
GENERATING THE FIVE PLATONIC SOLIDS WITH NICHOLAS OF CUSA'S METHOD OF *FOLDING, UNFOLDING, AND ENFOLDING*

A New Year gift: Why is the Divine Proportion of the Dodecahedron such a knotty affair?

By Pierre Beaudry, 1/2/2023

INTRODUCTION

There is a Nicholas of Cusa method for generating the five Platonic solids by way of *folding, unfolding, and enfolding*. And, you don't need a compass, a straight edge, or any mathematical calculation to do the work. All you need to do is to wave your hands around like a chorus director. I like to call this the ironic waving around a knotty Divine Proportion, because it causes you to be creative by having your mind make an axiomatic backward flip into yourself to locate a higher epistemological level; that is, into a domain which discards all *simple hypothesis of circular folding* and takes you into the *higher hypothesis of continuous doubly-connected circular action*.

It may appear that all five Platonic solids can be generated by simple circular action *folding*, that is not true. The truth of the matter is that only the tetrahedron, the cube, the octahedron, and the icosahedron can be generated by *simple circular action of folding circles*, because simple *folding* cannot be applied in the construction of the dodecahedron. What is required is a *higher hypothesis of doubly-connected self-similar spiral action*, that is, by *folding, unfolding, and enfolding* in accordance with the method of Nicholas of Cusa. Add to this method the following *higher hypothesis* that Lyndon LaRouche made, in 1983, about the life and death question of "the significance of the Golden Section." He wrote:

"The rediscovery of what is known today as the isoperimetric theorem of topology, by Cardinal Nicholas of Cusa during the 15th century, was the central feature of Cusa's work founding modern European science and setting a rigorous physical science into motion among Cusa's successors. This rediscovery was indispensable for elaborating a rigorous understanding of the contents of Plato's *Timaeus* dialogue, the

elaboration on which the entirety of modern European mathematical science's fundamental contributions depends.

“The three central features of that *Timaeus* dialogue are, first, the isoperimetric principle, the proof that only five kinds of regular polyhedra can be constructed in visible space, and a principle described by Plato as the *hypothesis of the higher hypothesis*. The formal problem which European science faced in attempting to comprehend the *Timaeus*'s contents, until Cusa's work, was that this isoperimetric principle was present in the *Timaeus* only by implication, and that Europeans were burdened by the mistaken view that Plato's principles of geometry were in agreement with the axiomatic, syllogistic structure of the version of *Euclid's Elements* written more than a century after Plato's lifetime, in Egypt.

“Cusa's rediscovery of the isoperimetric principle led in the direction of the elaboration of a non-Euclidean geometry of the type of Prof. Jacob Steiner's 19th-century elaboration of a synthetic geometry, a geometry without axioms or syllogistic structures, based solely on the principle of construction starting only from the isoperimetric principle.”¹

This takes us to the question of how to go beyond the apparent limitations of simple circular action into a higher non-Aristotelian and non-Euclidean geometry; that is, how to discover the pathway of constructing the dodecahedron from the vantage point of a *higher principle of Divine Proportion*.

GENERATING THE PLATONIC SOLIDS WITH NICHOLAS OF CUSA'S METHOD

True beauty is not self-evident and does not manifest itself in the appearance of any object or in the shape of its form; it appears in the process by means of which that object or that form is made to reveal to you the higher domain of the principle that generated it. Beauty is in the creative process of discovering that your mind is similar to the Mind of the Creator. Raphael's *The School of Athens* is a good example where the beauty incorporated into it lies in the difference between faith and reason, theology and philosophy; that is, when their unity in the *coincidence of opposites* makes you discover the central difference between Plato and Aristotle.

There is, however, no unity of opposites between Plato and Aristotle; there is only an *irreconcilable difference of axiomatic proportion as between continuous spiral action and simple discontinuous circular action*. This difference can best be expressed by the *actions of folding, unfolding, and enfolding*, in the simultaneity of eternity, which Nicholas of Cusa developed briefly in his essay, *The Vision of God*. Cusa expressed the four step process as a rigorous form

¹ Lyndon LaRouche, [A Matter of Life or Death](#), EIR, Vol. 49, No. 50, December 23, 2022, p. 39.

of epistemological geometry which generates the five Platonic solids by conceiving eternity as God's Conception of the clock.

“Now, because in God's Concept the clock is the Concept, we see to some small extent how the following are true: (1) that succession is present in the clock without there being succession in the Word, or Concept; (2) that in this most simple Concept are enfolded all movements and sounds and whatever we experience as in succession; (3) that whatever occurs successively does not in any way pass outside the Concept but is the unfolding of the Concept, so that the Concept gives being to each [successive thing]; (4) that the reason [each event] was nothing before it occurred is that it was not conceived before it existed. So, let the concept of a clock be, as it were, eternity itself. Then, in the clock, movement is succession. Therefore, eternity enfolds and unfolds succession; for the Concept of a clock—a Concept which is eternity—both enfolds and unfolds all things.²

In essence, beauty is not found in sense perception. One way to understand Cusa's concept of *folding* is to apply it by generating the five Platonic solids. However, only the first four solids are constructible by simple circular action; that is, the tetrahedron, the cube, the octahedron, and the icosahedron.

