THE IMPERIAL ROOTS OF FASCISM BEHIND THE CRUSADES: PART 1.3
THE KEPLER WATER SPHERE OPTICAL EXPERIMENT

[CLASS 8: BOGOTA, CALI, AND BUENOS AIRES LYM. DECEMBER 20, 2006.]

by Pierre Beaudry

A SECOND NOTE ON THE PLATO-KEPLER-LEIBNIZ PRINCIPLE OF PROPORTIONALITY: AN EXPERIMENT IN PLATO'S CAVE.

First, let me welcome the youth from Cali, Buga, and Pitalito of the Valle region of Columbia. Welcome to the LaRouche organization and to this class on universal history. My name is Pierre Beaudry and you are, I presume, Juan Carlos, Lorena, Catherine, Nadia, Gustavo, Umberto, and Diego. Tonight we are going to pursue the topic of the principle of proportionality following the last class discussion, and I want to identify for you how Plato, Kepler, and Leibniz expressed this principle in different ways. So, I refer you to Plato's {***Timaeus***}, to the Kepler {***Paralipomenes***}, and to Leibniz's {***Memorandum of 1671***.}

I already discussed, in the last class, how Leibniz established the principle of proportionality as a living-cognitive relationship between reason and power. The advantage of this Leibnizian approach is that his principle is directly relevant to the LaRouche principle of political interventions, as you well know. And if you don't know, Pedro will explain this to you, by getting you into trouble. However, there is more to be said because the same principle is also useful for solving paradoxes, especially the paradox of projecting the image of a sphere onto a plane as illustrated by the stereogram experiment that I discussed with some of you two weeks ago, and which I will further develop today with Kepler. I will show you later how this principle works with the doubling of the cube by Archytas and with the creation of the astrolabe by Hipparchus.

But for now, I just want to restate first, for the new Cali members, the nature of the paradox, because anomalies and paradoxes are fundamental for the development of the human mind, and should never be avoided. And so, this particular anomaly of {***Sphaerics***} is also going to be important to understand astrophysics and economics. But the main thing to grasp here is the universal principle of proportionality linking primarily Plato, Kepler, and Leibniz.

PLATO'S DIVINE PROPORTION

First, Plato states the principle in the form of a higher hypothesis of divine proportion, and as a function of astrophysics. In the {***Timaeus. 47b.***} Plato said:

"... God created and bestowed vision upon us so that we, contemplating the orbits of intelligence in the heavens, might put them to use by applying them to the orbits of our reason, which are related to them…"

In other words, your conception of physical geometry will be a reflection of your conception of God, man, and the universe as a whole. It is that sense of proportionality, given as a power by God, which enables man to change from a lower geometry to a higher geometry. This is the proportionality we are interested in. This is anti-entropy, as LaRouche puts it in so many of his writings. However, that cognitive capability requires a lot of hard work, as Plato himself indicated in his Letter VII to Dion. So, you should read that. It is only after a long period of companionship, committed to the common good, that is, committed to bringing prisoners out of Plato's cave, that one can acquire a true sense of proportionality. A simple example of how this higher Platonic proportionality works can be found in the solution to this following problem. {***Given six sticks of equal length, generate four equilateral triangles***}. Those who know the solution should not tell others until they try and fail to discover the solution by themselves. I will give you the solution next week.

KEPLER'S DIVINE PROPORTION

Next, look at how Kepler states the principle with respect to the sphere and the image of God. He said:

