The Right and Wrong Usages of the Term 'Reason'

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Today, there are three mutually exclusive usages of the term "reason," two popular usages, and one correct one. As our culture has become increasingly irrationalist, especially during the period 1963–87, "reason" tends to be associated, with increasing frequency, with the act of persuasion, as by such irrationalist means as rhetoric. Literate persons of stricter sensibilities would prefer Immanuel Kant's notion of rational behavior, and would equate "reason" to the achievement of the quality of consistency associated with an axiomatic-deductive mode of formal logic. Many ostensibly literate persons, including large numbers with terminal professional degrees from universities, are ignorant of the third, proper usage of the term.

Although the three are mutually distinct, formal logic partakes of rhetoric, and, not infrequently, the true, higher form of reason employs some aspects of deductive method. The rhetorical, or irrationalist aspect of formal logic is located more obviously in its axiomatic basis; the axioms are based upon assumed "self-evidence," without proof, and are therefore the products of an arbitrary act. The deductive method also partakes of irrationalism, by denying arbitrarily the intelligible existence of certain of the most important, and provably existent among nonlinear processes, as Immanuel Kant did. The higher form of reason makes limited use of aspects of deductive method, although the deductive method is incapable of intelligible representation of reason itself. Both rhetoric and formal logic are irrationalist in the common respect that both deny the existence of that higher aspect of human mental behavior uniquely deserving of the term "reason."

Here, we focus upon the distinctions between reason and logic, the two forms of mental behavior which contend for the title of "rational." In contrast to these two, rhetoric is an entirely irrationalist mode of behavior, even when it borrows something from formal logic. We need consider only those two general forms of mental life which might be represented as rational: the opposition of the axiomatic-deductive method to what is most conveniently identified for sake of brevity as the synthetic method.

We begin this presentation by addressing the fallacy of Kant's insistence that the human mind is incapable of an intelligible representation of the mental processes by which such results as valid fundamental discoveries in physical science are effected. Kant's argument, which he deceives himself to be proof of his assertion, is based on the fact that the transitive verb "to create" can not be represented in an axiomatic-deductive mode of formal logic.

For Kant, and kindred viewpoints, a result attributable to "creation" may be demonstrated. The occurrence of a scientific discovery may be demonstrated, for example. In general, the existence of something now, which did not exist at some point in the past, can be demonstrated. However, all that formal logic can do, is to narrow the time-gap between two moments, to such effect that in the preceding moment something does not exist which does exist in the succeeding moment. The existence of an efficient causal process linking those two moments in the mode of a continuous mathematical function, is not possible within the terms of any axiomatic-deductive system.

Thus, for such as Kant, "creation" means no more than "ostensibly created." They point to an object, as the object might be designated by use of a noun, and say, "This was created." They can not offer an intelligible representation of the process by means of which this "createdness" was caused to occur. So, in the vocabularies of Kant and his kind, the verb "to create" is an empty term, used to refer to something which, for them, does not exist as an object of thought.

In modern experimental physics, we are shown that no elementary particles exist self-evidently. Electrons, for example, are a special form of continuous electromagnetic radiation, whose existence we know to be determined by the curvature of the continuum of subatomic physical space-time. However, even without knowledge of such matters as modern experimental physics, we have the most compelling evidence that there is an intelligible representation of a process corresponding to the transitive verb "to create." The possibility of a human population in excess of approximately 10 million persons on this planet depends absolutely on a fundamental difference between human beings and beasts, the power to generate and assimilate what we term scientific and technological progress.

It is from the latter vantage-point that the most important features of true reason can be adduced. If we show that human creative processes, as demonstrated by valid fundamental discoveries in physical science, are susceptible of intelligible representation, we have demonstrated thereby that the verb "to create" has an intelligible object corresponding to such a representation.

The Refutation of Kant

It is perhaps my most notable contribution to science to have created that mode of conclusive refutation of the cited argument of Immanuel Kant which bears most directly on

the subject matter of physical science. My formal proof begins with Kant's own terms of assumption, axiomatic-deductive method. This part of my proof proceeds as follows.

Since Kant represents the form of neo-Aristotelian (Cartesian) materialism codified by the eighteenth-century "Enlightenment," we refute him most clearly when we begin by attacking him on his own chosen ground. The ground is, broadly, the axiomatic-deductive method typified by Euclid's *Elements* and the schoolbook geometry formally taught in schools. The modern form of Euclidean reasoning in physics, is typified by the work of René Descartes and the parody of Descartes' image of matter, space, and time popularly associated with the traditions of Isaac Newton and James C. Maxwell. If we accept the formal logic adopted by Kant on his terms, and examine certain properties of that system of logic, we understand Kant's deluded confidence in his own asserted proof, and we are able to show that Kant's philosophy is entirely a delusion.

The relevant property of all axiomatic-deductive systems of formal logic is a feature sometimes identified as "the hereditary property."

To build a formal axiomatic-deductive system in logic, we begin with arbitrary assertions, called axioms, and supplementary assertions of kindred quality, called postulates. The axioms are presented as assumptions so self-evidently correct that they require no proof. In the strictest usages in formal logic, "postulates" signify assumptions to which somewhat lesser authority is attributed than to axioms; postulates have the function of stipulating supplementary rules of argument introduced to protect the perfect deductive consistency of the entire body of theorems based upon the original set of axioms.