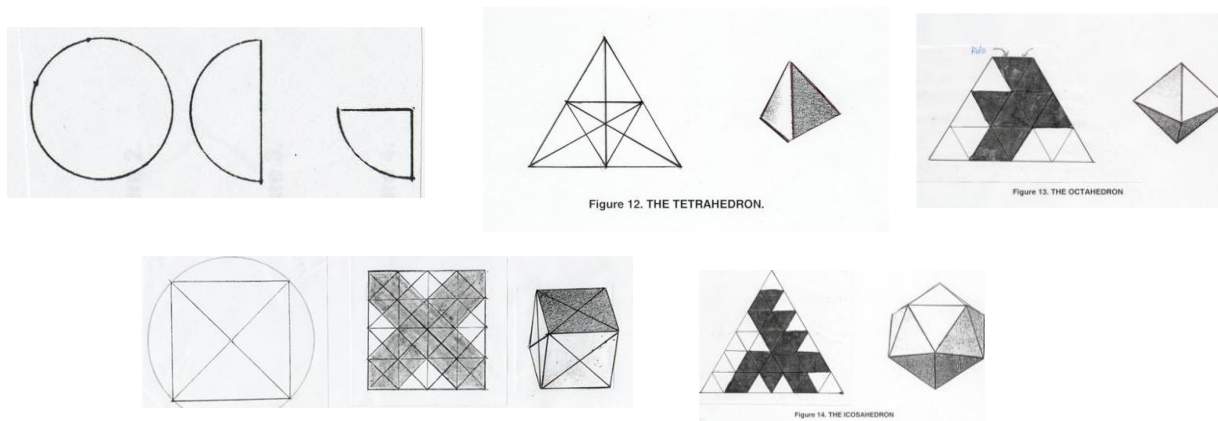


Figure 1. The four Platonic solids constructible by *simple circular folding*

² ***NICHOLAS OF CUSA'S DIALECTICAL MYSTICISM***, Text, Translation, and Interpretive Study of *De Visione Dei*, translated by Jasper Hopkins, The Arthur J. Banning Press, Minneapolis, second edition, 1988, p. 701.

The reason the dodecahedron cannot be constructed with simple circular action is because two motions are required for the generation of the Golden Section of Divine Proportion; that is, a doubly-connected form of two continuous circular actions at right angle to each other: a Poloidal circular action that is *going inside of itself (enfolding)* and a Toroidal circular action that is *going out of itself (unfolding)*. Thus, the torus is the geometrical spiral which forms such a *doubly-connected circular action*. Cusa speaks of the coincidence of those two opposite circular motions as follows:

“Trusting in Your help, O Lord, I turn once again in order to find You beyond the wall of the coincidence of enfolding and unfolding. And when at one and the same time I go in and out through the door of Your Word and Concept, I find most sweet nourishment. When I find You to be a power that enfolds all things, I go in. When I find You to be a power that unfolds, I go out. When I find You to be a power that both enfolds and unfolds, I both go in and go out. From creatures I go in unto You, who are Creator—go in from the effects unto the Cause. I go out from You, who are Creator—go out from the Cause unto the effects. I both go in and go out when I see that going out is going in and that, likewise, going in is going out. (By comparison, he who counts unfolds and enfolds, alike: he unfolds the power of oneness, and he enfolds number in oneness.) For creation's going out from You is creation's going in unto You; and unfolding is enfolding. And when I see You-who-are-God in Paradise, which this wall of the coincidence of opposites surrounds, I see that You neither enfold nor unfold— whether separately or collectively. For both separating and conjoining are the wall of coincidence, beyond which You dwell, free from whatever can be either spoken of or thought of.”³

The crucial issue to understand, here, is the matter of *underlying assumptions*, because such epistemological matters are not obvious and people do tend to make mental mistakes when they defend their false assumptions about the reality of things without realizing it. Take for example, the case of points, lines and surfaces: most people believe that bodies are made up of surfaces, flat or curved, which are made up of lines, which are made up of points. That is an Aristotelian-Euclidean-Euler fallacy of composition. Here is how Leonardo Da Vinci destroyed the fallacy of the underlying deductive assumptions about points, lines, surfaces, and solid bodies:

“The point has no centre, but is itself a centre and nothing can be smaller. The point is the minimum. The point is indivisible by the mind. The point has no parts. The point is the end which nothingness and the line have in common. It is neither nothingness nor line, nor does it occupy a space between them. Therefore the end of nothingness and the beginning of the line are in contact with one another, but they are not joined together,

