The essential role of 'time-reversal' in mathematical economics

by Lyndon H. LaRouche, Jr.

The centerpiece of my August 31, 1996 keynote address to the Reston Labor Day Weekend Conference, was the identification of the determining role of "time-reversal" in constructing any competent mathematical representation of an economic process.[1] The same principle of efficient time-reversal, as met in Classical motivic thorough-composition, was also demonstrated, following that keynote, in a performance of Wolfgang Mozart's motet ***Ave Verum Corpus*** (K. 618).[2] During the discussion period of that conference, I also emphasized the relevant, crucial role of Carl F. Gauss's treatment of the subject of "biquadratic residues," in constructing an adequate representation of any mathematical function which purports to address the implications of "time-reversal."[3]

In order to make clear the apparent paradox, I asked the audience to acknowledge the perplexity, the which this notion of "time-reversal" would pose to the ordinary professional mathematician. I state here, as then: *How might one represent, mathematically, a function in which an event in the future might serve as the apparent cause for an event in the present?* This was, in fact, being considered by the famous Soviet physicist Sakharov, as a formal problem in mathematical physics, during the later years of his life.[4] The issue of the functional role of "time-reversal," is the most important of the fundamental issues confronting mathematical physics today. It is also a key, axiomatic issue in the field of natural law, and, in a related way, important for cleansing theology of certain cultish, intrinsically pagan superstitions, which have no proper place in the teaching of Christianity, Judaism, and Islam. Here, all those

1. Labor Day Weekend Conference, co-hosted by the Schiller Institute, Reston, Va., U.S.A., August 31-September 1, 1996.

2. A presentation by Mindy Pechenuk, with chorus directed by John Sigerson, during the second panel, August 31, 1996. This highly sophisticated, compact, and beautiful work, is among the most convenient illustrations of the same principle of "time-reversal" otherwise underlying both experimental physics in general, and physical-economic processes specifically. Any master's Classical composition according to the principles of motivic thorough-composition, such as those of Wolfgang Mozart, L. v. Beethoven, F. Schubert, R. Schumann, Johannes Brahms, et al., must be performed by applying the developed conception reached at the close of the composition, to the interpretation of every portion of the composition, from the beginning of the performance of the composition. The modification so imposed by the intent of such a composer, results in what the celebrated conductor Wilhelm Furtwängler identified as "playing between the notes." The relationship of the counterpoint in this motet to Mozart's derivation of the principle of motivic composition from Bach's ***A Musical Offering,*** illustrates the relevant historical point, that although full-composition motivic thorough-composition was introduced by Wolfgang Mozart during 1782-1783, as prompted by the preceding work of Joseph Haydn, motivic thorough-composition would not have been possible without the preceding development of the principles of counterpoint, based upon C= 256, by Johann Sebastian Bach, whose work provided the basis for Mozart's discoveries. Video recordings of the August 31 pedagogical presentation of the motet are available through the Schiller Institute.

3. As indicated in Lyndon H. LaRouche, Jr., "Leibniz from Riemann's Standpoint," ***Fidelio,*** Fall 1996: notes 15, 18-20, pp. 21-22. (G.F.) Bernhard Riemann, *Über die Hypothesen, welche der Geometrie zu Grunde liegen* ["On The Hypotheses Which Underlie Geometry": 1854 habilitation dissertation], ***Bernhard Riemann's Gesammelte Mathematische Werke,*** H. Weber, ed. (reprint of Stuttgart: B.G. Teubner, 1902), (New York: Dover Publications, 1953) [also (Vaduz, Liechtenstein: Saendig Reprint Verlag], pp. 272-287. The specialist should supplement the habilitation dissertation with several additional Riemann and Gauss references. These include Riemann's own later (Paris) report on the substance of his mathematical discussion in the 1854 habilitation proceedings. The most essential such references are, the following. For the reader of Latin: *Commentatio mathematica, qua respondere tenatur quaestioni ab Illma Academia Parisiensi propositae,* op. cit., pp. 391-404; the mathematics can be followed, with help of cross-reference to the appended notes, in German, pp. 405-423. On Riemann's reference to Gauss on the relationship of biquadratic residues to a general theory of curved surfaces, see ***Carl Friedrich Gauss Werke*** [***Werke***] (Hildesheim: Georg Olms Verlag). Riemann references explicitly *Theoria Residuorum Biquadraticorum: Commentatio Secunda* (1831), ***Werke*** Vol. II, pp. 93-138; but see the German notice: *Zur Theorie der Biquadratische Reste* ***Werke*** Vol. II, pp. 315-385. The text of Riemann's dissertation references *Disquisitiones Generales Circa Superficies Curvas* (1828), ***Werke*** IV, pp. 217-258. But, for relevant background, see Gauss's *Allgemeine Auflösung der Aufgabe die Theile einer gegabenen Fläche so abzubilden Dass die Abbildeten in den Kleinsten Theilen ähnlich wird* ["Copenhagen Prize Essay"] (1822), ***Werke*** IV, pp. 189-216. Compare with Riemann's *Theorie der Abel'schen Functionen* (1857), ***Riemann Werke*** pp. 86-144, especially the celebrated *Lehrsätze aus der analysis situs für die Theorie der Integrale von zweigliedrigen vollständigen Differentialen,* pp. 96-99. The origins of Gauss's development of biquadratic residues, are found in his 1799 doctoral dissertation, ***Disquisitiones Arithmeticae*** (1801), ***Werke*** Vol. I; it was the development of the early work of his doctoral dissertation, through later work in astrophysics and geodesy, which produced, twenty to thirty years later than the ***Disquisitiones,*** the refined notions of a general theory of curved surfaces, to which Riemann makes reference.

4. Andrei D. Sakharov, "Cosmological Models of the Universe with Reversal of Time's Arrow," ***Collected Scientific Works*** (New York: Marcel Dekker, 1982), pp. 131-136. Originally published in ***ZhETF*** 79:689-693 (1980); ***Sov. Phys. JETP*** 52:349-351 (1980), trans. See also, in the ***Collected Works:*** "Violation of *CP* Invariance, *C* Asymmetry, and Baryon Asymmetry of the Universe," pp. 85-88; "The Baryonic Asymmetry of the Universe," pp. 115-130; and "Maximum Temperature of Thermal Radiation," pp. 137-150.

issues are implicit; but, it is the decisive role of "time-reversal" in any competent economics teaching, which is the topic explicitly addressed in the following pages.

This physical principle of "time-reversal," and its importance, were themes which had been featured aspects of my original discoveries in physical economy, during the 1948-1952 interval. For example, some of my former students will recall, that I had stressed that central, "world-line" feature of physical-economic processes in my lectures delivered at Columbia University campus, during the Spring 1973 semester. I had stressed that, in the published version of my lectures on the dialectical examination of Karl Marx's economics.[5] During preceding years, I had written and lectured often on related principles underlying the Classical method of composition and performance of motivic-thorough-composition in music,[6] and had addressed this recently, in response to remarks, on the subject of "time-reversal," by Nobel Prize economist Kenneth Arrow.[7]

Nonetheless, although the notion of time-reversal has always been the core of my discoveries and teaching in the science of physical economy, it is only since the Reston address, that I have received demands, from among my collaborators, for in-depth background expositions on these, and interrelated matters. One might speculate, that, perhaps, it is the psychological tremors set off by the onrushing, global disintegration of the world's monetary and financial systems, which increase sensible people's interest in questions of physical-economic fundamentals. My students had often heard this conception presented by me earlier. The difference is, this time, they had decided it was now necessary to consider actually mastering the concept, rather than simply acknowledging the importance which I place upon it. Thus, at last, the stunning implications of the relevant paradox have been noticed.

The future as change

A dog reaches for a bone; a dog hunts for prey not yet seen, heard, or smelled. How does human reaction to the idea of the future, differ from what an observer might attribute to the "intentions" controlling the dog's action? In short, the difference is, that, except when a man is behaving with the simple-mindedness of a *macho,* materialist, or empiricist, the object of the relevant expression of human intent, is not the apprehension of a sensory object, but, rather, a desired *change* in the *axiomatic* characteristics of some referenced pattern of human behavior. That point may be stated otherwise: ***What is desired is not a mere event, nor a mere change in opinion, but, rather, either a change in hypothesis, or theorem.***

The change which distinguishes characteristically human ideas of the future, from the bestial intent which might be expressed by a beast, or in a man's moment of beastliness, is always of the *ontological* quality designated by the connotations of the term *Platonic idea,* rather than mere contemplation of a real, or merely desired object of sense-perception.[8]

We may desire the coming into being of a condition which is consistent with a theorem of an established hypothesis, a condition which does not presently exist. More profoundly, we may desire a revolutionary change, a new hypothesis, to replace the reigning hypothesis of existing practice. The properties of Plato's method of hypothesis, are indispensable keys for rendering transparent the meaning of the "time-reversal" paradox. Bernhard Riemann's 1854 habilitation dissertation[9] then serves as a pivotal reference, for transforming the mathematics of "time-reversal" into the form of expression suited to validation according to Nicolaus of Cusa's and Riemann's principle of experimental physics: *measurement.*[10]

Let us now restate the case in the terms of my customary pedagogical tactic, from the standpoint of a system of theorem-lattices.

For pedagogical purposes, define a deductive "theorem-lattice" as follows. Given, any set of propositions, for which it may be shown, that no pairwise permutation is, apparently, deductively inconsistent. Employing Plato's Socratic method, adduce a set of axioms, postulates, and definitions,

5. On "world line," as presented in the Columbia University lectures, see LynMarcus (pen-name of Lyndon H. LaRouche, Jr.), ***DialecticalEconomics*** (Lexington, Mass.: D.C. Heath, 1975), pp. 61-62, 134. The crux of my criticism of Karl Marx's ***Capital,*** now as then, was to point to Marx's repeated admission, that he had constructed his doctrine without considering the implications of technological progress; thus, what was generally accepted as "Marxist economics" among its professionally qualified scholars, was a parody of those combined, mechanistic doctrines of Quesnay, Adam Smith, et al., which each and all presumed zero-technological growth as the axiomatic basis underlying all of the fundamental theorems of the doctrine. I.e., they implicitly deny the distinction, the individual potential for creative mentation, which sets mankind apart from and above all the beasts, and which, thus, defines the only admissible basis for either an economic science or the study of history. An incident from the late 1950s is relevant. An acquaintance invited me to deliver a lecture to a class of his students of Karl Marx's ***Capital,*** Vol. III. When I identified the need to apply the implications of technological progress to correct the flawed notion of "extended reproduction" used by Marx, consternation erupted among both students and host!

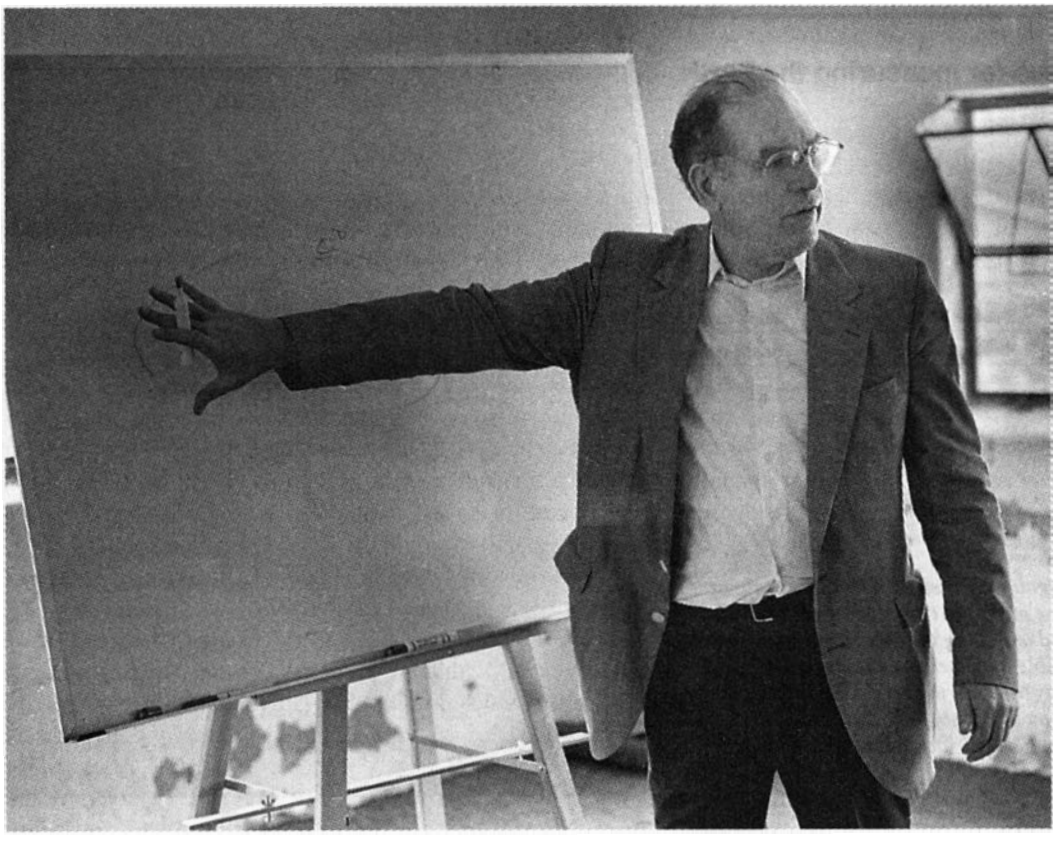
6. Lyndon H. LaRouche, Jr., "That Which Underlies Motivic Thorough-Composition," ***Executive Intelligence Review*** Sept. 1, 1995. —, "Norbert Brainin on Motivführung," ***Executive Intelligence Review*** Sept. 22, 1995.

7. Lyndon H. LaRouche, Jr., "More 'Nobel Lies,' " ***Executive Intelligence Review*** May 31, 1996.

8. For both Riemann and the present writer, this notion of the "ontological" quality of a "Platonic idea" references the *ontological paradox* underlying Plato's ***Parmenides*** dialogue. The notion is, that the type of paradox elaborated within the ***Parmenides*** can be solved only by recognizing *change,* rather than "fixed objects" of sense-perception, as the form of the primary substance within physical space-time. I.e., in this dialogue, which serves as an implied preface for all of his later dialogues, Plato reconstructs Heracleitus' much-cited, and often misapprehended statement: *Nothing is constant, but change.* Cf., ***Proclus' Commentary on Plato's Parmenides,*** Glenn R. Morrow and John M. Dillon, trans., (Princeton, N.J.: Princeton University Press, 1987).

9. op. cit.

10. See Nicolaus of Cusa, ***On Learned Ignorance*** (***De Docta Ignorantia***), Jasper Hopkins, trans. (Minneapolis: Banning Press, 1985). Riemann, habilitation dissertation, *passim,* respecting the axiomatic distinction between mathematical physics and experimental physics.



LaRouche gives a class to his associates in 1985. Concerning the concept of time-reversal, LaRouche writes: "My students had often heard this conception presented by me earlier. The difference is, this time, they had decided it was now necessary to consider actually mastering the concept, rather than simply acknowledging the importance which I place upon it. Thus, at last, the stunning implications of the relevant paradox have been noticed."

the which must necessarily underlie that set of propositions. The latter then represents the *hypothesis* for that set of propositions, and the propositions qualify as *theorems*. In this case, there also exists an empty or non-empty set of additional propositions, the which could qualify as possible theorems of the set defined by that hypothesis. The addition of the qualifiable theorems from the latter set, to the initial set of propositions, defines a deductive theorem-lattice of that hypothesis.

