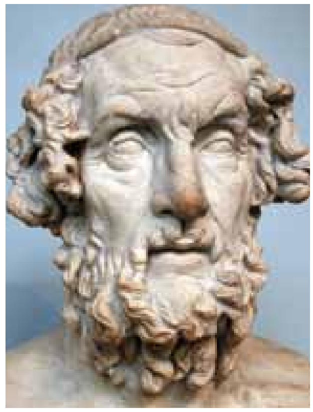
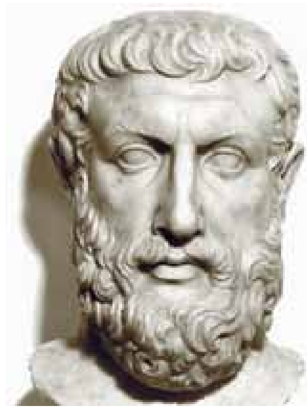
Leibniz from LaRouche's Standpoint

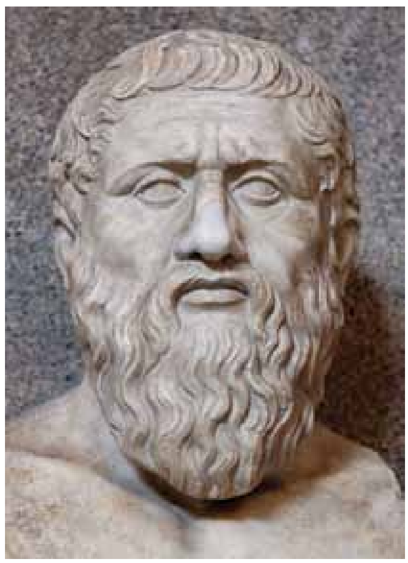
by Ernest Schapiro

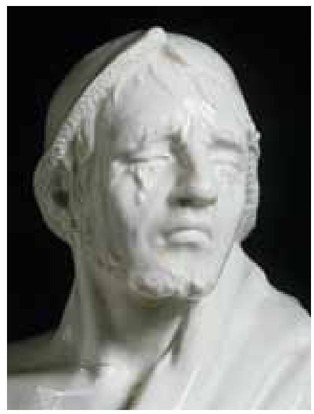
INTRODUCTION
The Study of Historical Specificity Leads to the Higher Hypothesis

It is not widely appreciated that Lyndon LaRouche has founded a new theory of knowledge, namely that the truth of a Platonic idea—an immaterial physical principle—is only to be determined by situating that idea within a historical series of such ideas, and deducing what is common to them all, despite their uniquely individual historically specific content. More specifically than that, the validity of these ideas is demonstrated by their contribution to our ability to increase the potential population density of the society and of the planet as a whole. In Changing the Universe-A Philosophy of Victory, he tells us that he developed this strategy of defining the higher hypothesis bounding and subsuming an historical series of hypotheses, in the early 1950's as he began to look at the succession of ancient Greek playwrights, poets, and philosophers and began defining their successive hypotheses—Plato being the last and most advanced thinker of the series starting with Homer. He recognized that to understand any one of them you had to understand the principle of revolutionary axiomatic change that led from each of them to the next.[1]


Homer


Parmenides


Plato


Heraclitus

> Autobiographically: during 1951, the puzzle posed by the similarities and differences between the import of the known fragments attributed to Heraclitus, and the clarity of Plato's argument on the ontological implications of "becoming," prompted a crucial turn, at that time, in my own approach to the problems of a science of physical economy. The qualitative differences among the Homeric outlook, the pre-Socratic thinkers, that of the classical tragedians, and Plato's dialogues, must be appreciated if any useful knowledge for modern use is to be adduced from the study of the work of any among them. If a reader were curious as to where I developed the passion for historical specificity

1. Lyndon H. LaRouche, Jr., **The Economics of the Noösphere**, Executive Intelligence Review, 2001. See pages 116-122 for comments about Platonic ideas.

which I stress here, the answer is implicitly provided to him in the present location.[2]

I believe the crucial turn he is referring to was his discovery that the physical aspect of all economies is subject to an invariant principle or law, the series of such invariants being analogous to a series of hypotheses, which are subject to a common higher hypothesis.[3]

The invariant law was the requirement for a surplus of free energy, or negative entropy, over and above what was needed to maintain the status quo, a surplus violating the so-called Second Law of Thermodynamics. This growth process must have an exponential tendency.[4] He arrived at this invariant law after a rigorous study of the succession of economies back to ancient times.

However he also saw a second invariant principle historically specific to capitalism, the general rate of profit.[5] This was the "subjective" side of the economy, emphasizing "exchange value" as opposed to "use value," i.e. how the society views its own activity. In the last chapter of **Dialectical Economics**, "The Great Fugue," he elaborates the way in which the interaction of these two optimizing principles, each acting cyclically, played out over the post World War II period. The interaction of these two principles led to boundary conditions and singularities, i.e. general breakdown crises of the society, such as the crisis the trans-Atlantic nations are now undergoing.

The ideology of a society is its hypothesis or axiomatic structure.

G.W. Leibniz (1646-1716)

In order to account for specific subordinate ideologies within the general ideology, we need only recognize that the invariant of capitalist accumulation is not directly expressed to each group in the same way. The invariant generates a variety of special sub-characteristics, more or less in the same way that postulates determine theorems, causing occupants of different regions of capitalist space to see the whole in terms of pseudo-invariants, or "special laws." Yet while the immediate characteristics of consciousness may differ among social strata, the "hereditary" feature of the general principle embedded in the "special laws," is adducible from individuals "conscious" and "unconscious" behavior.[6]

LaRouche's uniquely proven ability to forecast is based on this complex understanding of what he called the "dialectical" interaction of the two optimizing principles, a conflict being mediated by the historically determined consciousness of the population. I believe this understanding benefitted from his study of Leibniz.

Leibniz spoke often of the two kingdoms: the kingdom of power or efficient causes, analogous to the

2. "LaRouche's Discovery", **Fidelio,** Spring, 1994. See especially the section "The Theory of Knowledge." In **The Economics of the Noösphere**, see the section starting on page 106, "The Problem of Historical Specificity," through page 115. Especially, see footnote page 113. See also Lyn Marcus, **Dialectical Economics,** (Lexington, Mass.: D.C. Heath and Company, 1975), for numerous references to historical specificity.

3. **Dialectical Economics** pp.136-139 and the chapter "Feudalism to Capitalism."

4. **Dialectical Economics**, page 47, on the subject of an exponential tendency.

5. See **Dialectical Economics** for numerous references to the general rate of profit and the paradox of the falling rate of profit which accompanies capitalist crises. To my knowledge, LaRouche is the only economist to solve this paradox.

6. **Dialectical Economics**, p. 60.

physical economy, and the kingdom of final causes, the latter being analogous to how the society defines its activity, both its social processes and its relationship to nature.

In his ground breaking treatise on dynamics, **Specimen Dynamicum**, Leibniz says:

> In fact, as I have shown by the remarkable example of the principle of optics, the celebrated Molyneux having warmly approved my interpretation in his **Dioptrics**, final causes may be introduced with great fruitfulness, even into the special problems of physics, not merely to increase our admiration for the most beautiful works of the supreme author, but also to help us make predictions by means of them which might not be as apparent, except perhaps hypothetically, through the use of efficient causes. Philosophers in the past have perhaps not sufficiently observed this advantage of final causes. It must be maintained in general that all existent facts can be explained in two ways—through a kingdom of *power* or *efficient causes* and through a kingdom of wisdom or *final causes*; that God regulates bodies as machines in an architectural manner according to laws of *magnitude* or *mathematics* but does so for the benefit of souls, and that he rules over souls, on the other hand, which are capable of wisdom, as over citizens and members of the same society with himself, in the manner of a prince or indeed of a father, ruling to his own glory according to the *Laws of Goodness* or *of Morality*. Thus these two kingdoms everywhere permeate each other, yet their laws are never confused and never disturbed, so that the maximum in the kingdom of power, and the best in the kingdom of wisdom, take place together. But here we have undertaken to set up the general rules for effective forces, which we can then use in explaining special efficient causes.[7]

Thus, in his writings on economics, Leibniz placed great emphasis on both the intrinsic moral and physical principles involved in economy, including the fact that unlike a mere beast, a worker's productivity requires an adequate and appropriate standard of living and a healthy cognitive environment in the work place.[8] He collaborated with Denis Papin in developing the first steam engine, which Papin said could allow one man to do the work of one hundred.[9] However LaRouche's second invariant, the general rate of monetary profit, was not relevant to the pre capitalist economy of his day, which lacked financial markets linked through central banking. Leibniz's view is in stark contrast to the view that economics, "the dismal science," is the domain of "objective laws," whether these laws are based on supply and demand or on a labor theory of value. His voluntaristic outlook thoroughly determined his view of both the moral and physical universe. Thus after elaborating his theory of pre-established harmony, he said:

> There is to be discovered in it also this great advantage that instead of saying that we are free only in appearance in a way sufficient for practical life, as several intelligent persons have believed, we should rather say that we are determined only in appearance but in strict metaphysical language we are perfectly independent relatively to the influence of all other creatures. This again puts in a marvelous light the immortality of our soul and the constantly uniform conservation of our individuality, perfectly regulated by its own nature, protected from all external accidents, notwithstanding any appearance to the contrary. Never has a system put our elevation in greater evidence. Every mind being like a world apart, sufficient unto itself, independent of any other creature, containing the infinite, expressing the universe, is as enduring, as subsistent, and as absolute as the very universe of creatures.[10]

