SACRED GEOMETRY*

Steve Hendricks†

For most of the history of mankind, Beauty was *not* in the eye of the beholder. For the craftsmen and artists who built the first Gothic cathedrals, their work in wood and stone was made so the beauty of the permanent could shine through into the world of the transient. They were known as the masters of the compass rather than architects.

This saying of a medieval stone mason's guild reveals their source of beauty:

> A point that goes into the circle,
> Inscribed in the square and the triangle;
> If you find this point, you possess it;
> And are freed from care and danger;
> Herein you have the whole of art,
> If you do not understand this, all is in vain.
> The art and science of the circle
> Which, without God, no one possesses

Guilds were established in most of the trades for teaching, preserving, and protecting the knowledge that informed their art. It was not necessary

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* Keynote Address at the inauguration ceremonies for Dr. Christopher Clark, President of Bryn Athyn College, Bryn Athyn, Pennsylvania, September 25, 2009. Our company was very pleased and honored when asked to provide a design for the entryway to the Brickman Center and we are grateful to be here today as we welcome the first President of the Bryn Athyn College.

I am not an expert in the subject of contemplative or sacred geometry. I have taken a few classes and workshops in architectural proportion over a period of years and am fortunate to have teachers who approach these subjects from what might be called a perennial tradition. What I hope to share with you today is some of my excitement for the vast potential the study of geometry and proportion have for the building arts and how I have tried to incorporate some of it in building this entryway.

† Founder of Historic Doors, LLC, designers and fabricators of the Brickman Center main entrance at Bryn Athyn College.

for a craftsman to understand *why* something was done as long as he understood *how* —by way of learning and practicing the traditions of his craft. The master builders were charged with knowing why. But both the why and the how have a common origin and are learned through geometry as both a practical and an allegorical method.

But what is this lasting Beauty traditional artists sought to portray in every proportion of buildings and sculpture and stained glass? To introduce this subject, I would like to show you, in Figures 1 and 2, one of the most basic constructions of sacred or contemplative geometry. Many of you have probably already done this yourself, perhaps as early as kindergarten if you ever idled away some time with a compass. Sliding six pennies around a seventh as a center illustrates the same principle. The principle is that six fits precisely around one and that the first perfect number after one, or Unity, is six. Six is the first perfect number arithmetically because of its factors of 1, 2 and 3. 1+ 2 + 3 equals 6 and so does 1x 2 x 3 equal 6, the very definition of a perfect number. Geometry provides a form for this idea about number.

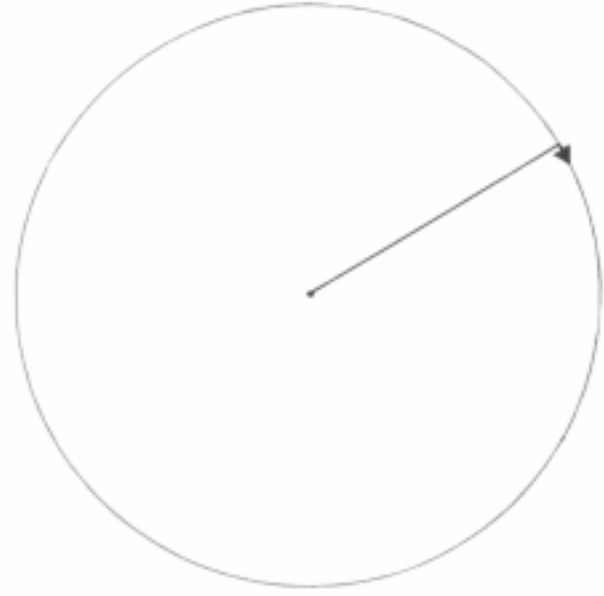

Figure 1

The radius of the compass determines a circle around the center point. Although we can easily draw and see this happening, this is called an "irrational" function in modern mathematics, requiring the use of Pi as a transcendental number to describe the results, and even then incompletely as the answer will never resolve into "real" numbers. I prefer to think of this "irrational" or "transcendental" function as a reminder that Unity is incommensurable in quantitative terms.