All hypotheses and theorems in that system of formal logic are therefore nothing but a fresh way of asserting what was already asserted by the arbitrary choice of axioms and postulates upon which that system is premised. To be consistent, the essential requirement of a formal deductive logic is that no theorem in the system must contradict anything embedded as assumptions in the "original" set of axioms and postulates chosen. All such deductive systems, however many consistent theorems are generated within them, can never grow to become more than a giant tautology: the elaboration of possible permutations of the initial set of axioms and postulates. Such systems contain no statement about the universe's characteristic features which is not already asserted by adoption of the relevant set of axioms and postulates.

So, it has been observed, the axioms and postulates of any formal logical deductive system are the "genetic code" of the system. No theorem is anything more than a deductively consistent permutation of the content of that "genetic code." This "property" of axiomatic-deductive logic is therefore called sometimes "the hereditary property" of all formal logic, Kant's included.

With that in view, let us examine the matter of human creativity in the context of valid fundamental discoveries in physical science. This aspect of creativity was that stressed in Kant's line of argument both as a follower and later critic of the British empiricism of David Hume—and as an opponent of Gottfried Leibniz, prior to and during the course of Kant's writing of his famous three *Critiques.*

Kant's physical universe was the universe of distinct qualities of matter, space, and time of Descartes. His mathematical physics is consistent with the axiomatic-deductive scheme of Descartes, with the irrationalist symbolic philosophy of Descartes' *deus ex machina*. That is, Descartes, and Newton and Kant after him, portray the physical universe as mechanical, and locate the act of creation as something external to the mechanical universe, and acting upon it by unintelligible means.

This mechanical universe is defined as the universe of Euclid's *Elements*, to which has been added the assumption that self-evidently existing discrete bodies have weight, and that action within the mechanical universe occurs solely either by percussive ("bumping") action, or "action at a distance." It is assumed that all discrete bodies' masses are comparable in arithmetic counting-number terms, or ratios of irrational numbers derived from counting numbers as a starting-point. It is assumed that space is simply infinite extension in straight lines, and time, too.

Many experimental phenomena in physical science can not be represented in an axiomatic-deductive schema of this sort. However, to the degree that the axiomatic-deductive view has held sway in schools and among professionals, mathematical physics is usually confined to those aspects of nature which can be described usefully within the limits of an axiomatic-deductive logic. As for those matters which refuse to be comprehended by aid of that sort of logic, the conventional view has been, that sooner or later someone will discover how to make these matters comprehensible in a way which does not call into question the veracity and adequacy of the axiomatic-deductive method itself.

The modem pursuit of the nonexistent "quark," is an example of the postulating of purely fictitious discrete forms of physical existence for no other purpose than to pretend that the axiomatic-deductive form of mathematics, modeled upon Descartes, Newton, and Maxwell, and employed widely in physics today, needs to consider no form of mathematical practice, and no geometry but the axiomatic-deductive ones.

This is the ground on which I choose to begin our battle with Kant and his like. Let us assume, for purposes of illustration, that all valid fundamental discoveries in physical science might be represented adequately as theorems in an axiomatic-deductive, neo-Cartesian form of mathematical physics. Let us see precisely where this assumption breaks down in practice.

Kant's and related assumptions in mathematical-physics practice are, that a truly consistent physics is a giant tautology of the form defined by "the hereditary property" of formal axiomatic-deductive argument. However, any valid fundamental discovery in physics has the form of what is sometimes termed "a crucial experiment," an experiment which demonstrates that some theorem inherent in the prevailing set of axiomatic-deductive systems of formal mathematical physics is wrong: Something is wrong with the tautology as a whole.

If this evidence is confirmed, then the fault in the disproven theorem is shown to be a flaw in the set of axioms and postulates upon which the existing body of physical scientific knowledge is premised. One or more of those assumptions must be altered or replaced. Hence, because of the hereditary property, all of the theorems of previously existing such knowledge, belonging to that tautology, must be changed in this respect. That is the nature of each and all valid fundamental discovery in physical science.

As a result of this change, we have two more or less parallel bodies of scientific theorems, the old and the new. These are two distinct "giant tautologies." The implication of "the hereditary property" is, that none of the theorems of the old tautology is consistent with the new, and none of the new consistent with the old. An unbridgeable gulf of such "hereditary" formal inconsistency lies thus between the two successive systems of knowledge.

In this way, we have brought the two successive states of knowledge, before and after the act of creation of new knowledge, as proximate to one another as possible. Yet, in formal logic, there is no way of representing the act of creation which lies within the gap. That is the critical representation of Kant's argument against the intelligibility of the verb "to create."

In reality, something does exist within the gap. Since human existence depends upon that which lies there, scientific and technological progress, that which corresponds to the verb "to create" in this instance, is a matter of the greatest importance, and is clearly an efficient principle. Why, then, can this principle not be made intelligible? An examination of the logician's problem provides useful indications of the pathway to solution of Kant's fallacy.

Socrates and Nonlinearity

The broader representation of the "crucial experimental" method of discovery which we have just identified is typified by the Socratic method, the method which Plato causes his Socrates to name "my dialectical method" in his dialogues. This method has nothing in common with the "dialectic" of Kant, Hegel, or Karl Marx; it signifies, in Plato's writings, simply "the method employed in these dialogues."

Most briefly, that method is the habit of critical examination of popular opinions and other propositions, by defining the assumptions on which those propositions are shown to depend. This process is continued, to examine similarly the deeper assumptions which must necessarily underlie the first layer of assumptions, and so on.

This method is otherwise known as the method of hypothesis. This does not signify the popular usage of "hypothesis" today. Popular opinion wrongly imagines "hypothesis" to signify an intuition, an assumption, an assertion. Even university classrooms teach such wrong meanings of the term. It means a certain form of rigorous employment of what we have described as "the hereditary property" of deduction. It means stating proposed theorems which are shown to be true if the assumptions on which the entirety of a relevant body of knowledge is based are true. An hypothesis is something which must necessarily be true, in that sense, under those conditions, and with precisely those limitations.