---

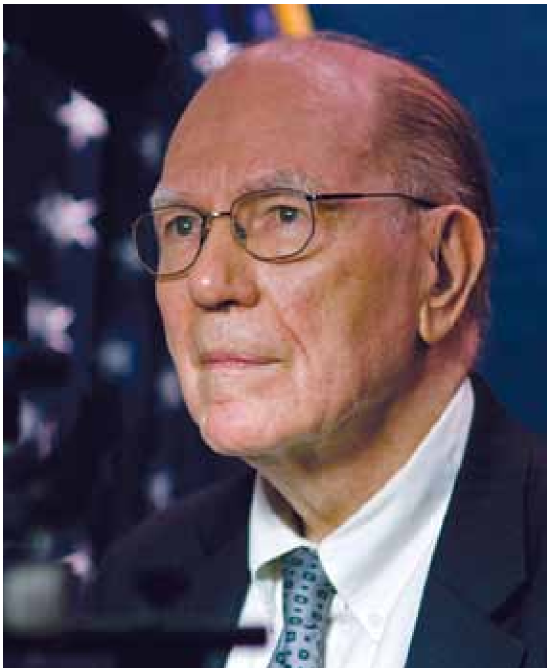
7. Leibniz, **Philosophical Papers and Letters**, Volume 2 Second Edition (D. Reidel Publishing Company, 1976). Leibniz, **Specimen Dynamicum** (Leroy Loemker, Editor), page 442.

8. "Leibniz, Society and Economy," **Fidelio,** Fall, 1992.

9. Philip Valenti, "Leibniz, Papin and the Steam Engine: A Case Study of British Sabotage of Science," **Fusion**, December, 1979 or http://www.schillerinstitute.org/educ/pedagogy/steam_engine.html

10. "New System of Nature and of the Communication of Substances, as Well as the Union of Body and Soul, 1695," in **Leibniz: Selections**. Edited by Philip P. Wiener (New York: Charles Scribner's Sons, 1951). Also in Loemker, page 453.

Both LaRouche and Leibniz placed great stress on Natural Law, i.e. universal principles which are knowable through creative reason and which therefore predictably govern the effects of our social and physical economic practice. This notion of a higher law is opposed to the Thomas Hobbes-Newt Gingrich "social contract," based on false, lying *a priori* assertions about the nature of man. Through natural law, a society based upon false and immoral principles will bring destruction upon itself without God having to intervene. Thus, what Leibniz referred to as "natural theology," as in the opening lunge of his first letter in the debate with Clarke, was an aspect of natural law.[11]



Lyndon H. LaRouche, Jr.

In LaRouche's Discovery paper, he says: "All along, there are certain virtually absolute social truths, with the force of *Natural Law*, embedded in the cumulative evidence of the historically successful Platonic higher hypothesis." He proceeds to enumerate three such truths, in a manner very reminiscent of Leibniz's writings on natural law, particularly Leibniz's view of what constitutes wisdom, happiness, and justice and the proper ordering of society to maximally achieve those ends for every individual. Leibniz's notion of freedom is the freedom to do good, rather than freedom to act upon one's idiosyncratic impulses. The exercise of this freedom was what the American founding fathers called "the pursuit of happiness."[12] Both Leibniz and LaRouche define the good we do as our access to immortality. The emergence of the sovereign nation state based on the common good in the 15th Century expressed natural law.

To sum up this introduction, I have come to the conclusion that something LaRouche and Leibniz have uniquely in common is the view that freedom is not only a necessary good for human progress, but that it expresses a universal physical principle present in all domains: the cognitive or social, the biological, and the non-living. This emerges with Leibniz's notion of the monad. Furthermore, it is to be found from the microphysical or subatomic out to the astrophysical dimension. I think one can usefully compare LaRouche's idea of a "strong hypothesis," simultaneously applicable to all of those domains, to a higher hypothesis which subsumes an historical series of hypotheses, each with its necessary predecessor.

Solving Paradoxes of the One and the Many: Axiomatic Revolutionary Change in One's Mathematics as Higher Hypothesis

In his papers "LaRouche's Discovery" and "Leibniz from Riemann's Standpoint," LaRouche discusses his debts to Riemann and to Leibniz, his debt to Leibniz being far greater. LaRouche says that dragons guard the secrets of nature. To make his discovery in physical economy, he had to reject the universally accepted Second Law of Thermodynamics, as applied to the universe as a whole, to the biosphere, and to a physical economy. Only then could he conceive of a society that generates a net surplus of free energy required to increase population density and productivity per capita. Had he not read and understood the deeper meaning of Leibniz's attack on Newton at the beginning of the Leibniz-Clarke debate, concerning the clock-winder paradox, he could not have gotten past the dragons, nor challenged Norbert Wiener's statistical or informational notion of anti-entropy.

In the "LaRouche's Discovery" paper, LaRouche gets at the root of Newton's self entrapment in the clock winder paradox, namely his choice of mathematics,

11. By natural theology he meant theology which could be demonstrated through creative reason, not requiring revelation.

12. Robert Trout, "Life Liberty and the Pursuit of Happiness: How the *Natural Law* concept of G.W. Leibniz Inspired America's Founding Fathers, Fidelio, Vol. 6, Number 1, Spring, 1997".

Nicholas of Cusa
(1401-1464)

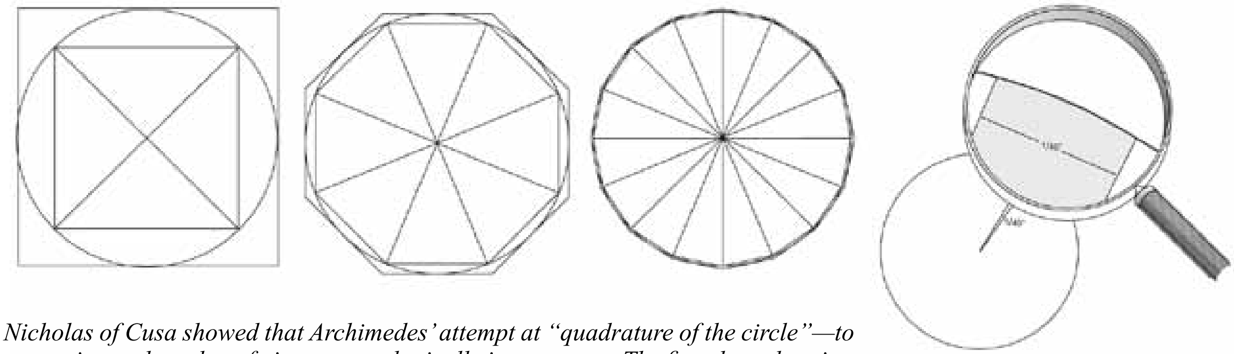
which is necessarily also a choice of physical assumptions. Newton's physics is an expression of his mathematics and vice versa. It is the belief in discrete things as primary, separated by empty space and interacting percussively or by "forces" over a distance. From this axiomatic standpoint, matter is that which is discrete, and its repeated division ends in an ultimate particle. Newton himself admitted that this was his method when he acknowledged that action at a distance was an absurdity.[13]

This choice of mathematics was also at the root of Archimedes' erroneous belief that one could construct a plane figure precisely equal to the area of a circle by trapping the circle between an infinite series of polygons inside and outside the circle. Cusa proved for the first time that π was neither a rational nor an irrational number, but in fact a new type of number, and that the circle subsumed the plane figures composed of straight lines and points.[14] In so doing he rejected Euclidean geometry, which axiomatically begins with lines and points, not the circle, and uses rotation of the line to produce a circle. This is not a dead issue. It is the reason Cusa's priority in discovering the transcendental nature of π is to this day not acknowledged. The real issue is Cusa's non-inductive resort to a method of hypothesis, a kind of non-inductive leap.[15] Denial of nonlinearity in the small is the root of Leonhard Euler's attack on Leibniz's monads, based on the tautology of assuming infinite divisibility, the very thing Euler needed to prove.[16] It is the root of Cauchy's epsilon-delta ritual to smooth out the curve as one approaches a "limit," by which he destroyed the physical implication of Leibniz's differential calculus.[17]

LaRouche personally had rejected Euclidean geometry in his first classroom encounter with it, before encountering Leibniz.[18] What he derived from Leibniz is succinctly expressed by Leibniz in 1697 in **The Radical Origination of Things**.

> In addition to the beauties and perfections of the totality of the divine works, we must also recognize a certain constant and unbounded progress in the whole universe, so that it always proceeds to greater development, just as a large portion of our world is now cultivated and will become more and more so. And while certain things regress to their original wild state and others are destroyed and buried, we must, however, understand this in the same way that we interpreted affliction a bit earlier. Indeed, this very destruction and burying leads us to the attainment of something better, so that we make a profit from the very loss, in a sense.
>
> And there is a ready answer to the objection that if this were so, then the world should have become paradise a long time ago. Many sub-

13. For Newton quote, See the online **Stanford Encyclopedia of Philosophy**, 2006 Revised 2014, Section 5: "The Aftermath of the Principia. I. Relations with John Locke and Richard Bentley."
14. William F. Wertz, "Quadrature of the Circle," **Fidelio**, Summer 2001.
15. Lyndon LaRouche, "How Bertrand Russell Became an Evil Man," **Fidelio**, Fall 1994. In Part III, Section (g) of the online version, LaRouche analyzes in detail the case of Felix Klein, and what led Klein to perpetrate a fraud in omitting the priority of Cusa.
16. Lyndon LaRouche, **The Science of Christian Economy** (Washington: Schiller Institute, 1991), pages 407-425, for some of Euler's letters and LaRouche's comments. Also see **Twenty First Century Science and Technology**, Winter 1995-96, LaRouche, "Riemann Refutes Euler."
17. Ernest Schapiro, "The Real Calculus Versus What You Learned," **21st Century Science & Technology**, Fall 1999. Especially see attacks on Leibniz's calculus by Charles Boyer and Richard Courant.
18. Lyndon LaRouche, "Economics as History," **EIR**, Sept. 18, 2009.