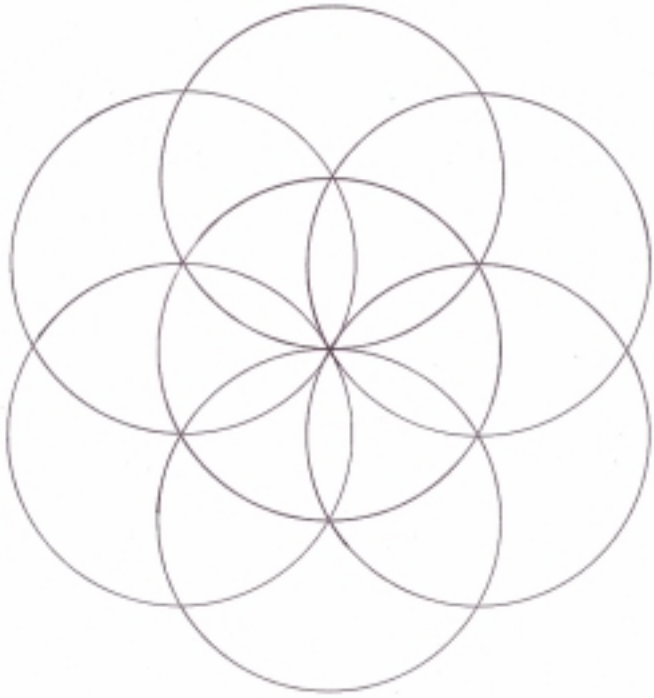

Figure 2

The first circle naturally divides itself into six, by means of the same compass setting that described the original circle, by "walking" the compass around the perimeter of the first circle. This describes six new center points where six new circles intersect each other and we discover that the six new circles are tangent to the original center point. By continuing to draw new circles with the original compass setting around each new

intersection, six full circles will be found to fit exactly around the original circle, tangent to it and to each other. The original center point and the first circle drawn from it are seen as both equally the center, differentiated only by degree.

There are probably countless numbers of things one can derive from this drawing (Figure 2), one of which includes every line of the arched transom of wood and glass above the exterior door to this building. I am going to show you how the transom design came to be a little later, but I hope some of you may be curious enough to try to discover it by this method on your own.

This geometry is called the Seven Days of Creation or Six around One and it serves to illustrate in a very introductory way how traditional artists and builders render beautiful the work they produce. They employ patterns and proportions discoverable in nature and revealed through geometry. The beauty of the permanent is therefore a reflection of the laws that govern creation. These laws are true regardless of the names we attribute to them and they indicate an underlying Unity. Whether this Unity is referred to as God, or Nature, the Universe or even Evolution, all attempt to explain one underlying reality which is always and everywhere the same. For traditional artists and builders beauty is something to be discovered rather than invented and therefore partakes as much of knowledge as it does inspiration.

Geometry is a word meaning, literally, to measure the earth, from *geo* for earth and *metric* for measure. The ancient Egyptians practiced and preserved it as a highly developed knowledge inherited from people who were prehistoric to them. Don't let anyone tell you ancient people thought the world was flat. It appears the Egyptians and other older cultures not only knew the earth was round but also knew its diameter and circumference, even though modern man has only been able to measure it accurately since the 1970s.

Quadrivium

Geometry is but one of four subjects comprising the original liberal arts curriculum of the Western world known as the Quadrivium. The

Quadrivium is an educational method and philosophy older than anyone knows and its purpose was to liberate the soul from entrapment in matter. Pythagoras is thought to have brought it from Egypt to the ancient Greeks. The four subjects of the Quadrivium are: Number, Geometry, Music and Astronomy.

The subject of Number or arithmetic is the essence of all of them, and treats of number differently than a modern person is inclined to expect. We are used to thinking about numbers as quantities. (Three chairs, four apples, ten dollars, how many people are in this room!). The Ancients, however, were more interested in *qualitative* number, as in the underlying nature of Oneness, Twoness, Theeness, etc. These are difficult concepts to understand immediately, but essentially, qualitative number treats of correspondences.

The Theological Writings of Swedenborg mention that the Most Ancient people had a direct revelation from the spiritual world and that their most profound ideas were represented in numbers rather than words. By means of numbers, ideas about spiritual things "were able to be introduced that are not so well comprehensible in ideas of the natural mind" (*AC* 6175). It is said that numbers convey more arcana than words. The Writings also make it very clear that there is no idea of numbers as quantities in spiritual thinking. Rather numbers represent the "qualities of things." (See *HH* 263; *AE* 336; *AC* 10255).

With the Quadrivium being about the study of this *qualitative* aspect of number, the subject of Geometry studies number in space. Music is number in time. Astronomy is number in both space and time. The underlying subject is the order of nature and the nature of order as it manifests in space and time. The Quadrivium offers a unified method of learning wherein each of the four subjects unfolds a particular manifestation of one reality known as Unity.

In order to better appreciate the meaning of geometry as an analogical method, I would first like to consider briefly how Music and Astronomy may be regarded from this perspective.

Music

The images (Figure 3) by Steve Bass show how the laws of harmony in music can be correlated to proportional relationships expressed geometrically and how this musical knowledge could have been used to inform the art of building. The first image shows how the fundamental note and its octave, as well as the fourth and the fifth tones are all easily found as proportional relationships through the diagonal and semi-diagonal of the square. Seeing pictures, of course, is nowhere near as romantic as actually hearing the harmonies produced in music, but this demonstrates a correspondence of proportional relationships discoverable in both sound and geometry.

