroque churches often incorporated two new shapes, rarely before used:

the triangle and the oval.

The equilateral triangle was hailed by R. Buckminster Fuller as the "only self-stabilizing polygon." Symbolically, the triangle represents the Holy Trinity, but aesthetically represents "yet only a principle of creation, forming the passage between the transcendent and manifest realms..." Despite this, it had little role to play in a geometry based on squares and circles. Historically, architects have avoided triangle-shaped rooms, because the tight angles are awkward and un-humanist. In a period marked by avoidance of human dimension, however, the triangle became fair game.

The oval had been introduced to architecture by Michaelangelo, in his Piazza Capidoglio. The oval is a dynamic form, a circle in motion; it represents the womb, or the seed. In Christian symbolism, the oval represents the fish, an early symbol for Christ. A similar shape, the Vesica Piscis, is created by overlapping two circles of equal radius so that the center of each falls on the circumference of the other. The ratio of width to length of the Vesica Piscis is $1:\sqrt{3}$, and it contains two equilateral triangles.

The oval appears in the Piazza for St. Peter's, as well as the Bernini's Church of Sant'Andrea al Quirinale and Borromini's San Carlo alle Quattro Fontane. Borromini's design for San Carlo clearly shows an interior based on two equilateral triangles; in the Collegiate Church of Sant'Ivo della Sapienza, these equilateral triangles shift into the Star of David, creating an interior space (with numerous chapels of various size) that resembles the "snowflake curve" known to modern mathematicians as a basic fractal shape. Guarini designed churches that incorporated ovals as well, such as Santa Maria della Divina Provvidenza in Lisbon, which had two ovals in the nave. The nave was flanked by two oval chapels on either side, oval transepts, and an oval chancel.

VI. Conclusion

Though space permits only the most cursory examination of the details involved, it is clear that Western architecture, specifically that of churches and temples, has carried very solidly a tradition of geometric symbolism. Despite advances in engineering, materials, aesthetics, and design, and changes in religion and ritual, the same geometric motifs have permeated Western sacred architecture.

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