Nicholas of Cusa showed that Archimedes' attempt at "quadrature of the circle"—to approximate the value of pi—was ontologically incompetent. The first three drawings show the process of estimating the area of a square approximately equa; to that of a given circle, as the average area of two regular polygons. In the last drawing, although the inscribed polygon of 216 may seem to closely approximate a circle in area, it actually contains a devastating paradox. There are slightly more than 182 angles of the inscribed polygon within each degree of circular arc.

> stances have already attained great perfection. However, because of the infinite divisibility [Leibniz's "worlds within worlds," not Euler's idea of infinite divisibility—E.S.] of the continuum, there are always parts asleep in the abyss of things, yet to be roused and yet to be advanced to greater and better things, advanced, in a word, to greater cultivation. Thus progress never comes to an end."[19]

In LaRouche's own similarly optimistic view, the universe as a negentropic continuum generates singularities of progressively higher power.[20]

The universe is governed by creativity and is alive. Since this applies no matter how small what you are considering is, there can be no linearity in the small.

LaRouche credits Riemann with taking Leibniz's ideas to a higher level. For example he used Leibniz's ideas of the universal characteristic and *analysis situs* to construct a succession of multiply extended manifolds, each subsuming and of a higher order than its predecessors of fewer dimensions. In going from the lower to the higher manifold, i.e. from n to n+1 dimensions, one encountered a discontinuous change in curvature or metric for the manifold as a whole.[21] LaRouche says that it was because he had intensively studied Leibniz's **Monadology** in his adolescence that he could compare Riemann's system with Leibniz's ordering of monads (or singularities) of increasingly higher power. Thus, LaRouche says that his own work in physical economy has increased the authority of Riemann, because LaRouche has replaced Riemann's manifold of independent dimensions with a manifold of independent interacting physical principles, and shown its applicability to physical economy. Each new principle finds expression via the machine tool principle, in new technologies, operating in a new Riemannian manifold, that increases our productivity and population density.

Such a succession of hypotheses, governed by axiomatic revolutionary change, could begin with Plato's Parmenides dialogue. Plato humorously shows that the only solution to the many formal paradoxes presented by the Eleatic philosophers, Parmenides and Zeno, is to introduce the principle of change, which LaRouche further characterizes as going to a new hypothesis, an axiomatic revolutionary change.[22]

As already cited, nearly 2000 years later, Nicholas of Cusa solved an analogous problem by introducing axiomatic revolutionary change , namely circular action, a physical principle excluded from Euclidean

19. Leibniz, "The Ultimate Origin of Things," 1697, in **Leibniz: Selections**, (see footnote 10). "LaRouche's Discovery," (see footnote 2) page 39.

20. See footnote 2.

21. Lyndon LaRouche, "Leibniz from Riemann's Standpoint," **Fidelio,** Fall 1996. See "The Principle of Universal Characteristics" and the subsection on Riemann's Principle of Hypothesis. Also, Leibniz, "Towards a Universal Characteristic" in **Leibniz: Selections**, page 17 (see footnote 10).

22. Lyndon LaRouche, **The Science of Christian Economy** (see footnote 16), see pages 258-259, 412, 419 and other references to the **Parmenides**. LaRouche there focuses on the problem of the one and the many.

geometry—which axiomatically only assumes lines and points—to subsume Archimedes' infinite series of inscribed and circumscribed polygons, with which Archimedes intended to trap the circle between, and thereby define its area. Cusa's discovery of the uniqueness of the circle, that it was of a different species and generating principle than the polygon, was the necessary predecessor for the discoveries of Kepler and Leonardo da Vinci, his acknowledged followers. Cusa's role in the Leibniz calculus will be cited later.[23]

Leibniz, a follower of Kepler, struggled for years with the "Labyrinth of the Continuum," so named because of its paradoxes pertaining to whether matter is continuous or not and whether it is infinitely divisible. This included Zeno's paradoxes of motion as well. Although Leibniz recognized that matter in principle—as is the clear case of a liquid—has no definite shape and is in constant flux. It is above all an infinite aggregate with no unifying principle that gives it an on-going identity.[24] At last, drawing on work by Huyghens in dynamics of elastic collisions, and his own redefinitions of the infinite and infinitesimal that led to his calculus, he was able to locate a singular intention in the behavior of matter expressed by a new physical principle, an innate power which he called live force or *vis viva* conserved in elastic collisions but, as distinct from Huyghens view, active in all collisions.[25] He was able to hypothesize a non-material *one*, the substantial form, which gave to associated matter its unity of action and continuing identity, and thereby governed the action of live force, which obeyed a universal physical principle, the conservation of live force. Today his live force, a principle of change, is stripped of its anti-entropic content and reduced to a thing, "kinetic energy." The substantial form was driven by an impulse or "appetition" to act, like all that is substantial, in Leibniz's view, i.e. the universe is alive down to its smallest part. Until his identification of this new principle of dynamics, which he later came to call the monad, the "substantial form" as named by previous philosophers, had been merely a tautology. It was therefore through *physics, not mathematics*, that Leibniz solved the labyrinth of the continuum, including Zeno's paradoxes. Living animals had the further distinction of being composed of machines down to their smallest part. Thus the organism as a whole, governed by its singular monad, was actually a hierarchy of subordinate monads. (This is what he called worlds within worlds.)[26] This was a prescient view considering there was as yet no microscopic observation of cells in tissues.

As previously described, LaRouche has taken this non-deductive process to a yet higher level, as applied to his study both of successive economic systems and the role of successive scientific discoveries and their incorporation into economic practice, social discourse and social organization in creating a society of increasing productivity and increasing energy flux density per capita. Again, knowledge or relative truth is to be found in the higher hypothesis that subsumes a series of such successive hypotheses or discoveries and their application via the machine tool principle in new technologies. The discovery of a new principle necessarily takes place in the mind of a sovereign human being or higher monad as an expression of freedom. LaRouche's discovery, which he made intelligible by basing it on his application of Riemannian physics to economy, re-

23. "LaRouche's Discovery," page 39 (see footnote 2). "Nicolaus's new solution for these [Archimedes theorems on trapping the circle between two converging sets of polygons-E.S.] is also a demonstration of the general solution for the ontological paradox depicted within Plato's **Parmenides** dialogue."

24. G.W. Leibniz, **The Labyrinth of the Continuum: Writings on the Continuum Problem**, **1672-1686**, edited by Richard Arthur. The Yale Leibniz Series (Yale University Press, 2001). Arthur provides a lengthy introduction. See especially sections 6 and 7 of the Introduction by the translator and the translations he cites. For an understanding of how Leibniz arrived at his understanding of live force and the substantiality of the monad, these translations are essential. The translator's introduction and footnotes are very helpful. It was from a study of this material that I situated Leibniz's discovery as solution to the one-many problem. See also Leibniz, "New System of Nature and of the Communication of Substances as Well as of the Union of Body and Soul." (See footnote 10). See sections 1-4. See footnote, page 106, where Leibniz reviews his discovery of *vis viva* (live force) and shows how it was pivotal for all of his subsequent work in metaphysics.

25. , "Specimen Dynamicum" in Loemker, page 439. (See footnote 7.) "So far as I know, Huygens, whose brilliant discoveries have enlightened our age, was also the first to arrive at the pure and transparent truth in this matter, by formulating certain rules which were published long ago. Almost the same rules were obtained by Wren, Wallis, and Mariotte, all excellent men in this field, though in differing measure. But there is no unity of opinion about the causes. It would seem, indeed, that the true foundations of this science have not yet been revealed." Leibniz's non-inductive leap to live force and the metaphor of the monad was the founding of the science of dynamics. Unlike these other scientists, Leibniz discerned that a universal principle must be involved. That is why, unlike even Christiaan Huygens, he was not satisfied to account for elastic collisions, but insisted a solution must subsume inelastic collisions as well.

26. Nicholas Rescher, ed. **G.W. Leibniz's Monadology** (Pittsburgh: 1991). See sections 61-70. He develops the necessity for his worlds within worlds in the living animal, which implies the animal is a machine down to its smallest part, unlike a man-made machine.

solved the paradoxes that result when an economy is viewed from the reductionist standpoint of a notion of value based on ephemerals like money or labor content, in fact upon anything other than that which increases the rate of growth of productivity of the society as a totality.

To what extent did Leibniz share this theory of knowledge? I am not aware of any direct statement on his part. I think we are dealing with the limitations of historical specificity, because Leibniz was involved in only the very beginning of the industrial revolution with his science of dynamics and work on the first steam engine. However, LaRouche in his *LaRouche's Discovery* paper, in the course of the section "The Theory of Knowledge," asks the reader to concurrently study Leibniz's article of 1695: *A New System of Nature and of the Communication of Substances, as well as of the Union of Soul and Body*.[27] In this article, Leibniz presents his series of ground breaking discoveries in historical sequence beginning with the modern science of dynamics which he founded with his definition of live force. (Although he doesn't mention it there, his discovery of least action, elaborated in his joint work with Bernoulli on the catenary, has been essential for all of subsequent physics). He goes on to show how his notion of the substantial form, in turn led to new paradoxes, and he goes through his solutions in succession in the article, so he can in the end subsume them under his idea of pre-established harmony.