³ Nicholas of Cusa, Op. Cit, p. 701.

for between them, dividing them, is the point. . . . And from this it follows that many points imagined in continuous contact do not constitute the line and therefore many lines in continuous contact along their sides do not make a surface, nor do many surfaces in continuous contact make a body, because among us bodies are not formed of incorporeal things. . . .”⁴

Here, Leonardo is applying Cusa's axiomatic *higher hypothesis* whereby points, lines, surfaces, and solids are imaginary incorporeal things which are produced by *folding, unfolding, and enfolding* spiral action. A point, a line, a triangle, and a square, for example, require only the repeated *folding* of the circle on itself; a Golden Section pentagon, on the other hand, requires all three functions of *folding, unfolding, and enfolding*. Such are the measuring means to be taken to produce anything without any underlying assumptions. (See Figure 2.)

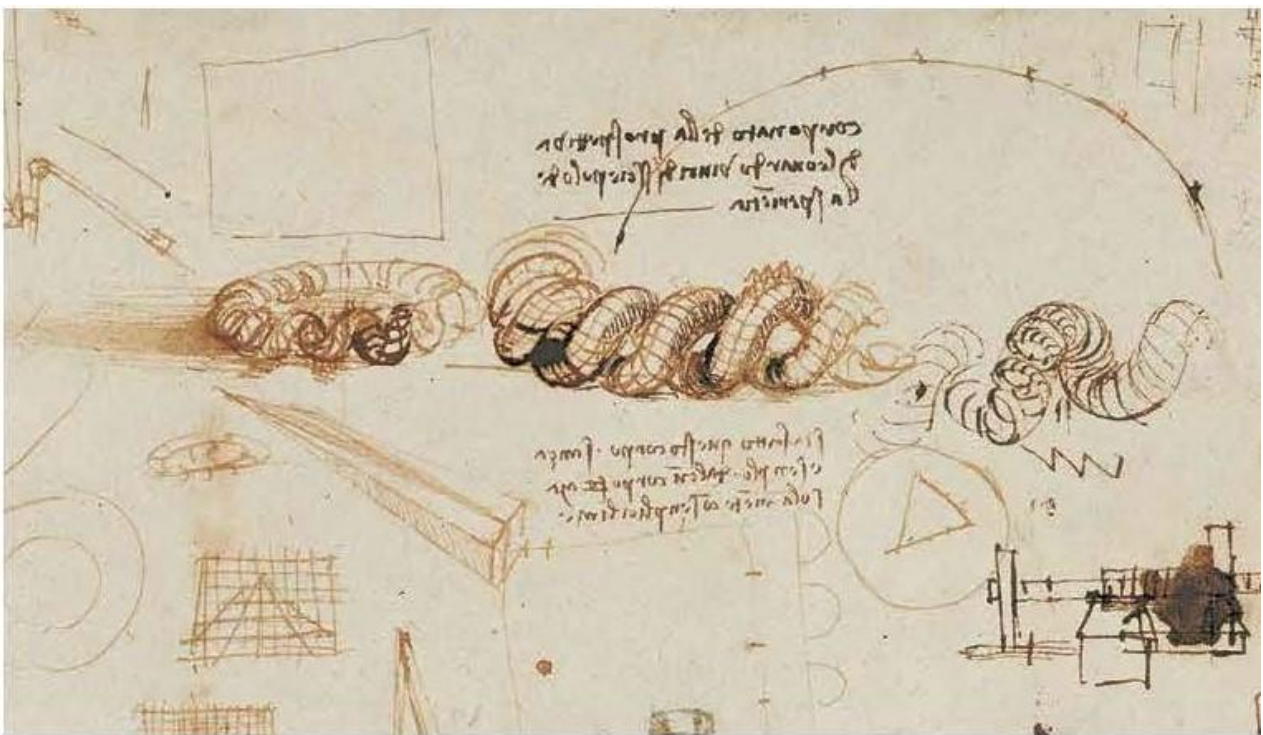


Figure 2. Leonardo Da Vinci torus designs

⁴ [The Notebooks of Leonardo Da Vinci](#), Oxford University Press, selected translation by Irma A. Richter, 1952. p.120.

This is how all of the five Platonic solids are best generated. However, if you use this Poloidal/Toroidal method, a singular surprise will come when you attempt to construct the dodecahedron by *folding* with simple circular action alone. It doesn't work, because the generation of the dodecahedron, which is also the geometrical form of the well-tempered musical system of 12 keys, is of a higher epistemological domain which involves the *higher hypothesis of folding, unfolding, and enfolding*. That's the beauty of Cusa's epistemological method of coincidence between faith and reason, between theology and philosophy.