Hypothesis, strictly defined, is not some assertion or intuition to be proven; it is itself a rigorous form of proof. To make our case clearer, we limit our attention to a special quality of hypothesis, sometimes called a "strong hypothesis." A "strong hypothesis" is one which corresponds to a crucial experiment. In physics, it is a design of crucial experiment which tests the existence of some principle of nature. An example is helpful.

What is deservedly among the most powerful instances of a proven strong hypothesis in modern physical science, is the establishment of a comprehensive mathematical physics by Johannes Kepler. Kepler, basing himself on the methods and evidence elaborated before him by Cardinal Nicholas of Cusa and the circles of Fra Luca Pacioli and Leonardo da Vinci, adopted as proven the principle that the elementary laws of organization of the physical universe are each and all rightly adduced by knowing what more modern usages term "the curvature of physical space-time." Kepler proposed that the curvature of universal physical space-time must be that reflected as a harmonic ordering congruent with the Golden Section. All of Kepler's physics is constructed entirely from this principle.

Later, Carl Gauss and such collaborators of Gauss as Bernhard Riemann showed that Kepler's hypothesis was true for astrophysics, and must be shown experimentally, sooner or later, to be true for microphysics as well. This has now been shown for subatomic physics and for the optical biophysics of nonlinear spectroscopy. We shall also indicate here, that not only are the mental creative processes susceptible of representation, but that these processes exhibit a curvature identical with the curvature of physical space-time in the astrophysical, microphysical, and biophysical domains.

In effect, Gauss *et al.* proved conclusively, that not only was Kepler's strong hypothesis correct, as far as he developed it, but that Kepler had proven the physics of Descartes, Newton, Laplace, Maxwell, *et al.* scientifically absurd even before those latter gentlemen had lived. The essential error of the work of those latter gentlemen, is their common flaw, that they attempted to define mathematical physics in a Cartesian manner consistent with the form of the axiomatic-deductive system of Euclid's *Elements*.

Let us return our attention to the gap of unbridgeable, "hereditary" inconsistency between the two tautologies described, before and after a valid fundamental discovery in physical

science. As we indicated, this was the result of a crucial experiment's obliging us to alter the logician's set of underlying axioms and postulates. The alteration of any part of a set of axioms and postulates defines two mutually exclusive "hereditary properties," as we might assume a change in the "genetic code" to define two distinct species.

Let us now use a different term to identify the unbridgeable gap of inconsistency between the two giant tautologies: "discontinuity." Let us restrict the usage of the term "discontinuity" to mathematics; wherever we encounter a phenomenon in the physical world which is in one-for-one correspondence with a mathematical "discontinuity," let us employ a different term, "singularity."

The physical world is full of singularities, more or less as scientific and related progress has the mathematical form of an increasing density of occurrence of discontinuities. If the universe is an existing process, rather than an arbitrary sequence of statistical "happenstances," then the physical laws which underlie the continued existence of the universe must be continuous laws, and so implicitly subject to intelligible representation by some kind of continuous mathematical function. In the world of mathematical physics, the mathematical representation of continuous processes which produce successive occurrences of singularities—mathematical discontinuities—is termed "nonlinear functions."

A "nonlinear function" is any continuous mathematical representation of a process in which there exists an apparently ordered or arbitrary frequency of occurrence of mathematical discontinuities. The goal of mathematical physics, as defined by Bernhard Riemann at the outset of his term as professor under Gauss and Lejeune Dirichlet at Göttingen University, is to show that every existing physical process, including those which appear to correspond to a purely arbitrary function, are implicitly susceptible of intelligible representation by mathematical physics.

Mathematically, a discontinuity is analogous to the gap of unbridgeable inconsistency between two successive sets of giant axiomatic-deductive tautologies. It is a gap defined by any required change in the set of axioms and postulates underlying an axiomatic-deductive representation of a physical function.

Hence, can we show that, for the case of assumedly continuous scientific progress (such that each new fundamental discovery is an advance over the predecessor state of knowledge), there exists implicitly a continuous mathematical-physical function which subsumes the ordered generation of such successive discoveries—such discontinuities? Plato's Socratic dialogues already show that such nonlinear functions exist.

To define such a function, it is necessary to dispense with all propositions but those which bear directly upon the manner in which a strong hypothesis alters the set of axiomatic-deductive systems of representation of knowledge. In other words, can we prescribe some

lawful ordering of changes within those sets of axioms and postulates which corresponds to scientific progress? In formal-logic mathematical physics, we can show such a pattern *a posteriori*; however, a more general solution to this problem lies, inherently, outside the scope of axiomatic-deductive analysis.

The method required for scientific progress is readily indicated from the internal history of science, even from the vantage-point of axiomatic-deductive method. Given any existing system of mathematical physics, the best thinkers concentrate on driving that form of knowledge to its limit, to discover an extreme condition under which that scheme of mathematical-physical representation breaks down in practice.

A classical example of this is the case of Bernhard Riemann's "prediction" of transonic and supersonic flight, in his famous 1857 paper, "On the Propagation of Plane Air Waves of Finite Magnitude." In this case, Riemann assumed the case of an accelerating projectile within a cylinder of indefinite length, and calculated the state of the system at the point the projectile accelerated to the apparent limit of the speed of sound. He applied to this case the method he had elaborated in the several inaugural dissertations he prepared for his appointment as professor at Göttingen, especially the preliminary program presented in his "On the Hypotheses Which Underlie Geometry," to show the existence of a transonic state, a state sometimes described, in juxtaposition to mechanistic gas theory, as "isentropic compression."