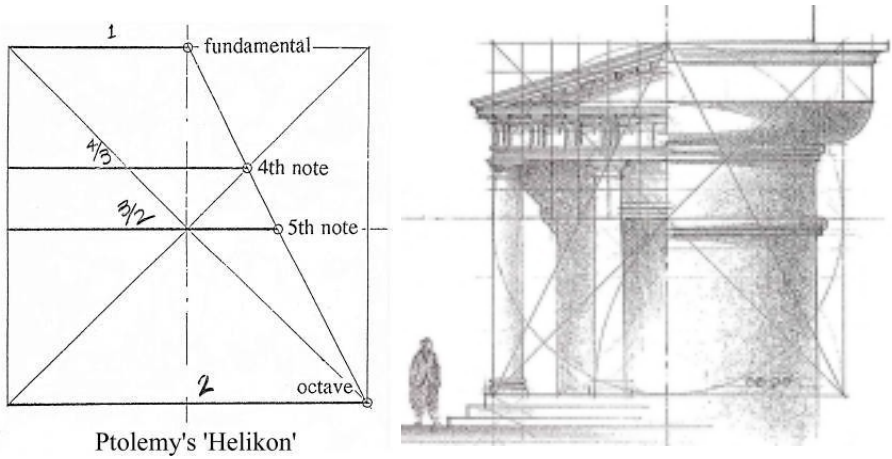

Figure 3. (Image courtesy of Steve Bass)

The second image shows the same division of the square by its diagonal and semi-diagonal used to inform the layout of a classical Greek temple front and all of the proportions of the column and capital. This illustrates the traditional principle of "As above, so below." The largest and the smallest details correspond to each other in following the same pattern and proportions. It is this awareness of common proportional

relationships between geometry and music which underlie the famous statement that architecture is frozen music. (This should not lead you to believe, however, that music is melted architecture!)

Werner Heisenberg was one of the most important physicists of the twentieth century. He helped develop the theory of quantum mechanics and is credited with the uncertainty principle. He would give lectures about Pythagorism in his own work on quantum theory, and would emphasize that the basic building blocks of nature are number and pattern with the conclusion that the universe is actually not made out of matter but out of music.

Astronomy

The ancients did not have TV or movies. Their prime-time show was the motions of the starry heavens which were presented at about the same time every night, seven days of the week, for the entire year, unless it was cloudy or raining. Perhaps in order not to miss what would happen in the rained-out episodes, they became adept at predicting the patterns of the planetary movements that played out above their heads in space over time.

Their perspective was imbedded in the appearance that the earth was at the center of all this motion. Modern astronomy actually still places the earth at the center of the universe in the way in which the stars and planets are mapped or charted. Stars and planets are mapped on a grid set up like a spherical screen in the sky surrounding the earth, from where we view them.

How many people here know how to find the North Star? And how many know why it is also named Polaris? Polaris, also known as the North Star, can be found from the Big Dipper constellation. Everyone needs to know how to find this star because it tells you how to find north, from which you can determine all of the other directions on the compass. The reason it is named Polaris is because, relative to the earth's rotation, it represents the pole or the axle, if you will, upon which the rotation of all the other stars appear to turn. A time exposure of the night sky centered on Polaris will show how the North Star remains relatively unmoved while the lights from all the other stars and planets circle around it over

time. This relatively stationary function of Polaris as the center point of the earth's axle is why you can count on it always to find north. All of the other lights of the night sky are in constant motion.

But the ancients observed far more than just amazing light shows while watching the night sky. A complex pattern is drawn in the sky over time by only one of these lights, that of Venus. Venus traces a five-petaled flower pattern around the earth every eight years (Figure 4), or thirteen years if you were to view it from Venus, whose rotation around the sun is shorter than ours. If one colours between the lines traced by this orbit, its beauty is revealed. To the ancients, who did not use telescopes, there were seven planetary bodies in motion against a revolving backdrop of fixed stars. They are the Sun, Moon, Mars, Mercury, Jupiter, Venus and Saturn. Our names for the seven days of the week derive from these, beginning with Sunday and Moonday. Today is Friday and is named after this star, Venus. This is but a small glimpse into an incredible body of knowledge showing ancient wisdom about space over time. It may be with this kind of knowledge that the wise men knew when to expect the birth of the Lord on earth, "for they saw His star in the East."