THE GOLDEN SECTION OF DIVINE PROPORTION AND NEGENTROPY

A rigorous examination of Plato's *Timaeus* will reveal that his dialogue demonstrates at least three *higher hypotheses* with respect to beauty, the first of which is that there are only five regular polyhedra, the second is that all five solids can be constructed in visible space from a higher isoperimetric principle than circular action, and the third is that the twelve face dodecahedron is the only Platonic solid which is built on the Golden Section of Divine proportion, which is a reflection of the twelve tone musical system as well as the negentropic universe we live in. LaRouche identified the essence of the matter as follows:

“If our own correction of Kepler's harmonics is taken into account, a more profound insight appears immediately.

“The fact that Kepler's astronomical laws are uniquely correct, with two qualifications, is crucial here. The shortcoming, in Kepler's laws, is that they should employ well-tempered harmonics instead of simple diatonic harmonies, and that they are inadequate in their given form for treatment of relativistic phenomena. Otherwise, they are valid. These laws are derived from both the isoperimetric principle, and from the principle of the five platonic solids. That is, the fundamental principle underlying Kepler's laws and the principle of gravity derived from those laws is the Golden Section—the same Golden Section which Pacioli, Da Vinci, and Kepler insisted to be characteristic of living processes, as opposed to non-living processes. In other words, the laws of astronomy show that the universe as a whole is governed fundamentally by the same principle otherwise characteristic of living processes. In modern language, the fundamental laws of our universe are those of a universally negentropic process.”⁵

⁵ LaRouche added: « It is necessary to stress this point, since, beginning the close of the 16th century, a school of mathematical physics contrary to the work of Cusa, Da Vinci, Kepler, et al. was developed in England and elsewhere, around the influence of Francis Bacon, Galileo Galilei, René Descartes, Robert Fludd, and others. This contrary school continues to premise itself upon axiomatic-syllogistic structures like those of the Egyptian versions of *Euclid's Elements*, with increasing emphasis on the assumed primacy of such axiomatic-syllogistic structures, less on geometry, than upon simple arithmetic. The Russell-Whitehead *Principia Mathematica*, modern logical positivism, and the so-called new math introduced to schools approximately at the close of the 1950s, are radically extreme versions of this axiomatic-syllogistic system.” Lyndon LaRouche, Op. Cit., p. 41.

“What does this astronomical fact really signify,” asked LaRouche? The Kepler diatonic harmonics must be replaced with well-tempered harmonics. That is a powerful insight, because it clears the way for adopting a higher geometrical domain of complex functions. That is what torus geometry opens the door to.

What is necessary to understand, however, is the critical role of what LaRouche called *underlying assumptions* in our ways of thinking; that is, the critical role of understanding what distorts the images of the universe as perceived in Plato's Cave. The problem is that most people are not used to putting into question their own way of thinking, and therefore, they don't see the necessity to inquire about the principles which makes them think. They are satisfied with the way they think because that is the way they are, and they think that that cannot be changed. However, the time has come to investigate the stupidity of what is happening in the world today, and the ability to investigate how “*underlying assumptions*” are becoming the most important things the mind can discover in order to progress in securing truthful knowledge, that is, the knowledge of beauty.

In fact, most of the so-called scientific knowledge of today is nothing but “fake science.” It is dominated by *underlying assumptions* which are not only false, but are also demonstrably absurd in their application. This is so important to understand about today's world because, unless the *underlying assumptions* of the present dominant ways of thinking are changed, the entire edifice of currently flawed assumptions is about to come crashing down like the house of cards did during the Middle Ages, and a new revolution in human thinking is about to take its place. Take the case of the dodecahedron as an example.

It is generally assumed in academic circles that the five Platonic solids can be constructed from simple circular action. This is a wrong assumption, because only four of the five solids can be generated in that way. The dodecahedron cannot be generated by simple circular action. Why not? What is the principle which distorts the mind, here, in such a consistent lawful way that an adequate construction of the dodecahedron cannot be produced from the circle? The dodecahedron can only be constructed from a transcendental function of self-similar spiral action; that is, doubly-connected circular action. However, LaRouche takes this a step further by saying:

“All transcendental functions are reduced to their most elementary form as either what we call a self-similar spiral on the outer surface of a cone or on the outer surface of a cylinder. In economic science, the self-similar spiral on the outer surface of a cone represents work, and on the outer surface of a cylinder of indefinite length is the normal form of *coherent, radiated energy*.”

