EIR Feature

Physical economy is the basis of human knowledge

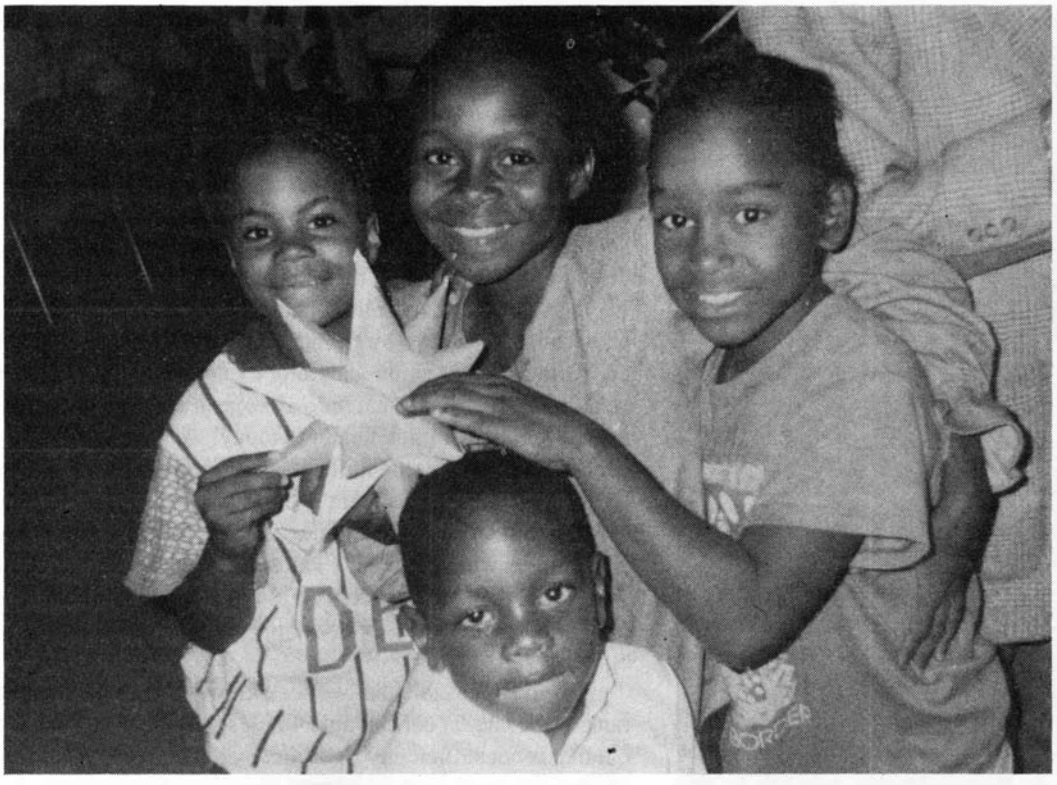
by Lyndon LaRouche

American statesman and physical economist Lyndon LaRouche was freed from prison, where he was held a political prisoner for five years, on Jan. 26. The following is Part 2 of a series entitled "The Science of Physical Economy as the Platonic Epistemological Basis for All Branches of Human Knowledge." Part 1 appeared in our Feb. 25 issue.

It would be an exaggeration, to say that the range of behavior of an animal species is delimited in a way which corresponds neatly to a notion of the formal logician's "hereditary principle." We can say, that members of animal species cannot transmit axiomatic-revolutionary forms of discoveries, as conceptions, from one generation of that species, to the next. It appears that, in sharp contrast to the human species, an animal species cannot willfully improve its behavior in the way the radiation of an individual person's scientific discovery of an axiomatic-revolutionary quality is the cause of a revolutionary advancement of the potential population-density of the human species.

Although "animal intelligence" does not correspond simply, ontologically, or otherwise to any system of formal logic, animals lack that principle of intelligent behavior which otherwise sets intelligent behavior apart from, far above any formalist's view of today's generally accepted classroom mathematics. "Animal intelligence" manifestly shares one quality with formal logic; it excludes ontologically the distinguishing, creative characteristic of human reason.

Human knowledge up to the present day is the continuing elaboration of an accumulation of successive, axiomatic-revolutionary discoveries over perhaps as far back as 2 million years. Reaching back less distantly, to recent millennia of European culture, we can trace all that we know of the roots of modern science through early discoveries in geometry, such as the Pythagorean theorem, Eudoxus' principle of exhaustion, and Plato's treatment of the regular polyhedral solids. With less exactness, but with essential certainty, we can trace back certain features



Construction of a stellated dodecahedron at a geometry class at the Child o' Mine day care center in Southeast Washington, D.C. "Reaching back . . . to recent millennia of European culture, we can trace all that we know of the roots of modern science through early discoveries in geometry, such as the Pythagorean theorem, Eudoxus' principle of exhaustion, and Plato's treatment of the regular polyhedral solids."

of this development of science to times and places long before Classical Greece, chiefly through the development of solar astronomical calendars: before 6,000 B.C. by channels of the Vedic culture of Central Asia, through such channels as Egypt before the pyramids, and also from the ancient roots of China's culture, perhaps earlier than 15,000 years ago. In general, we can prove geometrically that each step among even those more remote discoveries required an axiomatic discontinuity with respect to any attempted formal representation of a preceding state of knowledge. We also know that such discoveries have an implicit, although not necessarily denumerable successive ordering, an ordering determined by the notion of necessary predecessor.

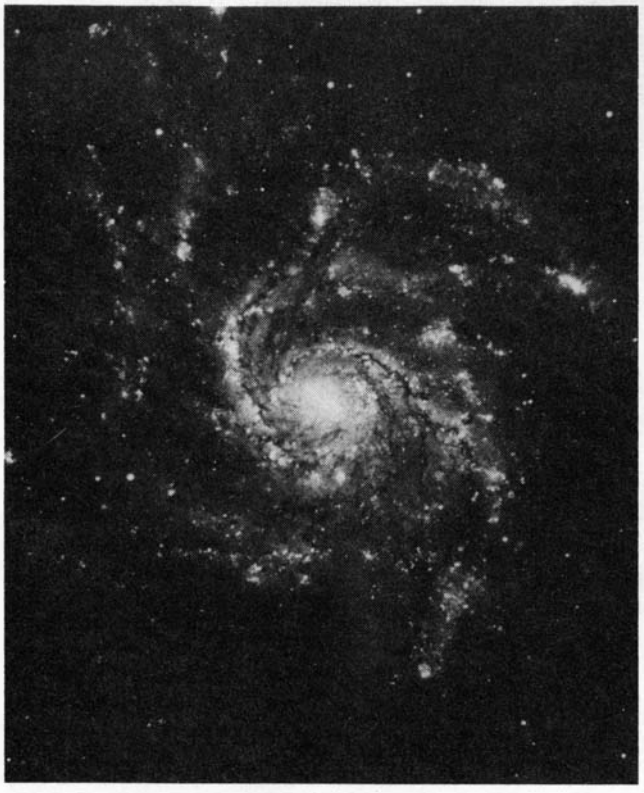
We have shown earlier in other published locations a similar, philological and physiological case for the rational development of European Classical music, for example, from the vocalized poetry of many thousands of years ago, through the necessary, most recent development of Classical polyphony by Haydn, Mozart, and Beethoven: all on the foundation of earlier development of Florentine methods of *bel canto* voice-training and of J.S. Bach's more immediate well-tempered revolution in counterpoint.