"First, it is fitting that the nature of all things be in the image of God the Creator, and to the extent possible in accord with the creation of each thing's own proper essence. For when the Most Wise Creator strove to perfect all things in the most beautiful and excellent way possible, He found nothing more beautiful and more perfect, nothing more excellent, than Himself. For that reason, when He took the physical world into consideration, He settled on a form for it as like as possible to Himself. Hence WERE GENERATED arose the entire gender of quantities, and within it, the distinction between the curved and the straight, and the most excellent figure of all, the spherical surface. For in forming it, the Most-Wise Creator played with it to form the image of His Reverend Trinity. Hence the central point is therefore like the source of the entire spherical solid, the surface is the image of the intimate point, and one may conceive that each pathway leading to it is generated by an infinite emanation (in all directions) coming out of the point itself and extending itself in an equality of all emanations, the point communicating itself into this extension and becoming equal to the surface, in accordance with the variation of the ratio of density. Hence, between the point and the surface there is everywhere an utterly absolute equality, a most compact union, a most beautiful convenience, connection, relation, proportion, and symmetry. And since these are clearly three – the Center, the Surface, and the Interval, - they are nonetheless one, inasmuch as not one of them, even in thought, can be separated from the others without destroying the whole." (Kepler, {***Paralipomenes a Vitellion***}, p. 107.)

Now, there are many aspects to this extraordinary metaphor, but I will single out one, which is {***the distinction between the curved and the straight***}. The problem is what kind of singularity or discontinuity do you encounter when you try to relate the curved with the straight, that is for example, when you try to map the surface of a sphere onto a plane? What is going on in your mind when that happens? And the answer to this

question cannot be found in some mathematical formula, because formulas are useless for discovering a principle. Mathematics cannot help us in this investigation of principle at all. In fact, any mathematical approach would be disastrous.

So, I am addressing an epistemological question, which relates to how the sphere, as a pedagogical device, can help us discover a universal physical principle. Don't get me wrong here. The intention is not to understand the nature of the sphere, but the nature of change when one introduces a new universal physical principle, that is to say, a new power. So, pay attention to the intention. We have seen, for example, that it was impossible to transform a spherical orange into a flat orange. Some people have tried it here, in the U. S., and they realized they had made a mess of things. So, you may want to try it also for pedagogical reasons, but bring a lot of paper towels. The reason that you cannot flatten an orange is because there are no direct linear connections between a spherical volume and a flat plane.

However, God seems to have no problem with that, as we shall see with the case of the physiology of vision, because He created it with built-in non-linearity. So, you can ask yourself, why did God make it so difficult for man to be in his image, and why is it that we have to work so hard to discover that? It's worth spending some time to attempt to solve that problem and fail. And then see why we have to fail in order to progress. And the only way to do that is to change axioms. The key to creativity is {***Axiom Busting***}. So, how do you change a sphere into a plane? How do you change axioms? What do you think? Can you map a sphere directly onto a plane?

Furthermore, the axiomatic difference here is not only between the two surfaces. There is also an axiomatic difference of dimensionality between a surface and a volume, a difference in power. And I am not talking about simply adding an algebraic power, like going from x^2 to x^3. I am talking about an additional epistemological power, when you discover a new principle of going from the line to the surface, and form the surface to the volume. You cannot make a surface from lines and you cannot make a volume from surfaces. As Fermat showed in his {***Great Theorem***}, the axioms of surfaces are not efficient for solids. Remember how he put it: "{***It is impossible for a cube to be the sum of two cubes, or for a fourth power to be the sum of two other fourth powers, or, in general, for any power other than two to be the sum of two similar powers***.}"

So, you actually have to change the geometry by changing axioms. This is what it means to go from a lower Riemannian manifold to a higher Riemannian manifold. This means that not only there is an incommensurable dimensionality between surface and solid, but there is also incommensurability between the surface of zero curvature of the plane and the surface of positive curvature of the sphere. I am sure that some of you, in engineering school, have come across some of these geometric problems before. However, generally speaking, university professors refuse to discuss these more profound ideas, because they have explicitly taken the habit of not teaching creativity.

Now, Pedro, Oscar and others should begin discussion of Lyn's program of Gauss with the new members, if you haven't done it already, and especially his {***Dissertation of 1799***}, as well as the Kepler {***New Astronomy***}. I will discuss the construction of a pedagogical model of the Archytas problem later. Any questions so far before we go to Leibniz and Kepler?

