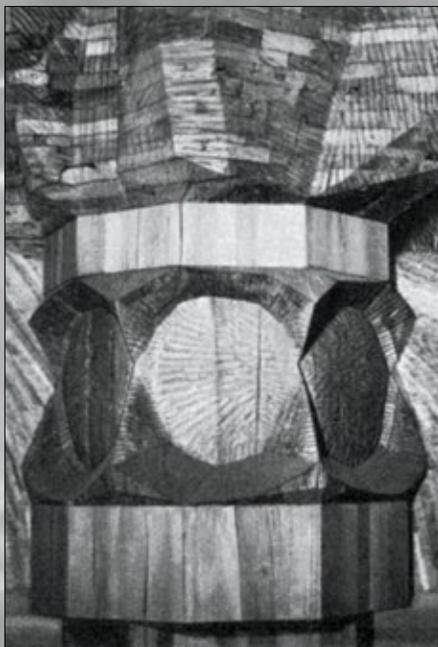


THE NEW SACRED GEOMETRY OF FRANK CHESTER

by Seth Miller, PhD.c.

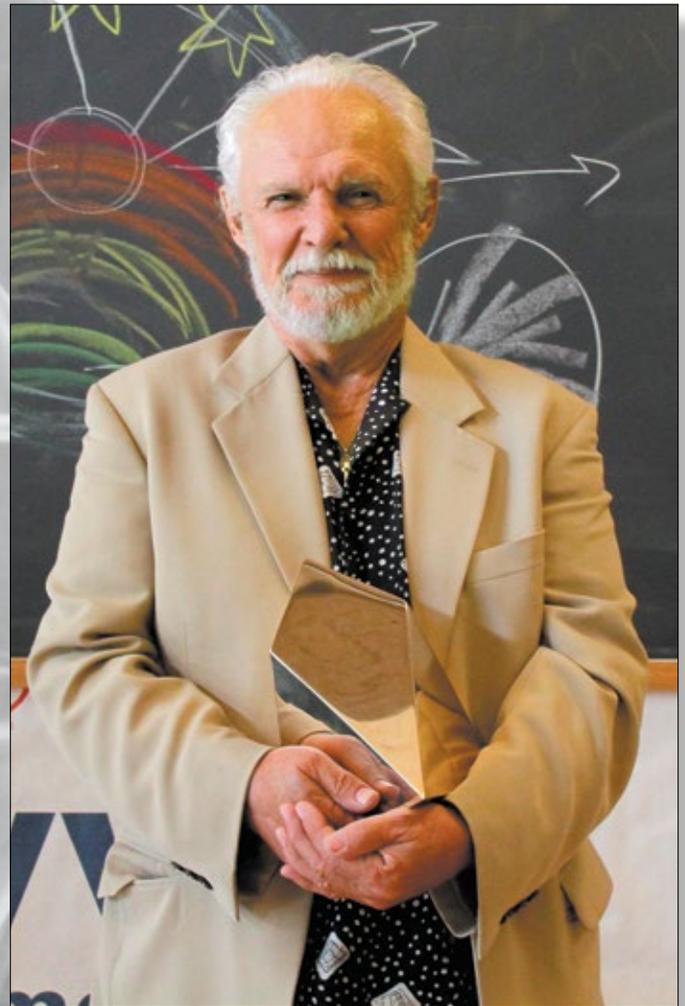
Discovering the Chestahedron

Let me introduce you to the work of Frank Chester: geometrician, sculptor, artist, teacher, and visionary. In the year 2000, Frank, who had recently retired from teaching sculpture and the arts for over 30 years, discovered the Platonic forms. These are volumetric solids formed by the three-dimensional tiling of a single two-dimensional shape, like a triangle, square, or pentagon. Of course you are familiar with the cube with its six square faces, or the tetrahedron, with its four triangular faces. You may also be familiar with the other Platonic solids: the octahedron, icosahedron, and the mysterious dodecahedron.

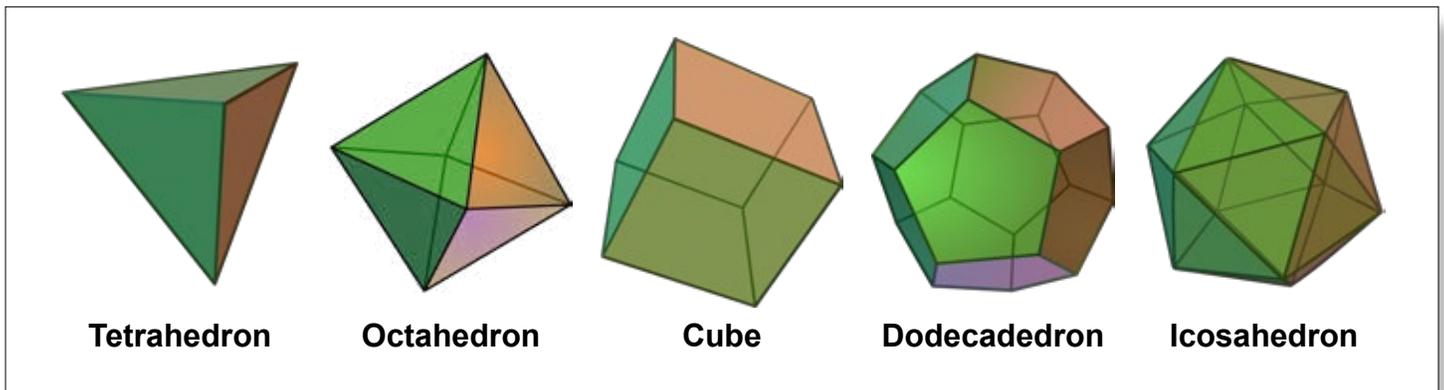


One of the original capitals
at the first Goetheanum.

Frank was fascinated by the precise way that the simple shapes of the faces fit together to create such symmetry and beauty. He had recently been to visit the Goetheanum, center of the spiritual-scientific movement known as anthroposophy, begun by Rudolf Steiner around the



POLYHEDRON						
NAME	FACES	POINTS	EDGES	TOTAL	POLYEDR	AREA
OCTAHEDRON	8	6	12	28	Δ	1.0
CHESTAHEDRON	7	7	12	28	$\Delta \square$	1.0
HEXAHEDRON	6	8	12	28	\square	1.0



turn of the 19th Century, where he began to be inspired by the number seven. The first Goetheanum included pillars with carved capitals that had a seven-fold nature, but the capitals were in relief, being essentially two-dimensional. Frank wondered if these seven-sided forms could be made truly three-dimensional.

Frank's discovery of the Platonic forms provided the impulse to research this question more deeply. Because he had never formally studied the Platonic forms before, he was unaware that only five Platonic solids are possible (at least in three dimensions), and immediately set out to see if there was a Platonic form that had seven faces of equal area that perfectly bounded a three-dimensional volume.