“In the case of the self-similar spiral on the outer surface of a cone, the so-called logarithmic spiral, the projection of the image of that spiral upon the circular base of the cone is a plane spiral whose characteristic features are the Golden Section. Treating this as a projection of the characteristics of a dodecahedron upon the plane, we divide the circular base of the cone into 12 equal sectors, which divides the arms of the spiral into segments whose harmonic relationships of length are those of the well-tempered system of polyphony. The interval of the fifth, the interval corresponding to the Golden Section, defines by a system of complements, all the harmonic relationships of the well-tempered system of polyphony.”⁶

Furthermore, such a *higher hypothesis* can be reduced to two different elementary forms of transcendental action, either self-similar conical spiral-action or closed-self-similar Poloidal and Toroidal spiral action, both of which are doubly-connected in the form of what Riemann called a transcendental function, which is such that it reflects the negentropic Golden Section of Divine Proportion. LaRouche established the significance of such a transcendental function as follows:

“The essential meaning of this relationship was discovered by Gauss in his solution to the general notion of elliptic functions, a solution derived from his determination of what is called the arithmetic-geometric mean. This solution is based on the principled features of a self-similar spiral generated upon a cone or some derivative of a conical function. This signifies, to make short of the point, that the laws of the universe are based on the fact that the real universe, which we see only in its lawfully distorted form as the visible universe, is governed by the root-principle of least action in which least action of work occurs in the form of self-similar spiral conical action, and that what we see as characteristics of behavior in visible space are projections of the higher-order real universe upon the lower-order powers of comprehension of our mental-perceptual apparatus. As the Apostle St. Paul says, ‘We see only as if in a darkened mirror.’”⁷

What this means is that the *underlying assumptions* of sense perception must be completely reexamined and discarded in a systematic way when appropriate by confronting them with a series of new *higher hypothesis* of negentropic implications whose measures correspond to a Riemann-Gauss manifold of the complex domain.⁸

⁶ Lyndon LaRouche, Op. Cit., p. 42.

⁷ Lyndon LaRouche, Op. Cit., pp. 41-42.

⁸ LaRouche made the following suggestion for further reading in that direction: “There are three aspects of Riemann’s work which bear upon this sort of inquiry in the most obvious way. First, Riemann’s definitions of a new method of mathematical physics provided as a preliminary statement in his 1854 habilitation dissertation, *On the Hypotheses Which Underlie Geometry*. Second, Riemann’s approach to electrodynamics, with emphasis upon Riemann’s elaboration of the notion of retarded potential. Third, Riemann’s application of the principle of