In short, as we drive processes to a limit, an apparent boundary condition, such as the speed of sound, or speed of light, the process does not necessarily terminate at that boundary. For example, we have in the universe large-scale processes which function in a coherent way, and yet in which actions within the system as a whole are occurring, relative to one another, at speeds greater than the speed of light. In neither case, is the true meaning, the true physical efficiency of the bounding condition, such as speed of sound or speed of light, discredited. Rather, the universe compensates in some way for the apparent violation of a boundary introduced. A new degree of freedom is introduced, somewhat analogous to the insertion of a new postulate into the hereditary-logical basis, and the characteristics of action beyond the limit differ from those before the boundary is reached by this factor of change in the "hereditary" basis.

In practice, nuclear fission enables us, thus far, to achieve a fourfold increase in energy-flux density of commercial power generation than simpler methods. A second generation of controlled thermonuclear fusion will exceed the energy-flux density achieved with fission by several orders of magnitude, such that where we write billions of watts for the capacity of a fission generating station today, we shall write trillions of watts within a generation or so.

There is a limit to fusion power, as studies of ratios of fuel-weight to accelerating space-travel remind us forcefully today. We have a muddled conception of a more powerful agency, in

what we probably misname today "matter/antimatter" reactions. Whereas fusion of the future will, probably within two generations, carry flotillas of manned spacecraft to the asteroid belt in a straightforward sort of propulsion scheme, we must do tricks with sending fuel ahead of manned craft to reach into and beyond the orbits of the outer planets. What we would identify loosely today as "matter/antimatter" reactions, we already know would suffice to carry us beyond the Solar System.

So, human technological progress is always driving toward the limits, and to exceed those limits. This technological progress is sustained by a fundamental scientific research which addresses the limits of existing technology, and forces to the surface new physical principles by means of which technology will surpass the present boundaries.

We know a great deal, empirically, about the relationship between scientific progress and technological limits. From the field of physical economy, the branch of economic science which is my specialty, we have proven that the increase of the productive powers of labor—the potential population-density of mankind—is tied to increase of energy supplies.

In first approximation, this is represented by an increase in the quantity of usable energy supplies per capita and per square kilometer of land-area. We have shown that the level of technology, and productivity, which a national economy can sustain efficiently, is a function of the amount of usable energy per per-capita unit of population-density, such that the greater the population-density, the less the amount of energy required per capita.

In the second approximation, we know that increasing the mere quantity of energy supplies is not sufficient. We must, at first glance, increase the operating temperature of certain rather basic processes. Looking more deeply, we recognize that measuring the quantity of energy per square meter of process cross-section is not an adequate definition of this. The coherence of the applied energy is decisive. The higher frequencies of coherent radiation self-focus their action upon targeted materials with relatively greater energy-flux density, as lasers exhibit this. With coherently organized particle beams, an added dimension of nonlinearity is added. We discover that the electrical potential radiated per unit of cross-sectional area is not the limiting condition, but rather the electromagnetic potential.

So, respecting mathematical physics, we are driven to understand the nonlinear functions defining the relationship between what appears to be continuous electromagnetic radiation, especially in a normal coherent form, and the creation and existence of so-called elementary subatomic particles. To organize progress in physics, we must concentrate upon the boundary conditions defined by the nonlinear functional relationship between continuous coherent radiation and the existence of elementary particles.

This, by itself, signifies that the axiomatic notions of self-evidently discrete matter and linearity must be expunged from mathematical physics. To the degree mathematical

development drives our thoughts in that direction, and that frontier crucial experiments in physics carry our thoughts into experimental practice, we are assuredly progressing.

This fundamental aspect of physical economy—as distinct from the folly which passes for university instruction in political-economy today—has what ought to be recognized readily as very great authority for physical science generally. The empirical proof of progress in scientific conceptions, is the demonstration that the application of scientific advances actually increases the potential productive powers of labor.

In other words, the demonstration that mankind increases its potential population-density, with increased life-expectancies, and so on, shows that mankind's per-capita power over nature has been increased, as the Biblical book of Genesis requires such a form of human practice. This signifies that mankind has improved its practice, and has thus brought its practice so into greater coincidence with the lawful ordering of the universe. The most authoritative empirical proof of scientific progress, is the demonstration that such alterations in our way of thinking about the universe leads to a practice which affords us greater per-capita power over that universe.

Thus, those pathways of scientific progress which correlate most directly with continuing progress in increase of the potential productive powers of labor, reflect a sense of direction for the ordering of transformations in what axiomatic-deductive method defines as an hereditary property of each stratification of progress in scientific thinking. In other words, what physical economy shows us to be the desired direction of transformations in the ontological aspect of axiomatic-deductive "lattices" of axiom-postulate sets, is the sense of ordering required for our nonlinear continuous functional representation of creative transformations in thought.

This standpoint of reference is indispensable for critical scrutiny of the internal history of axiomatic-deductive representations of mathematical physics. Without a yardstick to measure progress in change of sets of axiomatic-deductive axioms and postulates, the possibility of overcoming Kant's fallacy in practice would not exist for us.

The method for accomplishing that result exists, and has been known in a general way since the Socratic dialogues of Plato. However, the explicit form of this method required for mathematical physics did not exist for practice until the relevant discoveries published, during the middle of the fifteenth century, by Cardinal Nicholas of Cusa. Cusa is the true father of modern synthetic geometry, the only rational alternative to the axiomatic-deductive method. From the standpoint of synthetic geometry, all of the problems we have identified are inherently solvable, including the intelligible representation of human creative mental processes.