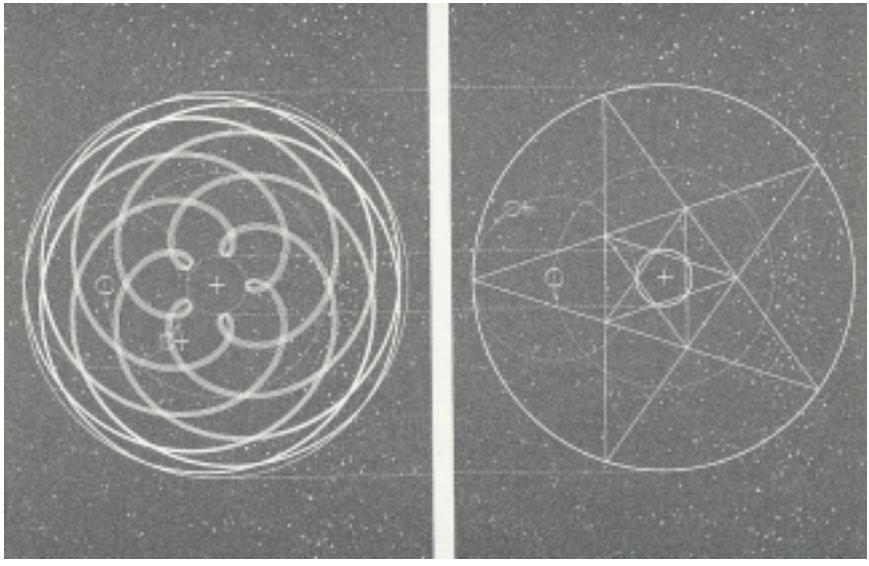

Figure 4. (Image courtesy of John Martineau)

Geometry

Many of the great artists of the Middle Ages and Renaissance, including Leonardo da Vinci and Michelangelo, had esoteric teachers in studying these subjects with geometry as a philosophical tool to inform their art. Luca Pacioli is known to have been a mentor to da Vinci. Their collaboration is evident in da Vinci's image called the Vitruvian Man. This image famously illustrates the proportions of the human figure squaring the circle (Figure 5). The squaring of the circle happens when a circle and square of equal perimeters are drawn together, one from the other. It is a key idea in contemplative geometry as it represents the harmonizing of the higher and lower worlds. The circle represents the spiritual, causative side and the square the material, manifest realm of being.

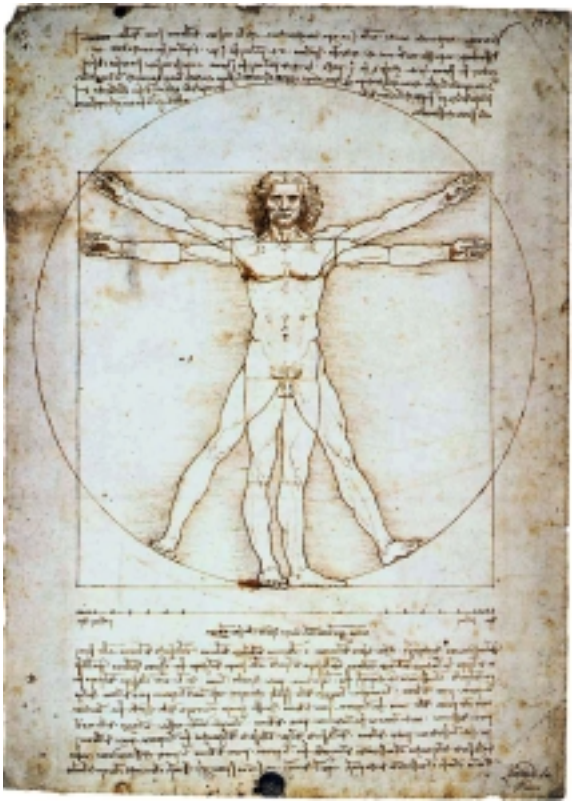

Figure 5.

When the human figure stands with his feet on the ground, his proportions fit within the square. When his proportions describe a circle, his feet do not touch the ground, appearing to defy gravity as a spiritual being. By showing this correspondence of human proportions within the squared circle, we have a graphic illustration of the simultaneous spiritual and material aspects of human consciousness. The squaring of the circle is the geometric equivalent of "as in heaven, so upon the earth."

The image is named the Vitruvian Man because da Vinci based his image on a description given fourteen hundred years before him by a Roman architect named Vitruvius. Vitruvius lived and wrote during the time the Lord was on earth and was attempting then to describe the rules of proportion in architecture that had been practiced by the previous Greek culture, which in turn inherited its wisdom from even more ancient cultures in Egypt and Phoenicia, but we lose the thread of its history prior to Pythagoras.

The central idea in all of this is that the study of geometry and the other subjects of the Quadrivium reveal the wisdom of the ancients and underpin a theory of beauty as practiced in the traditional arts. This kind of learning is as relevant today as it ever was and, because it treats of the order of nature, it will be equally relevant in any time to any people.

> How much the ancients surpassed the moderns in intelligence can be seen from the fact that they knew to what things in heaven many things in the world correspond, and consequently what they signify; and this was known not only to those of the church, but also to those out of the church, as for instance to the inhabitants of Greece, the most ancient of whom described things by significatives which at this day are called fabulous, because wholly unknown. *AC* 7729:[8]

Sun Symbol

To begin our discussion about Geometry, I would like to first consider the oldest known manmade symbol (Figure 6). A circle with a center point or with rays emanating from its center to its circumference is universally understood by archeologists and anthropologists to be a symbol of the sun. In fact, scientists today still use the symbol of a circle with a center

point as shorthand for the sun in astronomical notation. Variations of this sun symbol occur throughout the entire world wherever human settlements have been found and are acknowledged to be the oldest and most universal symbols from pre-historic mankind.