Any deductive mathematics *for which extension is presumed, arbitrarily, to be perfectly continuous,*[11] qualifies as such a deductive theorem-lattice. Thus, for pedagogical purposes of first approximation, any series of events which might be stated as consistent propositions of a presently generally accepted classroom mathematics, can be supplied a formal representation in the terms of a theorem-lattice, in the celebrated fashion of the time-worn Euclidean-geometry classroom. From such a mathematics, any consistent, commonplace schoolbook variety of lower undergraduate mathematical-physics is derived, such as the gas theory of Ludwig Boltzmann, and the crude, if sometimes complex systems of B. Russell devotees, such as Norbert Wiener's pseudo-science of "information theory" and John v. Neumann's theory of games.[12]

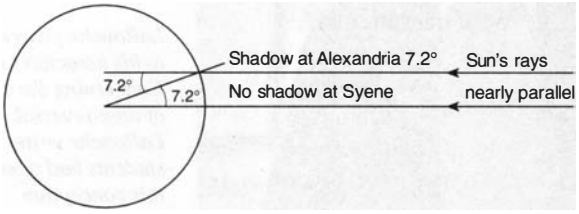
Although the principle of theorem-lattices upon which we are to focus, applies equally to all Classical forms of poetry, music, drama, and plastic art, we develop the relevant notions for mathematical physics and physical economy; the case for

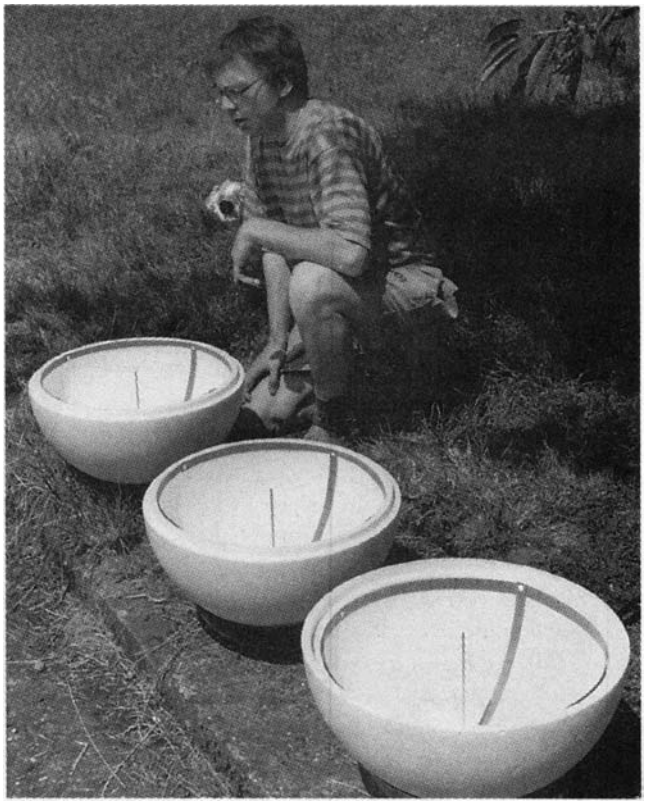
11. E.g., not only the mathematics of Galileo, Descartes, and Newton, but also all mathematics and mathematical physics derived from the widely popularized, tautological hoax concocted by Leonhard Euler in his "Letters to a German Princess" (1761) [***Letters of Euler on Different Subjects in Natural Philosophy, Addressed to a German Princess,*** David Brewster, ed., (New York: Harper & Brothers, 1840)]. Euler's hoax was his fraudulent claim, to have proven the pervasively perfect continuity of extension in physical space-time, by means of a formal geometry ("virtual reality"), in which perfectly continuous extension is axiomatically preassumed. This is the same hoax from which celebrated followers of Euler, such as Lambert, Lagrange, Laplace, Cauchy, Hermite, Lindemann, Felix Klein, B. Russell, et al., derived their insistence upon a universe consistent with nothing but perfectly continuous functions (e.g., "the sliding rule," infinite algebraic series). Notably, in the mathematical physics of G. Leibniz or B. Riemann, Euler's tautological fallacy is rejected. This rejection is the precondition for non-paralogical solutions for true "non-linear" functions.

12. Both Wiener and, later, v. Neumann were more than merely students of Bertrand Russell, they were epigonoi of Russell's beastly doctrines: Russell's wildly radical positivism in mathematics and views on physical science, and in that ultra-fascistic streak of utopianism characteristic of Russell, H.G. Wells, and their own and Aleister Crowley's acolytes: Aldous and Julian Huxley, and George Orwell. The beastly and mechanistic "theory of the mind" which is axiomatic to Wiener's "information theory" and v. Neumann's "systems analysis," pervades every aspect of the putative scientific work, as well as social and psychological doctrines of them all.

FIGURE 1

Eratosthenes' method for measuring the Earth





Above: By measuring the angular difference of the Sun's rays at two points nearly on the same meridian (Syene—known today as Awan—and Alexandria), and assuming the Sun's rays to be nearly parallel, Eratosthenes was able to determine what proportion of the Earth's circumference lay between the two locations. Right: Lothar Komp, of EIR*'s bureau in Wiesbaden, Germany, built hemispherical sundials to replicate Eratosthenes' calculations.*

music is employed only to the degree wanted to illustrate features of physics, leaving to other locations the relevance of the same principle of rationality in art generally. We begin at a point which leads most directly to the fundamental discovery of principle set forth in Riemann's 1854 habilitation dissertation: the celebrated measurement of the curvature of our planet Earth by Eratosthenes.[13]

In recent time, I have often employed this discovery by Eratosthenes. That choice reflects the fact that this discovery provides the simplest, cleanest example of the way in which *Platonic ideas* arise in *every* fundamental, experimental discovery of physical principle. By comparing the angles cast by the noonday shadow upon the interior of hemispherical sundials, along the meridian linking Syene (Aswan) to Alexandria, in Egypt, Eratosthenes demonstrated, geodetically, that the Earth was a spheroid, estimating the Earth's polar diameter with a margin of error of approximately fifty miles [**Figure 1**]. The relevant paradox is, that Eratosthenes measured the curvature of the Earth's meridian more than 2,000 years before any person was to have seen our planet's curvature.[14] The principle of the Earth's curvature, as adduced thus, represents a *Platonic idea: a conception of measurable* ***relationship****, a relationship which is not directly perceived as a sense-perception, nor as a new theorem of an existing deductive form of theorem-lattice.*[15]

All such notions of measurable relationship which underlie the principles of astrophysics,[16] are obtained only as "Platonic ideas." From mankind's successes in astrophysics, we derived later the method to open up the domain of microphysics.

In mathematics and mathematical physics, for example,

13. Lyndon H. LaRouche, Jr., "Leibniz from Riemann's Standpoint," op. cit., pp. 25-27, including Figure 1. In a modern case, Christiaan Huyghens' discovery of isochronism in the gravitational field, already took physics beyond the comprehension of Descartes' and related mathematics. The demonstration, through the work of Ole Rømer, Huyghens, and Jean Bernoulli, that a finite rate of retarded propagation of light, coincided with gravitational isochronism, already demanded a non-Euclidean geometry of relativistic physics.

14. The still-ocean "horizon effect" does not meet the requirement of experimental physics: clear *measurement* of *relationship*. Cf., the relevance of Leonardo da Vinci's treatment of a vanishing-point as a property of vision, rather than objects.

15. So, although we may see the Moon as a distant object, the measurable relationship governing the distance between the Moon and Earth is not an object of simple sense-perception. Consider the work of Thales, Aristarchus, and Eratosthenes on this subject, as an example of the problem.

16. As will be emphasized below, the notions of relationship employed here go beyond the generally accepted limits of conceptions found in the mathematical-physics classroom, into the broader range specified for analysis situs by G. Leibniz. The notion of experimental-physical relationship stressed in this report, is the efficient relations among events, propositions, theorem-lattices, and the hierarchy of hypothesis. This is introduced in the illustrative treatment of motivic thorough-composition, below.

a "Platonic idea" appears only as cognitive mental activity within the mind of either an original discoverer, or, of a student who comes to know that idea in the only way possible, through replicating the mental act of original discovery within the confines of the student's own, sovereign mental processes. In both cases, original discoverer, or student, knowledge can not be obtained by mere classroom and textbook learning of the means to pass an examination, such as that idiot-savant's delight, the multiple-choice questionnaire; it must be acquired by the kind of *deductively-discontinuous* mental processes unique to generating an original discovery. In the lesser case, the Platonic idea appears as the initial act of discovery of a theorem which is consistent with an implicitly preexisting hypothesis.[17] In the higher-ranking case, the same method of original discovery is the means by which the discovery of new axioms (e.g., a superior hypothesis) is accomplished.

As Riemann introduces this notion in his 1854 habilitation dissertation:[18] *The interdependent issues of* ***hypothesis*** *and of physical space-time* ***curvature*** *become unignorable in mathematical physics, whenever an experimental paradox compels us to introduce a validated new principle of experimental physics.* The paradoxes so posed are identical in principle with the famous ontological paradox of Plato's ***Parmenides*** dialogue.[19] *It is at this juncture, that the central role of "time-reversal" is implicitly posed to mathematical physics, and to economic science.*

At this point, define this connection as of a *type.*[20] Construct a preliminary definition of this type in its relatively most rudimentary terms. For this first-approximation definition, employ a pedagogical ruse borrowed from elementary Euclidean geometry. To the degree that the hypothesis underlying a deductive theorem-lattice is fixed, the lattice acquires the form of a deductive architecture, an architecture whose construction determines a sequence, or chains of sequences. In Classical motivic thorough-composition, or *Motivführung,*[21] the notion of sequence inheres in the nature of music: The unit of musical composition, is the interval, *not* the individual tone. In Classical composition, as distinct from musical composition more generally, the unit of thought is the polyphonic elaboration of a modal pair of intervals. The quality of sequence is paradigmatic for all naive (e.g., reductionist) notions of functional time in mathematical physics generally: a sequence of occurrences, such as a sequence of propositions, or theorems.

What transpires within the underlying hypothesis, during the lapse of time the lattice's petals bloom? The hypothesis itself remains unchanged during all moments of the unfolding. So, in the case of any chains of events, the which are presumably defined by propositions of a deductive theorem-lattice, the hypothesis underlying that lattice does not change with any referenced place in mathematical space-time. To employ a relevant Biblical allusion: The hypothesis is the "alpha and omega" of the array of theorems which it underlies.[22]

The science of musical composition

Consider the challenge of performing a Classical thorough-composed musical work by Mozart, Beethoven, Brahms, et al. The point most relevant for attention here, is that since Mozart's derivation of the principle of works such as his six Haydn quartets, his K. 475 Fantasy, etc., from a study of J.S. Bach's ***A Musical Offering,*** each masterwork by a Classical composer,[23] from Mozart through Brahms, is based upon an implicitly transparent, but not deductive, succession of modalities. The effect is, that the composition has the form of a succession of modal hypotheses, such that the concluding resolution of the composition defines the composition as a whole as an expression of the principle of higher hypothesis.[24] Thus, the characteristic of any successful such application of this method of composition, is the following:

The organization of the process of composition, for

17. Not all pre-existing hypotheses are consciously established. One's opinion-making may be regulated by underlying axiomatic assumptions of whose efficient existence one is not aware, assumptions which have the characteristic of irrational "blind faith." Thus, the corresponding hypothesis exists, but the victim is unaware of its existence as an hypothesis. Thus, most of today's secondary and university students of mathematical subject-matters, would accept Isaac Newton's fraudulent *hypotheses non fingo,* because they are ignorant of the hypothetical nature of those axiomatic assumptions, the which are responsible for their acceptance of Newton's wild claims on sundry matters. [See, e.g., ***Riemann Werke,*** op. cit., p. 525.] Thus, to state the general case, one must reference "pre-existing," rather than merely "established" hypothesis.

18. op. cit.

19. Lyndon H. LaRouche, Jr., "Leibniz from Riemann's Standpoint," op. cit. See pp. 18-24, under the sub-heading, "Riemann's Principle of Hypothesis."

20. In first approximation, this implies Georg Cantor's notion of a *mathematical type.*

21. This is the term for motivic thorough-composition attributed to Joseph Haydn, as employed by former Primarius of the Amadeus Quartet, Norbert Brainin. See my "Norbert Brainin on Motivführung," ***Executive Intelligence Review,*** Sept. 22, 1995.

22. Thus, the higher hypothesis is the "alpha and omega" of the array of hypothesis which it underlies; hypothesizing the higher hypothesis, is the "alpha and omega" of the array of higher hypotheses which it underlies; and, Plato's *Good* underlies, similarly, every past, present, and future change which exists within the universe.

23. This does not apply to Romantic composers, such as Franz Liszt, Hector Berlioz, Richard Wagner, et al., nor to the so-called "moderns." The essence of such styles of musical composition, is that they are premised upon the argument laid down by Immanuel Kant's ***Critique of Judgment,*** that there is no discernible rational principle in composition of works of art.

24. The ***Ave Verum Corpus*** was selected as a beautiful, short work, which demonstrates this principle of motivic thorough-composition. It is the role of the mental functions associated with the principle of higher hypothesis, which underlies the distinction between legitimate use of the term "musical genius," as contrasted with the lack of such insight in the mind of the learned musical pedant, or Romantic. This is key to the meaning of Furtwängler's famous references to "playing between the notes": see more on this, below.

such a case, is of the following form:

1. Each phase of the composition is of a quasi-mathematical **type,** representable by an underlying hypothesis, designated by the general, Riemannian form $\mathbf{h_i}$ (i=0, 1, 2, . . . , i, . . . , m).[25]
Thus, the compositional process is representable by a series of the form:

$$h_0, h_1, h_2, h_3, \ldots, h_m.$$

2. Thus, according to Plato's solutions for the ontological paradox posed in his ***Parmenides,*** the process of change underlying that deductively discontinuous series $\mathbf{h_i,}$ is of the relative *type* known as an "higher hypothesis," $\mathbf{H_j,}$ also symbolized as:

$$(h_i)^j$$
$$(j = 1, 2, 3, \ldots, j, \ldots, n).[26]$$

3. But, higher hypothesis H_j is a member of a series "hypothesizing the higher hypothesis." In this example, that "hypothesizing the higher hypothesis" defines the domain of all Classical motivic thorough-composition. Thus, the general representation of the domain, is symbolized for our reference here as:

$$(H_j)^k$$

or,

$$[(h_i)^j]^k.$$

4. These functions are each and all representable as a sequence of events: polyphonic intervals, is the elementary character of the immediate event within performed music; the ordering of hypotheses (e.g., modalities), is also presented in sequence; etc.

5. However, every hypothesis, or higher hypothesizing, acts simultaneously upon every possible element of sequence within the domain which that hypothesis underlies.[27] Thus, all times within the historical past and future are subsumed by:

$$[(h_i)^j]^k.$$

6. The characteristic action within that domain of change, is symbolized by:

$$\left[\frac{(h_i + 1)}{(h_i)}\right]^{(k,\, k+1)}$$

The root-model for the principle of motivic thorough-composition employed by Mozart, Beethoven, Schubert, Schumann, Brahms, et al., is that which Mozart derived from mastering the implications of the six-voice *Ricercare* from Bach's ***A Musical Offering.*** The Beethoven Opus 13, like the Opus 111, like the Mozart ***Ave Verum Corpus,*** is an example of the same method (i.e., higher hypothesis) of ordering of successive modalities, the which one had met in earlier applications of this Bach-rooted discovery, such as Mozart's six Haydn quartets and the K. 475 keyboard Fantasy. Mozart's derivation of the role of the Lydian mode in the works such as that ***Ave Verum Corpus,*** or the significance of that mode in Beethoven's Opus 132, are expressions of the hereditary pervasiveness of that principle of musical higher hypothesis, the which Wolfgang Mozart adduced from this study of Bach's ***A Musical Offering.***

Two additional facts must be stressed here, by aid of this reference to the musical case.

First, a relevant observation on the role of differentiated higher hypotheses. Each successful piece composed according to that principle of thorough-composition, represents a series of mutually distinct hypotheses (modalities). The unity of the composition as a whole, lies, therefore, in that corresponding principle of higher hypothesis, which subsumes (underlies) the resolutions connecting the succession of hypotheses (modalities) of which that piece is composed. Thus, in the relevant, Leibnizian analysis situs, the generalized principle of motivic thorough-composition, the which Mozart adduced from his study of Bach's ***A Musical Offering,*** is of the order of *hypothesizing the higher hypothesis.* E.g.:

$$[(h_i)^j]^k$$

Second, the role of higher hypothesis, of hypothesizing the higher hypothesis, has the same significance in music as Leibniz's principle of *necessary and sufficient reason* in mathematical physics. At this juncture, consider, once more, the author's frequently supplied illustration of the relevant point.