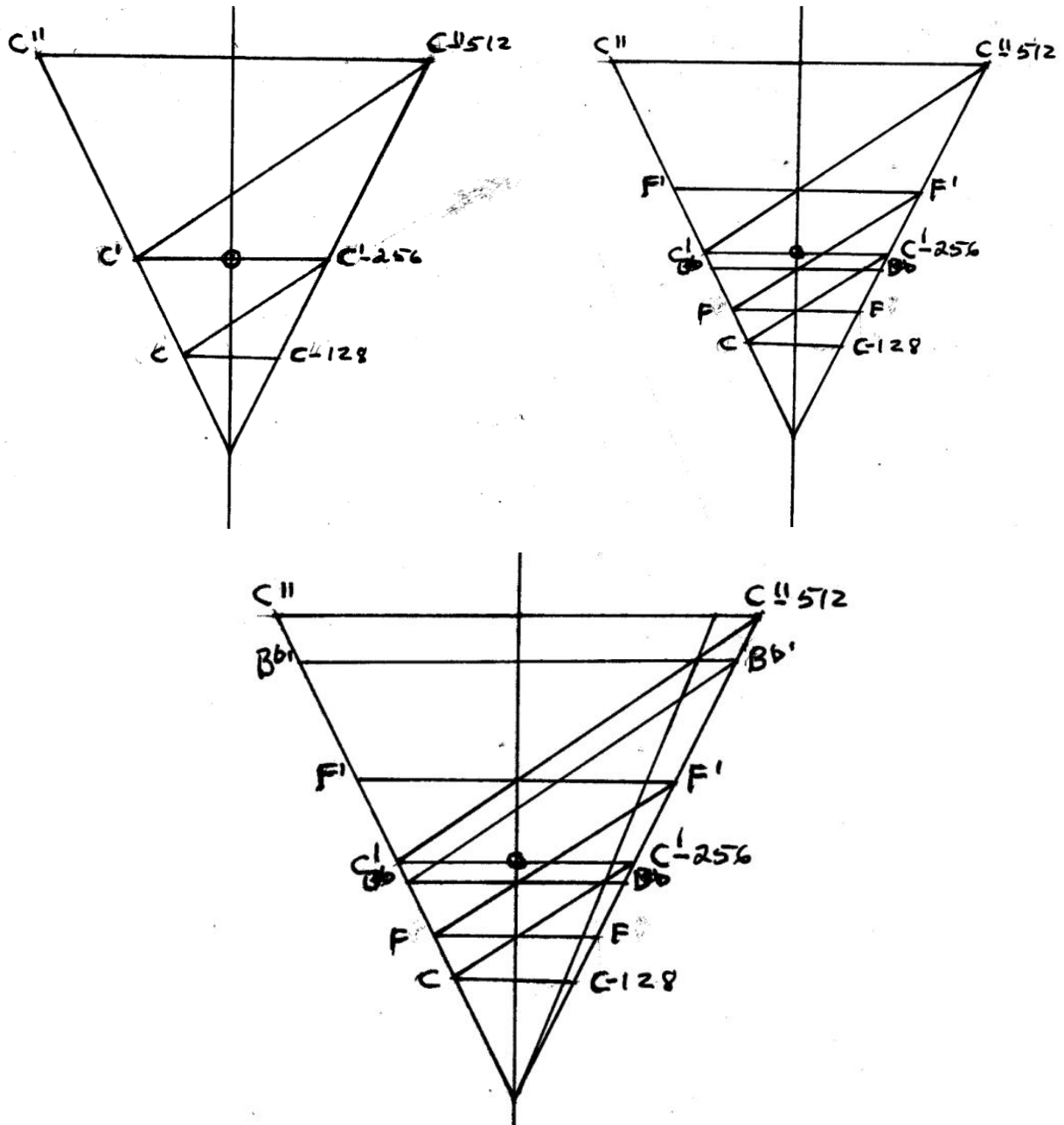


Figure 3. The three first steps of the logarithmic cone showing the placement of the circular cuts of **C**, **F**, and **Bb** inside of the cone reflecting the circle of fifths

electrodynamic retarded potential to the case of the generation of acoustical shock-waves, in his 1859 paper, "On the Propagation of Plane Air Waves of Finite Magnitude."

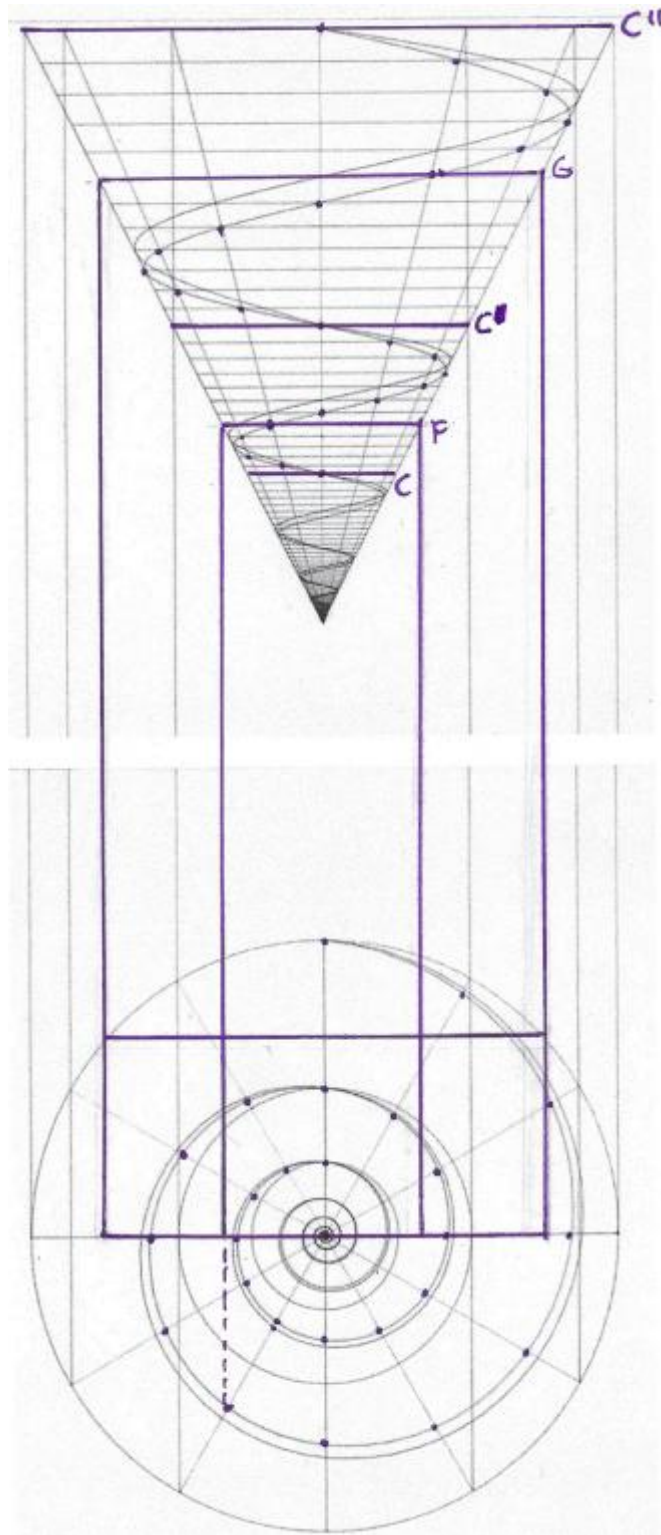


Figure 4. **C**, **F**, and **G** provide the logarithmic frame for projecting the Golden Section from the complex domain to the plane domain