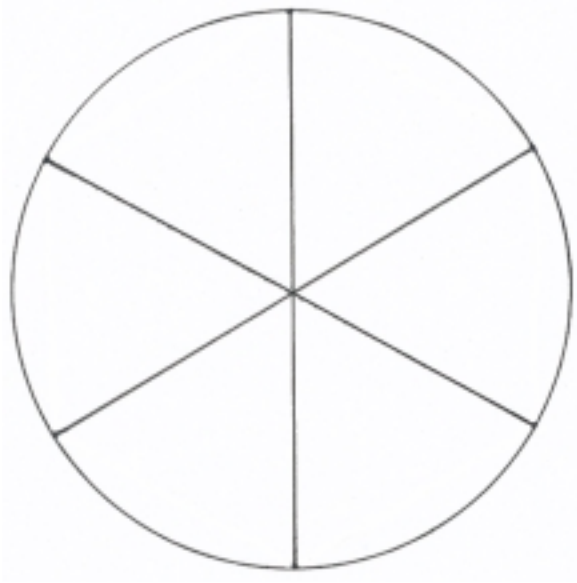

Figure 6.

The reason that such a symbol is both so ancient and so prevalent among primordial man is eloquently stated by Black Elk, a Native American:

> Everything the Power of the World does is in a circle. The sky is round, and I have heard that the earth is round like a ball, and so are all the stars. The wind, in its greatest power, whirls. Birds make their nests in circles, for theirs is the same religion as ours. The sun comes forth and goes down again in a circle. The moon does the same, and both are round. Even the seasons form a great circle in their changing, and always come back again to where they were. The life of a man is a circle from childhood to childhood and so it is in everything where power moves. (Joseph Epes Brown, *The Spiritual Legacy of the American Indian*; Crossroad Publishing Company; 1984, p. 35)

Using one of these symbols, I will attempt to show how geometry can serve as a graphic allegory to tell stories about creation and the nature of the created world. We will focus on this symbol exhibiting six rays because sixness is the most universally manifested number in the created world.

Seven Stars

In dividing the circle into six equal parts, we also discover the geometry of the hexagon by connecting the six points around the perimeter (Figure 7). With the hexagon and the six rays drawn together within the same enclosing circle, we generate a pattern referred to as the Seven Stars, with six points being our found points on the circumference and a seventh as the center point of origin. As a symbol, this center can be thought of as the sun of our solar system with the six other orbiting lights visible to the ancients' unaided eye.

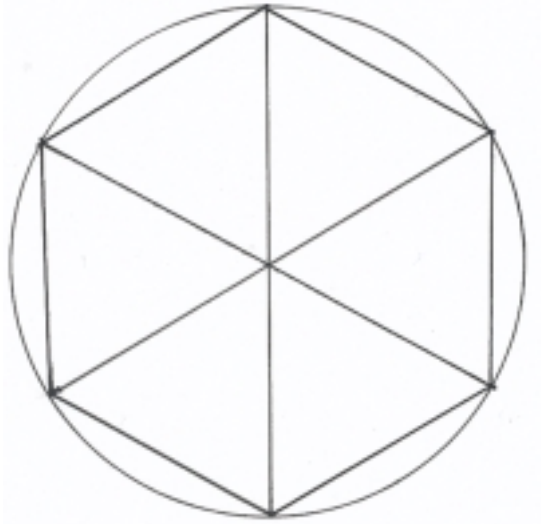

Figure 7.

But as an image expressing Seven Stars, there is more in this geometry than meets our physical eye. By looking again, the mind's eye can perceive

a perspective drawing of a cube. A cube also expresses six, with six faces in three dimensions while a hexagon has six sides in two dimensions.

In this three-dimensional view, though, our mind's eye finds that behind the center there is hidden another point, an eighth point invisible to our eyes but discernible nonetheless by our intellect. This represents a spiritual realm sustaining the manifest world of appearances from the "land beyond the sun." It is a source of further study in contemplative geometry that the rays from the hidden sun to the other seven points are in side lengths of one, the square root of two and the square root of three.

In our symbol of a circle with rays emanating from a center (Figure 6) is also the image of a wheel in motion. The motion of the wheel is a figure of the constant change which everything manifest is subject to. The point at the center, however, is a still point, remaining fixed and unmovable. If you will imagine a spinning shaft, the rotational speed of the shaft can be measured because it possesses dimension. Engineers can calculate angular velocity along a line from the shaft center. The speed will be highest at the circumference and decrease toward the center until we arrive at a dimension too small to measure. The center resides beyond this, a dimensionless still point remaining constant and unmovable. Like the hidden sun, we can visualize the necessity of this still center even though it transcends our ability to see or measure. By analogy, this geometry helps us understand how the still center point as a state of being is eternally present in the changing realm of manifestation.