The answer is: no! No such form exists. Now imagine if Frank had been told this by an expert geometer and accepted this as a fact. He never would have embarked on the long and fascinating journey that has since transformed his life, and which stands poised to transform much more than that. His work can help us gain a new and complementary perspective on a diverse set of fields; from art, sculpture, and architecture to the form and function of the human heart, the interior of the Earth, fluid mixing methods, and more. Sometimes what we don't know is more important than what we do know, because it is from our unknowing that questions arise which propel us forward.

Luckily, Frank—ever manifesting a bent towards the practical manipulation of physical realities—was unaware that only five Platonic forms can ex-

ist, and immediately set out to make such a form. He walked to the nearby American River running through Fair Oaks, CA, where he was attending Dennis Klocek's Consciousness Studies program at Rudolf Steiner College (where he learned about the Platonic forms), crouched down at the shore, made a ball of mud and stuck seven little sticks into it, and set about trying to make the distance between the points equal.

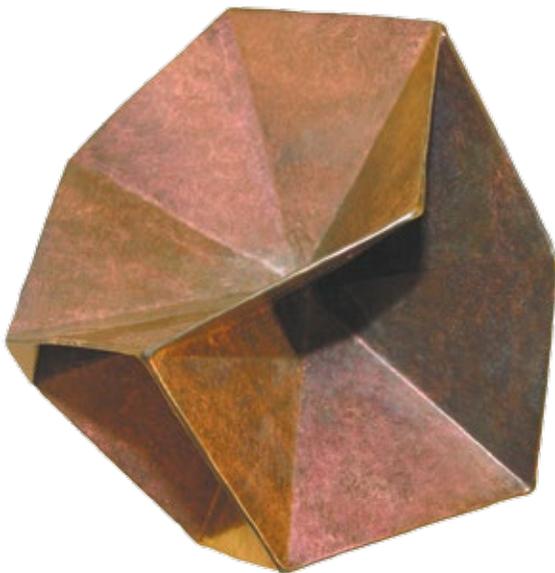


This seemed promising at first, but unfortunately trying to make faces by connecting the points with planes didn't yield a seven-sided figure, but rather an uneven figure with ten sides. Not to be discouraged, he then took a new avenue towards the problem, this time taking seven equal spheres (in his case, fishing bobs) and pressed them together around a ball of mud. This yielded an interesting sculptural form but was obviously not much closer to a Platonic form, which at the very least needs to be made of flat, planar faces and not curved edges.



The space between seven spheres pressed together.

So Frank then set to work constructing a more objective model of the negative-space between seven spheres, trying to use as few planes as possible. Triangles emerged and flexed around seven hollow spaces. Although there were far too many individual triangles, this seemed to be somewhat nearer the mark, particularly if some of the triangles could be flattened together, which would yield some faces that had four sides—quadrilaterals—in addition to the triangular shape of other faces. Could he get it down to seven total faces?



Moving towards objectivity.

It didn't seem possible. Every manipulation that flattened some faces had unintended effects elsewhere on the form, offsetting each attempt at symmetry. Perhaps this was related to another problem: this form was concave, but the Platonic solids were all convex, enclosing a space. Frank knew that if he filled the seven spaces with clay he would end up with a volume enclosing a space, but the key would be to make sure that the form only had seven faces in total.



The Chestahedron. A volume enclosed by seven sides of equal area, made up of four triangles and three quadrilaterals.

By moving back and forth between intuitive, subjective, and exacting, objective modes of working, Frank was able to refine the form into something he had never expected: a seven-sided form that enclosed a volume, made up of faces that all had an equal area, which is now called the Chestahe-

dron, both after its discoverer and because of its connections to the human chest, seat of the heart. What was unusual about Frank's new form was that instead of having only one shape for all its faces like the Platonic solids, it had two. The form is made of four equilateral triangles and three quadrilaterals (kite shapes); the triangles have exactly the same area as the kites, and there are seven faces in total. Although not a Platonic form, Frank had discovered something quite amazing!

Between Art and Science

From a purely geometric perspective, the Chestahedron is a remarkable form. Since the form was discovered in 2000, Frank has devoted himself full-time to its exploration, unraveling a series of connections that he never could have expected nor predicted. Not content with only studying traditional sacred geometry, Frank is working to extend and update both the operative principles and the content of sacred geometry for the modern era. Not a theorist but an intrepid practitioner who learns through the phenomenology of action, Frank solves questions by creating models, drawings, sculptures, and contraptions, and then keenly observing the results. He then feeds back his observations into his creative process both through concentrated study and through deep reflection. This leads him to generate new questions, which in his world is tantamount to the invitation to create new forms. The whole cycle is a meditative one, a phenomenological unfolding of the transformation of form through the work of his hands. Frank is an alchemist of form.

Rudolf Steiner said that geometry is "a knowledge which appears to be produced by man, but which, nevertheless, has a significance quite independent of him." Frank's work perfectly exemplifies this dynamic interplay between the creative effort of producing entirely new forms and the difficult but rewarding search for their possible significance.

This way of working can be contrasted with the current split between "pure" and applied sciences.



An exhibition of some of Frank's work

The history of mathematics is replete with cases where freely created abstract mathematical relations with no obvious ties to the physical world eventually become central to solving "real-world" problems. But when the link between the pure logic and its potential significance is not held in dynamic balance in the individual, a great opportunity for the two poles of activity to mutually enliven each other is lost.

Frank's style of working serves as a kind of healing of this gap, constantly weaving between the abstract logic of geometry and the way that the relations found there illuminate the world around us. Importantly, the way that this weaving between worlds is accomplished is by virtue of a rhythmic artistic process. This allows new directions to be explored not just on the basis of purely logical consequences on the one hand or purely material considerations on the other, but in a way that is colored by a deep engagement of the soul in the creative activity as it unfolds between the abstract and material.



It is a process that is recursively open to both new logical insights and new material discoveries, and acts as a bridge between them. The bridge itself is constructed out of soul activity as it shifts in response to the tension between the logical and material, between the spiritual and physical, and between the archetypal and the particular. As in a suspension bridge, the functionality depends upon harmoniously balancing forces from multiple simultaneous directions, not by eliminating the tension, but by maintaining it as the very source from which new creative work springs.