This was the basis for the work of a group of collaborators centered around Pacioli and Leonardo at the close of that same century. This line of work, so developed, was the basis for the establishment of a comprehensive mathematical physics by Kepler. It was the line of work pursued in important aspects by Desargues, Fermat, Pascal, Huygens, and Leibniz, continued by Gaspard Monge's direction of the Ecole Polytechnique, and brought to a certain degree of perfection by the work of such as Gauss, Dirichlet, Weierstrass, and Riemann, and their immediate collaborators.

Unfortunately, although the contributions of these scientific leaders have been borrowed by modem textbook physics to a significant degree, the method employed to make these discoveries has been generally suppressed, especially during the course of the recent hundred years or so. Modern taught physics is dominated by the "classical" axiomatic-deductive method of Descartes, Newton, Kelvin, and Maxwell, with a modern statistical method proximate to the wildest sort of cabalistic mysticism ("symbolic philosophy') superimposed upon it. The so-called synthetic or "constructive" method of geometry has been virtually outlawed from the profession.

The Present Crisis in Physical Science

If we put to one side natural disasters prompted by causes beyond the control of nations, all calamities deserving of a strict usage of the term "crisis" are the reflection of stubborn error in the practice of ruling authorities. When man defies natural law's efficiency, for the sake of defending an adopted policy or method, nature takes cruel vengeance upon the nations which permit such hubristic practices. So, as a man who leaps from the upper story of a skyscraper, to exhibit his will to defy gravity, is destroyed by his willful defiance of natural law, so those deeds of defiance of natural law, as policies of governments or methods of other sorts of influential authorities, turn those deeds themselves into the efficient means by which the perpetrators are either severely punished, or even destroyed. Such is the nature of all calamities strictly deserving of the name of "crisis."

In that sense, a crisis exists in physical science today. The stubborn effort to explain lawful phenomena according to assumptions in defiance of the lawful character of those phenomena, is the essence of this crisis. We are confronted in many aspects of physical science, including biology, with phenomena which are efficient beyond doubt, and yet which have the import of crucial-experimental evidence overturning the hallowed presumptions of the scientific authorities. The prevailing tendency has been, rather than to accept the import of such crucial evidence, to patch up the statistical tables of the defective science, and thus to delude oneself that, by virtue of such patchwork, no crisis has existed.

This unhappy state of affairs is matched by a more general spread of irrationalism, in the policy-shaping institutions of government, and in the habits of popular opinion.

In the matter of economics, the U.S. government insists upon policies of "free trade" which have predictably destroyed our economy's potential, and yet government insists that such policies have such an axiomatic sort of rightness to them, that no contrary empirical evidence will prompt them to consider correcting the policies.

In general, arbitrary opinion is taken as self-evident, to the effect that the existence of conflict in opinion is taken as occasion for negotiating compromises among conflicting opinions, rather than discovering a truth which might happen to coincide with none among those opinions. The degenerate form of modern liberal philosophy of practice, in policies of government, and even in physical science to a large degree, is to follow a radical form of David Hume's irrationalist dogmas of empiricism, to insist that mankind is incapable of knowing truth, to such effect that truth is excluded pragmatically from judgment of opinions.

This was made explicit by the liberals who administered the Anglo-American postwar occupation, and "re-education" of Germany. The Catholics of Germany were instructed by these liberals, many among them, like the evil Margaret Mead, prominent "New Agers," that Catholicism's Platonic emphasis upon reason had fostered the existence of the "authoritarian personality type," the which the liberals insisted had made Hitler's reign possible. To remedy this, the liberals insisted to German theologians, the corrective influence of Swiss Nazi sympathizer Martin Heidegger must be introduced, specifically Heidegger's existentialist notion of "inner freedom" of the individual. For the Protestants, the kindred existentialist views of the Swiss Nazi sympathizer Karl Jaspers were recommended.

The philosophical congruence of such liberalism and Nazism ought to be obvious. Nazism was, like the irrationalism of Ayatollah Ruhollah Khomeini's bestial tyranny in Iran today, the assertion of arbitrary opinion in defiance of reason, as the famous orgiastic, torchlight Nazi mass rallies exemplify this. On this account, Nazism and Muscovite Bolshevism are twins; both assert a racialist "blood and soil" dogma, respecting what it is asserted must become a ruling race on this planet, which must exert supremacy as a matter of irrationalist racial will, in defiance of a notion of a universal natural law, and universal reason, to which all peoples and persons are equally subject, and to which all have equal, universal rights of access. Margaret Mead was far more a Nazi than any of our liberal news media and universities today would wish to admit.

Dr. Sigmund Freud was also such a Nazi-like figure in his philosophy of practice.

Irrationalist sentimentality professes to be shocked by such an offensive assertion "against such brave fugitives from Nazism as Freud or Kurt Lewin." This hysterical view of the matter forgets that irrationalism degrades men into beasts toward men. The fact that Freud was the prey of the Nazis, reminds us of the fish that eat the fish who eat fish. That Freud was a victim of Nazism is no sign that Freud was not a Nazi-like beast in his own fashion.

Irrationalism binds irrationalists together against reason, but has no greater inclination to "species loyalty" than the female spider or praying mantis who is eating the head of the male who continues to be happily engaged in fertilizing her eggs.

Philosophically, Freud denied any fundamental emotion but the erotic form of irrationalism, and was a materialist in the same sense as the gnostic theologian Ludwig Feuerbach. It was out of Freud's psychoanalysis that the doctrine of "the authoritarian personality" was introduced as an authoritative, pseudo-scientific psychological dogma during the postwar period to date.