LEIBNIZ'S DIVINE PROPORTION

In his {***Memorandum of 1671***}, Leibniz used a very beautiful metaphor to illustrate the incommensurable proportionality between man and God, that is, how man, "created in the image of God," works as an axiomatic change of curvature in the caustic form of light propagation. The text is on page 10 of my Introduction to the translations I did of the Leibniz ACTA ERUDITORUM:

"{***9. From this it follows inexorably that charity, the love of God above all, and true contrition, on which the assurance of blessedness depends, is nothing other than that love of the public good and of universal harmony; or rather, on that account, the glory of God and to understand are the same, and how great it is in itself to make greater, for there is no more distinction between universal harmony and the glory of God, than between body and shadow, person and picture, between a direct and a reflected ray of light, since the one is what is in fact, the other what is in the soul of him who knows it. For God creates rational creatures for no other reason but that they should serve as a mirror, in which His infinite harmony would be infinitely multiplied in some respects. From which must arise in due course the completed knowledge and love of God, in the beatific vision or the incomprehensible joy which the mirroring, and to a certain degree the concentrating of the infinite beauty in a small point in our souls, must bring with it. And thus, a burning mirror or burning glass is the natural image here."*** [Gottfried Wilhelm Leibniz, **{OUTLINE OF A MEMORANDUM: ON THE ESTABLISHMENT OF A SOCIETY IN GERMANY FOR THE PROMOTION OF THE ARTS AND THE SCIENCES (1671)},** in **{THE REAL POLITICAL ECONOMY OF THE AMERICAN REVOLUTION**}, edited by Nancy Spannaus, Second Edition, Washington D.C., 1996, EIR, p. 217.]

Now, in order to illustrate this Leibnizian metaphor, understood as if in a glass darkly, let's relive an actual experiment that Kepler constructed in his studies of application of optics to astronomy that he called {***discarded things***} or {***Paralipomenes***:} (choses laissees de cote). I am referring to the French translation of {***Les Fondements de l'Optique Moderne: Paralipomenes a Vitellion, (1604)***}, Traduction de Catherine Chevalley, Paris Vrin, 1980.] Now, let's go through this Kepler experiment of axiomatic change, step by step, and pay attention to the changes that occur in each one of those steps. But, mostly, pay attention to the intention.

Figure 1. [Step 1. Projection of a scene through a water-filled sphere.]

Choose a sunny day to do this experiment. Fill up a spherical bowl with cold water and set it on a table inside of your house about 10 feet from a window, or an open door. The illustration I have attached below was taken from a double French door in the back of my house. Put behind the bowl an upright piece of white cardboard at a distance to the sphere, which is equal to the radius of that sphere. On the one hand, the entire scene enclosed within the frame of the window will be projected through the sphere, in an upside down manner, onto the plane surface of the white cardboard, with total accuracy of lines and colors, and all of the straight lines of the window will be projected as straight lines through the sphere and onto the plane.

On the other hand, the images of the same window, which appear on the front and back surfaces of the sphere, are entirely curved. Now, this should provoke a series of questions like: what causes the curved lines of the spherical images of the sphere to be transformed into straight lines onto the plane? What is the physical principle that generates such an axiomatic changes in what appears to be the same image? In other words, what causes the propagation of light to solve the paradox of projecting a spherical image onto a plane image? How does each ray of light and shadow know where to go in order to affect such a transformation? Where is the principle to be found? Is it in the nature of the object being projected? Is the cause the shape of the bowl? Is the cause in the nature of the water? Is it in the nature of light? Is it in the nature of my eye? What is the universal physical principle that causes such an axiomatic transformation? Now I must warn you that if you think that the cause of the change is simply the product of a lens, think again. Remember that we are looking for a principle, a power, not a thing or an object. Now, let's leave those questions to incubate in the back of our minds for a while and see if Kepler can help us with these questions. Let's pursue the experiment a step further.