To summarize this section, it is the successive introduction of axiomatic revolutions in physical science, often made intelligible with the help revolutionary ideas in mathematics, that has led to human economic progress. This history needs to be taken as a whole to appreciate fully any particular discovery in the sequence, each discovery being replicated and reproduced in its historically specific form and context. LaRouche has emphasized that this approach to science education should supersede the textbook method, which deliberately leaves out the historical drama of conflicting and hotly debated higher hypotheses at stake in each of these cases cited.[28]

27. **Leibniz: Selections**, page 106 cases cited (see footnote 10).

28. Lyndon LaRouche, "On the Subject of Education," discusses a classical education in science based on reliving the experience of successive discoveries. In "LaRouche's Discovery" (see footnote 2) he describes how this trains the student to find the ordering principle or higher hypothesis generating the series.

The Moral and Material Domains Together Under Natural Law: The Hypothesis of the Higher Hypothesis

As discussed in the introduction, LaRouche and Leibniz utilized their pivotal discoveries in physical economy and dynamics respectively to develop a system, an all-encompassing view of the universe and of human society acting upon and transforming itself through universal principles. By a system, I can best refer to LaRouche's section in **Dialectical Economics** on the phenomenological or dialectical method of proof.[29] Any particular, starting with the simplest and most pervasive phenomenon, can be understood only in its relationship with the ongoing *free* development of the totality. Situating the particular in any lesser domain leads to paradoxes. This coheres with the **Monadology**. Each monad, in Leibniz's words, has a perfect spontaneity, while its actions take into account everything else in the universe, based on God's design which tends towards progress. In his only full length book published in his lifetime,[30] **Theodicy**, Leibniz resolves the paradox of God's foreknowledge with man's free will, based on his distinction of contingent versus necessary truths and a principle of sufficient reason.[31]

Moreover for both Leibniz and LaRouche, the moral domain is multiply connected with the physical domain, by which I mean that every action we take has a particular significance in both domains, i.e. it is double valued.

29. **Dialectical Economics**, pages 241-253. (See footnote 2.)

30. G.W. Leibniz, **Theodicy**. (Cosimo Classics, 2010). Part I, Essays on the Justice of God and the Freedom of Man in the Origin of Evil. See sections 279-300, especially section 300, discussing freedom as an aspect of pre-established harmony. See sections 58-66, addressing the relation of his metaphysics to the moral domain. See section 365 for the question of God's foreknowledge.

31. See sections 14 and 15 of the last part of the **Theodicy**, "Observations on the Book Concerning 'The origin of Evil' Recently published in London," for application of the principle of "sufficient reason," which he discusses in Leomker, "Leibniz On the General Characteristic ca. 1679" (see footnote 7), page 227. "This axiom, however, that there is nothing without a reason, must be considered one of the greatest and most fruitful of all human knowledge, for upon it is built a great part of metaphysics, physics, and moral science; without it, indeed the existence of God cannot be proved from his creatures, nor can an argument be carried from causes to effects or from effects to causes, nor any conclusions be drawn in civil matters. So true is this that whatever is not of mathematical necessity, as for instance are logical forms and numerical truths, must be sought here entirely." Regarding sufficient reason, see throughout the Leibniz-Clarke debate (see footnote 7), the hilarious, complete inability of Clarke-Newton to distinguish sufficient reason from arbitrary power.

For this reason, LaRouche supported and illustrated his voluntaristic definition of a universal physical principle by referring to the **Monadology**.[32] Such a principle is one we not only discover, but we then transmit it to others, and together we apply it to change the universe, which is predisposed to obey us. This coheres with Leibniz in the **Monadology,** saying God created the universe for spirits formed in his image, including us.

LaRouche saw in Leibniz's notion of the intention embedded in each monad, however lowly, the scientific basis for our own intention to transform the universe. What is implicit in Leibniz becomes apparent for man in the space age from LaRouche's standpoint. In yet another example of a principle of both the natural and moral domain, LaRouche extended Leibniz's dynamics to social processes such as the mass strike, where a powerful idea moves the population to act as a *one*. Such ideas may also be destructive ones. Percy Shelley portrays this principle of dynamics in the last paragraph of **A Defense of Poetry**.[33]

This LaRouche/Leibniz view of natural law removes the artificial separation of art, including statecraft, from science, a separation which has caused great harm to both. The creative quality of mind of the classical artist and statesman is expressed by metaphor in science as well. An education in re-experiencing the great discoveries in classical art and science is essential for the moral character, by focusing on that quality of creativity and freedom which distinguishes us from animals. The development of the modern nation state based on the common good in the 15th Century, represents a revolution in the application of the principles of natural law as a higher hypothesis.

The Calculus as Expression of a Higher Hypothesis

Does Leibniz's discovery of the differential calculus fit LaRouche's notion of progress through successive hypotheses of increasingly higher power? I believe it received an essential contribution from Cusa's idea of the Maximum-Minimum relationship.[34] Cusa wrote that in the Divine Mind, opposites such as the maximum and the minimum coincide, because the exemplars (forms) of all things are in God. In the actual physical world, however, this would imply that in any dynamic or living process acting as a one, what is essential about the whole, its intention, must be expressed in some way, even in its most infinitesimal part.

This maximum-minimum principle finds its leading expression in our relationship with the Creator in whose image we exist. As potentially creative beings, we share in His creativity and are in a direct unmediated relationship with Him. Thus, in a section of the **Science of Christian Economy** entitled "Leibniz's Mind," LaRouche elaborates the implications of the fact that "the organization of the universe is based on the action corresponding to creative reason by monads." Later, "that gives us the essential map of the universe in germ." Later still, "Hence, the **Monadology** is perhaps the most essential document in all of physics."

LaRouche continues: "You will note that Leibniz, in essence, says in his own terms of reference, exactly what I say here—which is not entirely incidental; about the age of 13 or14, I learned this from Leibniz directly. I wrestled with it then for over a year and I got it into my head; so, today, I don't have it necessarily in the form I learned it from Leibniz, although I was stimulated to my discovery by him."

Kepler, a follower of Cusa, applied Cusa's insight to finding a knowable relationship between an infinitesimal portion of the planetary orbit and the orbit taken as a totality.[35] According to his area law, the area swept

32. **Economics of the Noösphere** (see footnote 1), section "Monadology," starting page 126.

33. LaRouche elaborates his view of dynamics in "Economics as History," (see footnote 18) as a conception applying to both the social domain and to physical science.

34. Nicholas of Cusa, **On Learned Ignorance**, Jasper Hopkins, tr. (A.J. Banning Press, 1985). In Book II, Chapter 9, Cusa uses his maximum-minimum principle to show that the Platonic and Aristotelian views of the exemplars—forms (of things are necessarily incorrect. Thus the Platonists situate forms in a world soul. Cusa agrees with the Platonists that the intelligence that directs change must be based on exemplars or forms, contrary to the Peripatetics, including Aristotle, but to situate pure uncontracted possibility, i.e. a maximum, anywhere but in God violates the maximum-minimum principle. Being therefore both in God, maximum and minimum must coincide. See online pedagogical **Riemann for Antidummies** number 59, "Think Infinitesimal," by Bruce Director for elaboration of Cusa's contribution to development of calculus and modern science. Bruce Director's pedagogical series, especially the many numbers which elaborate the history of the complex domain and its application to mapping by Gauss and Riemann, demonstrates the application of an ordering principle or higher hypothesis in great depth, especially by showing the necessary connection of modern science with principles discovered by the ancient Greeks. They are available on the Internet.

35. Johannes Kepler, **Astronomia Nova**, translated by William A. Donahue (Santa Fe: Green Lion Press, 2015). See chapters 40 and 59.

out, taking the orbit as an ellipse with the Sun at one focus, is proportional always to the time. This implies a determined relation between the total orbit and any portion of it, and further, since each orbit is different, the possibility of harmonic relationships between the orbits of different planets exists. Kepler recognized that his area law still did not allow one to precisely calculate where the planet would be at a given subsequent time, so he challenged future mathematicians to solve this problem.[36]

Leibniz studied Kepler's work extensively, especially after he found Newton's explanation of universal gravitation unacceptable. Leibniz sought a way to account for Kepler's results based on true universal physical principles rather than occult action at a distance, which contradicted Leibniz's view that force must be transmitted through a form of contact. Above all, Newton's system violated Leibniz's principle of pre-established harmony, since it implied a direct action of one substance on another substance.[37]

Although he could not solve the Kepler problem mentioned above, Leibniz through his differential calculus was able to represent how the physical principle generating a total trajectory can be used to define the intention of the process at any given interval, however small.[38] By using his method of differentials, he was able to express its nonlinear characteristic, based upon insights gained in his struggle with the Labyrinth of the Continuum. In particular, he concluded that there are no true infinitesimals. Rather, they are fictions to be used by us voluntaristically. That allowed him, where appropriate, to assert that a numerical magnitude could be made as small as we wished.[39]

Leibniz's calculus exemplified a principle LaRouche has taken to a higher level, metaphor, by developing its fundamental role in both scientific discovery and artistic creation. Humorless critics of Leibniz's calculus, such as Richard Courant, insisted on taking Leibniz's

Johannes Kepler (1571-1630)

36. Bruce Director and Jonathan Tennenbaum, "How Gauss Determined the Orbit of Ceres, **Fidelio**, Summer 1998. See page 25, "Kepler Calls for a New Geometry," for an in depth study of what is called the "Kepler problem."