This dogma was imposed not only upon institutions of occupied postwar Germany; it was imposed inside the United States, too, if not by simple decrees, by a more insidious set of psychological-warfare mechanisms and conduits such as mass entertainment and news media's assertion of "approved values" to such effect. It was Dr. Spock's and kindred doctrines of child-rearing. The effects of this persisting indoctrination were the subject of books published during the 1950s and early 1960s, showing the pathetic degradation of much of the U.S. population into the depths of Riesman's famous "other-directed personality-type." With the assertion of the "New Left" and the rock-drug-sex counterculture, beginning approximately 1963—with the prominently included role of the same Margaret Mead who had earlier conducted such psychological-warfare operations in occupied Germany—the dogma of hatred against "the authoritarian personality" emerged gradually as the accepted standard of value during the course of the 1970s.

Today, even the person who adheres to an axiomatic-deductive form of rationality is classed as an "authoritarian personality," and the advocate of higher qualities of reason classed as a virtual "neo-Nazi." So, Western civilization, gripped by a self-imposed collapse of the physical economy, veers in the direction of early imposition of fascism under the banner of such names as "Project Democracy."

So, Western civilization is presently gripped by a crisis of irrationalism. We face terrible calamities. Yet, each of those calamities has a rational form of objective remedy. The trouble is not so much those calamities themselves, but the cult of irrationalism which prevents us from seeking and adopting rational remedies for these grave problems.

Those portions of leading public and private institutions which deplore the trend toward aggravated irrationalism are crippled to a large degree by the fact that their notion of rationality is limited to the axiomatic-deductive forms. Thus, they are disinclined to undertake the rigorous reexamination of underlying assumptions of present-day policy-trends needed to discover a solution. They fail, similarly, to recognize that the political and related processes are passing through a phase-shift, this to such effect that there is no validity to the attempt to project policies for the coming months and years from perceived trends of the recent years past. In these and related ways, even those concerned strata are so far

unwilling to consider changes in institutionalized practice, but rather seek nonexistent solutions within the framework of existing forms of institutionalized practice.

That commitment to established institutionalized practice ensures than none of the existing objective remedies for our calamities will be adopted by them. The immediate problem is, that the needed remedies are each and all of a form which the institutionalized forms of practice exclude from adoption. For that reason, as long as those habits of institutionalized practice persist, no remedies for the calamities will be adopted. Therein lies the crisis in political life.

This prevailing temperament, so exhibited on the political side of life, fosters a kindred circumstance inside scientific practice. The connection between the two is both broadly implicit and more direct. It is implicit in the respect that it is impossible for the scientist to separate what he or she is in daily social life, including political practice, from the quality of personality carried into research and related work. It is direct in the respect that the institutionalized practice of science is under the effective control, in the largest degree, of the establishment which dominates governmental policies, the private laboratory, and the classroom. Thus, we see in science the same dismal forms of "politicization" we encounter in government, corporate life, and faculties, and intruding into scientific practice as such the philosophical tendencies of "other-directed" irrationalism which have become pervasive in the society generally.

"Conservatism" against naked irrationalism in science takes generally the form of an axiomatic-deductive rationality. To go further, to take up the cause of creative reason, is deemed "much too radical," and extremely hazardous to one's career.

The clearest symptom of this crisis in science was the relative ease with which even competent scientific workers were lured into the cult of the "quark." The "quark's" existence was not suggested by experimental evidence; it is a nonexistent elementary particle, which was adopted solely for the reason that it promises to provide appearance of axiomatic-deductive consistency for a reductionist scheme in the mathematics of popular mathematical physics. No other argument but that has been advanced for the existence of the "quark." It is Viennese positivism run amok: a purely postulated existence.

Morally, the advocacy of the existence of this mythical "quark" is nothing better than a student's outright cheating in the classroom. Presented with evidence which contradicts the answer the student looks up in the back of the textbook, the student fakes the mathematical argument to fit the approved answer, by inventing an experimental datum which causes his calculations to achieve the desired result. The "quark" was adopted as a way of defending the axiomatic-deductive sort of reductionist mathematical method against compelling, crucial-experimental evidence, that no "elementary particles" exist self-evidently. To evade this evidence, an imaginary elementary particle, the "quark," was adopted.

The result is, the cheater reacts to crucial evidence against axiomatic discreteness by asserting, "Once we have solved the mysteries of the quark, you will see that everything can be explained in terms of axiomatic discreteness."

Synthetic Geometry

One of the important obstacles, which prevent many members of the scientific community from recognizing the fallacy of their axiomatic views, is the myth that mathematics is a distinct language, which stands on its own ground, independently of spoken language. In Plato's dialogues, Socrates insists that this is false; Socrates insists repeatedly that every argument in the dialogues can be restated in a geometric form. The internal history of Indo-European language, of which classical Greek was a form relatively more advanced than modem languages—although potentially less so than Sanskrit—helps us to understand this problem.

The key is the great Sanskrit philologist, Panini, who wrote *circa* 500 B.C. Panini shows that a proper form of language is defined by the transitive verb, rather than the noun. It happens, that emphasis upon the noun, a revolution in European grammar introduced more or less coincidentally with the emergence of Stoicism and the "false Euclid's" authorship of the famous *Elements*, is both the axiomatic basis for nominalism and the adoption of that axiomatic-deductive method typified by the Elements.

The difference is essentially this. If we adopt the transitive verb as the characteristic feature of language, the object of conscious thought becomes not the discrete thing, toward which a noun might point, but rather the process of transformation on which the existence of the thing is conditional. In other words, a transitive verb takes "action" as the primary object of thought, rather than the thing-in-itself.