To grasp adequately this principle of axiomatic-revolutionary discovery, otherwise termed "Platonic hypothesis," we must rise above the popular myth of so-called "scientific objectivity," to the higher vantage-point of "scientific subjectivity." This is the place in the present report to supply the following interpolation.

Science as Classical poetry

Contrary to prevailing opinion among today's professionals, and also contrary to today's popular opinion, the "secret," if you will, for accessing true human knowledge was presented in a fresh way by Georg Cantor's treatment of the transfinite. At this point in our report, that principle of knowledge is located by "triangulation" of three points of reference: Cantor's principle of transfinite *types,* Cantor's direct comparison of that principle of the higher mathematics with Plato's treatment of the relationship between the *Becoming* and the *Good,* and a comparison of Cantor's work and Plato's method with the inner artistic principle of composition of Classical tragedy. We now describe that summarily, as follows.

In each of those three facets of today's accumulated human knowledge, and in all taken together, we see that, relative to any attempted formalist representation of knowledge, that knowledge exists in no such formalism, but rather in no less than that Cantorian type of principle by which each and all successive phases of man's progress are ordered. To sum up this point in the simplest admissible terms: In contrast to a formalism, such as today's generally accepted classroom mathematics, knowledge is not symbolic, but is premised upon a process of successive axiomatic-revolutionary discoveries. Knowledge lies not in any among those successive discoveries as individual elements of a series, nor in an formal construction derived from a collection of such elements. In contrast to the formalist standpoint, knowledge appears as



A spiral galaxy in Ursa Major (32 NGC 5457). "Perhaps we shall not reach deeply enough into the interior of the atomic nucleus until we have completed the appropriately corresponding work of exploration of space."

a succession of those "mathematical discontinuities" which mark the formally impassable boundaries separating the lower form of knowledge from the higher.

These boundaries, these singularities are bridgeable only by that principle of discovery under which Plato subsumes commonly the distinctions among hypothesis (discovery), higher hypothesis (principle of successive discoveries, or type of discovery), and hypothesizing the higher hypothesis (the ordering of revolutionary improvements in method of discovery).

As a matter of contrasts, modern empiricism is formally *reductionist*. It seeks to find the smallest, ostensibly indivisible element of matter, to the purpose of defining the universe as a whole inductively, by building upon the assumedly most elementary relationship among the most elementary building-blocks of matter. As that reductionist method is exemplified formally in the extreme by Bertrand Russell and Alfred North Whitehead's *Principia Mathematica*, such radical empiricists or positivists adopt the same fallacy met in today's popularized neo-malthusian foolishness of "non-parametric" statistics: the absurdity of seeking a substitute for causality within the empty expanses of bare linear space-time.

On the contrary, the ontological principle illustrated by Plato's *Parmenides* obliges science to seek knowledge by ascending to that inclusive whole which is not comprehensible as a member of the set which it externally bounds and defines. In a sense, we must find the pathways to the secrets of microphysics in astrophysics; perhaps we shall not reach deeply enough into the interior of the atomic nucleus until we have completed the appropriately corresponding work of exploration of space. We must find the lawful basis for causal determination of the relationship among parts in the principles of ordering of the universe in the astrophysical very-large.

It is relevant, that the most ancient known roots of modern physical science may be found, tens of thousands of years ago, in the solar astronomical, long-cycle calendars of Central Asia from which historical Indo-European and Chinese civilizations sprang. Coming nearer to today, we have similar evidence of the development of solar astronomical calendars in Egypt long before the great Pyramids were designed. According to such ancient evidence, even before historic times, any culture which lacked a calendar of more than 26,000 years, based on a sound conception of sidereal and solar cycles, was pathetically poor in its relative cultural development.

It is indispensable that we seek knowledge in the highest rank of the largest conceivable wholes, not the smallest part; but that is not sufficiently rigorous, by itself. We must examine the accumulation of human knowledge by means of a constant criticism of our own thinking-processes at each stage of generating, regenerating, and transmitting scientific knowledge. In each successive phase of this process, we must attain a higher level of conscious reasoning by adopting the relatively lower levels of our own thinking as the sensuous-like objects of consciousness. This is the method of Plato's Socrates, of ferretting out and rendering intelligible the often hidden, often provably false axiomatic assumptions which underlie carelessly a tolerated blind faith in that received as authoritative opinion.

What else could be a more useful method today? Virtually all governments have been ruining the planet over decades, by tolerating generally accepted academic opinions on economics, opinions which have all long-since proven themselves, by events, to have been virtually a global mass-suicide pact among nations.

It is not sufficient to accept the fact, that we must achieve conscious control of those blind assumptions which govern the tongues of the illiterate Ph.D.s, and of others today. To render this Platonic method, and its terminology, truly intelligible, Plato himself would have considered it quite proper that we imagine this Socratic process as like a classical tragedy being performed before a theater audience. After all, are not his dialogues written as dramas? The players are performing the script on stage. The audience is watching the minds of each of the characters on stage, and the playwright, seated in a box above both stage and audience, is watching the minds of the members of the audience, and thus seeing his own mind's activity more clearly in that way.

Let it be said, in memory of Plato, Dante Alighieri, Leonardo da Vinci, Raphael Sanzio, Johannes Kepler, and Gottfried Leibniz, that without a mastery of the Classical fine arts, there can be no true physical science. Without rejecting the irrationalist, romanticist aesthetics of Immanuel Kant, the skills of the physical scientist dwell in but a small imperilled oasis within a Dionysiac wilderness of a Wagnerian opera, within the irrationalist, romantic mind of a raving, existentialist beast. Unless the leaders in physical science reject Kant and Friedrich Karl Savigny's barbaric dichotomy of *Naturwissenschaft* (natural science) and *Geisteswissenschaft* (art), unless they reject contemptuously the existentialist lunacy of "art for art's sake," physical science as a whole tends to become sterile; powers of creativity are lost, and only the soulless formalities of a no longer creative, dead science remain, until even that, too, is rotted away. "The play's the thing, to catch the conscience of the king"; in the great Classical tragedies of Aeschylus, Miguel Cervantes, William Shakespeare, and Friedrich Schiller, the doors to the innermost secrets of creativity in natural science are opened for the sake of those willing to enter. Imagine the tragedy as a Plato dialogue, and discern the structure of that dialogue to parallel Cantor's exploration of higher reaches of the transfinite.

Imagine that that play we chose to watch, follows the practice of such classic Platonic tragedies as Cervantes's celebrated prose-drama *Don Quixote,* in which the characters within the tragedy step briefly out of their roles to address the audience in soliloquies. These soliloquies have the effect of a character's showing his or her awareness of the audience; but, there is a certain ambiguity about this: Is the player speaking to the audience in his capacity as the character portrayed, or as the actor playing that part? As the audience is watching the drama, the drama is looking into the mind of the audience; this is the case at the same time that the soliloquist is presenting a view of the state of mind of the characters within the ongoing drama.