Point as Center

Defined as having location without dimension, it is with the point as center that geometry begins. But a point has no actual existence in the material world. This "center is before all else the origin, the point of departure of all things, (it is) without form, without dimension, therefore indivisible, and consequently the only image that can be given to Unity. From it, by its radiation, all things are produced, just as Unity produces all numbers without its essence being modified or affected in any way." (Rene Guenon, *Symbols of Sacred Science,* English translation of second French edition, published by Sophia Perennis, 2004. p. 57.)

Vesica Pisces

Contemplative geometry can help us visualize other profound ideas such as the creation of matter from the immaterial (Figure 8).

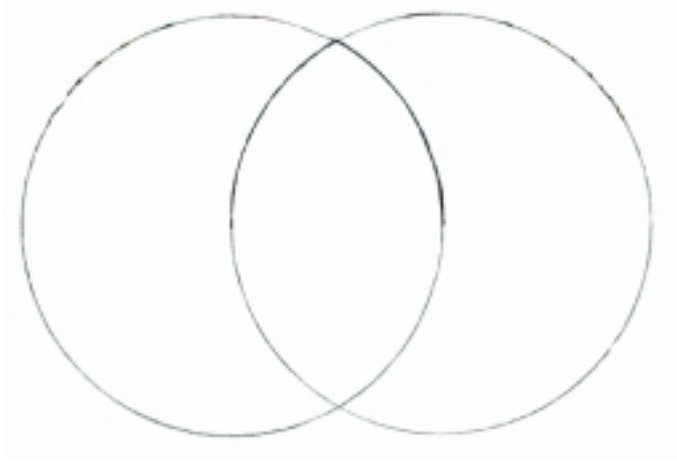

Figure 8.

In drawing geometry, we start with a point remembering that it has location without dimension and is therefore an image of the immaterial. As our compass moves to find the center, its point first passes through the paper, as if into another dimension. A circle is then drawn around the point by means of our compass. In the next step, similar to how a single cell divides itself in biological growth, our original circle divides itself by moving outward as if on a ray toward its own circumference. This is done by setting our compass anywhere on the circumference of the first circle and then drawing a second intersecting circle of the same size. As the geometric center of our first circle moves, as it were, to become tangent with its own circumference, a unique shape known as the Vesica Pisces is formed within the overlapping circles. In this first division from Unity, an amazing occurrence takes place within the Vesica Pisces. Within this form, all of the information needed to construct a straight line, to divide that line equally in two with another line at 90 degrees, as well as to construct an

equilateral triangle, a square, and a hexagon are simultaneously given. To describe a pentagon is only one more circle away. To carpenters and stonemasons or anyone who designs or builds things, this is a gold mine of information.

Figure 9 illustrates what is happening here apart from the constructions involved. As this sequence illustrates, each and every regular polygon with a side length equal to one, as defined by the Vesica Pisces, will unfold from this pattern to eternity with the first vertices of each new polygon landing on the original two circles that comprise the Vesica. One of the clues is to find the center of the containing circle for each new shape. Our illustration counts from one to twelve by means of polygons.

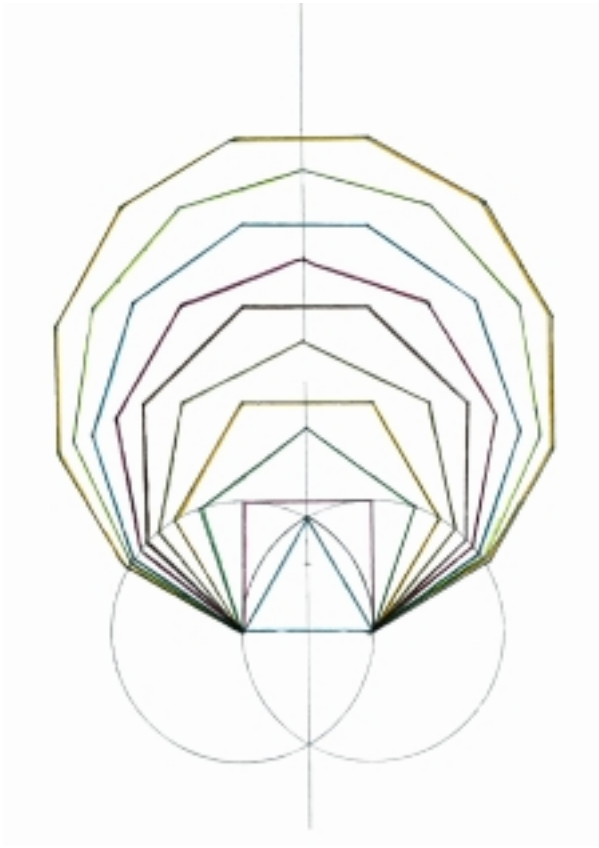

Figure 9.