GENERATING THE POLOIDAL/TOROIDAL DODECAHEDRON

When you are investigating Cusa's action of *unfolding*, you are considering the result of such an action; that is the effect that has been created. However, when you are investigating Cusa's action of *enfolding*, you are looking at the cause which produced that effect, that is, the creative process itself. Those are the two most important forms of action to be considered simultaneously in this constructive method. Take the construction of the dodecahedron, for instance. The difficult part is located in the conception of the *unfolding* and *enfolding* actions which generate the Golden Section of Divine Proportion forming the pentagon; that is, in constructing from the effect to the cause by using what is created (the effect) in order to generate what is uncreated (the cause). Going back to the cause from the effect means that what has been caused is going back to its origin.

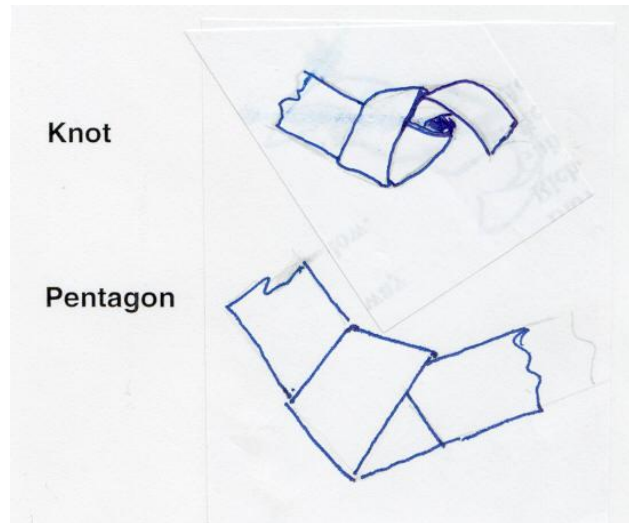


Figure 5. Generating the pentagon by *enfolding* and *folding* a strip of paper

The simplest and most effective way to generate the dodecahedron is to use 3 strips of 7 feet long rolled paper tape and attach all of them together, from end to end, to form 21 pentagons in a series of *enfolding*, *folded*, and *unfolded* Golden Section pentagonal-knots of 6/10 cm each. Each of the 21 Poloidal/Toroidal spiral actions made with a foot long strip of paper is *enfolding* into itself to form a continuous transcendental action of Divine Proportion rotation into a closed dodecahedron.

1. *Fold* carefully each spiral pentagon along the two uneven knotty sides of the tape to form a single closed Golden Section pentagonal-knot of 21 pentagons of Divine Proportion. This *enfolding* action is the equivalent of Cusa's thoughtful self-reflective action of going back from the effect to the cause (*enfolding*); that is the action where

- the mind goes back into itself to discover the process that created such a (e)motion. (See Figure 6.)
2. Connect the 21 continually *enfolding* pentagonal-knots alternating into a spiral-like left and right chiral motion to form 14 continuous double and single, clockwise, and counterclockwise pentagons. (See Figure 7.) The number of continuous pentagons to be used may vary from 13 to more than 21. The choice I made here is 14.
 3. Fold the 21 pentagons, two by two as needed, in such a manner that they form a series of 14 *unfolded* (going out) and *enfolding* (going in) living unities of Poloidal/Toroidal action. All double-folded pentagons reflect the inside and outside action of the dodecahedron like the living chirality of your right and left hands.
 4. Rotate and fold together as many double pentagons with paper clips as you need, clockwise (I have done 8), and then rotate the single pentagons to close the dodecahedron on itself. Secure the whole with scotch tape. (See Figure 7.)