Respecting the problem of formal discontinuity separating two giant tautologies, "action" signifies the transformation by which the preceding tautology is transformed into the successor. Whereas the nominalist method examines each of the preceding and succeeding states internally, as a system of deductive relations among objects, the standpoint of the transitive verb takes as its object the transformation, the apparent discontinuity as such.

Obviously, only the latter choice, the standpoint of the transitive verb, addresses directly the object to which the verb "to create" corresponds.

Thus, all axiomatic-deductive tautologies are nominalist constructions, whereas the name of the real universe is a giant, self-reflexive form of transitive verb.

Translate this into geometry. Consider the case of the circle, which the isoperimetric theorem of topology shows us to be the only self-evident form of existence within the scope of a Euclidean geometry. As a bare circle, the circle is a noun. However, the circle is also the

product of circular action; in this aspect, we have shifted the definition of the object of conscious thought from a noun-object to a verb-object. The former definition of the circle is the rigorous basis for an axiomatic-deductive mathematics; the latter, circular action, is the rigorous basis for a synthetic geometry, and the mathematical physics of the complex domain.

This bears directly on that discovery, first published in his *De Docta Ignorantia*, by which Nicholas of Cusa founded modem physical science. Cusa introduced the notion of a "Maximum Minimum Principle," a discovery associated with Cusa's restatement of Archimedes' theorems on the quadrature of the circle. In abstract mathematical form, this is congruent with what was known, after the later work of Bernoulli and Euler, as the "isoperimetric theorem" of topology. In physics, it is known as the principle of physical least action, as posed by Fermat and elaborated by Leibniz.

The isoperimetric theorem indicates Cusa's proof to define circular action as the minimum perimetric action which subtends (generates) the largest relative area or volume. If we read "action" in the sense of physical action, this is the principle of physical least action as we have it from Leibniz. (There are deeper implications to Cusa's principle, but we focus here only on the matter of physical least action in terms of a synthetic geometry).

In geometry, this principle prompts us to throw away all of the Euclidean axioms and postulates, and also the method of deduction. If we but acknowledge, that circular action acts reciprocally upon circular action, during every interval of action, the entirety of Euclidean geometry is constructed without any use of axioms or postulates, and by aid of prohibiting the use of the deductive method. We use the deductive method only negatively, as we have done in comparing the non-consistency dividing two giant tautologies from one another; we may use the deductive method to prepare ourselves to restate the proposition correctly, as a proposition in synthetic geometry.

The elaboration of synthetic geometry in this way brings us to a limit associated with the Platonic solids. This limit was the central feature of the collaboration centered upon Pacioli and Leonardo. Pacioli elaborated a reconstruction of the proof of the uniqueness of the five regular solids, as referenced by Plato. He and his collaborators showed, that the morphology of growth and function of normal living processes was harmonically ordered in a manner consistent with the Golden Section of the circle. This defines, to this day, the characteristic curvature of biophysical space-time.

Pacioli's and Leonardo's exploration of the limit, by methods elaborated by Cusa, was the basis for the work of Kepler. Kepler reasoned that if the universe were the work of a living Creator, the elementary laws of action in the universe as a whole must be adducible from the implications of the Golden Section as a limit. Although Kepler's results were inadequate, as he explicitly identified those shortfalls, his hypothesis has been proven correct, and all

directly contrary hypotheses—such as those of Descartes, Newton, and Maxwell—false to reality.

From this, Leibniz adduced the basis for his notion of universal physical least action: The curvature of physical space-time defines the least action required to accomplish the relatively maximum work on the universe. All elementary laws of physics are rightly adduced as derivatives of that curvature, in that sense and in that manner.

Carl Gauss was the first to redefine Kepler's work more or less exhaustively, and to prove by this means that Kepler had been correct and Descartes and Newton false. Gauss's general accomplishment was to unify matter, space, and time formally as physical space-time. He accomplished this, as his treatment of the arithmetic- geometric mean illustrates this for novices, by situating Cusa's universal circular form of least action in the physical space-time in which living processes exist. In that case, circular action becomes the conic form of self-similar-spiral action. Such self-similar-spiral action, acting during each interval upon itself (in a "multiply-connected way"), defines the complex domain of Gauss's physics.

The peculiarity of this complex domain, in contrast to other approaches to complex functions, is that multiply-connected self-similar-spiral action inherently generates discontinuities (or, singularities). This topological peculiarity of the Gaussian complex domain, was examined and its crucial problem solved by the work of Prof. Lejeune Dirichlet, a collaborator of Gauss and, with Gauss, one of the sponsors of Bernhard Riemann's work. Riemann elaborated the implications of Dirichlet's principle of topology, as the Gauss-Riemann complex domain. The functions generated in this way are continuous functions, and also what are termed "nonlinear."

Thus, the possibility of intelligible representation of a seemingly arbitrary form of continuous, but nonlinear process, depends upon stating the problem in Gaussian terms. First, one must state the problem solely in terms of representation by means of synthetic geometry. Second, one may translate this into an algebraic form by use of the appropriate trigonometry describing the relevant function as a locus. Then one must define such trigonometric functions as statements of a rate of increase of the density of discontinuities (singularities) per adopted small interval of action within the continuous process so defined.

A student of the relevant work of Karl Weierstrass and Riemann, Georg Cantor, focused his work on nonlinear functions which could not be represented by the methods of Fourier Analysis. The crucial element of physics within Cantor's work on transfinite orderings, is a theorem defining the enumerability of the ordering of discontinuities within a very small interval of a continuous nonlinear function. The more general representation of this proposition, to conform to the broadest specifications for a Riemann Surface function, defines the prescribed approach to achieving intelligible representation of a seemingly arbitrary functional ordering of a continuing physical process.