There are principally two diametrically opposing views on the subject of the nature of mathematical physics: one, the semi-literate, relatively more popular, misconception, that mathematical physics is the discovery of an explanation for a physical phenomenon, from the repertoire of a fixed, hypothesis-free type of generally accepted classroom mathematics; second, the view, shared by Leibniz and Riemann, for exam-

25. I.e., n, n+1, n+2, ... In other words, these successive modalities must have the form of effect of physical space-time curvatures of increasing mathematical cardinality (increase of implicitly denumerable density of singularities per interval of action).

26. It should be sufficient at this point, merely to note the fact that the notion of functional relationship indicated by these formulations falls under the implied category of Leibniz's generalized notion of analysis situs.

27. As Mindy Pechenuk emphasizes in her August 31, 1996 presentation of the Mozart ***Ave Verum Corpus,*** the mind of the performer must recognize, functionally, not only every quoted mode of each passage, but, also, all of those modalities are defined implicitly by reversing (mentally) the direction (e.g., up, or down) of the succession of intervals considered, both in the same voice, and also with respect to cross-voice, polyphonic intervals. Thus, the theorem-lattice of any modality, or succession of modalities, employed within a composition, includes all of these additional "possibilities," whether they are explicitly quoted, or not. That general scope of the relevant theorem- and hypotheses-lattices, subsumed under the general functional relationship symbolized above, applies throughout the domain of all possible Classical forms of motivic thorough-composition.

ple, that crucial discoveries of physical principle, generated, outside of mathematics, in the domain of experimental physics, oblige us to overturn previously existing mathematical physics, to fit the axiomatic features of mathematics to the discovered principles of nature. This issue was sharply defined during the 1690s, as the uncompromisable issues of principled difference, between the algebraic school of Galileo, Descartes, Newton, et al., and the non-algebraic, or transcendental school of Leibniz, Jean Bernoulli, et al., and, just over a century and a half later, Riemann. This was the core of the underlying difference in hypothesis, between the fraudulent, and unworkable calculus of Newton, and the previously introduced, and successful calculus of Leibniz.[28]

For all but those who were blinded to facts by their fanatical devotion to the cults of René Descartes and Isaac Newton, the case for Leibniz and Bernoulli's argument, was established conclusively by Bernoulli's and Leibniz's collaboration in recognizing the identity of two apparently distinct experimental-physical discoveries of principle, during the late Seventeenth Century: Christiaan Huyghens' study of the experimental-physical principle of isochronism in the gravitational field,[29] and the work by Huyghen's student Ole Rømer and Huyghens on the implications of Rømer's astrophysical measurement of the speed of light.[30]

The implication of this 1690s discovery of a principle of special relativity, by Bernoulli, Leibniz, et al., is that the notion of mechanistic "causality," which is characteristic of all such philosophical reductionists as the materialists, empiricists, and logical positivists, can not account for the actual measurements of action within real physical space-time. The interdependency between the two Seventeenth-Century discoveries had discredited entirely the mechanistic, "pull-me/push-me" world of Galileo, Hobbes, Descartes, Locke, Hooke, and Newton. It also discredited, in advance, the same mechanistic world-outlook and method of David Hume, Adam Smith, and Leonhard Euler. Today, that discredited, but still widely advocated view, is no better than bad "science fiction." It is an Ockhamite delusion, a mere "virtual reality."[31]

Modern empiricism, prior to the 1690s, relied upon an algebraic method derived from an Ockhamite reading of formal Euclidean geometry.[32] It relied upon the arbitrary, axiomatic presumption, that space-time was extended without limit in four mutually independent senses of direction ("dimensions"), and that this extension, of space-time itself, was perfectly continuous, without possibility of interruption (of "discontinuity"). This four-dimensional space-time manifold served the empiricists as a kind of empty box, into which a continuous fluid of some sort (an "ether") might be poured by a Newton, or J. Clerk Maxwell, or not; "ether," or no "ether," physics was degraded into algebraic descriptions of the movement of perceptible (or, merely imagined) bodies in terms of that box-like four-dimensional manifold.

During the 1690s of Leibniz and Bernoulli, that algebraic view was challenged in a crucial way, by the measurable demonstration of isochronicity in a gravitational field. The measurement of a speed of propagation of light, was another devastating refutation of the algebraic world-outlook. The combined effect of Jean Bernoulli's experimental design: The measurable coherence between isochronism in the gravitational field, and the same form of function respecting refraction of radiation propagated at a measurable speed, was devastating refutation of the empiricist's algebraic standpoint in method [see **Figure 2**].

The *type* of paradox posed by this experimental evidence was the same which had been confronted, and resolved by Eratosthenes, in his approximate measurement of the curvature of the Earth's surface. In this case, the existence of a general curvature of physical space-time, inconsistent with the empiricist's algebraic method, was the import of the measurement.

Specifically, to bring axiomatic assumptions of mathematics into conformity with the experimental evidence, it was necessary to eradicate the notions of limitless and perfectly continuous extension of space-time, and to introduce certain additional reforms, those placed in view by Riemann's referenced, 1854 dissertation.

In Riemann's Platonic, Leibnizian physics, every discovered principle of nature which is validated by the methods of experimental-physical measurement specified by Cusa,[33] functions, like spatial extension and time, as an extensible

28. I.e., putting to one side Newton devotee Augustin Cauchy's Euleresque "correction" of Leibniz.

29. Christiaan Huyghens, ***The Pendulum Clock,*** Richard J, Blackwell, trans. (Ames, Iowa: Iowa State University Press, 1986).

30. Christiaan Huygens, ***Treatise on Light*** (1678), S.P. Thompson, trans., (New York: Dover Publications, 1962). Poul Rasmussen, "Ole Rømer and the Discovery of The Speed of Light," ***21st Century Science and Technology,*** Spring 1993. "Johann and Jakob Bernoulli. The Brachystochrone," ***A Source Book in Mathematics, 1200-1800,*** Dirk J. Struik, ed., (Princeton, N.J.: Princeton University Press, 1986); pp. 391-399.

31. "Okhamite" (var., "Occamite")=Followers of William of Ockham's radically reductionist parody of Aristotle. Approximately a century and a half after the establishment of a modern European science based upon Nicolaus of Cusa's principle of experimental-physical measurement (A.D. 1441), Ockham admirer Paolo Sarpi, and his followers Galileo Galilei, Francis Bacon, et al., introduced the mechanistic doctrine of empiricism, in the effort to destroy the established modern science of Cusa, Luca Pacioli, Leonardo da Vinci, Johannes Kepler, et al. Leibniz, the French Leibniz school of Gaspard Monge, Lazare Carnot, et al., Gauss, and Riemann typify the continuation of modern science, despite the relative political hegemony of the empiricism and positivism of Laplace, Cauchy, Kelvin, Clausius, Helmholtz, Mach, et al.

32. For our purposes here, there is no significant distinction to be made among such forms of linear, mechanistic reductionism as materialism, empiricism, and positivism. With the convergence of the two Cartesian schools, of British Nineteenth-Century philosophical radicalism, and the positivism of such fanatical Newtonians as Laplace, Cauchy, Helmholtz, et al., the accidental, earlier distinctions between the Cartesians and British empiricists were dissolved, as if asymptotically, into a neo-Kantian homogeneity.

33. Nicolaus of Cusa, ***De Docta Ignorantia.***

On the curvature of physical space-time

In 1696, the mathematician Johann Bernoulli issued a challenge to the scientific world, to solve the following problem: "To determine the curve joining two given points, at different distances from the horizontal and not on the same vertical line, along which a mobile particle acted upon by its own weight and starting its motion from the upper point, descends most rapidly to the lower point." Or, expressed another way: "If the curve is replaced by a thin tube or groove, and a small sphere placed in it and released, then this [sphere] will pass from one point to the other in the shortest time." This curve, he called the **brachistochrone,** from the Greek words for "shortest time" (**Figure 2a**).

The curve in question, Bernoulli discovered, was the cycloid (**Figure 2b**)—a curve which had been investigated earlier by Christiaan Huyghens (1629-1695), and described in his book ***The Pendulum Clock.*** Huyghens determined that a weight falls along a cycloidal path in the same amount of time, no matter from what point on the cycloid it begins its motion. This curve, he called the **tautochrone,** from the Greek for "same time" (**Figure 2c**).

Bernoulli described his amazement, when he discovered that the two curves were the same: "But you will be petrified with astonishment when I say that precisely this *cycloid,* the *tautochrone of Huyghens,* is our required *brachistochrone.*"

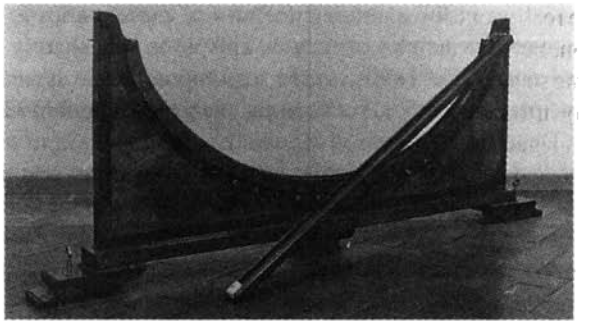
His amazement did not stop there. Bernoulli went on to write that the same property also applied to the refraction of light (**Figure 2d**): "I discovered a wonderful accordance between the curved orbit of a ray of light in a continuously varying medium and our *brachistochrone curve.* . . . The *brachistochrone* is the curve which would be traced by a ray of light in its passage through a medium whose rarity is proportional to the velocity which a heavy particle attains in falling vertically. For whether the increase in the velocity depends on the nature of the medium, more or less resistant, as in the case of the ray of light, or whether one removes the medium, and supposes that the acceleration is produced by means of another agency but according to the same law, as in the case of gravity; since in both cases the curve is in the end supposed to be traversed in the shortest time, what hinders us from substituting the one in place of the other? . . .

"Thus I have with one stroke solved two remarkable problems, one optical and the other mechanical; . . . I have shown that the two problems which are taken from entirely distinct fields of mathematics are nevertheless of the same nature."

(Quotations are from "Bernoulli on the Brachistochrone Problem," David Eugene Smith, ed., ***A Source Book in Mathematics*** [Mineola, N.Y.: Dover, 1959], pp. 644-655.)

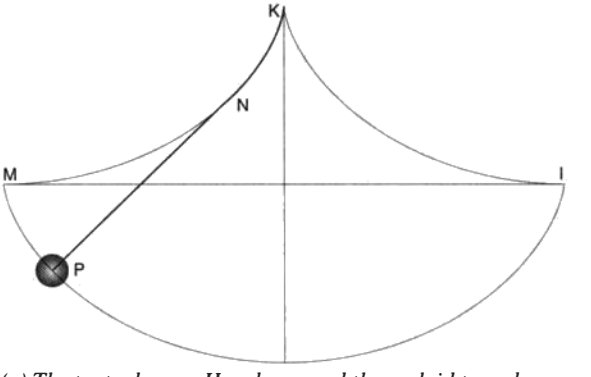
—Susan Welsh

FIGURE 2

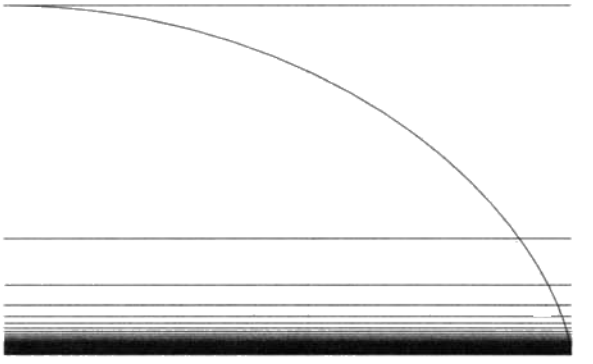


(a) A brachistochrone model built by Francesco Spighi in the 17th Century. A ball that rolls down the cycloidal track reaches the bottom faster than one rolling down the straight track.

(b) The cycloid is the curve traced out by a point on a circle, as the circle rolls along a line.



(c) The tautochrone: Huyghens used the cycloid to make a pendulum clock, because no matter how wide the swing, the time of the swing remains constant.



(d) Bernoulli proved that the cycloid is also the path taken by a ray of light passing through a medium of constantly increasing density.

dimension of a general physical-space-time manifold. With each validated addition of such a dimensionality, we are obliged to validate, by experimental measurement, not only the reality of the individual principle considered as if in isolation, but also the "geodetic curvature" of the physical space-time so defined. The demonstrated phenomenon of isochronicity in the gravitational field, and a measurable rate of retarded propagation of electromagnetic radiation, are individual principles which demand that we discover, that we measure, whether or not this principle is associated with some change in the curvature of the physical space-time associated with such a manifold. It is not sufficient to show that a finite "speed of light" exists; it is also necessary to show, how this affects the measurable curvature of the physical space-time manifold: in other words, to practice a "non-Euclidean" geometry.

The point of reference, from Eratosthenes' experimental estimate of the Earth's curvature, through Riemann's habilitation dissertation, and beyond, the standpoint for comparison of a Euclidean with a so-called "non-Euclidean" manifold, is the so-called "Pythagorean":

$$\sqrt[2]{(x^2 + y^2 + z^2)}$$

Given: an n-fold, Riemannian, physical-space-time manifold. What is the difference in the distance between two points in that manifold, when compared with the Pythagorean metric of Euclidean space-time?

The first step of approximation, in introducing this notion to the secondary pupil, is to challenge the student knowledgeable in solid Euclidean geometry and spherical trigonometry, to show how a person living on a very large, spherically curved surface would be able, by means of geodesy, not only to show that that is indeed such a surface, but to measure the curvature of that surface. We would challenge the student to define the kinds of mathematical methods and procedures required to conduct the relevant experimental measurements. With that grounding, the student is on the road to understanding how and why Riemann, in composing his habilitation dissertation, relied upon the referenced earlier work of Gauss.

Look at Leibniz's notion of *necessary and sufficient reason* from this vantage-point. Apply the same conceptions to Mindy Pechenuk's August 31, 1996 presentation of the succession of hypotheses of which Mozart's ***Ave Verum Corpus*** is composed.

Turn around Riemann's notion of the physical space-time manifold. Given: a measurement, in quasi-Pythagorean terms, of the estimated characteristic curvature of a physical-space-time manifold. What is the hypothesis which corresponds to this measurement? The hypothesis which meets those requirements, is a demonstration of Leibniz's principle of *necessary and sufficient reason.* Given: any crucial type of event; that is to say, an event which is typical of the measurement of the characteristic quasi-Pythagorean of the real manifold in question. The hypothesis which determines that physical space-time manifold, to have that typical curvature, expresses *necessary and sufficient reason.*

In physical economy, as in Mozart's ***Ave Verum Corpus,*** it is the Riemannian form of representation of a physical space-time manifold, which supplies us the most characteristic representation of the relevant "curvature." For reasons which need not be a topic of separate elaboration at this moment, each added "dimension" of a well-ordered Riemann series of the Leibniz analysis situs form:

$$\left[\frac{(n + 1)}{n}\right]$$

appears in the form of a validated formal discontinuity in the previously established form of mathematical physics (for example). It is the increase of density of such discontinuities, for any arbitrarily selected choice of interval of action, which measures the relevant, relative *cardinality* of the characteristic interval of action of two such Riemannian manifolds. In physical economy, as in the developmental processes of Mozart's ***Ave Verum Corpus,*** it is this type of increase of cardinality, the which is the strictest measurement of the characteristic difference of two compared manifolds. This choice of characteristic is in correspondence with the general expression already given:

$$[(h_i)^j]^k$$

In this sense of the matter, there is a relevant, direct correlation, among: 1) the "cardinality" of typical action within a physical space-time; 2) the order of the Riemannian manifold, which, according to Leibniz's principle of *necessary and sufficient reason,* represents that physical space-time; and, 3) the implicitly adducible hypothesis underlying statements expressed in terms of that manifold. It is the correlation of some physical value with the notion of the relative cardinality of the characteristic of action for a given manifold, which is the basis for a physical science, such as physical economy, and for Classical motivic thorough-composition.[34]

What does 'linear' mean?