At this point, it is very important to understand what Kepler meant by image. Kepler criticized Aristotle, Euclid, Vitellion, and others, from the standpoint of a Platonic conception, which is important to recognize, here. Kepler wrote:

"{***Indeed, opticians speak of an Image when we see the object itself with its colors, and the parts of its figure, however what we see is in another place, and sometimes with different measures and a change of proportion of the parts of its figure. In other words, the image is the vision of an object linked to an error of the faculties that make up vision. Thus, the image is almost nothing in itself, and it should rather be called imagination. It is a thing that is composed of the real species of color or of light, and of intentional quantities***.}" (Kepler, Op. Cit., p. 180.)

In other words, the image is not a characteristic of the empirical object, the thing in itself, but a "construct of vision" which has {***intentional quantities***}. In other words, the image is just a shadow. It is not this or that form but a shadow that reflects changes that is going on between this or that form, and which is projected onto the screen of our imagination as a fleeting impression going through a process of intentional correction of an error; and the process of imagining, that is of creating that image, is part of learning from that error. So, think of what we are witnessing through this spherical experiment of Kepler, is precisely the process of discovering the principle of an actual {***process of axiomatic change***} in Plato's cave. Now, a lot of things are going on here, so I will break them down into different steps. This is a pretty busy little sphere. Now think of these steps also as being similar to Leonardo's descriptions of the different steps that go into the physical principle of perspective of light and shadow.

1. External shaded objects project primary shadows from outside of the window.
2. An observer forms a visual image of those shadows from inside the window.
3. The image inside the window is projected directly onto a water sphere.
4. Two spherical images appear in the front and in the back of the water sphere.
5. The spherical image of the window is projected upside down as a flat image.
6. All five previous phenomena reflect the transformation of human vision.

These six steps show that the intention of the Kepler experiment is to discover that what you see is not reality but the deformed projection of reality that our eyes project onto our brain. So, our eyes don't see the change but only the result of the change. Our mind, however, sees the change. Again, this is as if we were going through the shadows of Plato's cave and making corrections about what we know, and what we think we know, and what we don't know. Now, you begin to have an idea as to why this process of change actually occurs. Any questions? Let's repeat the same experiment, this time, outside of your house. What happens when you do the same experiment in direct sunlight?

Figure 2. [Step 2. Projection of the sun through a water-filled sphere.]

If you do the same experiment in direct sunlight, you will find that the scene in front of the sphere, as previously projected through a window, will have disappeared completely and will be replaced entirely by the sun projecting a caustic of light densely concentrated at the place where the image was formerly located. This is quite an amazing discontinuity! Some of you would say: {***AWESOME!***} What is the Spanish word for "awesome"? How can primary incident sunlight rays and secondary reflected rays appear to be so axiomatically different? Furthermore, how can light rays go through cold water and come out burning in a densely compact point outside of the sphere? And, as Leibniz said {***and to a certain degree concentrating of the infinite beauty in a small point in our souls***}. How is this in the image of God? Why is the image of God reflected in a change of axioms?

Kepler made an extraordinary optical construction in trying to describe the process of this extraordinary phenomenon. I have never seen a reproduction of this experiment done anywhere else, nor with the same intention, not even in or around the group of Leibniz and Huygens in the French Royal Academy of Colbert or at the Ecole Polytechnique. This experiment of the least action principle of light propagation could become an interesting addition to your Pedagogical Museum.

Leibniz did an analogous but different experiment in his paper {***On optical Curves and other questions***}, ACTA ERUDITORUM, Leipzig, Jan. 1689. Leibniz used the same idea of light propagation using mirror reflexive rays as opposed to water-refracted rays. You can see how Kepler and Leibniz are moving in the same direction and with the same intention. So, let's row closer to their common shore and see what else we can learn from this experiment.