If we restate the definition of "energy" in the manner this development of synthetic geometry demands, in terms of universal least action defined in respect to universal physical space-time curvature, we have the following results.

We drop the neo-Aristotelian, caloric notion of "energy" which was arbitrarily introduced to physics for the purpose of avoiding the principle of physical least action. We measure "energy" as a nonlinear magnitude, referenced to a quantum of some standard-reference frequency of coherent electromagnetic radiation. This enables us to reference energy, so defined, to physical least action within a physical space-time of definite curvature.

We state propositions in physics (e.g., giant tautologies) in these standard terms of reference.

We compare successive giant tautologies in terms of the indicated sorts of discontinuities defining their nonlinear separation.

We read the series of discontinuities defined by advances in the sense of new physical principles as a potentially enumerable series of discontinuities. We thus translate a seemingly arbitrary function into an intelligible representation.

The problem of energy, as we have noted this for physical economy, and indicated the corrections to be made immediately above, provides the solution.

The result is a space-time of mental-creative activity which has the same curvature known to define astrophysical, microphysical, and biophysical space-time. The fact that the curvatures of these four domains are congruent, defines the unity of the universe (as a "unified field"), and proves the possibility of valid human knowledge of the lawful ordering of that universe. There is a direct correspondence between the form of knowledge generated by human mental-creative acts of discovery, and the curvature of physical space-time.

However, no other form of human knowledge excepting such creative-mental activity is in correspondence with the curvature of physical space-time. That form of human knowledge is thus the only proper choice of referent for the name of "reason."

The importance of "driving through the limits," in fundamental scientific research, is clarified thus. To discover new physical principles means to break through a discontinuity. To order willfully such breakthroughs, we must have a sense of direction, in the implied sense of a rate of increase of the density of discontinuities per interval of action. The ontological conceptions associated with a corrected notion of "energy" in terms of physical least action within a universe of known curvature, are the key to discovering this sense of direction.

Creativity Otherwise

Inevitably, the companion of my inquiries into creative processes, since the 1948–52 period of initial discoveries along the lines reported here, has been to show that certain other aspects of human creative activity, in addition to those associated narrowly with physical science and technology, are one and the same creative processes as those responsible for valid fundamental discoveries in physical science.

In the case of music, Kepler's insistence upon the congruence of a natural musical scale with the curvature of astrophysical space-time, shows the pathway. From the standpoint of applying the Gauss-Riemann complex domain to the approach taken by Kepler, a rigorous proof is supplied, that the well-tempered polyphony of J.S. Bach *et al.* is the only natural musical ordering, contrary to the Romantics and that industrious hoaxster Helmholtz.

However, the well-tempered system is merely the natural form of beauty. We must say "merely" in the sense that the mere copying of nature is not art. Art never departs from natural beauty, at the outset or conclusion of its compositions, or at any point in between. Everything in art must conform as perfectly as possible to the intelligible principle of natural beauty. However, without violating natural beauty, the composer must add something human to nature in this form of labor, as in all others. What is added in this way must also be beautiful.

Art is the application of nothing but the activity of human mental-creative processes to the principle of natural beauty.

Natural beauty is nothing but the principle elaborated as the curvature of healthy living processes, by Pacioli and Leonardo, and as the curvature of astrophysical space-time, by Kepler. Since classical Athens, this has been associated with orderings congruent with the Golden Section. The curvature of mental-creative space-time is the same. Mental creativity is beauty *per se*. It is the superimposition of this beauty upon natural beauty, in a multiply-connected way, which is true art—in music, in painting, and in architecture.

It is the case that classical poetry, from which music is derived, is governed by the same principle. In a different, but efficient way, great classical tragedy is permeated with the same principle.

All of these activities, the joy of natural beauty and the joy of classical beauty in art, and human mental creative activities, are associated with a distinctive quality of emotion, a kind of pleasure distinct from, and in opposition to the erotic (hedonistic) impulses. This emotion, associated with the Good and Beautiful by Plato, is named *agapē* in the original Greek of the New Testament, and translated as *caritas* in the Latin New Testament. In the King James version, *caritas* is rendered as the sixteenth-century English usage of "charity," a term which has acquired a degraded meaning in modem usages.

This is the emotional quality associated with “tears of joy.” It is the emotion of love of God, Christian love of mankind, love of truth, and love of natural and artistic beauty. It is the emotional quality composed into great works of classical art, the emotional quality, opposed to degraded erotic forms of sentimentality, whose evocation informs the great musical performer that he or she has achieved a valid interpretation in faithful reading of the score of a Bach, Mozart, or Beethoven work, for example.

It is the quality of emotion experienced as a reward for achieving a valid creative discovery. It is the emotion, without whose summoning there can be no sustained concentration span of the “driving quality” needed for creative work.

The form of reason, and the motivation of that reason by this “agapic” quality of creative work, are two inseparable facets of a common quality. “Reason” is properly defined in no way but the harmony of this form, this emotion, combined.

Science, unless it is motivated by what we signify in Western civilization as Christian love of mankind, is no true science, and can not sustain the quality of creative scientific work. The perfection of mankind, and the nurture of those potentials and their free expression for the sake of the Good in each individual person, is the true purpose of science, and the true purpose also of everything else that is not shamefully degraded in human practice. This, rejecting all Kantian-like “categorical imperatives,” is the practical purpose, and significance of Reason.