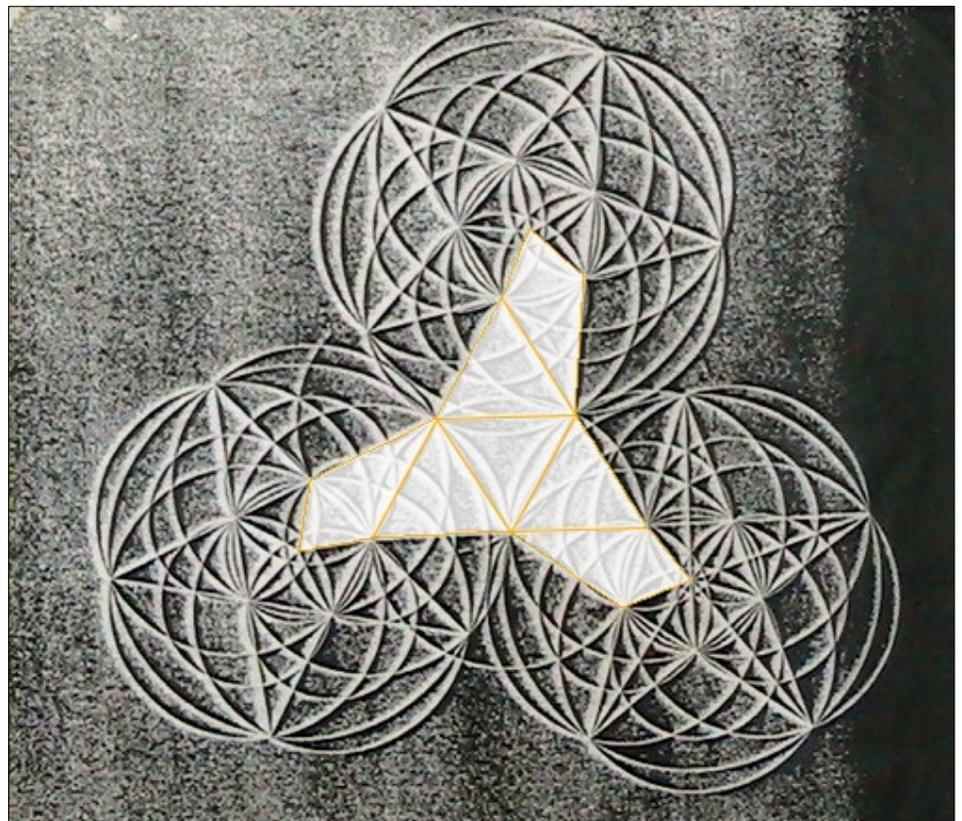
The kind of process Frank is working with has serious implications for the practice of both science and art. It points to the need for modern science, which is still laboring to free itself from the spell of the enlightenment-era notion of “objectivity,” to open its doors to a more subtle and human way of working that does not discount what it cannot immediately understand. Similarly, it points to how the arts can benefit from opening doors to science. Rather than ignoring or even disparaging science, the arts can engage with science both as a source of inspiration and as a way to bring to art the same kind of process that when directed at purely material relations yields scientific knowledge. What results is neither only scientific nor only artistic, but a marriage of the two that takes each further. It points to what I like to call an aesthetic epistemology, which is to say, a way of knowing that deeply integrates not only the best that modern analytic thinking has to offer, but also what is made possible through the full, sensitive, creative, intuitive powers of the human being.

Goethe called for something similar with his “delicate empiricism,” which inspired Rudolf Steiner’s creation of anthro-

posophy, or spiritual science, and which inspired Frank Chester, who is now carrying the impulse forward in his own unique way.

The Chestahedron and the Platonic Solids

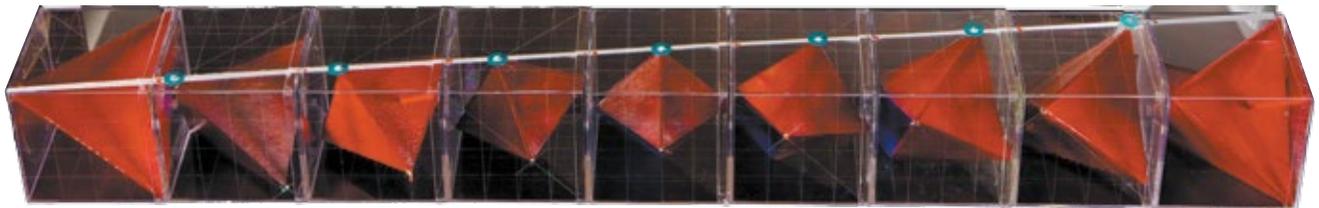
It is not enough to have discovered a new geometric form, never seen before, the first seven-sided volume with faces of equal area. (It should be noted that another, trivially formed, seven-sided volume with faces of equal areas exists, which can be described as a tetrahedron sitting on top of a triangular prism, such that the rectangular faces of the prism have an area equal to that of the triangles, but this form has none of the other interesting properties of the Chestahedron.) The process by which Frank found the form was not itself strictly geometric. But if the form is to be significant, it must be related to other forms in sacred geometry, and ultimately to phenomena in the physical world.



The full two-dimensional geometry of the Chestahedron, derived from the Vesica Piscis

This is indeed the case. Like any three-dimensional solid, the Chestahedron can be formed by folding up a two-dimensional form. What is fascinating about the Chestahedron is that its two-dimensional, 'unfolded' version (see picture on previous page) is found to relate exactly and unexpectedly to a perfect five-pointed star! It turns out that five of the Chestahedron's kite shapes, placed with their points together, makes the star pentagon. (See the Chestahedron construction template at the end of this article for how this works, and to make your own three-dimensional Chestahedron!) What this means is that the Chestahedron, which has three of the kite-shapes, can be created by folding up a star pentagon on itself, bringing it into three dimensions. Structurally, the whole form is there when this is done—try it!—with the four equilateral triangles easily found by connecting the three unconnected vertices together, which were the tips of the star.

Firstly, Frank found that the Chestahedron can be created in two very distinct ways from a tetrahedron. The first way involves placing a tetrahedron inside a cube, and—while keeping the boundaries of the cube inviolate—twisting the tetrahedron so that one of its points moves along the diagonal of one square face to the opposite corner. This requires that the tetrahedron change its shape. At the half-way point, the tetrahedron has metamorphosed into another other of the Platonic forms—the octahedron. But more importantly, there are two moments, intermediate between the original tetrahedron and the formation of the octahedron, that yield the Chestahedron. That is, the Chestahedron is both a transformation of the tetrahedron and the octahedron, within the boundaries of the cube, accomplished by the motion of lawful twisting. It is fascinating that the Chestahedron arises through a vortexial motion lawfully relating three Platonic forms.



Tetrahedron → Chestahedron → Octahedron → Chestahedron → Tetrahedron

This relationship is unusual—why should the kite forms be exactly the same as that in a star pentagon? Because the Chestahedron is related to the star pentagon, it is related to the normal pentagon as well—which forms the face of that most unusual of the Platonic forms, the dodecahedron. Could the Chestahedron relate to the other Platonic forms as well?