The common essential of all these relations, within the performance of the author's drama before an audience, is conscious viewing of consciousness as were that latter consciousness itself a sensuous object. The audience is watching the consciousness of the characters portrayed, as it is prompted to do so by such devices as Shakespeare's or Cervantes's soliloquist. The playwright is focused upon the conscious processes *within the minds of the members of the audience*. In a great tragedy, such as the *Prometheus* of Aeschylus, the tragedies of Shakespeare, and, most clearly of all, of Schiller, the interplay inhering in one consciousness being treated as an object by another consciousness is a truly Socratic dialectic.

All true human knowledge is Socratic in that sense. We touch knowledge as we rise above the beasts, as we rise above the empiricist's folly of knowing no objects but his blind faith in his felt reaction to the object-images of his sense-experience. Knowledge begins as we shift our attention away from his faith in his sense-perceptions, as we begin to search out the hidden, axiomatic assumptions which permeate and control the way in which we judge our own, and others' conscious processes of judgment, of opinion-making. Knowledge begins as we explore the implications of making indispensable modifications of those previously hidden assumptions which we are able to uncover, those axiomatic beliefs earlier hidden from our awareness.

Thus, great drama, especially the great classical tragedy reflected by such as Aeschylus, Shakespeare, and Schiller, is a wonderful, health-giving stimulus, a taking of pleasure in scientific rigor. Merely accepting a taught formal mathematics, is learning, not knowledge. As both the known and hidden axiomatic assumptions of all mathematics are treated as conscious processes, which are, in turn, properly objects of conscious criticism, that joyous experience which is truth-seeking knowledge begins.

Viewing Classical Greece through the eyes of Plato, one sees that knowledge begins by rising above contemplation of blind faith in sense-experience, to examining the states of consciousness associated with judging sense-experience.

This dramatically Socratic criticism of assumptions is no merely arbitrary negation. This point is conveniently illustrated by recognizing that Cantor's discoveries are a reflection of that same method of exhaustion we meet in the work of Plato and Archimedes, for example. The principle of solution in the case of Plato's *Parmenides* ontological paradox, as Cantor and Kurt Gödel have addressed this successively, is key to understanding the way in which the method of exhaustion succeeds. Briefly, we have the following.

Given, the recent 2,500-odd years of known history of civilization, and of education: The formal side of the proper education of the child, for knowledge instead of today's slapdash, behavioristic learning, comes into focus near the onset of adolescence, with the study of classical geometry, and a concurrently included study of Classical Greek culture from the reference-point of Plato's dialogues. In contrast to such stupefying empiricists as Pietro Pomponazzi, Francis Bacon, John Locke, David Hume, and so forth, Plato aids the student in overcoming the bestiality of blind faith in sense-experience as such. Viewing Classical Greece through the eyes of Plato, one sees that knowledge begins by rising above contemplation of blind faith in sense-experience, to examining the states of consciousness associated with judging sense-experience.

The method of judging is typified by Eudoxus' principle of limits. Drive every assumption to its limits, seeking out the way in which the ontological paradoxes, of the type presented in Plato's *Parmenides,* are forced into consciousness. So, the higher (than empiricist) state of consciousness associated with Platonic *hypothesis* is made a subject of consciousness. Our awareness of a state of consciousness of *hypothesis* as a Cantorian type, is consciousness of *higher hypothesis,* and so on. Thus, the secrets of physical scientific discovery are embodied in great dramatic tragedies.

The limit which situates the hypothesis of axiomatic-revolutionary discovery, is always as Plato's *Parmenides* defines it. This is the definition illustrated by Nicolaus of Cusa's revolutionary solution to Archimedes' formulation of the paradoxical chore of squaring the circle. By leaping directly to the outer limit of a process of generating evermore many-sided, regular, inscribed and circumscribed polygons, it is shown that such an increasingly precise method for estimating a numerical value of π could never bring congruence between the perimeters of the polygon and that of the circle. The two are of different species, the principle of *circular action* the superior species bounding "externally" the process of generating the polygons.

In that circa A.D. 1440 discovery by Cusa, we have the axiomatic germ of Leibniz and Jean Bernoulli's demonstration of a non-algebraic form of universal least action. Similarly, Carl Gauss's derivation of his *pentagramma mirificum* from examination of the principles of Keplerian regular and semi-regular partition of the internal surface of a spherical shell, is a fresh insight into the nature of the Golden Section in respect to the Platonic solids, not as a coefficient in Galileo's dynamics, but as an external bounding of a geometrical process driven to its limit.

Cusa's discovery of the absolute distinction between a circle and *circular action,* the germ of modern transcendental functions, is taken as an intelligible example of the principle of hypothesis. Grasp that discovery in terms of the type of generating principle to which it belongs; reach thus an intelligible representation of the notion of Platonic higher hypothesis. Once the preconditions for Cantor's work are seen in this kind of classical-tragic dramatic setting, as prompted by the relevant paradoxes treated earlier by Gauss, P.G. Lejeune Dirichlet, Berhnard Riemann, and Karl Weierstrass, the students' consciousness is lifted above the chimeras of naive denumerability, and the once awesome face of hypothesizing the higher hypothesis assumes friendly, intelligible form.

Cantor's writings reflect his own experience with such discoveries. Yet, more stunning at fresh encounter then than even all the reflection upon the role of hypothesis in scientific discovery, is the re-reading of Philo *On Creationism,* and the Christian writers on the interrelated topics of *imago Dei* and *capax Dei*. Acknowledge Plato's conceptual distinctions between "Becoming" and "Good," as Cantor insists that these parallel his own distinctions between "transfinite" and "absolute"; see then the meaning of *imago Dei* and *capax Dei* as that species-nature of the individual person which, according to Genesis 1:25-28, sets mankind absolutely above all other existence within a temporal universe.

Man's ability to replicate the behavior of Aristotle and Bertrand Russell's formal logic, we can simulate by a mere machine designed to handle such ontologically trivial matters as simultaneous linear inequalities. Poor Aristotle, poor Immanuel Kant, poor G.W.F. Hegel, poor Russell; one must wonder if they are not condemned to reside in Dante's Inferno forever, their tantalizing punishment that of being instructed monotonously throughout eternity in "the practical reason" by one of poor John Von Neumann's machines! Their crime, for which they might be punished so appropriately, is that their evil life's work was devoted to preventing their dupes from discovering the beauty of what it can be to be human.