37. Paolo Bussotti, **The Complex Itinerary of Leibniz's Planetary Theory** (Birkhäuser Publishers, 2015). See especially page 152 regarding action at a distance. In the case of an elastic collision, Leibniz saw the recoil as resulting from the activation of the innate or potential force in each body. This accords with his Platonic notion of innate ideas which are latent and potential in our mind, but which only come to awareness when we reflect upon experiences. Analogously, LaRouche also identifies the unique role of metaphor to provoke a thought object in the mind of the listener. Leibniz criticized Kepler for hypothesizing magnets in the Sun and planets to account for their interaction, in "Against Barbaric Physics," in **G.W. Leibniz: Philosophical Essays**, translated by Roger Ariew and Daniel Garber (1989).

38. Ernest Schapiro, "The Real Calculus versus What You Learned" (see footnote 17).

39. Refer to footnote 24. See page 65, "On the Infinitely Small," regarding infinitesimals as useful fictions, and relevant footnotes; see pages 393-4, 396 . See page 89 of "Infinite Numbers" for discussion of the circle as a fiction. In **The Secrets of the Sublime, Labyrinth of the Continuum**, page 49, he says if "matter is actually divided into an infinity of points . . . hence it follows further that any part of matter is commensurable with any other. . . . In that connection, I should examine the line of reasoning I have used elsewhere, according to what it seems to follow that a circle, if it exists, has a ratio to the diameter of one number to another . . . Hence it follows that any part of matter is commensurable with any other." Leibniz is saying that were there to be actual infinitesimals, the circle could be squared. Instead, there are no actual infinitesimals; they, like the circle, are useful fictions. In fact, "the ideal determines the real." This last quote is from Letter to Varignon, with a note on the "Justification of the Infinitesimal Calculus by that of Ordinary Algebra." Loemker, pages 542-546. Leibniz arrived at this revolutionary view of infinitesimals in 1676 in Paris, the same year he concluded that in finding the area under a curve by integration, one need not divide the base below the curve into equal infinitesimal units, but simply can take the subdivisions as small as one liked. I believe he was the first to take this bold step. See **The Early Mathematical Manuscripts of Leibniz,** translated by J.M. Child (Open Court Publishers, 1920), page 125. See pages 183-187 in **Labyrinth of the Continuum**, "Dialogue on Continuity and Motion," for his critique of Descartes on infinite divisibility of liquids, and hence of matter generally (see footnote 24). Leibniz's argument against actual infinitesimals involves mathematics *and* physics, because both are subsumed under metaphysics. Richard Arthur's introduction (pages li-lxi) is an insightful review of the evolution of Leibniz's views of the infinitesimal.

dy/dx literally, arguing that it implies dividing by zero at the point where dy/dx is being evaluated. LaRouche sees metaphor—in sciences and in classical art—as a means of pointing to an elaborated invisible principle, what he calls a thought object,[40] e.g. Leibniz's monad or Riemann's *geistesmassen*,[41] which represents the solution to a paradox not solvable by deductive methods. By means of the metaphor, the original idea can be evoked, not by "information" but rather by a creative mental effort that replicates the thought object The thought object for dy/dx subsumes the process by which Leibniz resolved paradoxes of the infinitely small and infinitely large. It also represents the interaction of an invisible principle with the trajectory.[42]

By historically situating Leibniz's discovery of calculus as one of a series of fundamental breakthroughs, including those of Cusa and Kepler, Leibniz's and Bernoulli's joint elaboration of the calculus in physical "least action," and Gauss's later application of calculus to mapping the complex domain, a lot has been gained. The grasp of metaphysics and of the method of hypothesis common to each of them makes clear why Newton, who crassly asserted: "I don't make hypotheses," could not possibly have independently developed calculus. It also helps us understand why so much effort up to the present day, has gone into obfuscating Leibniz's method of hypothesis, and ignoring the importance of his many years of struggle with the "labyrinth of the continuum."

LaRouche also utilized Cusa's maximum-minimum principle underlying the calculus as a higher hypothesis in his 1980's seminar discussions with scientists including Dr. Daniel R. Wells and Dr. Robert Moon, who had hypothesized a quantized structure for physical space time, and, by implication' for the atomic nucleus itself. In response, LaRouche proposed that the atomic nucleus must be Keplerian, as the minimum, in reciprocal relationship to the Solar system as the maximum. LaRouche has referred to this as the "reciprocity of extremes."[43] Moon proceeded to devise a model of nested platonic solids, which corresponded to and predicted many facts of atomic physics and important features of the Periodic Table.[44]

Calculus, In Turn, Generates a New, Higher Hypothesis, Least Action

As an outgrowth of his calculus and his principle of sufficient reason, Leibniz was able to more rigorously define unique action, i.e. that path of action which could be achieved in only one way. He applied that to the reflection and refraction of light,[45] and together with Bernoulli, to the shape of the catenary.[46] Leibniz's insight involved his principle of sufficient reason. Therefore when it comes to the path of reflection from a mirror, the universe will select the path whose length can be achieved in only one way. All other possible path lengths occur as "twins" and there is no basis for

40. "LaRouche On the Subject of Metaphor," Fidelio Fall, 1992.

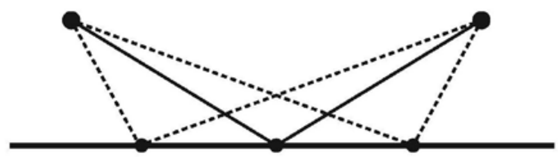
41. **Bernhard Riemann: Philosophical Fragments**, "section 1. On Psychology and Metaphysics," in **21st Century Science & Technology**, Winter 1995-1996. Or Helga Zepp-LaRouche, "Overcoming Your Fears by Increasing Your Geistesmassen," **EIR**, Oct. 10, 2003.

42. Bruce Director, "Think Infinitesimal," **Riemann for Anti-Dummies** Number 59, addresses Leibniz's calculus in depth, using animations to illuminate the relation of a trajectory to unseen principles.

43. Lyndon LaRouche, "The Reciprocity of Extremes: The Astrophysics of Gurwitsch Radiation," in **21st Century Science & Technology**, Fall 1998. Here LaRouche asks what the phenomenon of mitogenetic radiation necessarily tells us about the universe as a whole, and how it might express the interaction of principles.

44. Numerous articles since 1987 on the Moon model of the atomic nucleus in **EIR** and **21st Century Science & Technology** are available on the Internet.

45. Leibniz, "Tentamen Anagogicum, An Anagogical Essay on the Investigation of Causes," in Loemker (see footnote 7), page 477.



In both the cases of reflection and refraction, he obtained what he called the "most determined magnitude" by using his calculus to find the maximum or minimum of the path length or time taken, respectively. In the simpler case of reflection, where the least action path is the total path length from emitter to absorber by way of the mirror, he argues that with one exception, any particular path length can be achieved in two ways; i.e., there are two equal, total path lengths resulting from two points of reflection on the mirror. The exception is the unique total path length, whereby the twin points of reflection coalesce. That unique point lies between the twin points for all of the pairs. See Leibniz's diagram and explanation on page 480. A further geometric representation is in Richard Courant and Herbert Robbins, **What Is Mathematics**, (Oxford University Press, 1978), page 330.

46. Johann Bernoulli, "Lectures on the Integral Calculus," translated by William A. Ferguson, **21st Century Science & Technology**, Spring 2004. Here the least action form of the hanging chain was achieved by basing the mathematical formulation upon the physical assumption that every portion of the chain, however small, includes the original lowest point, satisfies the same set of conditions. That ensured that all such chains are still catenaries and fulfills Leibniz's broader conception of what came to be called "least action."

choice—see drawing. That unique path in this case is also the shortest. Leibniz's discovery was subsequently applied to the dynamics of moving bodies as "least action," action having the dimension of *energy times time* for a particular path.

Least action as conceived more generally by Leibniz, was a Platonic idea or thought object expressing a universal physical principle that itself qualifies as a leading example of a higher hypothesis which has generated in turn an ongoing series of discoveries, starting with Cusa's discovery and application of the fact that circular action uniquely generates that closed perimeter which encloses the maximum possible area, i.e. it constitutes a path of action achievable in only one way, which is an important aspect of what Leibniz meant by what came to be called "least action."

Carl Friedrich Gauss

Kepler took Cusa's idea of "unique action" further by utilizing the sphere, instead of the circle, as primary. He took the nested five Platonic solids uniquely resulting from equal partitioning of the surface of the sphere by great circles as representing the orbits of the known six planets.[47] He later developed the idea of elliptical planetary orbits, i.e. conic sections,[48] anticipating by nearly 200 years the higher form of unique action developed by Gauss's discovery of the complex domain. In this reference,[49] Gauss shows that a complex number is equivalent to a combination of linear extension and rotational action. LaRouche elaborated Gauss's complex domain, making it intelligible as the continuous domain of conic self similar spiral least action.[50]

By implication, the elliptical planetary orbits are self-similar spiral paths around a cone. Further, in defining the musical harmonic relationships among the elliptical planetary orbits by their relative angular velocities as viewed from the Sun, Kepler was modeling the Solar system on a metaphorical musical or aesthetic archetype, emanating from the mind of the Creator without reference to forces.[51]

In the view of LaRouche, this was an expression of force-free action or least action obeying the curvature of physical space time. LaRouche is the first in recent times to relate the musical scale to the principles of astrophysics. By thus identifying the musical scale with a universal physical principle, LaRouche's historic rediscovery has clarified the coherence between the necessary tuning of the musical scale and the biological properties of the trained force-free human singing voice, upon which the classical tradition from Bach to Brahms was based.