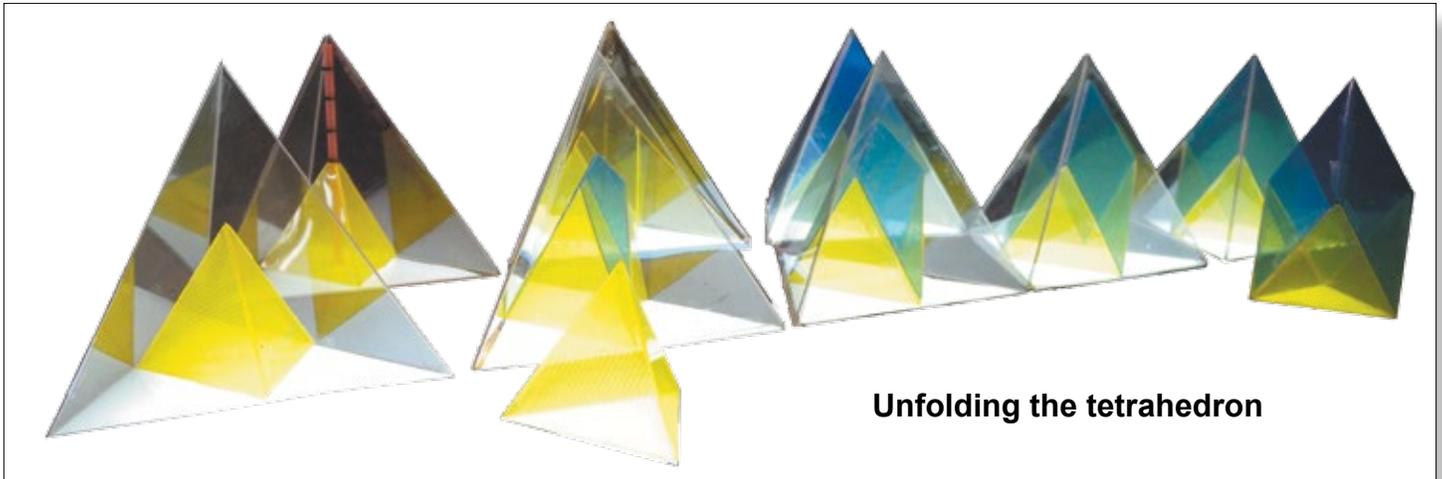
It has taken Frank, working essentially alone, over a decade to answer conclusively in the affirmative. I am here only going to directly relate a few select results from these decades of work, as a detailed examination of all the geometric relations and how Frank discovered them would be too much for an introductory article. What follows can therefore only be indicative.

To my knowledge, no one else has ever done something like this: twisting one Platonic form within another. Kepler embedded the forms in successive layers, but the geometry of the Chestahedron is a geometry of motion. This is not the more austere countenance of traditional sacred geometry, but one that depends entirely on metamorphosing, transforming, evolving, and relating forms dynamically to each other. The Chestahedron itself is merely a balanced moment of rest in a whole field of geometric activity that involves all of the Platonic forms. But I mentioned two ways of creating the Chestahedron from the tetrahedron.

Whereas the first way is a contractive mode, constrained by the boundaries of the cube, the sec-

Another way of forming the Chestahedron is expansive. It begins with the tetrahedron, which is then unfolded like a flower with three petals. I have created an animation of this transformation, which can be seen here: www.frankchester.com/2009/chestahedron-from-a-tetrahedron/

and at this moment the transformed Chestahedron takes the shape of a perfect octahedron that has sitting on top of it a tetrahedron that is exactly the size of the original tetrahedron. What is more, this whole form itself is bounded by a tetrahedron that is exactly twice the size of the original. Again we see the



Unfolding the tetrahedron

In this sequence, the opening of the tetrahedron immediately creates a seven-sided form with the addition of the three kite-shaped faces (blue in the image above). It only remains to unfold the petals to the exact angle at which the area of the kite faces equals the area of the equilateral triangles. This occurs at a dihedral angle (formed between the triangle and kite faces) of 94.83° . At this moment, the faces all become equal in area and the Chestahedron is formed.

Chestahedron appearing out of a dynamic relationship between the tetrahedron and octahedron.

Frank has also found a way to lawfully relate the Chestahedron to the icosahedron and dodecahedron as well. In each case the fundamental uniting factor is the base equilateral triangle (see below).

His work with the Chestahedron led Frank to a very interesting and unexpected discovery with respect to the relationship that the Platonic solids

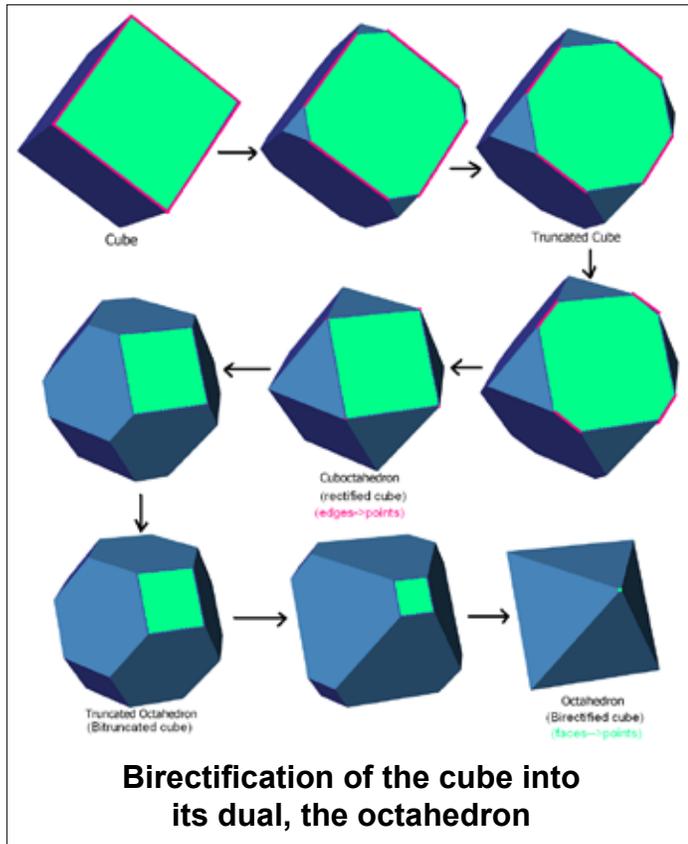
What should be pointed out is that this unfolding sequence, traced through time, can be taken further. If the unfolding of the petals continues past the point at which the Chestahedron arises, then a moment comes when the dihedral angle becomes 109.47° ,



An unfolded Chestahedron and the dodecahedron, a Chestahedron inside a dodecahedron, and the Chestahedron's relationship to an icosahedron.

have with each other. It has long been known that every Platonic solid can be subjected to a procedure of transforming its points into planes and its planes into points, to create what is known as its dual form. To find the dual form of a Platonic solid, you simply squish the form at its points into planes, a procedure technically known as truncation. Continuing this process to its penultimate

The dual of the cube is the octahedron (this also means that the dual of the octahedron is the cube), and the dual of the icosahedron is the dodecahedron. This leaves the tetrahedron, which is dual to itself. But this leaves the Platonic forms only related in two pairs with the tetrahedron forming a special pair with itself. Because the Ches-tahedron seemed to be a form that related some of the Platonic forms with each other, Frank wondered if there might be another way in which the Platonic forms could be related so that instead of only forming isolated pairs, a full sequence could be had that lawfully related all the forms together. Indeed, such a serial transformation was found, using the principle of truncation (contractions) as follows:

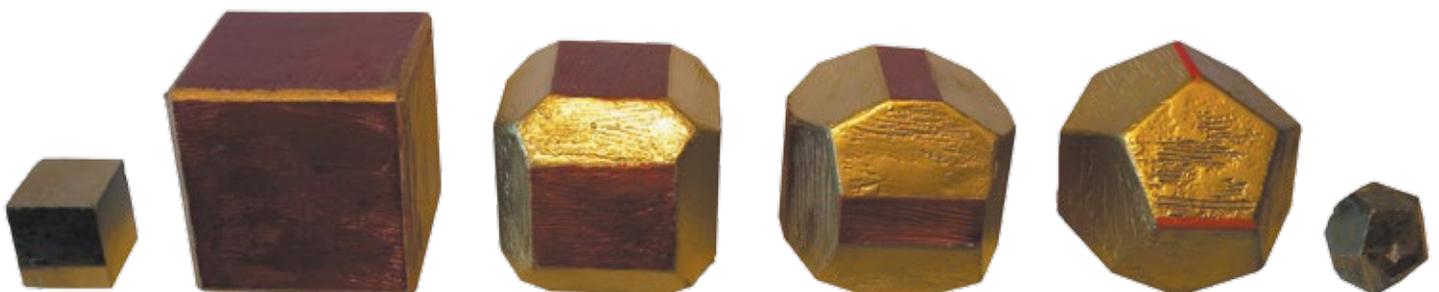


Truncating the tetrahedron yields the octahedron (as a transitional form halfway between the tetrahedron and its dual, which is itself). Then the octahedron's points are truncated so its dual, the cube, arises. However at this stage we have a challenge: truncation of the cube only yields the octahedron again. Here is where Frank made a discovery: he found that the cube can transform into the dodecahedron if, instead of pushing points into planes, the edges of the cube are pushed into planes.

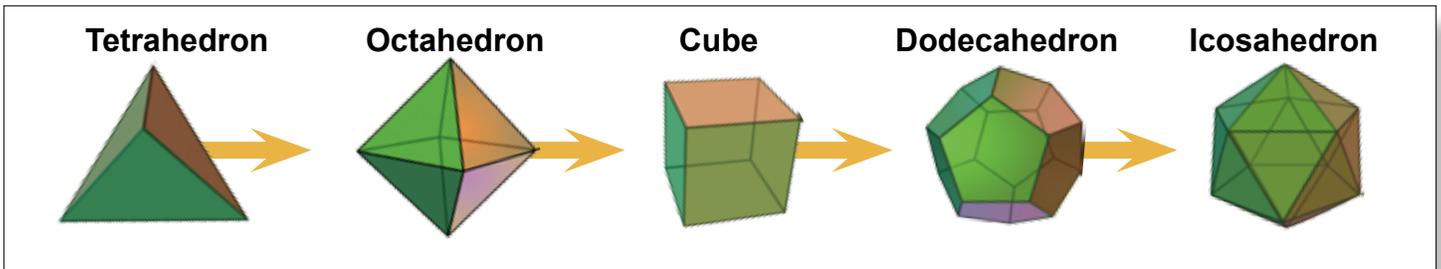
stage is known as birectification, when the dual form appears and no further truncation is possible using the original planes. I highly recommend that you experience this directly by getting a small amount of softened wax or clay and transforming it with only your hands.

Finally the dodecahedron's points are truncated to yield the icosahedron. The order of the Platonic solids can thus be formulated to follow the sequence: tetrahedron, octahedron, cube, dodecahedron, and finally icosahedron.

What is important about this sequence is that it uses the contractive principle of truncation to phenomenologically yield a coherent and complete transformative ordering which includes all of



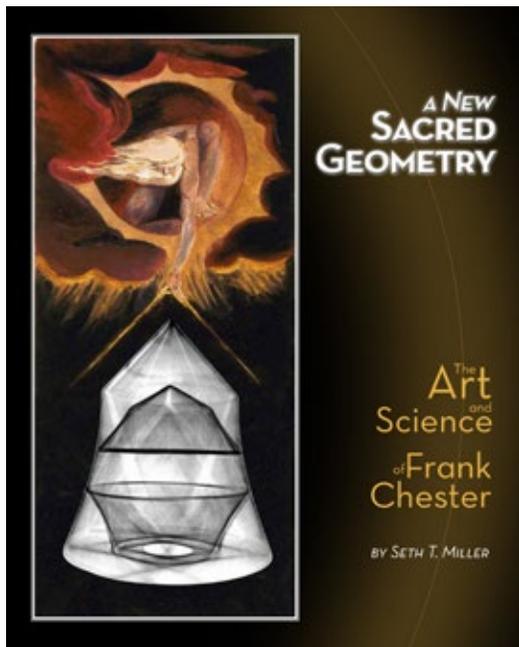
Transforming the cube into the dodecahedron by truncating along its edges.



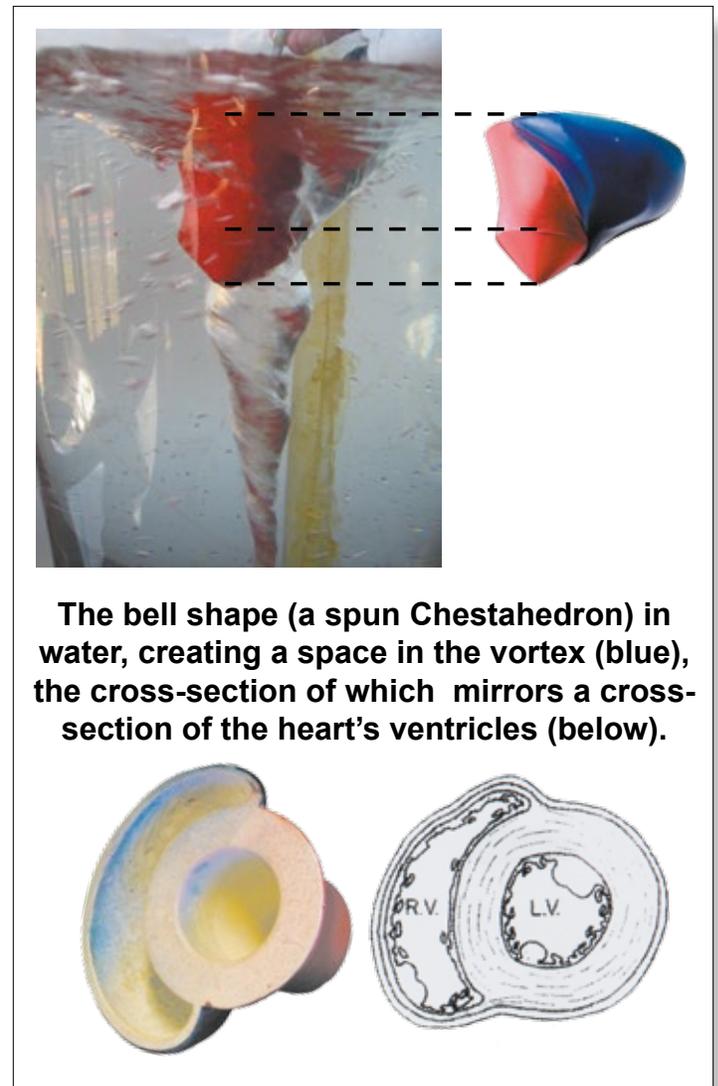
the Platonic solids. This is a new way of working with these forms and their order. In both Western and Eastern traditions, different orderings have been used, but Frank's is the first sequence based on phenomenological, not abstract or concept-based, transformations of the forms. See his lecture Architecture and Form for more on: www.frankchester.com/2012/lecture-architecture-and-form/