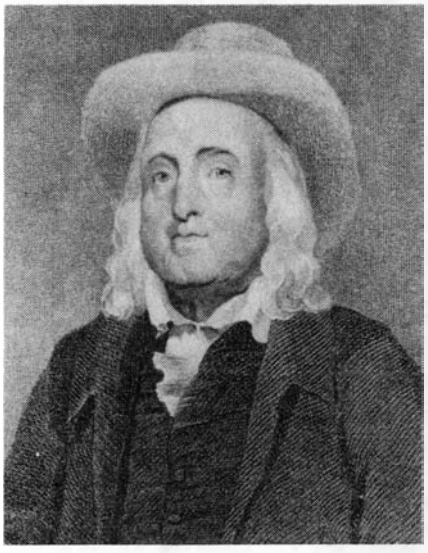
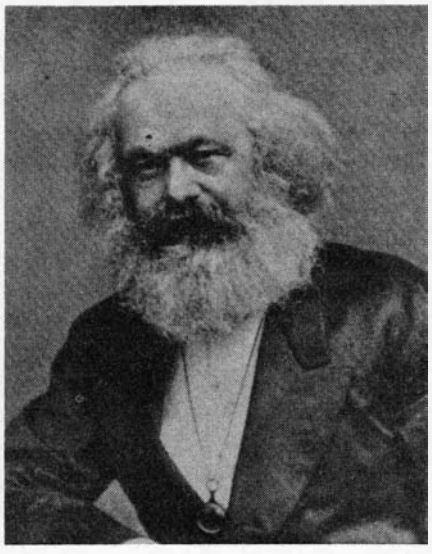
The form of the interdependent qualities of *imago Dei* and *capax Dei* is reflected uniquely in that quality of supra-formalist creative reasoning which is directly illustrated in valid axiomatic-revolutionary discoveries in science, and in analogous discoveries in the Classical forms of the fine arts. From the standpoint of making ourselves conscious of the successively higher layers of our own capacity for scientific and artistic thinking, we recognize hypothesis, if but negatively, at the paradoxical, Eudoxian limit typified by Plato's *Parmenides* and Cusa's *De Docta Ignorantia* and *De Circuli Quadratura*. We recognize creativity, in its form as hypothesis, as the formal discontinuity implicit in any axiomatic-revolutionary form of discovery.

With those considerations of scientific progress as a subject of Classical tragedy in view, now view the conflict among Leibniz, the Physiocrats, and the British free traders as such a tragedy.

The tragedy of empiricism

The essential falsehood, the lie upon which the teaching of the Physiocrats, Adam Smith, Jeremy Bentham, Karl Marx, John Stuart Mill, and John Von Neumann is commonly premised, is the same lie about mankind for which Aristotle, Kant, Hegel, and Russell might be justly tantalized forever in Dante's Inferno. Contrary to such persons, that historical increase in mankind's potential population-density which sets mankind apart from and above all other creatures within temporal eternity, defines individual persons as in the imperfect image of the Creator. This is so by virtue of manifest powers of axiomatic-revolutionary forms of efficient creative powers: in Latin, the powers of *imago Dei* and *capax Dei*.

One of the subjects of this report is, that those customary pagan Gaia-worshippers, the Physiocrats, deny such creative powers to man. It is appropriate that the core of these Physiocrats was provided by a political union of feudal landlords and financial usurers, like the North American defenders of the institution of chattel slavery. In the opinion of such worshippers of that old whore of Babylon earth-mother, it is a capital


Contrary to the beliefs of empiricists like (left to right) Jeremy Bentham, Karl Marx, and John Von Neumann, the historical increase in mankind's potential population-density sets man apart from and above all other creatures, and defines individual persons as in the image of the Creator.

crime of *hubris* to attribute the image of the Creator to that mere serf, or slave for whom they would care no more, perhaps less than the cattle they compassionately fatten for slaughter.

Adam Smith's employers were a late-eighteenth-century variety of British Liberals, radical empiricists. Therein lies the nub and source of their differences with the Physiocrats.

The Physiocrats, together with their allies among the banker usurers, were defending their traditionally greedy bucolic's forms of feudal oligarchism, defending their usurious social customs, so to speak, against the encroaching social, economic, and political outgrowths of the fifteenth century's, Florence-centered Golden Renaissance.

The radical empiricists Earl of Shelburne and Jeremy Bentham exhibited the point of conflict with the Physiocrats, as they, from London, directed the Jacobin Terror of their agents Orléans, Robespierre, Danton, and Marat against France. The British East India Company's radicals were the Physiocrats' allies against the heritage of the 1439-40 Council of Florence, but were unwilling to subordinate their rapacious utilitarianism, their neo-Roman lusting for world empire, to the restraining force of any form of social custom, even that their sometime feudal Physiocrat allies. So, later, did Lord Palmerston's "Young Europe" revolutions of 1848-49 treat Britain's faithful allies Metternich, the czar of Russia, and the king of France most ungratefully.

Formally, there are two essential differences between the empiricists and the best spokesmen among the Physiocrats, Quesnay and Turgot. First, the best Physiocrats have a clear sense of the structure, if not the functional characteristics of the productive process, where the empiricists, from Smith through John Stuart Mill and Jevons, never have. It is essentially on this single count of Marx's debt to Quesnay that he is superior as an economist to his Haileybury predecessors, and to the modern monetarists. Secondly, the leading Physiocrats believe in the existence of a net social profit to society as a whole, whereas the empiricists do not. Although Marx the economist is superior to Smith and David Ricardo on one point, he is otherwise, mathematically, the faithful follower of Bentham and Ricardo. That said, we have situated ourselves to concentrate upon the formal side of empiricist economics.

The key to a mathematical reading of the economic dogmas of Smith, Bentham, Thomas Malthus, Ricardo, Marx, and Mill is the social doctrine of John Locke. In Locke's system, society is merely the aggregation of a large number of discrete, neo-Aristotelian particles, people, into an interacting, polymorphous tangle defined essentially by the consideration that each of these particles is motivated by nothing more than three primary impulses: to stay alive (Life), to pursue sensual gratifications (Liberty), and greed (Property). For Locke, there are no "innate ideas." Excepting a lively, utterly amoral libertarian zest for greed, the individual is born a "blank slate" (*tabula rasa*). This, Locke's definition of "human nature," serves as the axiomatic basis for the "hedonistic calculus" of Bentham, and, later, the radical-positivism "systems analysis" doctrine of Von Neumann et al.

Each and all of the formal systems presented by Smith, Marx, et al. demand no more sophisticated a form of mathematics than a system of simultaneous linear inequalities. Marx's would not be as crude a model as Von Neumann prescribed, but there is nothing essential in *Capital* which is not implicitly encompassed by such a general system. For this reason, the mathematical form of the ideas of each of

these political economists, from Smith and Marx, through Von Neumann and his followers, produces a zero-growth model. Perhaps what we have just said on the distinctions and kinships of Marx and John Von Neumann was in the minds of Cambridge's Joan Robinson and Nicholas Kaldor, as they blended portions of Marx, John Maynard Keynes, and Von Neumann to cook a poisonous Cambridge proprietary "systems analysis" stew for export into the International Institute of Applied Systems Analysis's (IIASA) Moscow.

The crux of these connections is, that systems representable in the form of simultaneous linear inequalities describe only "zero-growth systems," or, more precisely, entropic processes. Consequently, to the degree a successful effort is maintained to regulate any physical process according to the specifications of such a mathematical system, that physical process will have imposed upon it in this way a negentropic form of degeneration. We should add the corollary observation, that even processes which are not otherwise inherently entropic will, if so controlled, either slowly degenerate in this way, if they do not abort such control by collapsing outrightly.