Christian symbol

In contemplative geometry as well as in the practical building arts, the Vesica Pisces represents a formative and creative power. In the first division from Unity, this unique moment that occurs exhibits a principle of perpetual creation. It is therefore not an accident or anything arbitrary that inspired the early Christians to regard the Vesica Pisces as a symbol for Christ, the formative power of the cosmos, for "All things were made by Him and without Him was nothing made that was made." The Vesica Pisces is therefore extensively used in Early Christian and Medieval art to convey the Divinity of Jesus Christ as Creator of all things (Figure 10).

Figure 10.

Brickman Center Door Design

By now you are probably wondering what any of this has to do with the designs for the Brickman Center entry. The work we provided for the west façade of the Brickman Center includes the round window and the transoms and doors that fill the opening below it. While the general parameters for the design were established by Spillman Farmer Architects, we were asked to contribute ideas to refine the design for the West Entrance façade. Recognizing the importance of this building to the College as well as its unique relation to the beautiful architecture across the street, it was an honor to participate in this challenge. As an alumnus of this College, I also hoped our design might be informed by ideas from correspondences as they are a central teaching of our Church.

At the beginning of the project, an opportunity presented itself of using wood from an oak tree taken down on the College property. This tree is thought to have been growing here since the Academy was first founded in 1877. The logs were taken to a neighbouring sawmill, custom sawed and kiln dried to provide lumber for the interior set of doors—the doors facing the room we are in, as well as the fireplaces in the Great Hall and the dining hall.

Rose Window

We started with the design of the Rose Window (Figure 11), the most important focal point, as this seemed an auspicious place to visually mark the entrance. My first thought was it should be in the form of a circle, as this partakes of a deeper tradition for this type of window, and would therefore reflect a simple beauty in and of itself.

In terms of its qualities, seven is known to have special meaning in the teachings of the New Church and I was intrigued to learn what clues the Writings would provide in determining whether this might be a good place to use a unique geometric scheme exhibiting seven. A few ideas that stood out for me are contained in the following quotes from the *Arcana Coelestia* and *Apocalypse Explained*:

Figure 11.

Seven in the Word signifies beginning and end, thus an entire period and a full state and therefore all, because all makes what is full. (*AE* 20)

Seven signifies what is Holy or Sacred and involves a whole period from beginning to end; therefore intervals of time are distinguished into sevens and are called weeks. (*AC* 482)

Seven is a Holy number and signifies the Lord's advent into the world and every advent of His in particular. Seven days signifies the beginning of a new church and the end of the old one. (*AC* 728)

> "I will serve thee seven years" signifies study and then a holy state. (*AC* 3824)

> "The light of the sun sevenfold as the light of seven days" (from Isaiah 30.26) signifies a full state of intelligence and wisdom. (*AC* 9228)

The quality of seven representing the beginning of a New Church based upon a particular advent of the Lord, occurring in the fullness of time, combining with ideas of "study leading to a holy state" full of intelligence and wisdom were, needless to say, exciting ideas to come across in considering this symbolism for a New Church college building!

I am not going to take you through the geometry for this window today. It is too involved for the time we have and is difficult to reproduce. Interestingly, among geometers it is said of the number seven, that "its geometry has not yet been revealed." That does not mean that a seven-pointed figure cannot be produced – it obviously can be. But the layout of seven does not happen easily and automatically as it does with six. You have to get close on the first try and then average out the differences until you find it.

The only other seven-petaled window I am aware of is in a side chapel at Chartes Cathedral in France. The figure presented by sevenfold geometry is dynamic in its being simultaneously the end of one and the beginning of another. Just as a scale of "do, ray, me fa, so, la, ti" is not complete until the final "do" has been uttered, the seven-pointed figure seems to be in perpetual motion, seeking its resolution in the next beginning, which is already foreshadowed within itself.

Arched Transom

Once the rose window design was settled, the arched transom above the exterior doors was next. The architects had already indicated a pointed arch in their preliminary design for the doorway. This gesture to the Rose Window begged the question of what ideas could be expressed that would point to those conveyed by the sevenfold pattern above and how would their form harmonize with the curves of the Rose Window design?

This led to the geometry of the Vesica Pisces. As we have just seen, the Vesica Pisces with its formative power has been a traditional Christian symbol from the earliest days of the Christian Church. By basing the design of the transom window on the geometry of the Vesica, a centerpiece is manifested which points to the Rose Window while exhibiting the proportions of the Christian vesica symbol, as if to say this is the former Christian church pointing to the new advent which fulfills the True Christianity.