Applications

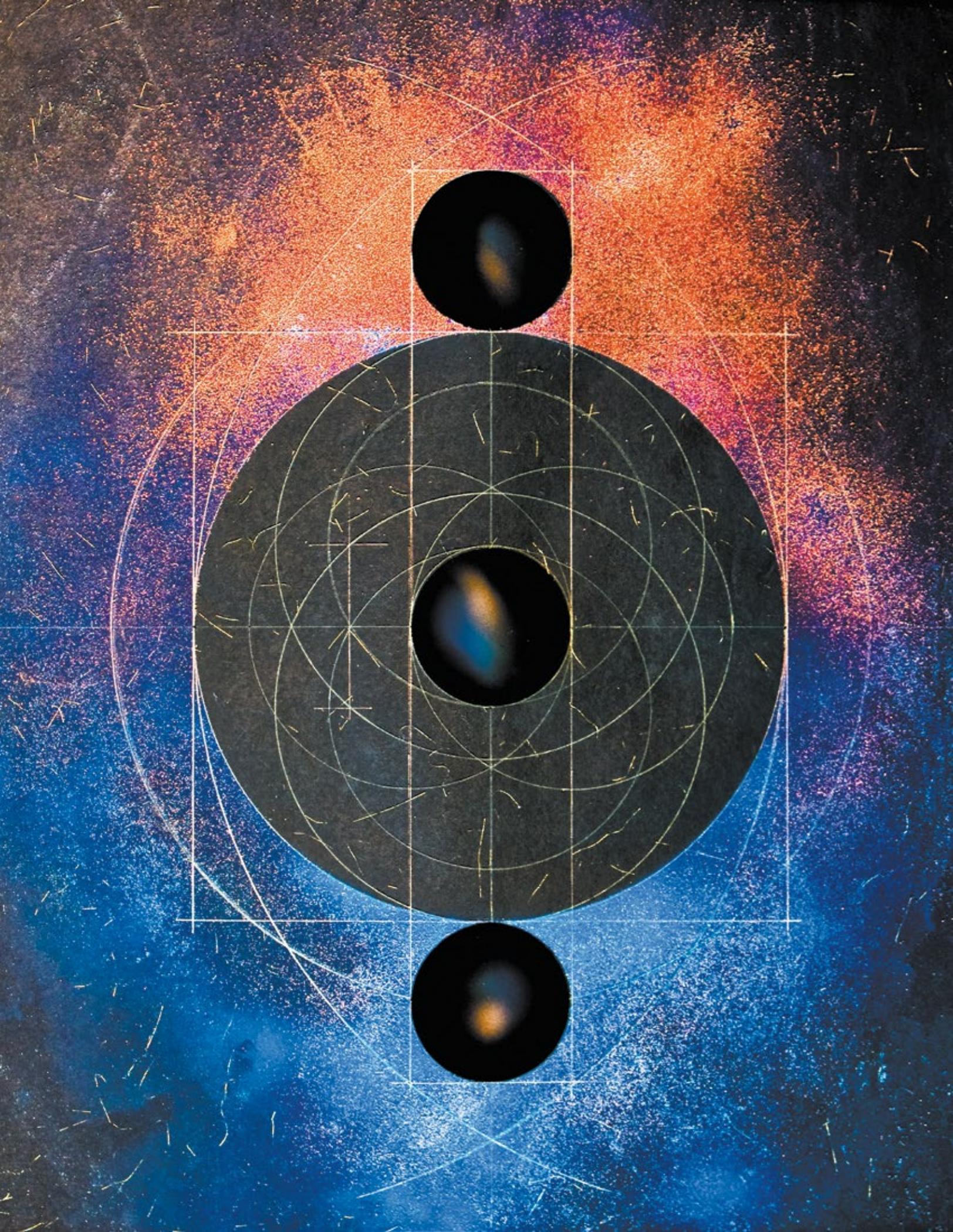
The above has been only a basic glimpse into the unique geometric aspects of the Chestahedron. This is fascinating enough in itself, but Frank has discovered that the Chestahedron has a number of unusual connections to worldly phenomena as well. These can only be indicated here; a more detailed exploration can be found in my book, *A New Sacred Geometry: The Art and Science of Frank Chester*, available at: www.spiritalchemy.com/book.



The most important of the connections that Frank has found has to do with the geometry of the human heart, including both the positioning of the heart in the chest cavity and the actual geometry of the heart itself, particularly the shape and relative sizes of the left and right ventricles. When spun, the Chestahedron traces out a unique bell shape; this bell shape, when spun in water at an angle equivalent to the angle at which the heart sits in the chest, produces a vortex that has a uniquely-shaped cavity that appears around



The bell shape (a spun Chestahedron) in water, creating a space in the vortex (blue), the cross-section of which mirrors a cross-section of the heart's ventricles (below).

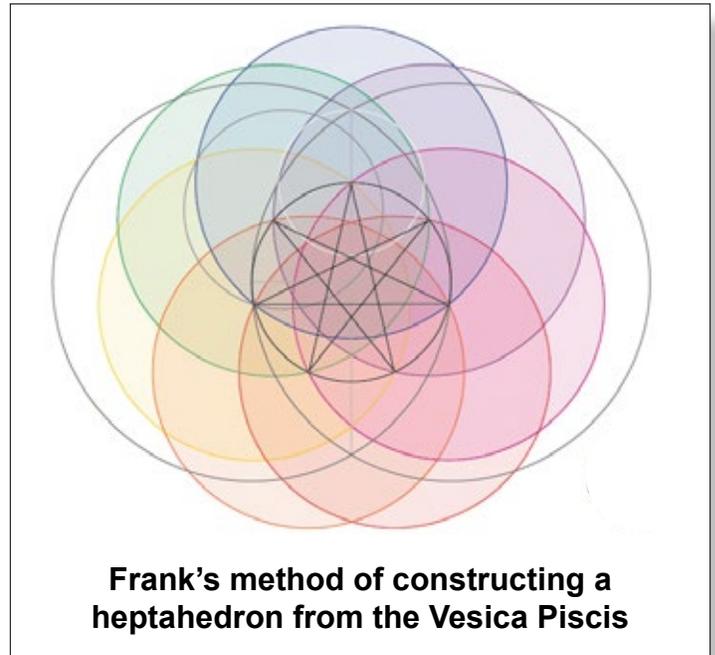


the form. A cross-section of the bell and cavity bears a striking resemblance to a cross-section of the human heart. Frank has also shown how the Chestahedron relates to the orientation of the successive layers of the heart's muscles, the relative thickness of the ventricle walls, the size of the ventricle openings, the shape of the whole heart, the extreme thinness of the heart's apex, the vortexial motion of the heart and of the blood inside it, and how all of this relates to the famous sacred-geometric form of the Vesica Piscis and the square root of 3. Much more could be said on this topic; I refer you to his lecture *The Heart's Art*, available for free at www.frankchester.com/2011/the-hearts-art/. (See a list of all the available videos on the site at: www.frankchester.com/category/video/. Frank is very kind to make these recordings freely available in an effort to share his discoveries as widely as possible.)