Under these conditions, a policy-shaping system which describes mathematically an entropic process, if used to control a society, will drive any society so controlled to entropic collapse. That is the key to the ongoing spiral of collapse of both the former Soviet and the Anglo-American systems.

3.0 Negentropic processes

The essential lesson which all literate persons must learn from the presently ongoing collapse of the global economy as a whole, is that whenever a physical process, such as an economic process, is efficiently regulated by ideas whose mathematical representation is entropic, the result will be a collapse of whatever process was effectively regulated in this way. Thus, we have indicated that the efficient, increasingly strict imposition of the ideas of John Locke, of Adam Smith, et al. upon more and more of the world's economy, is the leading cause for the want and chaos spreading throughout the United States and the world as a whole during the recent quarter-century.

To this effect, we have indicated already that the attempt to express the political economy of Adam Smith, Karl Marx, John Von Neumann, et al. in a form suited for administration of economic affairs, such as accounting, imposes an entropic collapse upon any economic process efficiently regulated in this way. We have emphasized that all possible mathematical descriptions of any among the British and derived dogmas in political economy, that of Marx's *Capital* included, has the inherently entropic characteristic more nakedly presented by Von Neumann's (zero-sum) systems of simultaneous linear inequalities. They are each and all, in fact, zero-growth models; therefore, they are each and all entropic models.

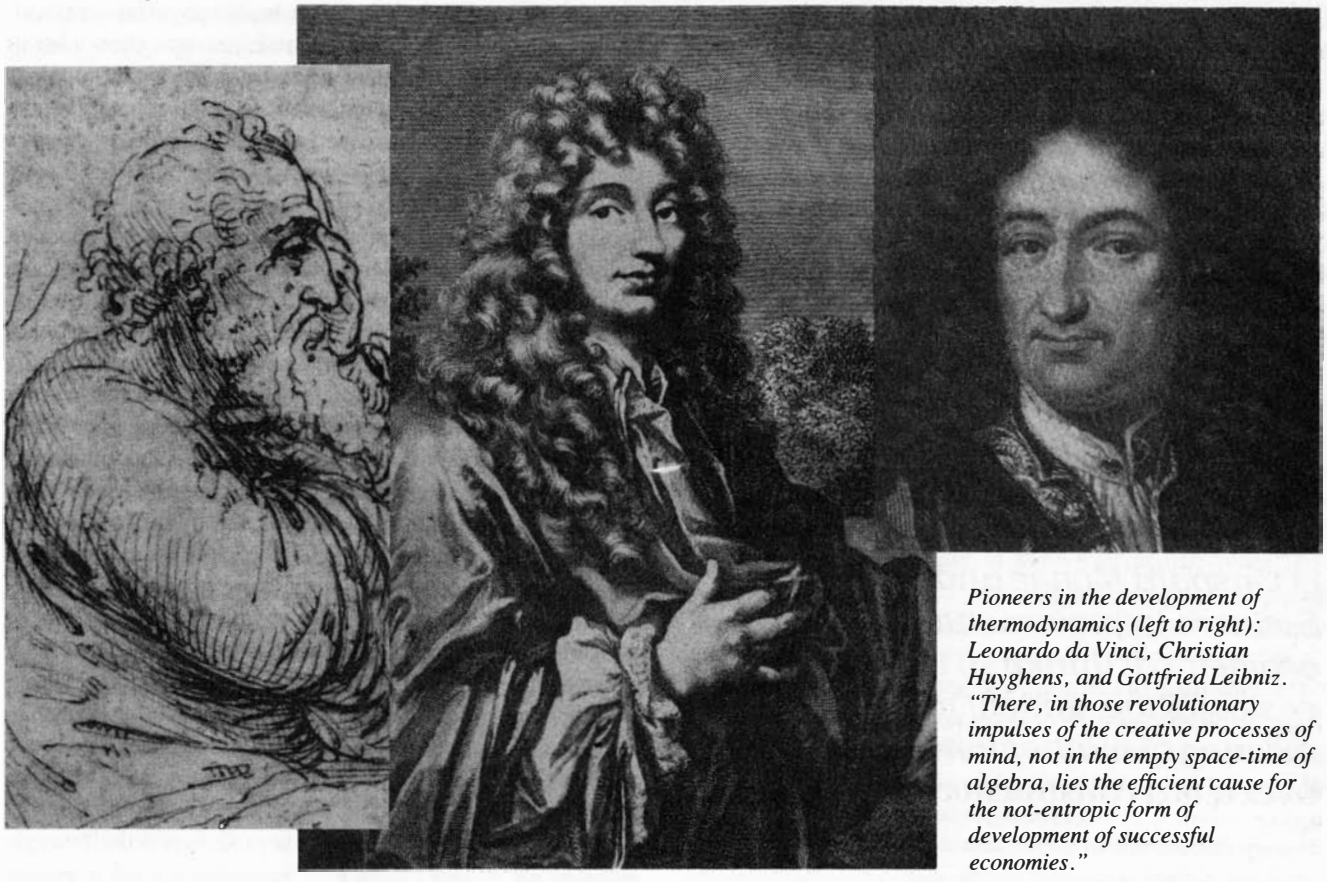
We have also indicated that, although the leading Physiocrats did recognize the possibility of a net physical profit to society as a whole, they denied that the generation of such a physical profit could be induced originally by willful human intervention.

We have indicated that real economic growth must be compared with such evolutionary models as our biosphere, or that implicit in such a view of our universe's generation of that array of elements and isotopes presented by the Periodic Table. We have stressed, that this "model" is certainly not entropic, but neither is it merely "negentropic" in the sense that the work of Ludwig Boltzmann, Norbert Wiener et al. define "negative entropy." Any consistent apologist for Boltzmann would be obliged to emphasize, more or less readily, that Boltzmann allowed the occurrence of reversed entropy only within the limits of what Von Neumann termed a "zero-sum game" for economy.

All of those British and derived models of political economy which are found in the pantheon of "Economics 101" are dangerously absurd, in that sense that any economy efficiently regulated by them must suffer a general collapse. Emphatically, any national or global economy tightly administered on behalf of present-day "neo-conservative" ideas of "democracy and free-trade," or of so-called "International Monetary Fund conditionalities," is doomed to collapse into a state of economic and political disintegration, into chaos.

We have also noted, in contrast to that dismal side of the matter, that the human race has exhibited some notable successes in political economy. We have risen from a species endowed naturally with cultural potentials at the level of baboons, from a potential living population of not more than approximately 10 million, short-lived persons, to a present global potential, at present levels of existing technologies, of about 25 billion and rising. We have taken the first steps toward the feasibility of not merely exploring, but colonizing nearby space. We have increased vastly the productive power and feasible standard of living and average life-expectancy in regions of the world economy which have access to the benefits of investment in scientific and technological progress. Such evidence of long-range, quasi-evolutionary forms of upward social development of systems of political economy is what we understood during 1945-63, for example, as the kind of referent which defined modern civilized use of the term "economic growth."