In the Ockhamite and related forms of algebraic methods, derived from a formalist interpretation of Euclidean geometry, the characteristic unit of action within algebraic space-time is a quantity of linear extension. Thus, the "distance" between two points is measured, typically, by the simplest form of the "Pythagorean":

$$\sqrt[2]{(x^2 + y^2 + z^2)}$$

In "non-Euclidean physical geometries," such as that of Riemann's habilitation dissertation, the unit of displacement

34. For example: In the case of any masterwork in the mode of the type of motivic thorough-composition introduced by W. Mozart, the cardinality expressed measures the creative mental power applied by the composer, and, hopefully, exciting the performance.

("distance") on a curved surface, has an outward appearance which would have been tolerated by Leonhard Euler, et al.; but, underlying that mere appearance, the smallest length of displacement "outwardly" represented by a simple line or arc, is transfinitely dense with "holes," called "discontinuities," sometimes identified by, and sometimes arbitrarily suppressed as, the infinitesimals inhering in the Leibniz calculus.[35] These are each *transinfinitesimally* small interruptions, which mark the location of an actual, or possible new singularity, such as a new "dimension" of an expanded Riemannian manifold.[36]

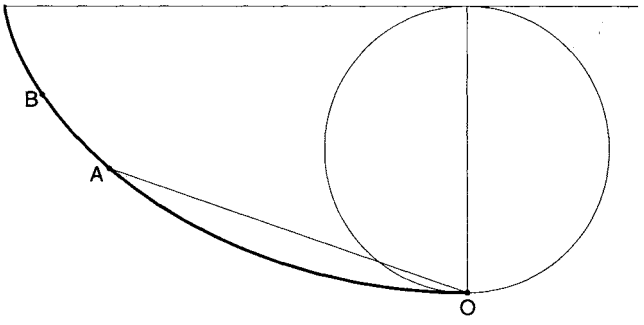
In other words, we must distinguish between the mere appearance of a simply linear displacement, and the physically efficient content masked by that displacement, the density of discontinuities/singularities. We must distinguish, thus, between the formalist's merely virtual reality, and that which the formalist masks, the underlying, physical reality.

These considerations lead to conclusions which will prove indispensable, at a later point here, in tackling crucial implications of functional "time-reversal" in physical-economic and other processes.

Consider a significantly simplified representative of a relatively simple experiment, an illustration nonetheless accurate enough for the point being made. Construct a cycloid by rolling a circle along the underside of a line. As for C. Huyghens' case,[37] the attributed, radiated impulse of gravity is normal to the line on which the circle has been rolled. Designate the low point of the generated cycloid by ***O,*** and mark a point, ***A,*** other than ***O,*** on the descending pathway of cycloid [**Figure 3**]. Construct the straight line ***AO.*** As for the Huyghens experimental study of isochronicity,[38] compare the lapsed time required for two balls to fall to the lowest point ***O,*** from ***A,*** one along the constrained pathway defined by the arc, the other the inclined straight line. Observe that the longer pathway, the arc, is faster. Then, observe that the lapsed time to fall to ***O,*** along the arc, from any other point ***B,*** is the same as from ***A:*** *isochronicity.*[39]

In those Riemannian manifolds which experimental physics imposes upon us, two leading considerations are immediately relevant to examining that algebraic fallacy, of assumed linearity, upon which the mathematical physics of Sarpi, Galileo, Descartes, Newton, Euler, Cauchy, Clausius, Helmholtz, et al., are each and all premised.

FIGURE 3
The study of isochronicity



First: Any change in an axiomatic assumption, imposed upon us by validated discovery of a revolutionary principle from the domain of experimental physics, establishes a new hypothesis, which supersedes, and is inconsistent with every preceding hypothesis. Each of the two hypotheses, new and old, compared, represents a different manifold, and physical space-time curvature, different from, and functionally inconsistent with the other.

Nonetheless, although no theorem in either of these two theorem-lattices will be consistent with any theorem in the other, the valid experimental physics of the old lattice, is carried forward within the new theorems internal to the new theorem-lattice. In this case, the relatively valid theorem-results in the old lattice, have the form of the relatively degenerate case, in respect to the new lattice. Therefore, the mathematical function containing the transition from phenomena satisfactorily explained by the old hypothesis, to the experimental phenomena characteristic of the new, will be typified by the relevant discontinuity[40] in the function constructed to describe such a case.[41]

Second: for any valid function, the transfinite cardinality of action is, primarily, the density of discontinuities determined by the cumulative "dimensions" of the relevant physical space-time manifold. This "property" is crucial for identifying the expression of "time-reversal" within the action of, for example, performing a composition which were composed as an application of Classical motivic thorough-composition: conductor Furtwängler's "playing between the notes."

35. In abstraction, a "purely" linear displacement (without "holes") may be generalized as a displacement whose density of discontinuities is "0."

36. The use of the terms "transfinite" and "transinfinitesimal," here, should be recognized as involving, not only the distinction between the mathematical transfinite of Georg Cantor, and bad notions of "infinite" and "infinitesimal," but also the distinction, implicit in the discoveries of B. Riemann, between a merely mathematical (formal) transfinite, and an ontological (physically efficient) transfinite.

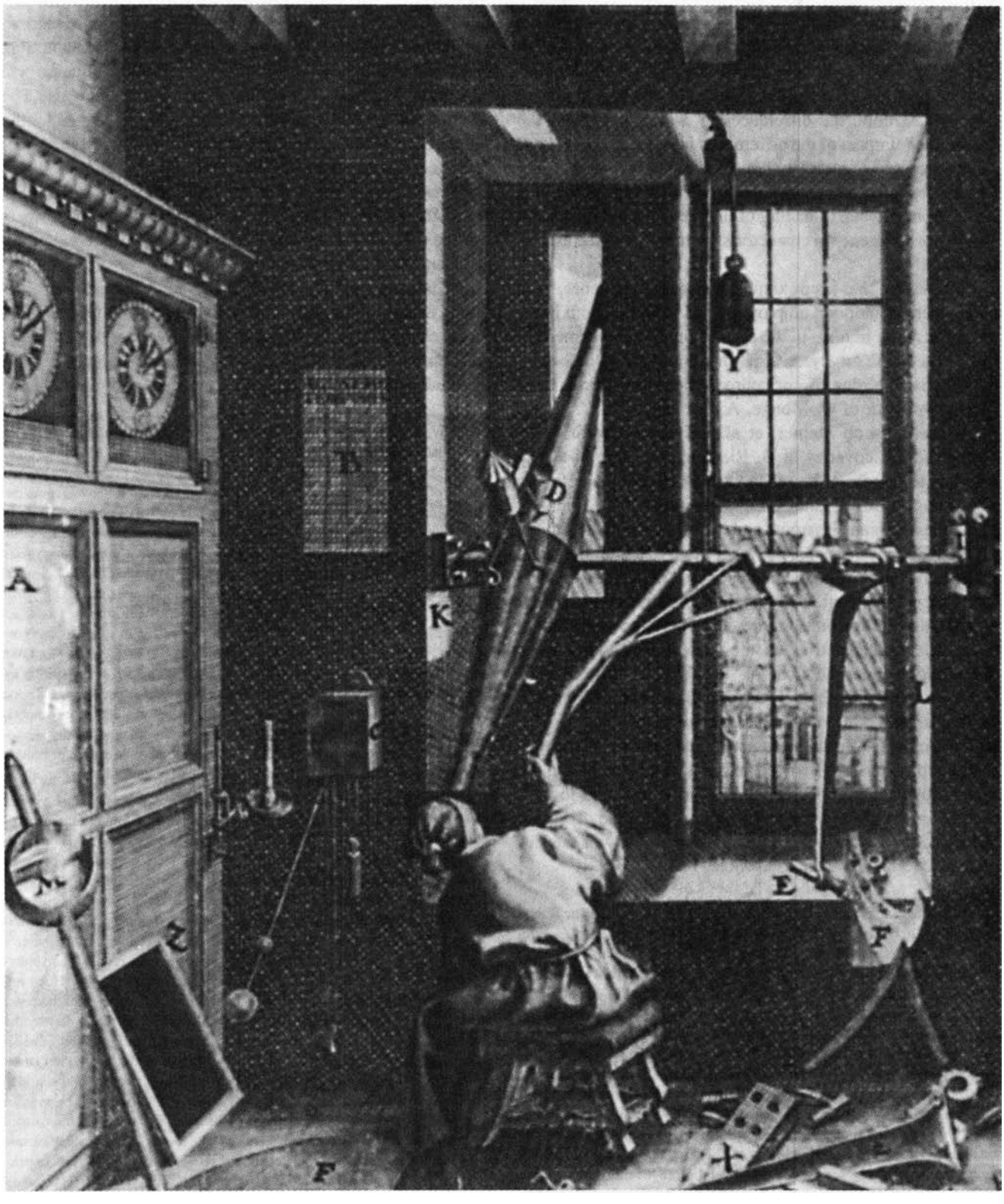
37. ***The Pendulum Clock,*** op. cit.

38. ibid.

39. ibid.

40. I.e., "transinfinitesimal."

41. For an example of this, see B. Riemann, *Über die Fortpflanzung ebener Luftwellen von endlicher Schwingungsweite* ("On the Propagation of Plane Air Waves of Finite Amplitude": otherwise known as Riemann's exposition on the cohering topics of sonic shock waves, transsonic flight, and isentropic compression), ***Riemann Werke*** [see note 3, above], pp. 157-175. Note that Riemann was not the original discoverer of sonic "booms"; that distinction belongs to Leonardo da Vinci, who also recognized the finite speed of propagation of sound, through such means as observing lightning-strokes.



Ole Rømer in his observatory in Copenhagen. To his left is the cycloid pendulum developed by Christiaan Huyghens. Rømer's ingenious method for measuring the speed of light enraged the Cartesians, who insisted that light propagates instantaneously. Rømer timed the eclipses of Jupiter's moon Io, from two extreme points in the Earth's annual orbit around the Sun (the point closest to Jupiter, and that farthest from Jupiter). The fact that the eclipses took place later than expected, when the Earth was farthest from Jupiter, proves that it takes time *for light to travel that enormous distance. The implications of this research were developed by Huyghens and Bernoulli.*

As Riemann stresses in his *Hypothesen* dissertation, the root of the difference in curvature expressed, by two mutually distinct physical-space-time manifolds, lies within the contrasted hypotheses. To borrow the argot of the modern mathematics classroom, the differences in curvature express the "hereditary" impact of the differences in axiomatics, as these axiomatics are located within the respective, underlying hypotheses. One must sense the efficient immediacy of the correlation between a shading of difference in axioms, and a shading of difference in characteristic curvature of the associated manifold.

"Curvature" has been examined, since Eratosthenes, from the geodetic standpoint employed by C.F. Gauss, both in astrophysics and, in turn, in the revolutionary development of modern geodetic surveys. Even in those outwardly "innocent" excursions, the idea of curvature, generalized through the successive work of G. Monge, A.-M. Legendre, C. Gauss, Karl Jacobi, Jacob Steiner, et al., acquired new meaning through the discoveries of B. Riemann, and this in a way which is absent from the related work of such geometers as (the younger) Bolyai, and N. Lobatchevski.[42]

In the common classroom and campus cant on the subject of "non-Euclidean geometry," there is a tendency to seize, with wild-eyed zeal, on the matter of the "parallel postulate." Such ivory-tower contemplation, has contributed much to the proliferation of tiresome, sterile, and utterly counterproductive academic sophistries on the subject. The viable issue often hidden under the cloak of "non-Euclidean geometry," is not a matter of mathematical formalism; it is, as Riemann stresses throughout, a matter of experimental physics. As Riemann also stresses from the outset of the *Hypothesen* dissertation, the problem to be solved requires that we abandon the domain of deductive mathematical formalism, and look at the way in which physical reality demonstrates the pervasive fallacy of the generally accepted classroom view of the Euclidean axiomatic system as a whole.[43]

The crucial evidence is directly contrary to those modern mathematical physicists who insist upon the presumption, that physical space-time in the small is either linear, or a nearly asymptotic approximation of blissful linearity. The truth of the matter is precisely the opposite: The smaller the interval of action, the more radically non-linear the microphysical domain becomes! Paradoxically, because of "time-reversal" considerations, as we shall show at a later point, here, the smaller the interval, the more pronounced the impact of the density of singularities, relative to the interval of action chosen.[44]

Riemann's mathematical physics requires us to deny primary efficiency to the attributed linear span of displacement, and locate efficiency in the transfinite terms, of density of discontinuities (singularities) per interval of action. However, to render Riemann's earth-shaking discovery transparent, we

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42. On relevant exchanges between C. Gauss and the members of the Bolyai family, see ***Carl Friedrich Gauss: Der "Fürst der Mathematiker" in Briefen und Gesprächen,*** Kurt-R. Biermann, ed., (Munich: Verlag C.H. Beck, 1990). On Gauss's relations to the younger Bolyai and the work of Lobatchevski, see pp. 27, 137, 139-140, 176. Editor Biermann (p. 27) cites Gauss's remarks to Wolfgang Bolyai, Johann's father, as found in ***Briefwechsel zwischen Carl Friedrich Gauss und Wolfgang Bolyai,*** Franz Schmidt and Paul Staeckel eds., (Leipzig: 1899): "Hingegen müdste sich der Sohn seines Jugendfreundes Bolyai, Janos [Johann] Bolyai, ebenfalls einer der Pioniere der nichteuklidische Geometrie, mit der merkwürdigen Annerkennung bescheiden, Gauss könne ihn nicht loben, denn ihn loben heisse, sich selbst zu loben." (Gauss could not praise Janos' discovery, if to praise him, would mean that Gauss were praising himself.) Cf. Biermann, op. cit., p. 139. On Gauss on Lobatchevski, see Gauss's 28 November, 1846 letter to H.C. Schumacher, ***Carl Friedrich Gauss: H.C. Schumacher Briefwechsel*** III (Hildesheim: Georg Olms Verlag, 1975); pp. 246-247.

43. The referenced case of L. Euler's tautological hoax, is a useful choice of example of such formalist traditions of academics' propensities for being most pedantically arrogant, when they are at their tiresomely tedious worst on such accounts. They reason like "jailhouse lawyers," imposing upon a selective interpretation of the language of a chance-read precedent, the delusion that the application of deductive casuistry to a mere quibble, must command the mighty rivers of the judiciary to bend to the proponent's exalted sense of cabalistic authority. Pathetic? Then, Leonhard Euler was more pathetic than such a petty jailhouse quibbler, and Lambert, Lagrange, Laplace, Cauchy, Clausius, Helmholtz, Maxwell, Hermite, Lindemann, and F. Klein, among many others, after him. Construct a deductive proof, which rests entirely on the mere arbitrary presumption, that extension in space-time, is essentially linear, unbounded, and perfectly continuous; then, employ that systemic error of axiomatic presumption, pervasively, to construct a deductive edifice, whose relevant conclusion is: "Extension in space-time is perfectly linear, boundless, and perfectly continuous, Q.E.D." Only a fool or a charlatan would propose to prove, or disprove an axiom of the system by means of a chain of deduction from the theorem-lattice which depends upon that axiom. On this premise of this pathetic, deductive, fallacy of composition, today's generally accepted mathematics classroom is politically ideologized to the proverbial gills, with the pagan religious cult-dogma of Euler's deluded view of infinite algebraic series: "linearization in the very small."

44. ***21st Century Science & Technology*** quarterly, will soon publish a report by Laurence Hecht, documenting those fundamental discoveries in electrodynamics which empiricists, such as J. Clerk Maxwell and H. Helmholtz, worked to ban from the classroom and textbook. Hecht's report is the outcome of what had been, initially, the 1975 prompting of me and my associates by the University of Chicago's Professor Robert Moon, deceased during late 1989. It was Moon who first emphasized the deeper significance of the discoveries of the founder of electrodynamics, the Monge Ecole Polytechnique's A.M. Ampère. The implications of Ampère's work were rescued from oblivion by C. Gauss's and B. Riemann's collaborator Wilhelm Weber. However, the circles of Britain's Lord Kelvin, including the practiced scientific hoaxster Hermann Helmholtz, and J. Clerk Maxwell, were dedicated to destroy the influence of Gauss, Weber, and Riemann; Maxwell apologized for his unacknowledged parodying of the electrodynamics discoveries of the Gauss-Weber-Riemann circle, by emphasizing, that it was the intent of the British circles to refuse "to acknowledge any geometries but our own [Newtonian dogma]." During the middle of the Nineteenth Century, Weber demonstrated the relationship between "strong" and "weak" forces, on the scale of atomic and nuclear physics, and, then, estimated coefficients, derived from experimental inquiry, which are close to Twentieth-Century values. The role of "strong forces" within the domain of the microphysical small, continues to defy efficiently those among today's fanatics who continue to insist on a mathematical physics which presumes linearity, or near-linearity in the very small. Hecht's report presents the relevant accomplishments of W. Weber, aided by Gauss, in developing experimental proof for the relevant discovery of nuclear "strong forces," as being implicit in the discovery of Ampère.

must leave the campus department of mathematical physics, for the laboratory of physical economy. We have now set the stage for the argument to be made. Now, we proceed to demystify "time-reversal" from that standpoint.