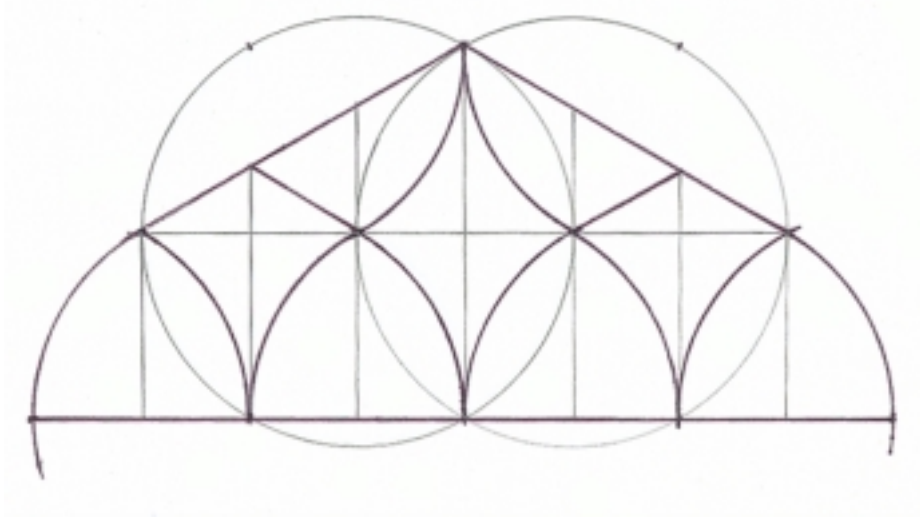

Figure 12.

As we have already seen, the Vesica Pisces occurs when two circles of the same diameter intersect one another with the center of one on the circumference of the other. This is drawn with one compass setting, obviously, as the definition is that they are the same circle, geometrically representing the division from a Unity of One. Again without changing the compass, the two original circles naturally divide into sixes, giving us new points to use in swinging our compass. Within just a few circles, we have all of the information needed to lay out the lines of the entire transom design, including points to find the lines used in the leaded glass assemblies within the separate window openings (Figure 12).

It is interesting that the first lines drawn determine the points needed to layout all other lines for the frame and sash and glass stops, but these original lines remain invisible in the built project. It is analogous to the still center of a spinning shaft in that they define the entirety of the built work while never appearing as one of the visible lines manifested in the material body of the work. These are the points described by our medieval stone masons that, once found, will free you "from care and danger." If you are off in your beginning layout, so many separate components will never fit together.

Doors

A challenge we met early on is that four doors were required by safety code for emergency egress from the building. This was originally conceived as two sets of double doors, one beside the other. In our years of designing doorways, we have learned that an entrance to a space, especially an important space, is improved if it is centered, so we recommended redesigning the entrance with one centered double door flanked by a single door on either side. By enabling only the center pair of doors to operate from the outside, with the side doors appearing fixed, a centered entrance was established while all four doors can open from the inside for egress.

As the Brickman Center is the admissions building for the College, it seemed important to have doors which invited in light and did not act as visual barriers to the interior of the building. So while the doors are wood, there is a large portion open for glass. The glass we used is a hand-blown glass produced in the same way all early glass was made, by first blowing a sphere of molten glass, then cutting it while still soft and letting it lay and harden in sheets. The resulting glass has air bubbles and natural defects and does not have a perfectly flat surface, so it plays with and reflects light in a livelier manner than modern-made glass.

All of the doors and other woodwork were finished in a natural oil finish developed in Europe from old recipes using flax seed oil. As in so many other areas to do with true sustainability, we find that what is old is new again.

Wrap up

We hope the design and construction of the components we provided will stand the test of time. Our shop is very blessed with a dedicated and talented team and it is their skill and craftsmanship that you see in the doors and windows here. We enjoyed our collaboration with the architects and construction managers, as well as with Gurney Kerr Contracting, whose skillful and thorough installation has brought the final function to these doorways as they are now able to be used.

Sacred Geometry

So, in closing, what is of value about sacred geometry for the building arts or as a subject of study? To answer, we have to ask what sacredness is. Sacredness is about timelessness. It is experiencing a unity with that which we realize is bigger than ourselves. The experience of sacredness appeals to that which is the deepest and richest in us and puts us as near as possible in tune with that which is eternal. We are often filled with a sense of beauty when this happens.

Sacredness has implicit in it the recognition that there is an underlying order to creation and that we are a part of it. Man is created in the image and likeness of God. Our ideal human form is therefore a reflection of our Creator. When we attempt to mirror the beauty inherent in all of creation, our work can be animated by something outside of ourselves. Geometry can help in this discovery. Its laws give form to eternal principles that are not written by man. Studying geometry from this perspective can help us see the order underlying all created things. It helps us to understand that, rather than being in the eye of the beholder, "Beauty is nothing but the transparency of its existential envelopes; an art . . . is beautiful because it is true" (Titus Burckhardt, *The Foundations of Christian Art*, published by World Wisdom, Inc., 2006, p. 2). ❑