Although the causal principle of this progress cannot be represented in any existing form of generally accepted classroom mathematics, there are crucial adumbrated features of this process which, although anomalous in mathematical-physical implications, we may define more or less readily in terms which admit of representation as mathematically comprehensible forms of physical constraints. Those crucial adumbrated constraints show us that the process so reflected is absolutely not entropic. Although these constraints define an ordering which does not fit within the axiomatic assump-



Pioneers in the development of thermodynamics (left to right): Leonardo da Vinci, Christian Huyghens, and Gottfried Leibniz. "There, in those revolutionary impulses of the creative processes of mind, not in the empty space-time of algebra, lies the efficient cause for the not-entropic form of development of successful economies."

tions underlying the so-called three laws of Clausius-Kelvin thermodynamics, that ostensibly anomalous characteristic is precisely what must be represented. That representation suffices to show that the proper descriptive term for this anomaly is not "negative entropy," but the more modest term "not entropic."

This anomaly does not represent a reversal of entropy, but rather a completely different ordering of the relevant processes.

This anomalous form of the process parallels the similarly anomalous forms of living processes. Thus, we may say, that as the Classical Greeks of Athens carved their geometrical way of thinking about life in Acropolis stone, and as Nicolaus of Cusa, Luca Pacioli, Leonardo da Vinci, Kepler, et al. have presented this case during the past five and a half centuries of the existence of modern science, living processes are certainly not characterized by a statistical notion of "negative entropy," but are better described as simply "not entropic."

Consider the following, interpolated summary of the way in which a simplified, but indicative set of such constraints is built up for statistical comparisons.

As we have indicated above, the set of constraints which shows this anomaly must be derived from an expression of mankind's practical relationship to the universe as a whole. Obviously, since man's relationship to the universe is currently expressed in terms of Earth's location within our solar system, all these relations are reflected in mankind's habitation upon the planet's surface: per square kilometer. The functions of production and consumption, and correlated functions, of survival (reproduction) of the human race are expressed thus in per-capita values. Since the individual's demographic existence is a function of the family household, we must reflect this, too. We have, thus: total, per capita, per household, per square kilometer.

Man's activity on this account is represented chiefly as a correlative of *physical* production and consumption. The only forms of *services* which are closely correlated with those physical features, are education, professional medical care, science, and classical forms of the fine arts of poetry, drama, music, painting, sculpture, and architecture. However, the requirements for these forms of *services* are implicit in the cultural levels underlying sustainable successive increases in per-capita and per-square-kilometer physical productivity.

So, the indicative parameter of the reproductive relationship between the universe and mankind as a whole, is the Cantorian *type* of process represented by this view of humanity's consumption of its own production. This kind of "input-output" relationship is the pivot for an adumbrated notion of statistically representable "function." This undertaking is broadly analogous to squaring the circle. In the latter case,

as treated by Nicolaus of Cusa, the attempted squaring provides a linear approximation of the value of π, whereas the use of the method of exhaustion to show an absolute species-difference between the polygonal and circular perimeter forces the mind to recognize the superior ontological actuality of substituting non-algebraic *circular action* axiomatically for the naive Euclidean axiomatics of point and straight line.

The analytical key datum for defining this function, is the ironical relationship between the physical quantity of contents represented by the per-capita household or producer's market-basket and the number of labor force working-years of production per capita required to produce that per-capita market-basket of consumption. This market-basket, in turn, is correlated with relative cultural level of physical productivity per capita, per household, and per square kilometer. The physical constraints immediately associated with these ironical input-output relationships form the keystone for building the required statistical representations.

Unfortunately, to the degree mathematical training lays more or less primary emphasis upon algebraic thinking, rather than that of Gaspard Monge and Jakob Steiner's improvements in geometrical thinking, it is much easier for the student to lose that mooring of mathematical sanity which is a constructive geometry.

The first approximation made to this purpose, is the definition of *productivity*.

The first term of the general function for statistical representation of productivity is: The content of the physical market-basket must be improved in quantity and quality over successive intervals, but the proportion of the per-capita working year required to produce that improved market-basket must be less than the proportion required formerly to produce the old.

The second term of the same general function is: the ratio of per-capita expenditure for producers' goods, relative to households goods must increase, without lowering the per-capita households' goods market-baskets. This reflects the necessity for increasing "capital-intensity."

The third term of that same pivotal function, is the requirement of an increase in the ratio of "free energy" to "energy of the system." For this purpose, free energy signifies the increase of total market-basket physical value produced with respect to total market-basket physical value consumed. This margin of increase is absorbed chiefly twofoldly: in expanding the scale of the physical economy, and in increasing the capital-intensity of investment in production. These gains must be expressible not only in terms of production as such, but also physical values per square kilometer, per capita, and per household.

This type of function is obviously anomalous mathematically. Nonetheless, it describes the relevant statistical appearance of those qualities of phenomena which accord with successful economic growth; also, it describes the statistical reflection of actual processes conforming to successful growth of physical economies. Although other constraints must be considered in a fuller statistical treatment, the kernel of the anomaly is situated within this set of axiomatically pivotal terms of the function as a whole. This typifies the statistical appearance of the constraints adumbrated by a "not-entropic" process.

This pivotal, core set of interlocking constraints is closely associated with central features of Leibniz's representation of a physical economy based upon the principles of heat-powered machinery. Firstly, it was Leibniz's initial objective to provide mankind with the benefits of the fact that one man, employing a heat-powered machine, could accomplish the work of 100 others not so equipped: Broadly, a "not-entropic" form of rise in productive powers of labor requires a trend of increase of both the quantity per capita and the "energy-flux density" of power supplies. Secondly, it requires a coordinate advance of the level of technology. Also, the quantity of usable qualities of water, for both personal and other essential consumption available per capita, per square kilometer, per day must increase. The ton-miles of freight moved per hour, per square kilometer, and per capita must increase, and the relative physical cost of moving a ton-mile must decrease. The relative duration, facilities for, and intensity of that type of leisure devoted to science and classical forms of fine arts must increase, to foster thus the extent and rate of development of the creative powers of the individual mind.

Within the constraints of systems analysis, for example, such a set of constraints could not be satisfied. Wherein lies the paradox?

It is the same paradox referenced by Isaac Newton, in warning the reader against the tendency of his *Principia* to paint the universe in the color of what we call "entropy" today, a universe which could not exist were God not to wind it up periodically. That is the same Newton "Clockwinder" paradox famously referenced by Leibniz in the book of Leibniz-Clarke-Newton correspondence. The fact that we can locate within a set of statistical constraints a type of result which cannot appear in systems analysis ought not to be considered surprising, unless a mathematician were committing an all-too-common elementary blunder of the positivist, the naive ontological blunder of attributing the quality of causality to the space-time gaps of an algebraic function.