The historical basis for this study

To repeat what is already known to those familiar with my work, my original discoveries in economic science, including the material bearing upon "time-reversal," were prompted by a 1948-1952 project, originally undertaken to refute Professor Norbert Wiener's radical-positivist hoax of "information theory." It is relevant, that the success of that 1948-1952 project, was grounded in my intensive study, during my adolescence, of primary sources in Seventeenth- and Eighteenth-Century English, French, and German philosophy. That youthful undertaking prompted me to adopt G. Leibniz as my mentor, a dedication which I had affirmed in an essentially competent refutation of those attacks on Leibniz's work, the which are central to Immanuel Kant's ***Critique of Pure Reason.***[45]

Sometimes, as in the present instance, it is as important to know how certain discoveries came about, as to know the details of the discoveries themselves. Human beings, and individual human behavior, do not happen; they are expressions of an historical process. Not to include that process as such, would be to perpetrate a fallacy of composition, by excluding much of that crucially relevant evidence. To assess a person out of his historically determined setting, is such a fraud: a fallacy of composition. The case of my discoveries in that science of physical economy which was founded by Leibniz, is an example of the crucial importance of such an historical approach. The matters immediately to be addressed at this point in the report, are permeated with such specific historical implications as the deeply embedded impression which the Leibniz-Clarke Correspondence, and the posthumously published Leibniz work known as the ***Monadology*** made upon all of my development leading into the 1948-1952 project; one could not understand the discoveries themselves, without considering the functional role of the relevant, historical setting, of the U.S. economy and economic policy, during the late 1940s and the 1950s.

As I have stressed repeatedly, in other locations: Knowledge can not be learned; the student must re-create knowledge, by means of reenacting the type of act of discovery experienced, either as by a relevant original discoverer, or based on the model of a subsequent reenactment of that discovery by some relevant person. The act of discovery is not the communication of a literal statement, but, rather, the student's solving of a paradox for which no literal solution is available to him. That solution could not be generated within the bandpass of a medium of communication. That re-discovery may be accomplished, only within the sovereign creative mental processes of each individual person. That process, of evoking a successful reenactment of a discovery of principle, within the sovereign bounds of the individual's cognitive processes, is the only manner in which actual knowledge of a principle could be transmitted.[46] That process of rediscovery (not classroom or textbook learning of successful responses to anticipated multiple-choice questionnaires), is knowledge.

My task of presenting the notion of "time-reversal," to a largely lay audience, albeit one of relatively exceptional literacy and intellectual commitment, is to enable, especially, those readers who are either "Baby Boomers," or representatives of "Generation X," to reenact, each in his, or her own sovereign mental processes, the kind of process through which I came to those discoveries represented here. For the reader to accomplish the implied reconstruction, he, or she must be presented with those features of the historically determined background, which brought me into conflict with a specific, relevant nest of paradoxes; he, or she must also be able to reconstruct the historically specific circumstances, the setting in which the challenges motivating the discoveries were experienced. Without at least a strong indication of those features of the setting indicated, the present-day reader would be at a loss to recognize the problem for which those discoveries served as solutions.[47]

The most important of the preconditions to be met, by any person who came to adulthood after the assassination of President John F. Kennedy, is to muster insight into the historically determined differences between the cultural hypotheses of the "Baby Boomers," and those of their parents' and grandparents' generations. For this purpose, the glib term "generation gap," excuses more ignorance than it corrects; this involves no mere "generation gap," but, rather, the moral separation of the "Baby Boomers" from their parents, by a

45. The report of the relative competence of that adolescent's defense of Leibniz, rests upon a 1970s rereading of one of the notebooks on Leibniz and Kant, which I had filled with relevant comment, during the 1936-1938 interval.

46. E.g., "principle" is employed here in the sense of the act of discovery of a validated principle of physical science, or comparable principle of Classical art-forms. As above, such a principle is to be situated as Riemann does, as a "dimension" of a physical space-time manifold, and, hence, an axiomatic feature of some type of an hypothesis (hypothesis, higher hypothesis, hypothesizing the higher hypotheses), as distinct from a theorem-like proposition.

47. This would be understood as the Classical humanist approach to education, among that shrinking, already tiny minority, from among the victims of Twentieth-Century trends in U.S. educational policy. The influence of the model of Britain's Oxford and Cambridge Universities, which President Charles Eliot imported by fiat, to replace patriotism and the influence of C.F. Gauss and the Humboldt brothers (e.g., Louis Agassiz) at Harvard University, was accompanied and followed by the "decorticating" American Pragmatism of William James, the Rockefellers' successful promotion of the Fabian John Dewey, and the more recent takeover of U.S. education generally by the influence of the "deconstructionist" current, such as the followers of Jacques Derrida, or the Modern Language Association (MLA). The increasingly predominant uselessness of the generation of recent science graduates for serious scientific research into anything but the depths of "virtual reality," is largely a reflection of the lack of even a remnant of Classical humanist principles in the elementary, secondary, and higher educational institutions today.

gulf of a "cultural revolution" more fundamental than any experienced since the adoption of our original Federal Constitution. The "Baby Boomer" reader must abandon any sense of "naturalness," or "self-evident rightness" of today's "politically correct mainstream-thinking," and see the fundamental, axiomatic incompatibility between typical American patriots of all earlier generations, and the victims of the 1966-1979 "cultural revolution."[48] The generations are thus separated by axiomatically uncompromisable differences in cultural hypothesis.[49] No competent appraisal of the problems of the U.S.A. and the world today were possible, unless the two hypotheses are seen simultaneously, from a higher vantage-point than each.

So, we continue, to complete the remainder of the relevant background.

For all their faults, the first two decades of the post-war U.S. economy were a virtual paradise, if compared to the spiral of degeneration which has dominated policies, practices, and their results, since the 1966-1979 "cultural paradigm-shift." To understand the mind of the majority of the labor-force from the earlier, relatively happier time, one must take into account the large percentile, much more than a majority, of the total labor-force, the which was engaged either in production and physical distribution of physical goods, in basic economic infrastructure, or scientific and related professions. In that time, we were, predominantly, production-oriented, and the most likely employment opportunity for most, was the nearby factory-gate. As for the small ration among us associated with industrial consulting: technique, bills of materials, and process sheets, were the most commonly employed tools of our trade.

During that earlier time, most of us, if confronted with any among those fads of so-called "liberal economics" which have become "politically correct" opinion over the course of the recent three decades, would have retorted with words to the effect: "That's insane; with your 'funny-money' theories, you will collapse the economy!" We would have been right, and prophetic, in making such a response. After three decades of a cultural paradigm-shift, which features "post-industrial utopianism," the net physical output and input of the U.S. economy, as measured in physical market-baskets per capita of labor-force, has fallen to approximately half of what it was during the second half of the 1960s.[50]

The corresponding, relevant difficulty, today, is that the topmost positions in government and in the most influential private institutions of business and education, are populated, predominantly, by "Baby Boomers," the overwhelming majority among whom, have neither known, nor experienced a viable form of economic policy and practice during their adult lives. There are some exceptions, but they are relatively rare. Among today's typical influential and other "Baby Boomers," most of those radical policy changes of the 1970s through 1990s, including those policies which are responsible for the ongoing collapse of the physical productivity, income, and tax-revenue base of the U.S. population and its government, would be defended by most such "Baby Boomers" today as "mainstream thinking" of the post-1968 world. In German, the cant to this latter effect would tend to be seasoned with jargon such as *Weltgeist, Zeitgeist,* and *Volksgeist.*[51]

Consequently, the typical influential incumbent in government, university, or general economic practice today, will experience a great difficulty in overcoming his own, deeply engrained, misguided prejudices, when confronted with conceptions here which might have been understood with far more receptivity, and a higher level of competence in knowl-

48. The interval, including the 1971 monetary crisis, from the introduction of neo-Malthusian doctrines into the State Department agenda, through the introduction of those "Volcker Measures" of October 1979, which accomplished the rapid destruction of the once great United States.

49. E.g., either the Earth is flat, or it is not: an example of a difference in theorem rooted in an underlying difference in principle. The uncompromisable issue, is primarily the principle; the fact that the theorem must not be compromised, is an "attribute" which the theorem "inherits" from the principle. Since British philosophical liberalism is premised upon a denial of knowable hypothesis, empiricism allows no notion of "uncompromisable principle" in the sense we employ it here. Our difference with the empiricists, on this point, is uncompromisable.

50. See Christopher White, "NAM's 'Renaissance' of U.S. Industry: It Never Happened," ***Executive Intelligence Review,*** April 14, 1995; "U.S. Market Basket Is Half What It Was in the 1960s," ***Executive Intelligence Review,*** Sept. 27, 1996.

51. This is not only a U.S.A. problem. In Germany for example, the 1989 assassination of Deutsche Bank's Alfred Herrhausen, marked the end of the post-war era of successes in the German economy. Herrhausen was the last leading banker schooled in Hermann Abs's school of principles of sound industrial banking; Herrhausen's successors have turned out to resemble river-boat gamblers, more than bankers. It was during the 1980s, throughout the world, that representatives of my generation were replaced, around the world, by the "Baby Boomers' " rise to controlling executive and academic positions in most of the world's governmental and private institutions of policy-shaping power. The 1985 accession to Soviet General Secretary by Mikhail Gorbachov, symptomizes the same downshift to economic disaster in the last phase of the former Soviet Union. My generation, and its predecessors, were dominated by those capable professionals who specialized in promoting technological progress in physical development of infrastructure, agriculture, industry, and related qualities of educational, medical, and scientific services. The "Baby Boomer" generation is polluted with hedonistic fads in sociology, psychology, and monetarism. Since the approximately global "cultural paradigm-shift" of 1966-1972, the emphasis has shifted, from capital investment in increases of future physical-productive potential and demographic gains for the households of the population as a whole, into looting accumulated such investments from the past, to turn that loot into capital gains for "pirates" of the Carl Icahn, and Michael Milken types. So, as measured in income-ranges, the top 0.5% of the U.S.A. population grows fabulously richer, and ever more morally decadent, while the lower 60% accelerates its rate of downward slide into the depths of destitution. The 1982 Garn-St Germain Bill, the Kemp-Roth Bill, the rise of the "Junk Bond" pirates, and the fanatical commitment of the GOPAC cannibals toward ever greater orgies of tax-free financial capital gains, even if this means increasing the mortality rates among their parents' generation: It is the "mainstream opinion" which refuses to regard these recent trends as morally insane, which reveals that corruption of public opinion which is destroying us all.

edge, by the same classes of influentials earlier, among the parents and grandparents of today's "Baby Boomer" stratum.

Until the late 1940s aftermath of World War II, most patriotic Americans (excepting the sometimes very odd Anglophile), understood, as did President Franklin Roosevelt, that the British monarchy, and British "free trade," had been the consistent enemy of the United States throughout our history, and believed that the continuation of the British Empire was an abomination. We understood, whether we had studied Hamilton, Carey, and List, or not, that the (anti-"free trade") American System of political-economy was the best model of economy ever devised: The war-time economic mobilization showed us that we were correct in that patriotic estimation.

During 1948-1952, returned veterans of the war-time skyrocketting of the U.S. economy, out of ex-President Calvin Coolidge's 1930s Depression,[52] viewed the Truman administration's reversing President Franklin Roosevelt's intended post-war economic and foreign policies, as an embittering betrayal of our national heritage, of the policies which Treasury Secretary Alexander Hamilton named "The American System of political-economy." The disgusting problem which I met among my generation, during the moral downturn from President Franklin Roosevelt, in policy-making of the late 1940s and of the 1950s, was their fear-ridden, "politically correct," and, therefore, morally corrupt, capitulation to the unfortunate "way things were" under Truman and Eisenhower.

Such was the relevant collapse into cultural pessimism, which most of the parents of today's "Baby Boomers" suffered, as a result of the moral decay spreading through my own post-war generation. Yet, among those professionals and skilled operatives of my generation who had the courage to think for themselves, many could have readily recognized the basis for, and competence of the line of argument on economics which I employed during the 1948-1952 project, and summon, yet once more, here.

The ignorant prejudices, respecting economy, which have come to predominate among influentials and others of today's "Baby Boomer" generation, must be referenced in that historical setting. What must be said, to inform even relevant professionals among today's "Baby Boomers" (in particular), goes against today's perceived *Zeitgeist,* against that "mainstream" of opinion presently carrying our world civilization toward the cesspool. One may hope that these remarks have forewarned readers from the "Baby Boomer" generation, and others, against the misguided prejudices, which they will experience welling up within them, as we proceed.

From the outset, my work in the science of physical economy, was prejudiced by both my developed affinities for my adopted mentor, Leibniz, and the patriotic outlook on economy which I have summarized identified above. These were not merely prejudices; my 1948-1952 views on these matters, were significantly, if modestly well-informed, and, more important, stand up, in review, as predominantly correct, from my far more developed standpoint in knowledge and experience, today. Plainly, a generation of "Baby Boomers" which has, predominantly, accepted our nation's recent and continuing drift, into the rubble-fields of "post-industrial utopia," "information society," "world government," and "global economy," will react with prejudice against much of what I have to report. Nonetheless, on the condition, that such readers will recognize that their reaction must be considered suspect, as reflecting an ahistorical faddism, a prejudice, as I have indicated here, they are perhaps half-way to understanding the important series of arguments which I supply now.

'Not-entropy'

The standpoint of the bill of materials and process sheet, provides us the basis in experience, for showing that the productivity of labor, as of productive enterprises generally, depends upon continuing to supply not less than some minimum level of essential inputs. During 1946-1966, when we were still a nation oriented to the production of wealth, it was the natural presumption of anyone with exposure to scientific training, that there must be some notion of function associated with the array of experimentally verifiable, physical facts gathered into such bills of materials and process sheets. From that latter vantage-point, the notion of function, we are impelled to recognize that it is insufficient to regard these essential inputs merely as "financial costs." *Their functional significance lies not in the prices attached to their purchase, but, rather, in the physical significance of these inputs, in determining whether the potential productive powers of labor rise, fall, or are simply maintained.*

This applies to the level of income and public services supplied to the households of the labor-force; certain minimum standards of inputs must be met, if the productive potential, of both present and future members of the labor-force, is

52. The two most popular delusions respecting the causes of the 1930s Depression, are the myth that President Herbert Hoover caused it, and, second, Professor Milton Friedman's outright lie, that that Depression was caused by the Smoot-Hawley tariff legislation. Long before Smoot-Hawley's enactment, and years before the election of President Hoover, the 1930s was the foregone conclusion embedded in policies consolidated under Coolidge. Like the 1996 Republican Presidential candidate Robert Dole, encumbered with his Party's commitment to the so-called "Contract with America" lunacy, Hoover entered the office of President in March 1929, encumbered by the legacy of Coolidge, to meet the outbreak of the fabled stock-market crash less than six months later. The 1930s Depression was primarily a global phenomenon; the U.S.A., then the world's chief financial creditor, was caught by the tidal waves of financial collapse inhering in the Reparations system set up by the Versailles powers. On the domestic side, it was the U.S.A.'s drift, away from a Hamiltonian tradition, into radical "free trade" policies, and speculative binges only less wild than those of today, which ruined the U.S.A.'s ability to meet the tidal waves of bankruptcy sweeping through the financial systems of our European debtor-nations. The Smoot-Hawley tariff was adopted in recognition of the fact that it had been "free trade" policies of Coolidge and Mellon, which had already plunged us into the Depression, which must be reversed, in favor of return to a traditional, patriotic, "protectionist" policy.

to be maintained in such a way as to maintain both net growth and the technological progress upon which that growth depends. This requirement applies to basic economic infrastructure (as supplied, traditionally, either as economic activity of government, or by government-regulated public utilities). It applies to agriculture and related production, mining, manufacturing, and other industry. It applies to the supply of education, of effective demographic performance of health-care, and of scientific and related services. It applies to consumption by households, by branches of useful economic activity, and to allowable and required amounts of administration of both governmental and private institutions.