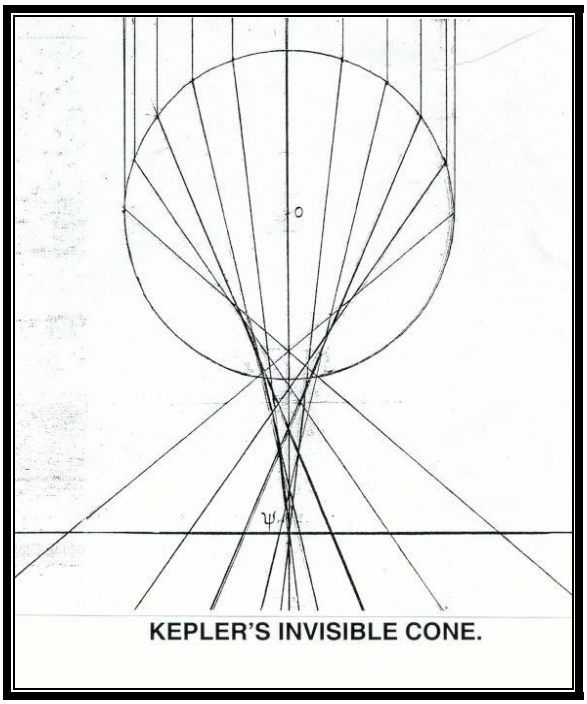

Figure 3. [Step 3. Negative curvature of the axiomatic change.]

This **Figure 3** is the actual illustration that Kepler gave of his optical experiment, at the beginning of the 1600's, in order to represent how the principle of human vision works non-linearly in transforming a spherical image of {***positive curvature***} onto a surface of {***zero curvature***} that the brain registers through some type of conic function process of {***negative curvature***}, probably in the fovea region of the eyes. However, you can easily recognize that Kepler was pursuing the same invisible conical function experiments that Leonardo da Vinci was working on a century earlier. And for similar reasons, as developed in his {***New Astronomy***}, Kepler showed us that the geometry failed to answer the question of causality. He can only describe a failure, which enables us to investigate further as to what the universal physical principle should be. It is not the geometric description of the object that counts, but what is the principle that produces this axiomatic change.

The most interesting aspect of the proof of the fallacy of geometric descriptions that Ptolemy, Copernicus, and Brahe had used in astronomy resided in the fact that the geometry model itself tended to make you believe, falsely, that you had succeeded in explaining the physical phenomenon. In reality, the geometric model showed you that you had failed, and by how much. So, the question is not how do I succeed in making a better geometric description and make it work more successfully, but how do I succeed in discovering the principle, the power, that causes the physical phenomenon to work the way that it does?

That is why Lyn keeps emphasizing that the universe is not composed of geometry but composed of universal physical principles. So, for Kepler, it was the failure of the apparent geometrical success that prompted him to ask the question: what is the

underlying generative principle that causes the motions of the planets? He was not looking for the shape of the orbit of Mars, but for the cause of it. Therefore, a good mathematical or geometric model is one that shows you how it failed by design, not by mistake. So, for the same reason, here, Kepler identified that in the process of imagination, {***the image is the vision of an object linked to an error of the faculties that make up vision***.}

This is a very important point that Kepler shared with Leonardo da Vinci and Leibniz, because this work on physical or physiological living processes of least action led directly to Pierre de Fermat who reconstructed the same type of experiment from which he derived his now famous formulation of the principle of least time propagation of light, that is to say: "{***The true pathway of light going from point A to point B is the pathway of shortest time or, if we account for the nature of different media through which it travels, it is the shortest optical pathway***.}"

Now, since you have already formed two camps, one in favor of the Cycloid and the other in favor of the Catenary, I think it will be interesting to see how we can form a progressive alliance between the two groups and discover, as you already suspect, that the cycloid and the catenary reflect different levels of the same universal physical principle. However, it is wrong to think that the difference between the two is that the cycloid is "man-made". All light caustics are nature-made cycloids.

The next step to take is to try to see how this Kepler optical experiment leads directly to the actual formulation of the Fermat least time principle, and the Leibnizian principle of least action as developed through the cycloidal {***Tautochrone function***} of Huygens, the {***Isochrone function of Leibniz***}, and the {***Brachistochrone function of Bernoulli***}, which Leibniz later ascribed to the more extended transcendental function of the catenary principle. We will go through these developments more extensively as we proceed further in the class. Merry Christmas to all!

FIN December 20, 2006