It was Leibniz, a follower of Kepler, who made unique action part of the broader conception underlying his universal pre-established harmony, going beyond a purely mathematical-physical conception to its being an expression of the fitness of things. In an essay, previously cited on how final causes are required to understand why physical laws take their particular form, Leibniz points out, in the cases of reflection and refraction of light as examples:

"The most beautiful thing about this new view [of God's work—E. Schapiro] seems to me to be that the property of perfection is not limited to the general but

47. Johannes Kepler, **Mysterium Cosmographicum** (1596), facsimile of the original Latin of the second edition of 1621, translated by A.M. Duncan (Abaris Books, 1981).

48. Johannes Kepler, **New Astronomy** (1609), translated by William H. Donahue (Cambridge University Press, 1993).

49. Karl Gauss, "The Metaphysics of Complex Numbers," translated by Jonathan Tennenbaum, **21st Century Science & Technology**, Spring 1990.

50. This video on The Power of Labor from the early 1980's introduces LaRouche's view of conical action as an expression of action in the complex domain. It also makes possible the distinction between work and energy. The complex domain plays a central role in LaRouche's work as the domain of universal physical principles or the domain of powers and of possibility. Plato's metaphor of the cave portrays the relationship of this higher domain to the world of our perceptions.PPSee also Chapter 3 of LaRouche. **So, You Wish to Learn All About Economics?** (Washington: EIR News Service, 1995).PPLaRouche, "Visualizing the Complex Domain," . Because the complex domain typifies what makes us human, i.e. our power to hypothesize the universal principles giving rise to perceptions, LaRouche demonstrates the grievous immorality of those like Leonhard Euler and Augustan-Louis Cauchy, who would reduce the complex domain to a mathematical device.

51. Kepler, **The Harmony of the World**, translated by A.J. Aiton, et al. (American Philosophical Society, 1997).

FIGURE 1

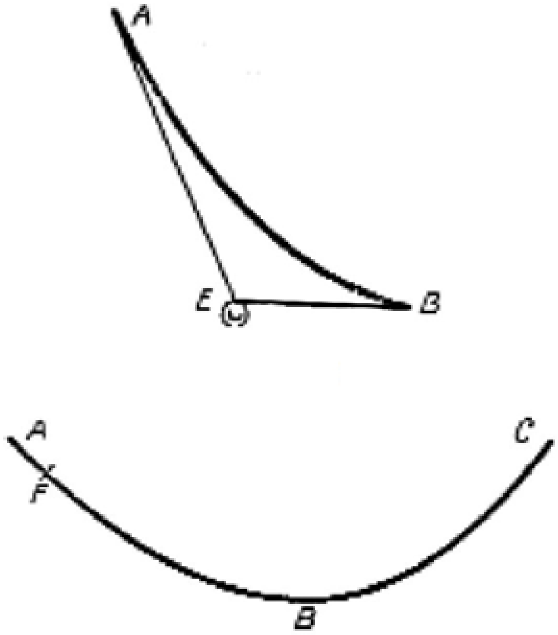
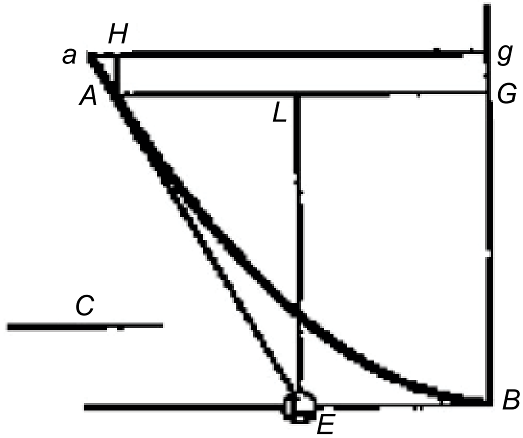


FIGURE 2



As we change the point of suspension from A to F, the shape of the remaining portion remains the same. The smaller catenary thus retains the same optimal characteristic as the original.

descends to the particulars of things and of phenomena, and that in this respect it closely resembles the method of optimal forms, i.e. forms that provide a maximum or minimum as the case may be—a method which I introduced into geometry in addition to the ancient method of maximum and minimal quantities. For in these forms or figures, the optimum is found not only in the whole but also in the part, and it would not even suffice in the whole without this.

How does the catenary conform to Leibniz's optimal form, as demonstrated above? It takes the unique shape that minimizes the work required to elevate it to where it is suspended from its particular endpoints, and therefore, conversely, the energy acquired in its falling to the ground. Also, if in **(Figure 1)** (see reference by Bernoulli), one changes the point of suspension from A to F, the shape of the remaining portion remains the same, and the horizontal force remains the same. The smaller catenary thus retains the same optimal characteristic as the original of which it was a part. Supposing the vertical direction is y and the horizontal is x, the slope of the tangent at any point along the chain, i.e., the ratio of the vertical and horizontal sides of the infinitesimal triangle, aHA in Figure 2, can be understood by Bernoulli's astute physical reasoning, because it is at the same time the ratio of the weight of the chain below the point at which we are taking the tangent, that is to say, the vertical force, to the horizontal force. The horizontal force is a constant throughout the length of the chain, including even the lowest point, where there is no vertical force. It is the changing value of this ratio that ensures the stability and gracefulness of the hanging chain **(Figure 2)**. Leibniz's invention of the calculus allowed him and Bernoulli to calculate the relevant length of the curved chain and invert its rate of change, dy/dx, i.e. integrate, thereby bringing to the surface the invisible process underlying the rate of change, which is to determine the hidden form of the entire catenary, as actually the arithmetic mean of two exponential curves.

However this physical least action is only the beginning, leading on to *cognitive* least action.[52] He describes that as follows:

> As for the simplicity of the ways of God, this is shown especially in the means which he uses, whereas the variety, opulence, and abundance appears in regard to the ends or results . It is true that nothing costs God anything less than it costs

52. For a helpful portrayal of cognitive least action, see Bruce Director, **Riemann for Anti-Dummies** number 37 "The Domain of Possibility" and number 40, "Cognitive Least Action." Director reveals the harmony introduced among the exponential and trigonometric functions and the conic sections made possible by the discovery of the complex domain by Gauss and Riemann.

> a philosopher to build the fabric of his imaginary world out of hypotheses, since God has only to make his decrees in order in order to create a real world. But where wisdom is concerned, decrees or hypotheses are comparable to expenditures, in the degree to which they are independent of each other, for reason demands that we avoid multiplying hypotheses or principles, somewhat as the simplest system is always preferred in astronomy.[53]

In his first article in 1691 on the catenary, he writes:

> The resourcefulness of this curve is only equal to the simplicity of its construction, which makes it the primary one among all of the transcendental curves [curves generated by motion-E. Schapiro]. …The curve can be constructed and traced very simply by a physical type of construction, that is, by suspending a string, or better a small chain of variable length, and as soon as you can discover its curve, you can discover all of the proportional means, and all of the logarithms that you want to find, as well as the quadrature ofhe hyperbola [the area under a section of the hyperbola—E.S.].[54]

But Leibniz's own discoveries were not the last expression of the opulence of the catenary. In solving the form of the curve, one encounters the sine, the hyperbola, and the actual form of the curve, the arithmetic mean of two exponential curves. Leibniz asked: What higher domain could subsume all of these transcendental functions? Also, what power could generate powers of negative numbers, such as the square root of minus 1, i.e. what was its logarithm? It was Gauss who answered Leibniz's questions by discovering the physical complex domain in which these functions could all be represented intelligibly in terms of the complex exponential function.[55] In so doing, Gauss refuted Euler, who treated the "imaginary numbers" as merely a useful formalism. Again, it was LaRouche who made an explicit representation of Gauss's idea in three dimensions as conical self similar spiral action, a higher form of least action than simple circular action.[56]

LaRouche has advanced the representation of still higher forms of unique action, this time capable of generating physical, not just mathematical, singularities, as well as explicitly developing the conception of unique action as force free. The higher forms he proposed involved not one single cone but a cone whose apex angle keeps expanding as it grows in time, so that one gets a hyperbolic cone that flares out to infinity. A succession of such flaring cones thus yields a series of singularities.

The Leibnizian principle of unique action has been reapplied throughout subsequent history. The most notable example might be its use by William Hamilton to develop a metaphor subsuming particle trajectory in mechanics with light pathway in geometrical optics. Erwin Schrödinger a century later utilized this largely overlooked metaphor to develop wave mechanics. Most recently, Vladimir Vernadsky's three laws of the biosphere are based on an optimizing principle.[57] It must not be forgotten that Leibniz saw "unique action" as an expression of natural law and natural theology. God selects that universe which, taken as a whole, has from His standpoint the least imperfection and also the greatest potential for further perfection and beauty. This principle has found so many different historically specific expressions that only by seeing the entire sequence can we do it justice and arrive at a higher conception subsuming them all. Thus, an important area of inquiry where such a review of least action is relevant is the millennium-long debate of the relative significance of negentropic potential as opposed to force in all three domains: the inorganic, living processes, and cognitive processes.