Such considerations, bearing upon necessary physical standard of incomes of households, were the leading feature of Leibniz's first writing on physical economy, his 1671 ***Society & Economy***.[53] The experimentally demonstrable relationship, between physical values of inputs and the predetermining of the potential (physical) productive powers of labor, pervades Leibniz's economic and related writings on technology, throughout the 1671-1716 interval. The implications of this view, of a functional dependency of productive powers of labor, upon maintaining minimal cost-inputs, are otherwise attested by all of the known demographic history and pre-history of mankind. This viewpoint in the science of physical economy, obliges the investigator to premise the study of economic processes on no lesser scale, than the known demographic history, and pre-history of the existence of the human species considered as a functional oneness.[54]

Such a study begins, with a general overview of the upward sweep, and also occasional impairments, of population-size, population-density, and correlated improvements in the demographic characteristics of typical households. This must be done from the standpoint permeating Leibniz's ***Society & Economy***.[55] From the historical period, we emphasize the dramatic improvements, on all counts, in not only the population of western Europe, but the world taken as a whole, since the first establishment of the modern form of sovereign nation-state, with the accession of France's Council of Florence-linked, Renaissance figure, King Louis XI, during 1461-1483. Featured, included emphasis in that approach, is upon the reproductive power of society, per capita, per family household, per unit of land-area, and upon the improvement of demographic characteristics of those households (longevity, health, level of cultural development, etc.).[56]

Examining this matter more closely, we note that the inhering factor of "technological attrition," relative to natural resources employed, prohibits a "zero-technological growth" model of society. We must examine the pre-historical and historical statistics of population and its demographic characteristics, from the standpoint of what we recognize, in modern civilization, as progress in science and technology.

These combined considerations lead us to a set of discoveries which, by definition, determine all the elementary features of not only a science of physical economy, but, also, any admissible theory of knowledge, knowledge of physical science included. It is that aspect of the inquiry which compels us to acknowledge the empirical evidence for the case of "time-reversal."

The summary argument required for our purposes here, goes as follows.

To state the most characteristic feature of a physical economy in the terms of approximation afforded by textbook thermodynamics, agree to define the *necessary* physical costs (input) of an economy's level of productivity (including administration), under the heading of "energy of the system," and to consider the not-wasted, remaining portion of output, as "free energy." "Energy of the system" includes both current new input, and the net replacement cost (in physical terms) of that portion of functionally significant physical capital, the which is stored within the economic process. The latter, stored, net (physical) capital investment, includes basic economic infrastructure, improvements in the physical-economic fertility of land, agriculture, industry, and a restricted portion of actively stored total services: in the form of education and health of the members of households, and science and technology potential of the labor force and enterprises.[57]

Express these, in first approximation, in my own changes in definitions for the symbology for the terms which Karl Marx adopted from his British teachers.[58] Let **V** signify input/

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53. J. Chambless, trans., ***Fidelio*** Fall 1992.

54. Lyndon H. LaRouche, Jr., "Non-Newtonian Mathematics for Economists," ***Executive Intelligence Review,*** August 11, 1995. Lyndon H. LaRouche, Jr., "Leibniz from Riemann's Standpoint," ***Fidelio,*** Fall 1996: "Potential Relative Population-Density," pp. 36-40.

55. ibid.

56. ibid.

57. Insofar as education of the household's members, science and technology, Classical cultural activities, and health care, affect the productivity of the labor-force, and the demographic characteristics of typical households, these services, unlike virtually all other kinds of services, determine the rate of growth of mankind's per capita reproductive power over nature, the power of our species over nature. The growth of man's potential power over nature, per-capita of labor-force, per household, and per relevant area, is the measure of the validity of discovered principles underlying society's practice, on the condition that the requirement for a demographic improvement is also satisfied.

58. During the span of his university studies, first at Bonn and later at Savigny's Berlin, Karl Marx was recruited to the British foreign service's "Young Europe" organization. He continued under the sponsorship of Lord Palmerston's Giuseppe Mazzini, from that point, until the death of Palmerston, and perhaps slightly beyond; for much of that period, Marx was operating in London under the supervision of Palmerston's subordinate and rival David Urquhart. It was under Urquhart's guidance, that Marx elaborated his so-called "early writings" on economy, during the 1850s, and laid the basis for his ***Das Kapital.*** François Quesnay, Giammaria Ortes, Adam Smith, and the British East India Company's Haileybury school (as developed under the patron of Lord Palmerston's career, the British foreign service's Jeremy Bentham), are the principal sources from which the analytical features of ***Das Kapital*** are derived. It is Marx's venom against such American System

output of the labor-force, **C** signify required materials input for the entire economy (functionally defined), **F** net (functional) physical capital, **d** necessary deductions for government and administration otherwise, **S** output in excess of *energy of the system,* and **S′** *free energy* (after deductions for both necessary administration and waste). Be reminded: read these symbols as defined here, not the Marxist reading. Prepare the way by describing the constraints to be examined, as follows.

The general constraints are:

1. The potential population-density of the economy (as a whole) shall not be decreased, and the demographic characteristics of the population as a whole shall be improved.

2. The inputs and outputs of the "market baskets," and of their contents, shall be increased in absolute (physical) terms, for households, for performance of infrastructure, for agriculture and related, for industry, for education, for health care, and for science and technology services. These increases shall be measured in market-baskets, also as contents of market-baskets, and in terms of per-capita (of labor-force), households, per-square-kilometer of land area.

3. The ratio of "free energy" to "energy of the system," so defined, shall not decrease, but the relative energy of the system (per capita of labor-force, per household, and per square kilometer) shall be increased through reinvestment of "free energy" generated.

These seemingly paradoxical requirements may then be expressed as:

Population-density (adjusted for demographic parameters):

$$\left|(F)\ P_1\right| \leq \left|(F)\ P_2\right|$$

"Free Energy" Ratio:

$$\left[\frac{S'_1}{(V_1 + C_1)}\right] \leq \left[\frac{S'_2}{(V_2 + C_2)}\right]$$

"Energy-Density" Ratio (per-capita of labor force):

$$\left[\frac{(V_1 + C_1)}{F_1}\right]_1 \geq \left[\frac{(V_2 + C_2)}{F_2}\right]_2$$

But, the physical content of market-baskets (M) for productive functions, per capita, for labor-force:

$$(M_v)^1 \leq (M_v)^2$$

and:

$$(M_c)^1 \leq (M_c)^2$$

This set of "market-basket" relations overlays a set of constraints defined in terms of divisions in output of employment of the total labor-force's operatives, letting ***V*** correspond to the operatives' ration of the total labor-force.[59] In this case:

$$\left(\frac{V}{C}\right)_1 \geq \left(\frac{V}{C}\right)_2$$

and:

$$\left(\frac{S'}{V}\right)_1 \leq \left(\frac{S'}{V}\right)_2$$

and:

$$\left(\frac{S'}{V + C}\right)_1 \leq \left(\frac{S'}{V + C}\right)_2$$

It should be noted, that the difference between the first, "market basket," model, and the second, "division of labor," model, is that the first states the relations of the second in terms of the *per-capita relations between the society and the universe in which the society exists.* The significance of the first, is that this representation is necessary for certain tasks, among which the most crucial is the consideration, that the relations between the physical-economic process and the process of generating scientific and technological progress, are located within those sovereign creative cognitive processes of the individual mind, wherein the generation and re-creation of valid discoveries of physical (and analogous) principle occur.[60]

Although this paradoxical set of expressions is set forth in descriptive terms used for modern nation-state economies, the implications so represented are necessarily characteristic of the human species' entire span of historical and pre-historical existence. The paradoxical appearance of this set of constraints, does not bespeak some fallacy in our argument; the error is the critics' own, the error of attempting to impose upon the universe at large, the purely fictional presumptions of the three so-called "laws" of thermodynamics, as the latter were prescribed by Lord Kelvin, Rudolf Clausius, Hermann Grassmann, H. Helmholtz, et al. The evidence refuting the

economists as Friedrich List, and later condemnation of Henry C. Carey, both motivated, according to Marx himself, by F. Engels, which, as the proverb goes, "give the game away."

59. See, Lyndon H. LaRouche, Jr., ***So, You Wish to Learn All About Economics?,*** 2nd edition, (Washington, D.C.: EIR News Service, Inc., 1995), *passim.*

60. As opposed to the social model of Thomas Hobbes, John Locke, Bernard de Mandeville, David Hume, François Quesnay's *laissez-faire,* Adam Smith, Jeremy Bentham, John Stuart Mill, et al. In the Hobbes model, the individuals of society are treated as kinematically interacting particles, of fixed, linear, axiomatic properties, interacting within the virtual reality of a mechanistic "gas theory." In reality, the determining relations are located with respect to the development of the sovereign creative cognitive processes internal to the individual's mind.

latters' widely taught thermodynamics dogma, is conclusive; it is now summarized as follows.

Probably, the student would not recognize the significance of many features of this process of human existence, if we focussed upon some pre-historical or early historical case, in isolation from modern societies; once the internal dynamic of modern civilization is understood, we recognize these same, underlying, hypothesizing of the higher hypotheses, the which underlie the modern, industrialized nation-state economy, already at work, in the assumptions which underlie the relative success or failure among even the earliest societies. The available data on changes in population, population-density, and demographic profiles of populations, from pre-history forward, to date, shows that the constraints we have just summarized here, are the characteristics of all successful efforts at continuing human existence.[61]

The known, combined, pre-history and history of mankind, presents us with the phenomena of a lattice of higher hypotheses: In other words, the phenomena subsumed by a functional notion which might be described only as the *hypothesizing of higher hypotheses.* That is to say, we have already extended the notion of "function," to satisfy broader notions of "relationship," notions of the higher types which Leibniz consigned to a generalized analysis situs. We have escaped the banality of a mathematics shackled by deductive formalism, into the primary relations which must necessarily underlie, and thus govern any competent mathematical physics, for example. *We have moved the location for the primary relations within physical processes, away from the inferior domain of deductive propositions, to focus upon the determining relations, within the ruling domain of hypothesis.*

The crucial paradox defined by the experimental evidence, which thus distinguishes successful from failed models of economy, is summed up: *The ratio of net "free energy" to "energy of the system" must not be decreased, although the per-capita value of "energy of the system," per capita of labor-force, per family household, and per relevant unit-area, must increase.* To underscore the nature of this paradox, the following remarks are interpolated.

The source of the accumulation of physical capital, is the transfer from the account of "free energy" (symbolized by "S′" above), to "F." The relevant experimental fact is, that should "S′" be distributed to increase of administration or personal consumption, above the "energy of the system" allowances for "V," "C," and "d," the result would be a lowering of the rate of gain in the productive powers of labor, and, sooner or later, a net lowering of the per-capita standard of living of the labor-force. The trend in economic growth and incomes would be either merely less than if the amount is invested in "F," or, worse, the factor of technological attrition would lead to negative growth, and, thus, to subsequent fall in standard of living of the labor-force.

However, in the alternative, that necessary consumption were postponed, in order to increase the stock of physical productive capital, as was done during the U.S. war-time recovery of 1940-1945, the results may be positive for the labor-force, and might have the effect of an economically successful "savings" program, which works to the advantage of the labor-force.[62] Traditionally, prior to the 1966-1979 "cultural paradigm-shift" in U.S. economic policy, every competent farmer or industrial entrepreneur, and others, recognized this principle of saving: of capital-accumulation through postponed consumption, as leading to greater aggregated consumption than the alternative policy. The reconstruction of war-ravaged economies, provides compelling images of the same principle in practice.

To get at the true nature of the indicated paradox, one must define productivity in the indicated physical terms, stripping away all efforts to substitute prices for the physical variables which are the actual content of economic processes. There is no greater, or more popular form of lunacy among academic economists and their deluded admirers, than the effort to explain business cycles in terms of movements of prices. It was not private investment of money savings which created modern economies; it was the modern nation-state, which

61. Relevant studies of so-called "primitive" societies, dispel the illusion that these are predominantly aboriginal, or approximately aboriginal forms; as in cases such as anthropological studies of the language and behavior of the so-called "digger Indians," in the usual case, virtually all cultures which some commentators prefer to identify as relatively "primitive," are in fact degenerate relics of the collapse of an earlier, relatively higher level of culture: either an externally imposed catastrophe, as in the instance of the so-called "digger Indians," or a self-imposed catastrophe, as in the case of the repeatedly failed cultures of ancient Mesopotamia.

62. The appearance, that the presenting of the war-time savings by the labor-force as demands upon the post-war economy, caused the inflation of 1946-1947, is a fraudulent reading of the evidence, a non-sequitur, a fallacy of composition. It was the Truman policy of 1945-1948 which caused the menacing inflationary spiral of that period (a policy which the Truman administration adopted at the behest of the Anglo-American establishment generally, and the Federal Reserve influentials in particular). To create the economic mobilization for war, a large mass of withheld wages and other income was channelled, through war-time austerity measures, into capital formation in agricultural and industrial potential, in addition to expenditure for military goods. To deal with the post-war effects of this postponement of personal income, it was imperative that, with the close of war, no significant industrial demobilization must be allowed. We should have converted the build-up of the tool-industry for war, to civilian capital-goods production; under no circumstances, should a general collapse of the level of industrial output be forced, as it was, or even allowed. The critical problem was the failure to deploy a "dirigist" program for rolling over war-time industrial build-up, rapidly, into high rates of agro-industrial build-up for civilian capital-goods output, a failure which collapsed the physical growth-rates of the U.S. economy, as the postponed monetary expenditure began to flood into the markets. Similarly, since 1971, a world-wide inflation has been sustained, not by an excess of money, but by a growing insufficiency of investment in technology-intensive, capital-intensive, and energy-intensive modes of both agro-industrial production of goods, and build-up of the capital stock of high-technology infrastructural investments. Where lunatic monetarists see an "excess of money," sane economists see a shortage of investment in technologically progressive output of goods.

created the credit, and built the infrastructure, under which a society composed of citizens, rather than feudal subjects, organized the preconditions for the successful proliferation of private entrepreneurship.

Once the mind has cleansed itself of the effects of that mental disease called "financial statistical analysis," the true nature of the paradox is forced to the surface. That paradox I have identified above, may be restated: The attempt to interpret economic processes, as if the presumptions underlying the "three laws of thermodynamics" were applicable, is effectively the act of a charlatan. What causes my constraints to appear to be self-contradictory to some would-be critics, is those critics' attempt to explain economic processes without regard to that which sets human beings apart from baboons: those sovereign, creative cognitive potentials of the individual human mind, upon which the generation and successful application of fundamental scientific progress depend.

The apparent paradox is: *The requirement that, under the conditions that net "free energy" is reinvested in the economy as a productive process, to increase the density of the process's "energy of the system," per capita of labor-force, and per relevant unit of land-area, the ratio of "free energy" to "energy of the system" must not decline.* In summary, the process is characteristically "not entropic."[63]

Thus, the associated, also crucial paradox, is, that experimental evidence also shows: *This successful performance can not be secured, except through progress in what modern civilization has come to identify as an emphasis upon policies adopted as necessary to foster investment in "scientific and technological progress."* For the defenders of today's generally accepted classroom mathematics, the implication of that requirement is more painful than any bare paradox; for them, it is a catastrophe.

These are paradoxes in the same sense as any experimental demonstration of the existence of a needed discovery of some new physical principle, a principle required to prevent existing mathematical physics' descent into intellectual bankruptcy in face of an undeniable experimental challenge. In this case, the root of the difficulty is ultimately identical to the *ontological paradox* characteristic of Plato's ***Parmenides*** dialogue. These are paradoxes derived from the pervasiveness of the cult of linearity in today's generally accepted classroom mathematics, paradoxes of a type ultimately as fatal to the mental life of science as the *paresis* resulting from long infection with syphilis.