Moving onwards with sketches of his work, Frank found that the Chestahedron fits also in a sphere, and this got him wondering about potential relationships between his form and the sphere of the Earth. He has found a number of interesting geometric relations, particularly with respect to the size of the inner and outer cores of the Earth, the placement of the auroras, and the relative size of the core of the Earth and the Moon.

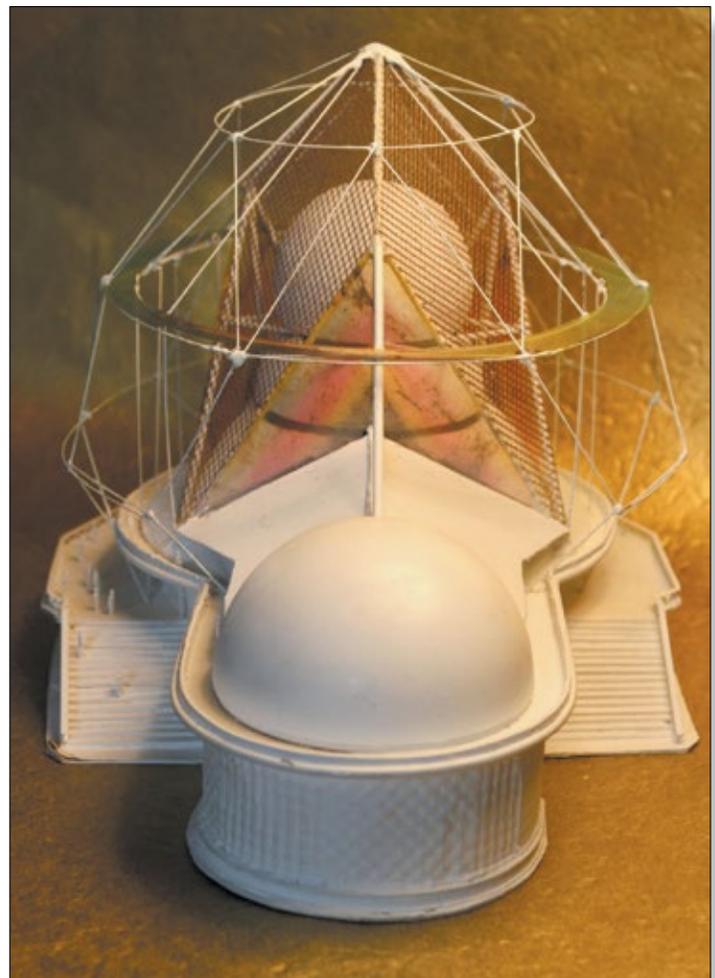
Continuing in a long line of sacred geometers, Frank has discovered a new way to square the circle (constructing a square and a circle that have equal perimeters). His method uses only a straightedge and compass, and is the first to work from the inside out using the Vesica Piscis. The mathematics of this construction are known exactly. Measurements of the circumference of the circle and the perimeter of the square agree to within 99.9+%, with the perimeter of the square ever so slightly smaller than the circumference of the circle. He has also discovered a new straightedge and compass procedure to create a heptagon, a seven-sided polygon, using the Vesica Piscis. This is the first known construction that places the heptagon inside the center of the Vesica Piscis.

Frank has also used the geometry of the Chesta-

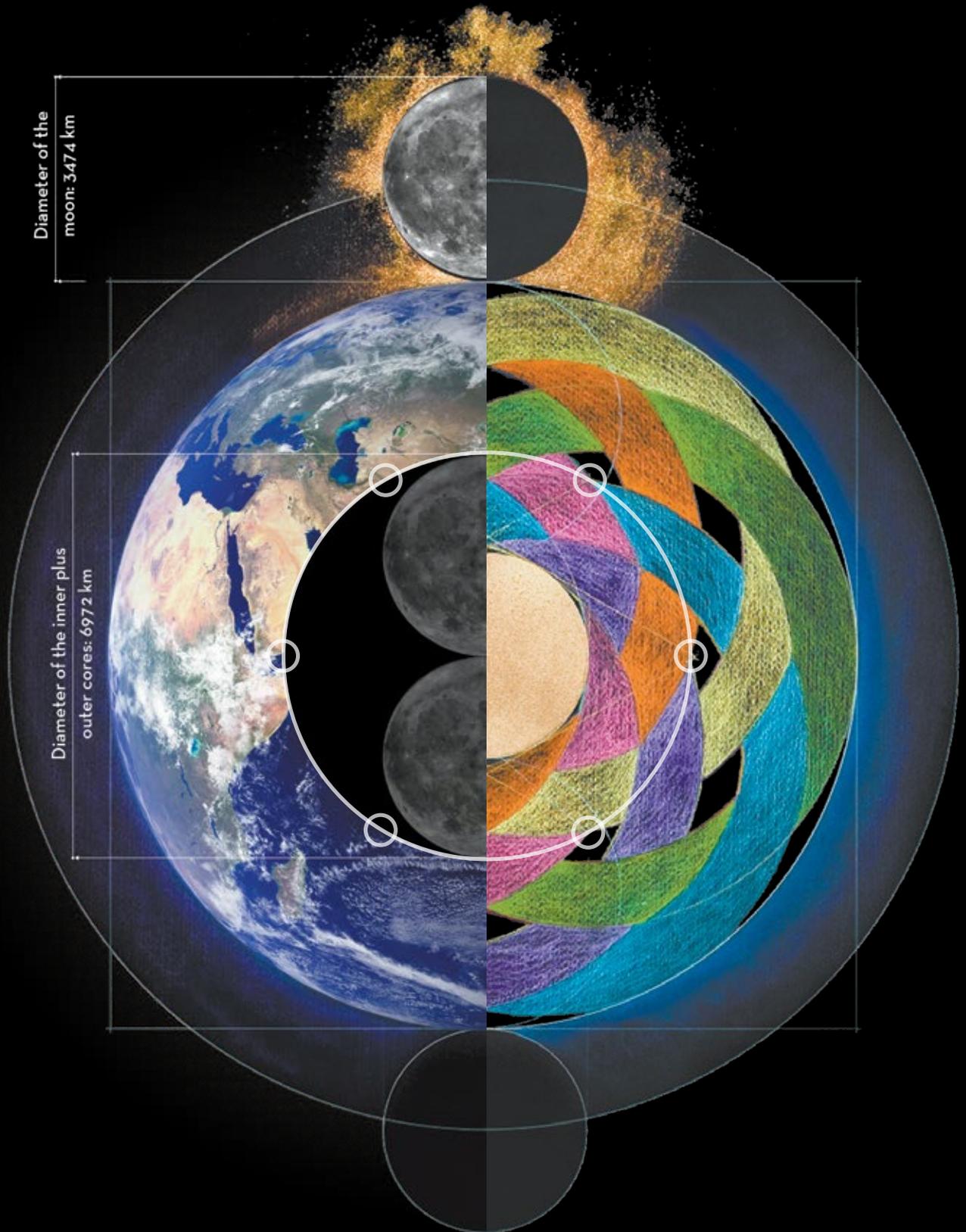


Frank's method of constructing a heptahedron from the Vesica Piscis

hedron, and its dual, the dekatria (a thirteen-sided form), as the basis for sacred architecture. See his lecture, *Building a New Mystery Center* (available at: www.frankchester.com/2012/building-a-new-mystery-center/) for more on this topic.