Can Unique Action Processes Be Force-Free?

As regards force-free pathways, LaRouche was convinced from an early point in his development that

53. Leibniz, "Discourse on Metaphysics." See Loemker (footnote 7), page 306.
54. Leibniz, "Two Papers on the Catenary Curve and the Logarithmic Curve, 1691," translated by Pierre Beaudry, **Fidelio**, Spring 2001. By "logarithmic" Leibniz means exponential.
55. Bruce Director, **Riemann for Antidummies**, number 49. "The Hidden History of the Complex Domain."
56. See footnote 50.
57. Andrey Lapo, **Traces of Bygone Biospheres** (copublished by Mir Publishing, Moscow, and Synergetic Press, Inc., Oracle, Arizona and London, 1987.

the planetary orbits harmoniously express the physical curvature of space time. Similarly, as opposed to the Newtonian view of forces acting at a distance through empty space to keep them in place, Leibniz proposed that the planets are surrounded by rotating ethereal vortices which cause all the planets to circulate in the same direction and also exert a net inward pressure opposing the planet's tendency to fly off on the tangent. He also suggested the possible role of the Sun radially emitting a material cause for gravitational attraction falling off as the square of the distance.[58]

LaRouche had force free processes in mind at a seminar in 1985. There he offered a suggestion to a plasma physicist, Dr. Daniel Wells, who was working on fusion energy from a plasma confined with the help of a magnetic field. Wells had invented a device called Trisops which projected plasma braided rings—composed of vortex filaments—from opposite ends of an enclosure and sought to prolong their stable lifetime in a magnetic field long enough for fusion to occur. LaRouche asked Wells if he had he applied his concept of plasma vortices stabilized in a magnetic field by balanced opposing forces to the formation of the Solar system. Wells had never seriously considered the problem until then! Wells' solution to LaRouche's challenging question started with cylindrical concentric rings of plasma in a magnetic field which eventually shrank down to braided tori—called Beltrami vortices—such as he observed in his machine. These rings in turn would each suddenly condense into a single ball, which he called the White Owl phenomenon. His calculation varied the parameters governing the relative amount of two opposing forces so as to equalize them, as well as minimizing the free energy of the system. The two opposing forces were: (1) a mechanical interaction between the plasma and the vortices rotating in it, known as the Magnus force, i.e., the force that lifts an airplane in flight; (2) An opposing force, due to the interaction of the magnetic field with the moving electric charges in the rotating rings, called the Lorentz force. By setting these opposing forces equal to one another, he obtained a remarkable result, using the calculus. The solutions to the variational problem were very close to the known planetary orbits in their relative velocities and relative distances from the Sun. They were also consistent with the varying magnetic properties of the individual planets.

In the conclusion to the article in which he reported these results, he said:

> We have obtained the geometry of the rings—planets—and the velocity ratios with a three dimensional field theory that is independent of any "action at a distance" forces, that is, is independent of gravitation. We have asked, what would the distances and velocities of the planets have to be if they were to achieve stable—that is, force-free—orbits, and all have orbital rotation in the same direction?

After describing the method of calculation, he continued:

> We discovered that the [observed—E.S.] Bode numbers for the inner planets are actually eigenvalues (roots) of the force-free field equation.

With a knowledge of the initial conditions of the system, obviously not known to us, "then a detailed description of both the morphology and scale of the system would be determined without invoking the gravitational inverse square law.

"This was the objective of Kepler, who took the opposite approach to that of Newton and Galileo. He did not view 'forces' as primary; instead, he derived his laws of planetary motion from the physical geometry of the planets and the Sun."[59]

LaRouche saw this as a major contribution to theoretical physics, because it offered a force-free account of planetary motion and of a particular many-body problem. Many-body problems are not solvable by purely mathematical methods; the only solution thus far has been Kepler's use of the modulated "hard and soft musical scales" to account for the planetary system as a whole, including the multiply-connected interaction of the planets with the Sun and with one another.[60]

58. Paolo Bussotti (see footnote 37). He not only develops Leibniz's work on planetary motion, but clarifies the influence of Kepler's method on Leibniz's own thinking. Leibniz used his calculus to intelligibly account for elliptical orbits and took Kepler's ideas of astrophysical harmony to a higher level in his monadology based on pre-established harmony.

59. Daniel R. Wells, "How the Solar System Was Formed," **21st Century Science & Technology**, July-August 1988, page 18.

60. LaRouche Memo of April 11, 1986: "The Coming Report on Kep-

Therefore, in a sense, Kepler's musical exemplar and metaphor is a still higher and more beautiful conception, than Wells's "physical geometry of the planets and the Sun." That is the case because Kepler expresses the curvature of physical space time. It is likely to have contributed to Leibniz's arriving at his pre established harmony. Again, Kepler was the first to identify the musical scale with fundamental principles of astrophysics. LaRouche has given this discovery new significance by rediscovering that the proper tuning of the scale must conform to the biophysics of the human singing voice. Tuning, therefore, which has in recent decades been treated as an arbitrary matter of taste is therefore a scientific question. Arbitrary tunings which raise the pitch strain and ultimately injure the vocal apparatus.[61]

Bernhard Riemann

The distinction between dynamis, Plato's principle of powers, such as the cognitive power by which we double a square; and Aristotle's notion of force as a self-evident push or pull, is the precursor of bitter and repeated scientific controversy. Kepler saw the planetary motions as a dynamic totality fulfilling an idea or intention guided harmoniously by the Sun, whereas Newton saw only pairwise forceful interactions using a formula plagiarized from Kepler's third law.[62]

Leibniz' focus of attack on Newton in the Leibniz-Clarke debate was Newton's oligarchical view that God acted arbitrarily and ruled by force, whereas his own God acted on the basis of creative reason—which he also called "necessary and sufficient reason." In his book-length critique of John Locke, in which Leibniz saw our most fundamental ideas as innate, Locke's associate argued that ideas are in effect inserted into the mind, comparing it to a passive blank slate.[63]

One hundred years later, the elaboration of a potential function by Karl Friedrich Gauss and Bernhard Riemann, and its essential role in their electromagnetic theories, starting with André-Marie Ampère's force free experiments, contrasts with Maxwell's elaboration of Michael Faraday's force fields. Riemann was one of the first to propose that electromagnetic waves represent propagation of a potential, an invisible thought object, with the speed of light, whereas Maxwell rejected the idea of potential as, at most, a mathematical construct. The development of the metaphor of the complex domain by Gauss and Riemann enabled them to conceive of a new domain of physical powers manifested as least-action pathways of increasing complexity, such as elliptical orbits.

LaRouche's proposal to Wells was an intervention into this historic debate against the unjustified authority of Newtonian methods in physics assuming the primacy of self-evident forces, which LaRouche encountered even among his closest collaborators in the scientific community. Historically, the idea of potential has

lerian Orbits" in Local Plasma and Related Events. LaRouche elaborates the revolutionary implications of the work of plasma physicist Daniel Wells supporting Kepler's relatively force free model of the solar system as opposed to that of Newton. The orbits and their harmonic proportions, as developed by Kepler in **Harmony of the World**, reflect the natural curvature of physical space time, and the musical scale appropriate to the human singing voice. An interesting question concerns why it should be that, by minimizing the free energy and force in a magnetohydrodynamic model of the plasma of the early solar system, one not only derives the known planetary orbits, but also approximates the musical scale which Kepler derived using the relative angular velocities of rotation of the planets around the Sun. There must be a principle applicable to both the biophysics of the singing and speaking voice and to planetary motion, i.e. what LaRouche called at that time a strong hypothesis.

61. **A Manual on the Rudiments of Tuning and Registration**, "Book I, Introduction and Human Singing Voice," (Schiller Institute, 1992).

62. **Science of Christian Economy** (see footnote 16), pages 374-376, "How Newton Parodied Kepler's Discovery," gives the details of the bowdlerization of Kepler's Third Law. The greater crime, however, was to conceptually reduce a principle of the Solar system as a whole to a so called law of pairwise interaction.

63. Leibniz: **New Essays on Human Understanding**, translated by Peter Remnant and Jonathan Bennett (Cambridge University Press, 1982).

been the means of elaborating a principle of anti-entropy and unlimited progress.

The Monadology Expresses a Pervasive Principle of Intention in the Universe

LaRouche sees the **Monadology** as Leibniz's greatest contribution to physics, and his discovery of least action as leading directly to his **Monadology**. My interpretation of this latter statement is that the **Monadology**, an elaboration of Leibniz's pre-established harmony, is the way the universe must be organized for least action to be possible. Least action, then, would be the entire universe expressing a universal physical principle by acting as a *one* to effect a result. LaRouche applied that idea to astrophysical processes which involve spatial order over such vast distances that one might hypothesize that the organizing intention must be conveyed at speeds far greater than light, in what he called "absolute time."[64] He also cited the case of a scientist who takes the discovery of someone from hundreds of years ago to a higher level. In that case he has instantaneously changed the significance of the original discovery. Raphael's painting *The School of Athens* might be a metaphor for that experience which LaRouche calls the "simultaneity of eternity." Convergent evolution, in which a form present in the past, such as feathers in reptiles, recurs in a much higher form of life—birds in this case—can represent an intention that has been preserved in some fashion so that it can act once again across millions of years.[65]

64. A 1988 memo by Lyndon LaRouche: "A Non-Mystical View of the Necessity of Existence of the Notion of 'Absolute Time.'" See chapter 16.