The function of the mathematics of denumerable orderings is to map space-time relations, not to attribute to space-time itself the causal principle governing the physical processes situated in that space-time. If we do not make that crude ontological blunder, we are at liberty to describe statistically either entropic or not-entropic relations; if we commit that ontological blunder, we fall into the "Clockwinder" paradox of which both Newton and Leibniz spoke so famously nearly 300 years ago. Unfortunately, to the degree mathematical training lays more or less primary emphasis upon algebraic thinking, rather than that of Gaspard Monge and Jakob Steiner's improvements in geometrical thinking, it is much easier for the student to lose that mooring of mathematical sanity which is a constructive geometry. The student who depends too naively upon algebraic methods, may lose a developed sense that algebraic thinking, at its best, represents pictures painted in mere space-time, which is never to be mistaken for the higher domain, the real domain, of physical space-time.

I think that nothing could expose this problem, and its implied solution more clearly than the science of physical economy.

The set of interlocking constraints we have described just above, describes the form of a not-entropic process in a special choice of phase-space, that shadow of the actual process being examined. Within those chosen limitations of the description used, that is the *form* of the transformation described by the constraints; what is the *content* of the same transformation? What are those causal features of the transformation which exist outside the domain of mathematical formalism as such?

The efficient cause is the mind of man, those processes of relatively more or less developed powers of creativity which are the source of the generation, transmission, and assimilation of ideas which represent a valid, axiomatic-revolutionary transformation in previously established opinion.

By their very nature, such ideas of discovery cannot be represented mathematically, nor communicated explicitly by any form of language; relative to any established formal system of representation, an axiomatic-revolutionary discovery is an absolute discontinuity, for which no consistent representation is possible. However, one man, the discoverer, may prompt the reoccurrence of that act of discovery in another person, by presenting effectively the paradox—the failure of the hearer's previously existing formal knowledge to be able to comprehend a relatively anomalous, hence, "paradoxical," phenomenon.

This form of communication is identified as belonging to the class of metaphor. Axiomatic-revolutionary discoveries cannot be communicated within the medium of previously existing forms of a language. They can be communicated only by employing the methods of paradox to generate a metaphorical, indirect form of artistic communication, by activating within the hearer the creative mental processes which are capable of replicating the creative-mental act of axiomatic discovery being described metaphorically by the speaker.

The form of not-entropic growth of economy which we have identified here is a result of the reorganization of human productive and related practice under the influence of scientific or analogous forms of beneficial, axiomatic-revolutionary discoveries. Although it is important that we understand the development of science and fine arts from the earliest knowable portions of our species' past, during most of the the recent six centuries of European history, until approximately 1967-74, there has occurred a general rate of growth of per-capita and per-square-kilometer productivity, beyond any precedent in the known evidence of the existence of the human species during the preceding 2 million years. This is associated with a correlated pace and intensity of revolutionary discovery in physical science and the Classical forms of fine arts beyond compare in known preceding times. Although there has been a generally accelerating collapse in literacy and the extent of Classical fine arts practice during the course of this century, especially during the recent 30 years, we have reached the condition that to maintain acceptable rates of progress in economy, we must devote up to 5% or more of the total employment of the labor force of leading nations to the generation and development of new technologies as such, in science and engineering.

Axiomatically, the implications of the recent centuries development of science-driven industrial society are but a continuation, albeit with qualitatively greatly intensified force, of what was always true for mankind. Nonetheless, the transformation of the required structure of the total labor force's employment over the recent 600 years, from over 90% rural as recently as the U.S. census of 1790, to less than 2% required directly today, and the growth of increasingly capital-intensive, energy-intensive urban manufacturing, with the latter's large science-driver requirement, has brought us to the verge of the colonization of locations within what science has redefined for us as relatively nearby space. The margin of the population required to be employed specifically in generating both fundamental scientific and technological progress, has thus grown from the relative scale of Plato's Academy at Athens, to a number of household-members supported by science and technology which would be greater than our total population of this planet 600 years ago. We have not yet reached those required levels of such employment, but the requirement itself, approximately 10% of the world's total population, is not the less indicative of the quality of change which has occurred over the preceding six centuries.

Unless this planet collapses into a prolonged "New Dark Age" about the onset of the new century immediately awaiting us, the tasks of physical economic recovery will have obliged us to move, at an accelerating rate, in the direction of virtually a purely science-driver form of global econo-

my. Under such conditions, it is an intelligible prospect that, within several generations, more than half of the world's labor force might be employed in developing the ever-more productive technology which the remainder of the labor force requires.

This is a transformation which began during the fifteenth century, centered then in Italy, around such central figures as Filippo Brunelleschi, Nicolaus of Cusa, the Paolo del Pozzo Toscanelli who constructed the map used by Christopher Columbus, Luca Pacioli, and Leonardo da Vinci. This is the outcome of the design of the industrial revolution based upon heat-powered machinery, a revolution already foreseen and designed during the seventeenth century by the Christian Huyghens who pioneered the piston engine using explosive fuels, and the Leibniz who shaped the development and application of the coal-fired steam engine.

There, in those revolutionary impulses of the creative processes of mind, not in the empty space-time of algebra, lies the efficient cause for the not-entropic form of development of successful economies. The constraints of that not-entropic economic process represent the preconditions which society must mobilize itself to fulfill, if that form of development is to be achieved. In effect, the form of not-entropic result defined by those constraints informs us, who must cause this to occur, that we must be willing to incur certain relative amounts of cost for certain essentials, such as science-driver, capital-intensity, educational, health, and power-intensity elements, or fail to realize those not-entropic goals. It is not the mathematician's empty space-time, but we, with our creative powers of mind, who are the cause of not-entropic forms of economic growth.

3.1 The politics of growth

The political implications of the fifteenth-century Golden Renaissance ought to be implicit for anyone who examines the prophetic quality of U.S. Treasury Secretary Alexander Hamilton's 1791 Report to the Congress *On the Subject of Manufactures*.

Leibniz cautioned that heat-powered machinery, such as the successful steam-engine designed by his collaborator Denis Papin, should be applied initially with an emphasis upon the improvement of mining. Then, the improvement of the extraction of coal in increasing amounts and cheapness appropriate to general requirements of heat-powered machinery was a precondition for the general application of heat-powered machinery. Hamilton, following Leibniz's conceptions, showed how the use of the "artificial labor" of powered machinery could be used to develop urban industries, while at the same time reducing the percentile of the population employed in agriculture, but increasing the per-hectare yield of farming above that earlier.

This transformation requires a relatively high quality of universal compulsory education of young children and adolescents. This must be a training which qualifies the young in general scientific principles, as a rigorous training in geometry grounds such capabilities, since the required character of employment will require included emphasis upon the assimilation of technologies derived from new discoveries.

If we educate the young accordingly, we produce a population which knows that all men and women possess that potential for creative reasoning which marks them, each and all, as in the living image of the Creator. Such a population will be inclined to accept, as useful to all, the practical recognition of development of relatively greater merit in some other person, but will resist the notion that inherited name or wealth constitute the members of a social class or caste morally better than themselves. The kind of world populated almost entirely by well-educated plebeians of that republican disposition is not a happy prospect for the classes of parasites whose wealth and power depend upon financial speculation and kindred forms of usury.