SQUARING THE CIRCLE USING THE VESICA PISCIS



He has connected the Chestahedron to the oldest sacred-geometric form, the Flower of Life, and has shown how the Flower of Life can be made into a three-dimensional form: www.frankchester.com/2013/lecture-chico-ca/

More recently, Frank has been working on a unique, patented, fluid mixing device based on the geometry of the Chestahedron, known as the Chesta Vortex Organizer or CVO. This device, still under testing, induces rhythmical vortex formation in water alternating with moments of impressively chaotic aeration. You can see a short demonstration of the device in action during a testing run in the Philippines here: www.frankchester.com/2013/san-carlos-research-laboratory/

Up until this year, Frank has been obliged to accomplish all this work alone from his very small apartment in San Francisco. Due to the generous donation of a workshop space from ADCO Outdoor Advertising and an initial seed grant from the Raphael Medical Foundation, Frank has been able to open the New Form Technology Research Center in San Carlos, CA, where he is currently researching and testing the CVO. Many volunteers now attend his open-workshop Wednesdays to hear him lecture and to pursue their own projects.

Frank's journey, and he would be the first to tell you this, was completely unexpected. Never in his wildest dreams would he have thought that his simple initial question about the existence of a seven-sided Platonic form would take him so deeply into sacred geometry, or that his search would have potential applications in such diverse realms. As a retired teacher, Frank supports himself in part through the sale of his prints (www.frankchester.com/prints/) and sculptures (www.frankchester.com/sculpture/). His artistic work demonstrates the central principle that runs through all of his endeavors: the balancing of the exact with the imaginative, the precise with the beautiful, the material world with the spiritual.

Like the alchemists, Frank seeks no less than an integration between the Above and Below. I invite you to explore more of his work at www.frankchester.com, or to get the book at www.spiritalchemy.com/book.



One of Frank's prints, utilizing the Chestahedron geometry and showing the way it relates five-foldness and seven-foldness

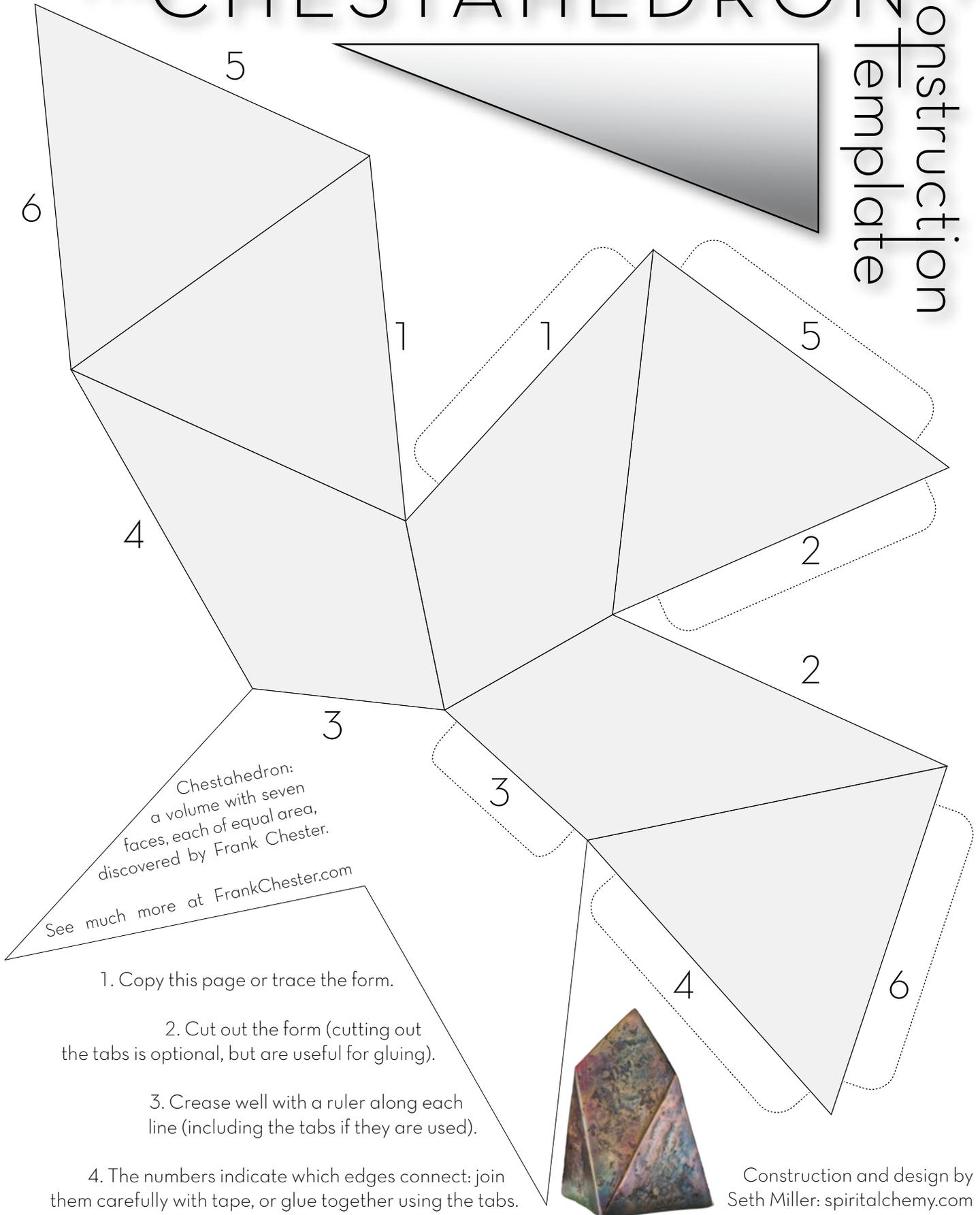
About the Author

Seth Miller has a closet of hats: professor, lecturer, Waldorf teacher, designer, author, tech support, webmaster, and perpetual student. He has a BA in Philosophy from The Colorado College, an MA in Consciousness Studies from JFK University, and is currently completing his PhD dissertation exploring epistemological connections between anthroposophy and second-order cybernetics. It's as esoteric as it sounds, but he is sure you'd find it fascinating over a nice cup of coffee sometime. He can be reached at spiritself@gmail.com, or through his website, www.spiritalchemy.com/contact.



The CHESTAHEDRON

Construction template



Chestahedron:
a volume with seven
faces, each of equal area,
discovered by Frank Chester.
See much more at FrankChester.com

1. Copy this page or trace the form.
2. Cut out the form (cutting out the tabs is optional, but are useful for gluing).
3. Crease well with a ruler along each line (including the tabs if they are used).
4. The numbers indicate which edges connect: join them carefully with tape, or glue together using the tabs.

Construction and design by
Seth Miller: spiritualchemy.com