65. Martin Lockley, **The Eternal Trail**, (Reading, Mass.: Perseus Books, 1999). He makes several references to his belief in a morphogenetic field, to account for the reappearance of similar harmonic patterns of body organization at vast time intervals as the remarkable phenomenon of convergent evolution. He also shows how the succession in time of morphologies itself constitutes a gestalt that gets repeated at vastly separated time intervals. See the chapter Spirit Trails, where he says: "One might describe it as evolution spiraling around a cone, so that each cycle resonates with the forms that manifest at that point in the cycle." This view is somewhat parallel with Rupert Sheldrake's controversial hypothesis on morphic resonance, which postulates a type of "field" or growth habit which influences successive generations to grow into similar shapes. I arrived independently at the conclusion that this view has merit through the study of fossil vertebrates and their tracks in the dimension of evolutionary time."

LaRouche is unique in his application of the role of intention in all possible domains, by showing that universal physical principles actually constitute intention. When we discover and as a society apply them, we change the universe. In his essay "The Gravity of Economic Intentions,"[66] where he discusses "truly knowing Leibniz's calculus," he emphasizes the disastrous implications for today's economists that the reduction of Leibniz's calculus to a mathematical technique, premised on linearity in the small, has had. The economist who sees economic cycles in monetary terms is at a loss to answer the question:What must we do now, in the small, to alter for the better the larger course of an economic cycle?

We must introduce a new physical principle, expressed via a technology, to change the productivity of the economy as a whole. A good example was Kennedy's introduction of a crash space program, and the inverse, the destructive effects on the entire economy of Obama's termination of the manned space program. Unfortunately, an economy is usually seen as the sum of millions of percussive interactions, lacking an intention, i.e., a self organizing principle, and therefore a foreseeable outcome. A shock wave, which is ordinarily also seen as an aggregate of percussive interactions, is described by LaRouche as actually a self-organized hydrodynamic process.[67] He has treated the form of Riemann's discovery of the shock wave as a universal phenomenon and written at length about economic shock waves.

66. Lyndon LaRouche, **The Economics of the Noösphere** (see footnote 1). The idea is also elaborated in LaRouche, "Economics: The End of a Delusion." See the section "The Physical Basis of Economic Cycles" where he says: "The motion within any local, much shorter interval, must be understood as an expression of the orbit as a whole; not, contrary to today's typically foolish Wall Street statistician, the orbit as an expression of the cumulative effect of localized motions. This is as true for economic cycles, as it is for Solar ones. This approach to the principle of cycles, was, incidentally, the method underlying and permeating the original, 1676, first published announcement of the calculus by Gottfried Leibniz; therefore, the principle I am invoking here, is by no means a Johnny-come-lately innovation, but is an elemenetary and solid matter of scientific method, as should be taught in all respectable secondary schools and universities today."

67. "What Are Economic Shock Waves?" See two ***EIR*** articles, Dec. 7, 1982, and Dec. 14, 1982. PPThey were written with the expectation that the SDI would be adopted by the Reagan Administration and the then-Soviet Union, and therefor that once the SDI's new physical principles were incorporated into the civilian economies, there would be an economic shock wave.

An Autobiographical Note: Why the Theme of this Article?

I proposed to do a class series around the theme of Leibniz from LaRouche's Standpoint because in the months before, I had been asked—in early 2015—to do a Leibniz class series with Phil Rubinstein. I had benefitted personally from LaRouche's idea of looking at any given discovery as one member of a historically specific series of discoveries, and then seeking the subsuming higher hypothesis.

In particular, I had become intrigued by the question of formative causation, i.e., are there immaterial exemplars which, while exerting little or no force, are able to guide, i.e. inform the processes of morphogenesis in molecular processes, morphogenesis in biology, and mental processes? In the 1980's, our organization began to research and feature the work of Alexander Gurwitsch who was able to histologically diagram the successive stages of development of embryos. He then showed that he could superpose a vectorial field at each stage predicting the ensuing change in geometry of the cells and their layers, including the direction of orientation of the cell nuclei. He characterized this as a non-material, non-energetic field, something never previously described, which he called the "dynamic preformed morpha."[68]

In 2012 I discovered the work of Rupert Sheldrake, including his book **The New Science of Life**. He generalized Gurwitsch's idea, but in the broadest, non-specific terms, to a much wider range of phenomena, including both non-living and cognitive.[69]

However, Sheldrake is extremely controversial, so I had at that time nothing to compare him with until after reading "Riemann Refutes Euler,"[70] by LaRouche, I read one of his references, "Riemann's Philosophical Fragments," translated in the same issue, wherein Riemann proposes that the mind of the earth or biosphere takes into itself the thought masses (Geistesmassen) of deceased plants and uses them (perhaps as an exemplar) to produce new species of plants. This seemed to be compatible with Sheldrake.

However, it was only after reading LaRouche's essay "Changing the Universe, a Philosophy of Victory," where he discussed historical specificity in relation to his theory of knowledge as higher hypothesis, it occurred to me I needed to do a much wider search for the idea of formative causation in a series of historically specific locations. I readily found the idea of formative causation elaborated in Cusa, Kepler, and above all in its first proponent, Plato. In the first section of **Parmenides**, it is the subject of heated debate between the young Socrates and Parmenides. Cusa made numerous references to formative causation.

> However because all living things have a natural understanding, a firm recollection, of their sustenance, and a sense of their similitude, and sense which beings are of the same species, Plato says this must necessarily stem from the idea, since nothing endures except ideas. From this you elicit that the ideas are thus not separated from individuals, as if they were extrinsic exemplars. For the nature of the individual is united with the idea, from which it has everything in a natural manner.

He is saying that something akin to mind is acting causally but not necessarily in the way we would ordinarily think of mind acting.

> Proclus explains more fully how the essential principles are intrinsic and not extrinsic, and how the individual by means of that contact in which the individual is joined to its idea, is connected through this intelligible idea to the divinity, so that according to its capacity it exists in the best manner in which it can be and be preserved.[71]

Kepler in his discussion of the ability of animals and humans to discern harmony in music says:

> For to recognize is to compare some external sensible thing with ideas which are internal, and to judge that they are congruent. That is splen-

68. Michael Lipkind, Alexander Gurwitsch, "The Concept of the Biological Field," **21st Century Science & Technology**, Summer 1998, Part 1; and Fall 1998 Part 2 . Both issues also feature LaRouche's in depth view of Gurwitsch's work.
69. See footnote 66.
70. See footnote 18.

71. Nicolaus of Cusa, **Toward a New Council of Florence: On the Peace of Faith and Other Works by Nicolaus of Cusa,** edited by Marinna Wertz (Washington: Schiller Institute, 1993). In this volume, see Cusa, "The Hunt for Wisdom," pages 462-463 for the two quotes.

didly expressed by Proclus by the term "awakening," as if from sleep. For just as sensible things which we meet externally recollect what we had known beforehand, similarly sensible mathematical things , if they are recognized, therefore, elicit intellectual things which are previously present within, so that things now in actuality shine forth in the soul which were hidden in it before, as if under a veil of potentiality. How then, did it break in? I reply that the *ideas or formal causes* [E.S. emphasis] of the harmonies, in accordance with our earlier discussion of them, are completely innate in those who possess this power of recognition but they are not after all taken within them by contemplation, but rather depend on a natural instinct, and are innate in them, as the number, (something intellectual) of the leaves in the flower and of the segments in a fruit are innate in the *forms* [E.S. emphasis] of plants.[72]

I find it striking that nowadays formative causation is not considered, perhaps because we tend to reject immaterial causes in physics, and it isn't considered necessary to ask how such great minds came to the idea, even by the scholars who translate their works. It might qualify as what Plato, Leibniz, and LaRouche called "innate ideas."

Although Leibniz used the term "substantial form" to be the immaterial entity which governs vis viva, live force, he eschewed its use to account for morphogenesis. The latter he treated as determined at the Creation by "Preformation." This may have been related to his idea that the monad has a program and is not directly influenced by its environment. [73]

LaRouche has written that the mind is distinct from the brain in the sense that is not merely an epiphenomenon of the brain, so that cognition is an independent physical principle in the universe; the three domains of the abiotic, the living and cognition being multiply connected. In his discussion of Gurwitsch's biological field, which Gurwitsch said regulated morphogenesis, LaRouche characterized its action as "not a discrete memory, simply genetic-mechanical, but rather some developmental impulse within the living process which follows a least-action pathway in respect to its relationship to its own previous development and its setting. This, again, is precisely what we find in physical economy."[74] He seems to be describing an imbedded intention in the development of the embryo.

I believe we may be dealing with the generally overlooked relation of mind, in whatever its particular concrete form, and matter. LaRouche emphasized: "The issue of the way in which living processes serve as the medium in which the development of cognition has occurred, is the key challenge for all the fundamental issues of modern scientific knowledge."[75]

---

72. Kepler, **The Harmony of the World**, translated by E.J. Aiton, A.M. Duncan, and J.V. Field, (Philadelphia: American Philosophical Society, 1997). The quote is from pages 307-308 of Book IV.

73. This article has a good discussion of the role of current biological thinking in Leibniz's monadology. Leibniz referred often to microscopic biological observations in support. Salvatore Russo, "The Influence of the Theory of Preformation on Leibniz's Metaphysics, 1931" (The Open Court).

74. Lyndon LaRouche's Remarks on Gurwitsch's method in **21st Century Science and Technology**, page 57, Fall 1998.

75. Lyndon LaRouche, "On the Subject of Education,"