For the sake of Life, Liberty, and Property as empiricist John Locke defined these, the oligarchs prefer the charms of serfdom's bucolic imbecility, and a hard-working, low-paid, simple sort of general urban population. The oligarch's utopia is a world in which the young are taught desirable attitudes, but not compelled to assume their duties of any fully free and mature human being, to assume responsibility for such knowledge as classroom development of the individual's cognitive powers for geometry, Classical fine arts, and knowing also the intrinsic intelligibility of that kind of a world of work and everyday family life which is dominated by the impact of the physical sciences.

For as long as history records such matters, and as the sundry kinds of surviving shards of the archeological record confirm this for pre-historic periods, the essential, global political conflict dominating all general and individual human life, has been: Which kind of a world shall we have, the oligarch's world in which scientific and technological progress is suppressed to the purpose that the overwhelming majority of people are kept as stupefied, manipulable brutes, or a world designed to fit the requirements of individual persons in the image of the Creator?

British "free trade" dogmas were developed by the self-styled "Venetian Party" of Britain, the oligarchical party. Those dogmas were formulated at the behest of "Venetian Party" leader Shelburne beginning at the time, 1763, Britain had broken the maritime power of France. This victory allowed Britain to achieve worldwide what Venice had earlier achieved as the pivot of its imperial power throughout the Mediterranean—absolute supremacy in sea-power. During that same post-1763 period, Shelburne and his lackey Bentham launched Edward Gibbon into production of his celebrated *Rise and Fall of the Roman Empire:* Britain's Liberal Party, the formal name for the "Venetian Party," intended to establish a British worldwide empire in fact, establishing London as the global capital of a "Third Rome." As Britain's brutalization of its colonial subjects attests, Britain's global

utopia was a world in which most peoples of the planet were kept ignorant, barefoot, and pregnant, but, by aid of disease and famine, not populous.

Britain has become almost a worldwide empire, even though the British Isles have become a post-industrial rust-bucket, large portions of its population reduced to the status of Yahoos, and its military power scarcely even a symbol of its former potency. It dominates the world not as a nation, a people, but through the nearly unchallenged hegemony, in all national capitals of the planet, of an empiricist's axiomatic assumptions of policy-shaping.

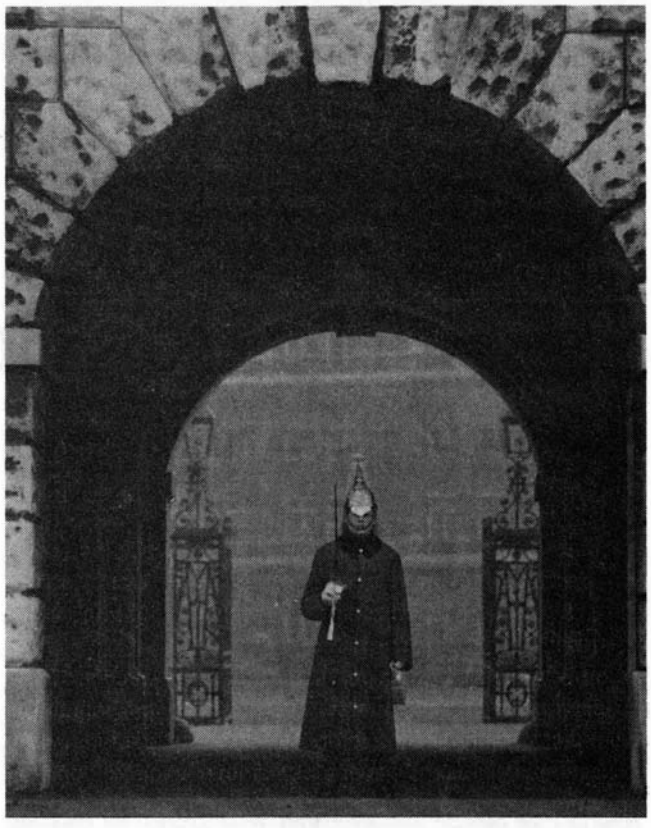
Today's Britain's world-empire does not fly the Union Jack. The old red coats of uniformed tyranny are no longer visible. Today, the empire exists in the more easily managed form of a multicultural human zoo, in which each nationality or ethnic grouping thus victimized is pitted against all others in that Hobbes form of conflict which Kant termed "heteronomic." Although the special belief of the respective tribes are mutually exclusive in this sense, each and all of this multicultural array of cult-dogmas is premised upon the underlying set of empiricist axioms as all others. Thus, each nationality is a gamepiece operating according to rules of the game embedded in each and all by the British ideological gamemaster. In the same way, each is a theme-park creature in a human game-preserve for which British empiricism is the gamekeeper.

This same imperial function of British empiricism extends to the domain of political economy, into the fine arts, and into the domain of physical science.

From the middle of the seventeenth century until about 1827, the anti-Descartes, and anti-Newton factions in France represented virtually unmatched world leadership in science and in technology. From about 1827 through World War I, the standard of competence in both education and physical science was Germany. The neo-Newtonians were brought into prominence in France by order of the victors at the 1814-15 Congress of Vienna, as the leaders of France's world supremacy in science at that time, Lazare Carnot and his teacher Gaspard Monge, were expelled: Carnot was sent into exile, in Germany, and Monge was expelled, together with his program of education, from the Ecole Polytechnique which he had built. It was the power of the victors of the 1815 Vienna Congress and the British house of Welf-Hanover, which imposed anti-Leibnizian, British empiricism's ideological influences, Kantian forms of romanticist irrationalism, Hegel, and Savigny upon post-1815 Germany.

Similarly, it was Britain's participation in the victors' role at the close of World Wars I and II, as in the Congress of Vienna earlier, which has made British empiricism hegemonic in law, in political economy, and the ideology of physical science throughout most of the world today.

None of this was done to the advantage of the British population—poor wretches that most of them are today. It was done for the sake of a parasitical form of oligarchical financial system which inhabits the United Kingdom, not as a citizen, but a succubus. As we dumb-down the cattle we breed for meat and milk, so the British imperial succubus dumbs-down the breed of human victims which it breeds and exploits like mere cattle. To accomplish this, it is not sufficient merely to destroy the victims' minds with "outcome-based education"; it is also necessary to remove from the economic process that factor of technological improvement of quality of goods and of productivity of labor, which depends upon fostering the cognitive powers of the mind of child and adolescent.



Standing guard at Whitehall. "As Britain's brutalization of its colonial subjects attests, Britain's global utopia was a world in which most peoples of the planet were kept ignorant, barefoot, and pregnant, but, by aid of disease and famine, not populous."

So, these succubus-imperialists of the Anglo-Saxon oligarchy treat all mankind as cattle, by turning all humanity into a Giuseppe Mazzini-style, multicultural zoo, one theme-park's ideology more imbecilic than the other. What is forbidden, above all, is to teach children and adolescents the form of scientific literacy which can be achieved only by shifting emphasis away from the schizophrenia of formal proofs to replicating in one's own mind the acts of axiomatic-revolutionary discovery of the exemplary greatest discoverers in all known history before this time. That prohibition, that state of mind comparable to the fertility of the eunuch, is what is called empiricism.