Figure 6. *Folded*, and *enfolding* dodecahedral pentagons



Figure 7. The 14 continuous pentagon *spiral-enfolded* dodecahedron

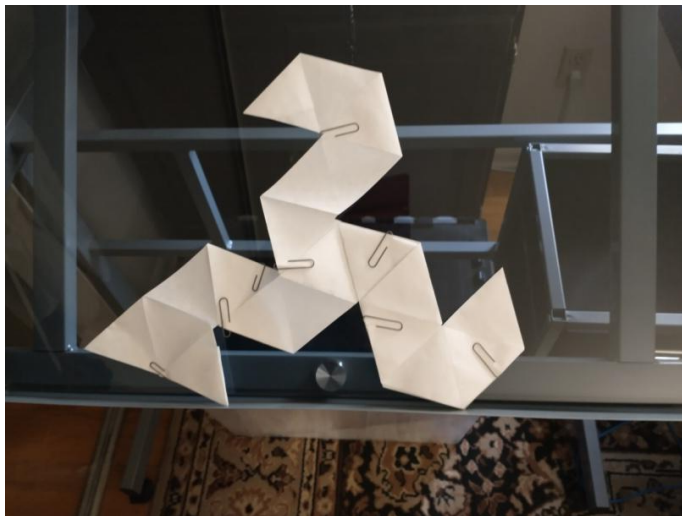


Figure 8. The 20 continuous triangle *circular-folded* icosahedron

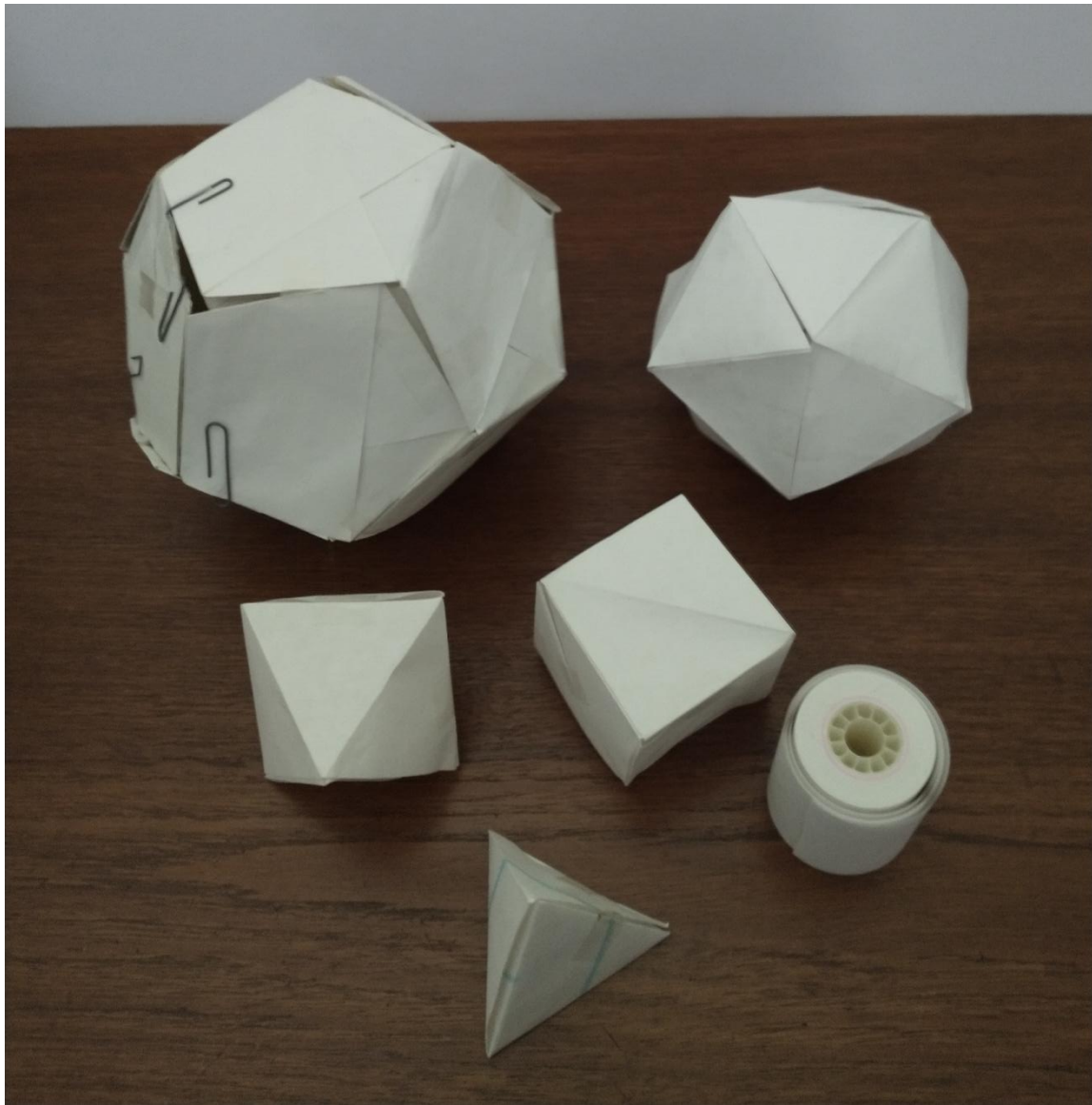


Figure 9. The 5 folded platonic solids

CONCLUSION

This pedagogical is a test of endurance and patience. By connecting the 21 pentagons into 14 continuous twisted and knotty faces of Divine Proportion, you were able to create a 12 sided dodecahedron through the generative process of the creative method of Nicholas of Cusa's *enfolding coincidence of opposites*. This means that you can now generate something full of beauty by generating the principle that makes it beautiful.

FIN