Underlying this blunder of the empiricists, of Leonhard Euler, of Immanuel Kant, et al., is a misconception of science, since Sarpi, Galileo, Fludd, Bacon, Descartes, Locke, Newton, et al., which has been concocted in search of congruence with that *degraded, Venetian misconception of the nature of the human species, and human individual introduced as the Seventeenth and Eighteenth Centuries' French and British "Enlightenment."*[64]

The essential subjectivity of science

Above, we employed the example of Mozart's ***Ave Verum Corpus*** to identify those features of B. Riemann's discoveries which are characteristic of both scientific and technological progress, and also of progress based upon discoveries of rational principle within the domain of the Classical art-forms.[65]

We now turn to present the principal implications of that evidence: *Contrary to simple-minded illiterates, and other superstitious persons, physical science is not "objective knowledge." Science is not a reflection of the universe as simply reflected into our minds by our senses, as if by a kind of mirror. Science is premised upon the experimental evidence obtained through mankind's relevant successes and failures in our species' efforts to increase its power over the universe.* The very term "scientific objectivity," is a paralogism; it bespeaks a person afflicted with superstition. Only after we have acknowledged the essential subjectivity of knowledge, do we escape from that erotic bondage called "sensual science."

Reference the general function identified above:

$$[(h_i)^j]^k$$

This, as indicated at an earlier point in this report, represents the role of *hypothesizing the higher hypothesis* as underlying all scientific and related progress in human knowledge and practice. This is a statement, in terms of a Leibniz-Riemann-referenced mode of analysis situs, of the axiomatic generality of all valid scientific knowledge: *Since the history of man's increase of our species' power to command the universe to our species' benefit, is a history of man's hypothesizing the*

63. The obligation to say "not entropic," rather than "negative entropy," has been imposed by the "information theory" cult's misuse of the term "negentropy," to signify a mechanistic implication of Ludwig Boltzmann's H-theorem.

64. Among the numerous published locations in which this writer has addressed the matter at some length, relevant recent instances include the following; "Non-Newtonian Mathematics for Economists," loc. cit., Aug. 11, 1995; "How Hobbes' Mathematics Misshaped Modern History," ***Fidelio,*** Spring 1966; and, "Leibniz From Riemann's Standpoint," loc. cit.

65. The rational employment of the term "Classical" is a choice of term which references the Classical period of ancient Greece, with emphasis on the Athens-centered culture, from the time of Solon through Alexander the Great's destruction of the Persian Empire. Otherwise, the rational use of the term "Classical," is limited either to certain Classical Greek models, or their reflection in modern forms of art and science. In western European civilization, from Augustine of Hippo through the Classical humanist followers of Friedrich Schiller in Nineteenth-Century Germany, the term "Classical" signifies art and science cohering with the rational principles of Plato and his Academy at Athens. In practice, "Classical" signifies contempt for arbitrary beliefs, in both art and science: e.g., those not governed by Reason. It signifies contempt for arbitrary, erotic effects in art. As noted earlier here: The principles of Classical musical, motivic thorough-composition exemplify the coherence of Reason (e.g., John Keats's "truth") and Beauty in art, and a degree of rationality which is identical with the function of Reason in science.

higher hypothesis, the term "science" is properly delimited in use to signifying rational comprehension of the process of hypothesizing the higher hypothesis. In that sense, we must think of the subjectivity of science.

In terms of the adding of relatively valid new theorems according to some fixed hypothesis, man's power to increase the potential relative population-density of our species has a limit. Our species exceeds that limit; but, that success occurs solely through experimentally validated, axiomatic-revolutionary changes in hypothesis. It is such axiomatic-revolutionary changes, all within the domain of hypothesis, which constitute the action, by means of which mankind exceeds the bounds of any fixed theorem-lattice. This action is the *change* referenced by Heracleitus' famous apothegm, "Nothing is constant, but change." That is the same notion of *change* which Plato introduces as the crucial conception of his ***Parmenides.*** In first approximation, this change, this action, is located ontologically within the domain of higher hypothesis: the efficient, valid change, from one hypothesis to a higher one. The generalization of this notion of change, or Plato's *becoming,* is located within the domain of hypothesizing the higher hypothesis.

Thus, the reality of the universe is comprehended by the mind, not the ignorant man's blind, irrational faith in the bare experience of his senses. That is the definition of *Reason,* as used by Johannes Kepler; we have already referenced this here, above, as Leibniz's notion of *necessary and sufficient reason.* The notion of the necessary, efficient existence of functional time-reversal, arises, as necessity, from these considerations.

The lesson of the progress of science, in these, Platonic terms of reference, is that the universe is, in effect, so predesigned, that it is obliged to obey man's will, whenever man's will is expressed according to Reason: according to valid changes in hypothesis, from lower to higher hypotheses. The relevant action, by means of which the efficient principle of existence of the human species is defined, is the advancement of man's operating hypothesis, from a relatively lower hypothesis, to a relatively more valid, more powerfully efficient one. In effect, the relevant changes are typified mathematically, in the form of an increase of the Gauss-Riemann physical-space-time curvature, by the relative, transfinite cardinality of action.

This is the essence of that which deserves the name of "science," or of "Classical art."

The experience of scientific, or artistic activity, so defined, is presented to our minds in two ways. On the one side as the form of analysis situs demonstrably cohering with the increase of mankind's power over the universe. In physical economy, this form is correlated with mankind's willful increase of the potential relative population-density of our species. On the other side, as Classical art typifies this, this activity of our minds is expressed in the form of the emotion associated with what Plato and the Apostle Paul identify as *Agapē*.[66] The mind is able to distinguish *Agapē* from the erotic impulses associated with the materialist's blind faith in sense-certainty.[67]

(Notably: The indispensable function performed by successful Classical art-forms, is to bring forth the motive quality of *Agapē* in its more concentrated expression. The Classical

66. I.e., Plato: love of justice, love of truth. Cf. Paul, ***I Corinthians*** 13. The charismatic "feeling" according to *Agapē* is never irrational, but always an expression of Reason.

67. The deepest secret of the Romantic existentialism of the proto-Nazi Friedrich Nietzsche, the Nazi Martin Heidegger, Jean-Paul Sartre, the irrationalist Martin Buber, deconstructionist Jacques Derrida, et al., is implicitly disclosed by the notorious *Liebestod* of "Young Europe" terrorist R. Wagner's ***Tristan and Isolde*** (as by Wagner's operas and music-dramas generally). A comparison of Jean-Paul Sartre's ("Sartre-Masochismus") autobiographical rant, with the notion of "thrown" central to the doctrine of the Nazi ideologue Heidegger, tells us much about the underlying kinship among French existentialists, German Nazis, and also existentialists of the Hannah Arendt and Martin Buber types. The kernel of the doctrine of existentialism is the impulsion to give freedom to (unleash) the "inner pig" one adduces as the essential kernel of one's innermost self. The lunatic Nietzsche, who has the distinction of being the most candid among the degenerate breed called existentialists, rightly attributes the ancestry of his cult to the Apollo-Dionysus dualism of the satanic, Delphi cult of Gaea-Python/Dionysus-Apollo, and, thus, implicitly, to the Hellenistic cult of Isis-Osiris: the victim whose erotic impulse has carried him, like Adolf Hitler and Heidegger, deep into the depths of Hell.

motivic thorough-composition of anti-Romantic, well-tempered polyphony, by W. Mozart, the later Joseph Haydn, Beethoven, and Brahms, is the typical expression of this, like the great and prolific well-tempered polyphony of J.S. Bach before them.)[68]

Hence, the fundamental distinction between Plato and Aristotle. Hence, the legitimately Aristotelean, modern, Venetian tradition of *mortalism,* traced through Padua's anti-Renaissance Pietro Pomponazzi and Michel Montaigne, through the Seventeenth-Century followers of Paolo Sarpi.[69] Whereas, in the relevant tradition of Christian civilization, the Aristotelean, like the bathless hesychast, the Stoic, the Epicurean, and kindred schools of pornography, contemplates the world, the Platonist masters that world, and that out of a sense of the responsibility inhering in a creature "made in the image of God," in the sense of the cup passed to Christ in Gethsemane. For the Aristotelean, such as the empiricist and irrationalist Immanuel Kant, the world is a construct, fabricated from the detritus of naive sense-certainty. Thus, for the Kant who purports to be the Apostle of Reason, it is the central feature of his Romantic reconstruction of empiricism, in his *Critiques,* that an *efficient* form of Reason does not exist.[70] Out of the related version of empiricism, the Ockham simplification promulgated by Paolo Sarpi and his followers, we have that contemplative standpoint in mathematical formalism of Isaac Newton, Leonhard Euler, and their radical-positivist followers, such as Bertrand Russell, Norbert Wiener, John von Neumann, et al.

Hence, given this fundamental controversy between the experimental standpoint of Cusa, da Vinci, Kepler, Leibniz, Monge-Carnot, Gauss, and Riemann, versus contemplative, "ivory tower" philosophies of science, any attempted approach to the issues of scientific method which is not rooted in rigorous study of the Plato-Aristotle controversy in philosophy, would be the bungling enterprise of a science-illiterate, one acting as a virtual charlatan. It is toleration of such charlatanry in the name of "generally accepted classroom mathematics," which gave us the infamous Solvay Conferences of the 1920s, the toleration of B. Russell's hoaxes, and the narrow corners, such as Andrei Sakharov's work, into which the evidence of "time-reversal" has been confined to date.

Man's knowledge of the lawful composition of our universe is limited, by necessity to those processes of knowledge which have shown themselves to lead to mankind's repeated improvement of the number, demographic characteristics, and per-capita power of our species over the universe. Let us agree to name that test of knowledge according to the spirit of Riemann's experimental physics, "The Great Experiment." The primary task of science is, therefore, to discern and define those processes within the sovereign domain of individual human cognition, by means of which the successful furthering of the process of hypothesizing the higher hypothesis is to be promoted. It is in that context, that a rational comprehension of the principle of "time-reversal" becomes accessible.

Riemannian 'time-reversal'

The measurable impact of "time-reversal" must necessarily lie within the conceptual bounds of the crucial discovery at the center of Riemann's habilitation dissertation. In other words, applying those methods of C.F. Gauss's general principles of curved surfaces (which Riemann incorporated in the method of his own discovery), there must be a measurable difference in the implied curvature of physical space-time, reflecting the action of time-reversal upon the function as otherwise determined. For this case, measurement appears in two available expressions: 1) The measurement of extension, as this is extended from Gauss's work on the higher expressions of biquadratic residues; 2) As expressed by discontinuities in attempted simple extension.

Once more, return to our referenced musical example, to define the form of this set of relations. What is to be emphasized here, as in reference to this musical case in earlier published locations, is that the characteristic feature of Classical art is the evocation of *Agapē,* by means of the rigorous subordination of art to that Platonic principle of Reason, the which is expressible only by the form of development which employs resolving transitions to new hypotheses of a relative higher cardinality than the utterance of the preceding hypothesis. Thus, as Pablo Casals instructed his master-class students, in great art, as typified by his beloved J.S. Bach, there is never repetition, but always contrapuntally progressive variation.[71]

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68. Hence, the intrinsically religious quality of virtually all of the music of these composers. Hence, for related reasons, the intrinsically satanic implications of bringing the dionysiac "Christian rock" into the churches.

69. Cf. Webster G. Tarpley, et al., "From Napoleon to Nashville," ***New Federalist,*** Sept. 23, 1996.

70. During World War II, the British propaganda service enlisted Heinrich Heine's prophetically insightful ***Religion and Philosophy in Germany,*** in warning that Immanuel Kant was a spiritual ancestor of Adolf Hitler's acceptance within Germany. Notable, is the strain of neo-Kantianism running through the positivism of Madame de Staël, her collaborator Saint-Simon, and Auguste Comte, in France, and Hegel's accomplice, Karl Savigny, in Germany. The *Volksgeist* irrationalism flagrantly displayed in Kant's ***Critique of Judgment,*** running through Savigny's Romantic school of law, and Hegel's philosophy of history, supplied the rationale for Germany's fatalistic submission to the Anglo-American financier-oligarchy's imposition of Adolf Hitler's rule in the "legal" coup d'état of 1933-1934. On the Anglo-American backing for the Hitler coup, see Webster G. Tarpley and Anton Chaitkin, ***George Bush: The Unauthorized Biography*** (Washington, D.C.: EIR News Service, 1992); pp. 26-62.

71. Among the greatest enemies of Classical music, on several grounds, are the leading recording companies. Exemplary of these firms' endemic, mercenary artistic imbecility, is the question often expressed by a performing ensemble: "Shall we do the repeats?" In Mozart and Beethoven, for example, there is never carbon-copy repetition, even when repetition might be suggested by the printed text of the score. That is to say, neither Mozart nor Beethoven intended mere repetition, but rather a recapitulation which is apposite to the initial utterance of the text. This is a device borrowed, so to

As we stressed earlier, here: In the referenced illustrative case, the progression through a series of polyphonic hypotheses, into the culminating hypothesis which concludes the composition, registers the composition as a whole as a process of development located ontologically within the domain of a specific proposition, that within the domain of higher hypothesis. Now, once that is apprehended by the performer, or hearer, every detail of the performance must be subordinated to that specific proposition otherwise defined only at the close of the piece. The result is a shading of interpretation in the shaping of each interval of the composition, both within the individual voice, and across the polyphonic voices. The effect is of a slight deviation of the "physical space-time curvature" in the performance: conductor Furtwängler's doctrine of "performing between the notes."

That must not be over-simplified. Each locality within the composition belongs to one among the sequence of polyphonic hypotheses, and must be so performed; but, that hypothesis must be affected in the shading of its performance by the proposition which locates the development process of the composition as a whole within the domain of higher hypothesis. The image of Gauss's development of, and Riemann's apprehension of higher implications of biquadratic residues, is forced to our attention, thus. In music, it is the ability to hear, to recognize, and to anticipate the distinction between appropriate and inappropriate shadings of difference of "curvature" within the performance, which is crucial. In music, as otherwise, such music must be heard first in the mind, and, after that, what is heard so in the mind must command the instruments employed.[72]

Those differences in manifest "physical space-time curvature," are, relatively speaking, the more readily accessible feature of the principle of "time-reversal": Its efficient presence can be measured so, whether in musical performance or physics as such. The more profound aspect of matter forces our attention to the functional implications of true discontinuities. The crux of the matter is efficiently introduced by the following proposition.

How is it possible for the human mind to perceive a mental object, whose form does not originate from within the domain of sense-perception? To most, that question immediately suggests the domain of microphysics; it must be recognized that the concepts of microphysics are but a derivative of the general category of Platonic ideas. Restate the proposition in other terms: How are singularities, such as metaphors, afforded discrete distinctness within the mind? The answer from any literate person should be: by the juxtaposition which we term irony: a "double meaning," the which can not be resolved deductively.

The quality of "definiteness" attributable to a Platonic idea, is derived from the association of such an idea with a formal discontinuity. This involves a "non-linear" transition, as from one hypothesis to another, a transition which occurs in such a manner that it must appear to a deductive mind-set as a "leap" of comprehension across an incomprehensible gap. This may be a valid metaphor, in poetry, Classical drama, painting, or music; or, it may be the introduction of the need to consider a new quality of principle (a new hypothesis), as a precondition for accounting for the actual continuation of a process, as in the case of Riemann's ***Fortpflanzung*** paper, referenced here earlier.

On this same point, consider a "map" of science in general, which we have identified in locations published earlier. If we seek to outline the full domain of scientific inquiry from the standpoint of the relations of hypothesis, we have the following, general, preliminary result.

We divide the domain of inquiry among three classes of phenomena and three categories of relationship of judgments to methods of empirical inquiry. The three general classes of phenomena are: 1) Ostensibly non-living processes, both organic and inorganic in ostensible composition; 2) Living, but presumably non-cognitive processes; 3) Cognitive processes. The three categories of inference are: A) Astrophysics, B) Microphysics, C) Macrophysics. This yields a table of nine cells. Since the existence of this evidence is conditional upon the existence of human cognition, it is the driving of the cognitive processes to the ever-expanded limits of inquiry into astrophysics, microphysics, living processes, and cognition itself, which underlies this nine-cell domain of science as a whole.

All of the permutations of relations among the nine cells are defined in terms of strict boundaries, strict discontinuities. Consider the most exemplary such case, the transition of what is ostensibly the same living process into a non-living state, and the distinction between living processes which are typified by cognitive functions, and those which are not. What are the transitions which separate these states? Define them functionally. The difference in organization of the three states is expressed as a difference within hypothesizing the higher hypothesis, a difference, however apparently subtle, in the effective curvature of the process.

On this account, the peculiarity of living processes, and also cognitive ones, is of the form of time-reversal: the apparent pre-determination of the next phase-state in a way which either distinguishes a living from a non-living process, or a cognitive from a non-cognitive activity within a living pro-

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speak, from Classical strophic poetry, which must be performed (and heard in the mind) as a process of constantly ongoing development, never as monotonous sing-song prosody. In the works of these composers, the "repeat" is always a lead into a new development.

72. The performance of music must never be from text to instrument, but through the digestion of the hearing as performed in rehearsal by no other instrument than the mind itself. Only in such a domain of memory, can the mind "hear" the interplay among all hypotheses and conclusion as if in relative simultaneity, relative to every interval of the relevant moment of performance. It is in replaying compositions, so, within the polyphony of the mind, and constantly adjusting one's interpretation according to all these considerations at once, that these notions can be mastered by the performer, or the musical audience.

cess. For this, the conceits of A.M. Turing and his followers will not do. Once we have identified the necessity of time-reversal for one class of processes within the array, we have identified the necessity for the generality of functional time-reversal.

The introduction of the notion of time-reversal, obliges us to face up to the implied questions: What is the efficient future to be considered? What is the efficient scope of the relevant past?

The truth is always elegant and lovely, but the delusions which commonly obstruct access to that truth, tend toward the ugly sentimentalities of the rutting Yahoo class. The clinical problem to be addressed, is illustrated by reference to those commonplace, pathetic commentaries upon musical compositions, the which inhabit concert program notes, or the dust jackets of recordings. According to that Romantic irrationalism, the which has dominated British taste since Thomas Hobbes outlawed metaphor, the purported explanation of a Biblical text or a musical composition is to be found in the orgasmic domain of erotic symbology.[73]

One might say, that our perennially prissy British art critics, like their American mimics, are as irrationally symbol-minded in their artistic opinions, as in their lunatic, low-church notions of the future, their so-called Biblical prophecies. Indeed, if we understand the mental breakdown of such critics, when faced with "time-reversal" as it occurs in poetic speech or music, we have ready insight into the pathetic mental condition of that homicidal, American, "Lost Cause" variety of Protestant cults, the which predict, that erecting a Hebrew temple on the site of Jerusalem's Dome of the Rock, will unleash "End Times" events, leading to the Rapture, thus, presumably, freeing them from the obligation to meet next month's mortgage-payment.

The name of the issue underlying each and all of those mental disorders of the symbol-minded, is "Bad Infinity." In gnostic parodies of Christianity, such pathetic symbol-mindedness may assume the form of "End Times" prophecies. In respect to Classical art, it appears as the inability to accept the notion that a future event, the apprehension of the metaphor at the close of a poem or musical composition, must efficiently shape the development of the composition at each preceding point in time. Thus, the distaste for Classical poetry and music among the cognitively illiterate, such as the wont for the rage-brimming, Brechtian soap-operas of "Country and Western" whines, like the wont for today's rutting-and-gore, story-free Hollywood entertainments, reflects the flight from *Agapē* to *Eros*.

The Classical composition, in any medium, follows the underlying model of the Greek Classic, the same Classical humanist model found in the educational programs of the Brothers of the Common Life and in the Schiller-Humboldt program for Classical Humanist education in Germany. Such education, and such art, submits to the policy, that the development of the mind of the young, must be the student's experience of the reenactment of the actual process of original discovery of a principle of nature within the sovereign domain of the individual student's mind. The re-discovery of the principle, at the end of that reenacted experience, is, thus, akin to the final hypothesis of Mozart's ***Ave Verum Corpus;*** in music, as in Paul's ***I Corinthians*** 13, as in life, the "test of death" returns our thought to an agapic vision of life's meaning.[74]

As Mindy Pechenuk's description showed, Mozart's setting of this motet, leads the music through a succession of hypotheses, thus impelling the singers and audience into the kind of excitation of the sovereign cognitive processes of the individual mind, which evokes the experience of re-creating Mozart's discovered principle, and thus evokes the quality of emotion which Plato and the Apostle Paul identify as *Agapē*. Thus, music, so employed, evokes the highest level of Reason.[75] This is the same Reason employed to effect either an original, valid discovery of natural principle, or the reenactment of that original, sovereign mental act of discovery.

Motivic thorough-composition, a revolution effected within the domain of J.S. Bach's well-tempered polyphony, demonstrates the two fold absurdity of the claims upon which Immanuel Kant bases the entirety of his famous *Critiques*. Mozart's ***Ave Verum Corpus*** demonstrates not only that the principle of valid original discovery of principle is cognizable, but that the same principle of Reason which Mozart employed for this composition, is the principle of Reason underlying all valid scientific discovery. The most fundamental principles of either art or science can be comprehended, only if we reject the irrationalist war-cry of Kant's ***Critique of Judgment,*** Savigny's hermetic separation of natural science (*Naturwissenschaft*) from art (*Geisteswissenschaft*), to recognize the underlying interdependency of art and science, as did the founder of comprehensive mathematical physics, Johannes Kepler. The notions of potential (i.e., cardinality) and efficient time-reversal, as adduced from Classical musical

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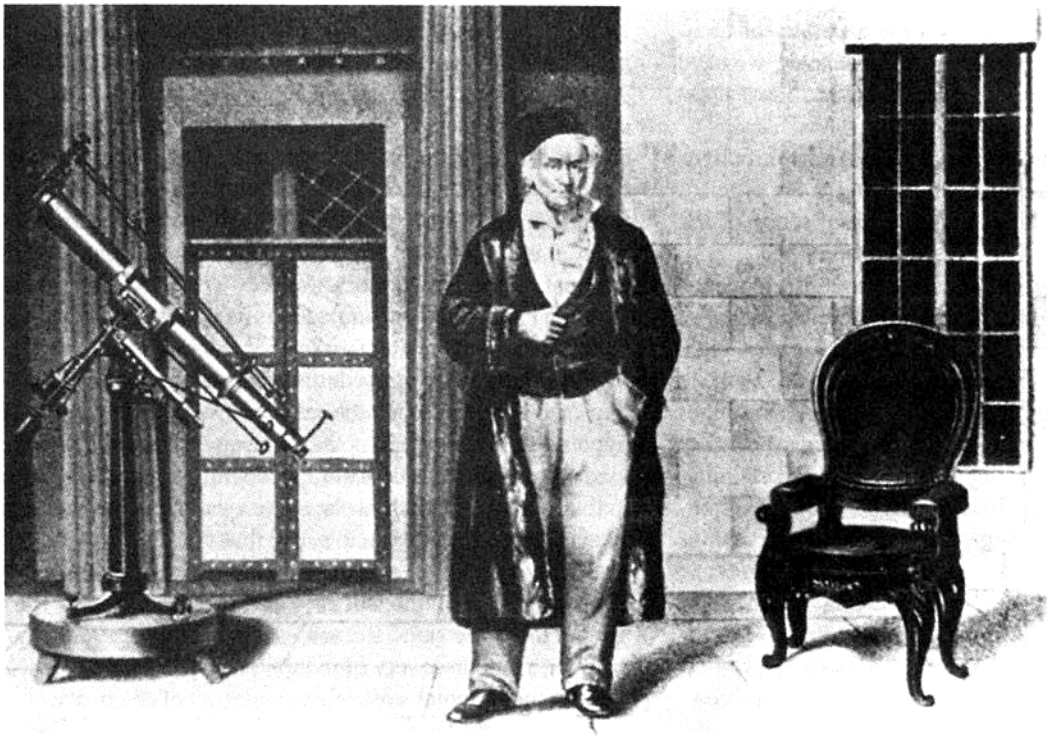
73. Unfortunately, there are performing musicians who attempt to breathe the spirit of such program notes into their performances, with all-too-common catastrophic results. Such obscenities could please no one but music critics and other devotees of the satanic cult of the *Zeitgeist*.

74. Thus, the importance of the Requiem Mass as a musical subject for Mozart and Beethoven. What joy could be found in the interment of a family member, or close friend, except that we return from such ritual refreshed in our commitment to free living from enslavement to the banal eroticism of petty things, to live a life whose duration shall have become durably necessary for humanity even long after one's passage through life has ended. This is not a matter of symbolisms; it is a matter of *Agapē*, in the sense of the term common to Plato and the Apostle Paul. In all art, all science, the composition whose conclusion defines, retrospectively, every moment of its unfolding, is the heart of the matter. Thus, the "test of death"; thus, the *Agapē* of the Lacrimosa of Mozart's ***Requiem,*** as contrasted with the ugly erotic parody of this Mozart Lacrimosa within the gnostic Hector Berlioz's blaring, Bonapartist ***Requiem.***

75. In this way, the true "religious feeling"—*Agapē*—is evoked, by Reason, *not* as irrationalist, Romantic, psychotomimetic exaltation.



Carl F. Gauss (1777-1855). He identified mathematics as "The Queen of the Sciences"—by which he meant that it was not the king. It is physical economy, which is "The King of the Sciences," LaRouche writes.

compositions such as this, are general for art and science: they involve identical cognitive potentialities of the individual mind.

Employ this musical context to explore a deeper meaning of "the future acting upon the present." At first, the thought will be a stunning one; then, gradually, the initial shock of astonishment will gave way to the consoling reassurances of Reason.

"When" is the future? At what point in time? Similarly, what is the beginning-point in time from which to define the cumulative past with which the future is to collide? The answer to this seeming paradox, was already known by Plato, by Augustine of Hippo, and, therefore, also, Thomas Aquinas: *All time is subsumed under a general regime of simultaneity!* The highest expression of *change,* is that lattice of higher hypotheses which expresses the transfinite notion of hypothesizing the higher hypothesis. What underlies that lattice? That lattice is underlain by what Plato distinguishes as *the Good.* In the analysis situs of hypothesis, that Good is "simultaneously" efficient in all times and places which might exist. Thus, in those terms of reference, the past and future, as hypothesis, are existent as efficient agency in each present moment.

Stunning? Consider, and remove the false assumptions which might be attributed, mistakenly, to what has just been uttered here. Does this signify that each and all events are predetermined—"predestined." No: recall the conditions of analysis situs which we have imposed, repeatedly, upon this report's content, from the outset. Everything we have said here on this matter, to the present moment of writing, is premised upon, and delimited to statements respecting the set of relations defined by the general principle of hypothesis, even as Riemann's 1854 habilitation dissertation expresses that Platonic principle as its pivotal foundation. The general set of relations defined by the principle of hypothesis are otherwise describable as relations within an hierarchy of available "pathways of change." The ordering principle underlying this hierarchy is cardinality, as we have indicated that principle of ordering of Riemannian physical space-time manifolds here. It is in terms of efficient choices of pathways of change, that the future acts upon the present. So, the choice of conception (higher hypothesis) reached with the conclusion of a Classical piece of motivic thorough-composition, determines the potentialities of each subsumed hypothesis, and, thus, of each interval of tolerable counterpoint, within the composition as a whole.

Therefore, we must anticipate the implications of time-reversal to be manifest in those instances a change in choice of hypothesis, to one of relatively higher cardinality, is demanded of us, as by the eruption of an undeniable anomaly from within the domain of experimental physics.

Physical economy as 'The King of the Sciences'

Look at that from the standpoint of the science of physical economy. C.F. Gauss famously identified mathematics as

"The Queen of the Sciences," which, the feminists must excuse us, was intended to indicate that mathematics must not be king. As for Nicolaus of Cusa, for Leibniz, and for Riemann, the essence of physical science lies with the employment of measurement to demonstrate those valid principles of nature accessed through either experimental physics or similar methods of inquiry. It is through experimental physics, and similar methods, that we demonstrate that every valid discovery of principle increases man's power of local intervention into the universe. However, it is only in the domain of physical economy, that we demonstrate the same principle applies to the relationship of mankind to the universe as a whole. Physical economy is "The King of the Sciences."

The principle of hypothesis affects the potential relative population-density of mankind by two pathways. In the guises of Classical art-forms, mankind discovers new, higher qualities of institutions, such as the constitutional modern nation-state, the institutions of education, the institutionalization of scientific and technological progress, and so on. In the guise of contributions to progress of science and technology, the productive powers of labor are advanced. It is the interrelation between the two aspects of these changes for human progress, that mankind's functional relationship to the universe is defined.

Human history, and pre-history, so read, shows that the universe is so designed, that whenever man's demand upon the universe is expressed as valid hypothesis, the universe obeys man. That, whenever man's demand upon the universe is expressed as a valid change in hypothesis, the universe obeys man's will. Thus, the pathway of change marked by valid directions in hypothesizing the higher hypothesis, expresses, as experimental physics, and as the increase of potential relative population-density, the lawful ordering of the universe. That demonstration is the essence of science; it is the only source of knowledge of that which we might regard as the laws of the universe. In that sense of the matter, we are obliged to end foolish babbling about "scientific objectivity," and think of "scientific subjectivity," instead.

In that sense and degree, the ordering within the domain of valid hypothesis does define the lawful ordering which *governs* the universe. It is upon that premise, that we may be certain of the efficient principle of "time-reversal" in physics, as well as Classical musical composition.

Consider as a relevant case, the choice of the future expressed by formulation of economic policy by the government of a modern European model of nation-state republic, such as our Federal republic under the anti-British, anti-Metternich, anti-"free trade," American System of political-economy, embedded as the intent of our Federal Constitution.

Contrary to the sewage which has spoiled the mainstream of economic-policy thinking the recent thirty years, the making of U.S. economic policy during all successful periods of our history, since the earliest period of the English colonies here, has been premised upon a commitment to investment in scientific and technological progress. Under the governance of such a higher hypothesis of national self-government, each promoted change in patterns of investment, production, employment, and trade, has represented shifts from practice of relatively lower cardinality to higher cardinality. Or, to say the same thing, in effect: In choosing the hypothesis of relatively higher cardinality, we have chosen the better future inhering in the latter hypothesis.

To provide the relevant contrast: Without introducing such considerations, of change of hypothesis, into policy-shaping, the relationship of future to present becomes as paradoxical as it was for Nobel Prize-winner Kenneth Arrow.[76] It is the transitions from one phase-space to a higher one, under penalty of "entropic" technological attrition if we do not so change, which display the functions of time-reversal in a clearer, relatively more immediate way.

It is so in life, as Mozart seeks to remind us in his setting of the ***Ave Verum Corpus.*** "The test of death": How shall I choose to live under the impact of the certainty of death? From the standpoint represented above, the answer is neither obscure, nor remote.

If I am conscious of the content of my own knowledge and practice, in the manner underlying a Classical humanist form of education, then I know that most of what I know represents valid discoveries of principle effected by individual original discoverers, some known by name, more unknown, most located deep in the lost pages of pre-history. In reenacting their discoveries of principle, I have relived in my mind, moments from the interior of their own. I am closer to these long-deceased persons than to most of the daily associates of my childhood, youth, and adult life. If I aid in transmitting these precious gifts from the past, into the countless generations of the future, and perhaps add one or two such gifts of my own, I am certain that my life will have been a necessary one: both a fulfillment of the past, and a gift to the future. I have thus met "the test of death."

That illustration implies the crucial point. It is in the terms of the relations of hypothesis, and in no other way, that the issues of scientific principle are rendered intelligible, even the rudimentary consideration that all processes in the universe are subject, as Wilhelm Weber's appreciation of Ampère's work, or Max Planck's related discovery attest, to an alteration of their curvature by efficient "time-reversal." That principle is already implicit in the deeper meaning which Plato's ***Parmenides*** supplies to Heracleitus' maxim, "Nothing is constant, but change"—nothing is real, nothing is efficient, but the quality of change which is located in the analysis situs of those relations defined by the architecture of hypothesis.

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76. loc. cit.