# ALBERT eINSTEIN
# THE INCORRIGIBLE pLAGIARIST

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## *The Incorrigible Plagiarist*

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For my father, Christian Edward Køren Bjerknes, to whom I owe everything that I am. . . .

*Christopher Jon Bjerknes*

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"For certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski. [***] I have not established the principle of relativity as rigorously and universally true. Poincaré on the contrary, has obtained a perfect invariance of the electromagnetic equations, and he has formulated the 'postulate of relativity,' terms which he was the first to employ."
—HENDRIK ANTOON LORENTZ

## 1. The Priority Myth

*"The secret to creativity is knowing how to hide your sources."*—ALBERT EINSTEIN

*"All this was maintained by Poincaré and others long before the time of Einstein, and one does injustice to truth in ascribing the discovery to him."*—CHARLES NORDMANN

IT IS easily proven that Albert Einstein did not originate the special theory of relativity in its entirety, or even in its majority.[1] The historic record is readily available. Ludwig Gustav Lange,[2] Woldemar Voigt,[3] George Francis FitzGerald,[4] Joseph Larmor,[5] Hendrik Antoon Lorentz,[6] Jules Henri Poincaré,[7] Paul Drude,[8] Paul Langevin,[9] and many others, slowly developed the theory, step by step, and based it on thousands of years of recorded thought and research. Einstein may have made a few contributions to the theory, such as the relativistic equations for aberration and the Doppler-Fizeau Effect,[10] though he may also have rendered an incorrect equation for the transverse mass of an electron, which, when corrected, becomes Lorentz' equation.[11]

Albert Einstein's first work on the theory of relativity did not appear until 1905. There is substantial evidence that Albert Einstein did not write this 1905 paper[12] on the "principle of relativity" alone. His wife, Mileva Einstein-Marity, may have been co-author, or the sole author, of the work.[13]

If Albert Einstein did not originate the major concepts of the special theory of relativity, how could such a historically significant fact have escaped the attention of the world for nearly a century? The simple answer is that it did not.

Some called Einstein's priority into question almost immediately. As early as the years 1905-1907, Planck,[14] Kaufmann,[15] Ehrenfest,[16] Laub,[17] Laue,[18] Minkowski, and Albert Einstein,[19] himself, referred to the Einsteins' theory as being a mere interpretation-generalization of Lorentz' well-known theory, which interpretation was first accomplished by Poincaré, and later became known as the "Special Theory of Relativity".

In 1908, Bucherer published a paper titled, "The Experimental Verification of the Lorentz-Einstein Theory".[20]

Minkowski acknowledged Voigt's priority for the "Lorentz Transformation", the mathematical backbone of the special theory of relativity,

> "In the interest of history, I want yet to add, that the transformations which play the main rôle in the principle of relativity were first mathematically formulated by Voigt, in the year 1887."

> "Historisch will ich noch hinzufügen, daß die Transformationen, die bei dem Relativitätsprinzip die Hauptrolle spielen, zuerst mathematisch von Voigt im Jahre 1887 behandelt sind."[21]

Minkowski named Lorentz, Planck and Poincaré, together with Einstein, as the developers of the principle of relativity,

> "H. A. Lorentz has found out the 'Relativity theorem' and has created the Relativity-postulate as a hypothesis that electrons and matter suffer contractions in consequence of their motion according to a certain law."[22]

and,

> "The credit for the development of the general principle [the principle of relativity] belongs to Einstein, Poincaré and Planck, upon whose works I shall presently expound."

> "Verdienste um die Ausarbeitung des allgemeinen Prinzips haben Einstein, Poincaré und Planck, über deren Arbeiten ich alsbald Näheres sagen werde."[23]

Planck[24] and Poincaré attributed the principle of relativity to H. A. Lorentz,

> "Will not the principle of relativity, as conceived by Lorentz, impose upon us an entirely new conception of space and time and thus force us to abandon some conclusions which might have seemed established? [***] What, then, is the revolution which is due to the recent progress of physics? The principle of relativity, in its former aspect, has had to be abandoned; it is replaced by the principle of relativity according to Lorentz. It is the transformations of 'the group of Lorentz' which do not falsify the differential equations of dynamics. [***] No, it was the mechanics of Lorentz, the one dealing with the principle of relativity; the one which, hardly five years ago, seemed to be the height of boldness. [***] In all instances in which it differs from that of Newton, the mechanics of Lorentz endures. We continue to believe that no body in motion will ever be able to exceed the speed

of light; that the mass of a body is not a constant, but depends on its speed and the angle formed by this speed with the force which acts upon the body; that no experiment will ever be able to determine whether a body is at rest or in absolute motion either in relation to absolute space or even in relation to the ether. [***] This is easy; we have only to apply Lorentz' principle of relativity."[25]

In 1909, Philipp Frank wrote of "Lorentz' theorem of relativity" and of the "principle of relativity according to Lorentz."[26] Max von Laue wrote of, "the principle of relativity of classical mechanics," and of, "the principle of relativity of the Lorentz Transformation."[27] Lorentz, himself, attributed the principle of relativity to Poincaré,

"For certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski. [***] I have not established the principle of relativity as rigorously and universally true. Poincaré on the contrary, has obtained a perfect invariance of the electromagnetic equations, and he has formulated the 'postulate of relativity,' terms which he was the first to employ."[28]

Albert Einstein stated,

"The term relativity refers to time and space. [***] This led the Dutch professor, Lorentz, and myself to develop the special theory of relativity."[29]

Einstein, who knew that Lorentz had the power to end



Einstein's masquerade at any time, wrote to Lorentz,

"My feeling of intellectual inferiority with regard to you cannot spoil the great delight of [our] conversation, especially because the fatherly kindness you show to all people does not allow any feeling of despondency to arise."[30]

Einstein was grateful to Lorentz, for his theory and for his tact,

"Lorentz is a marvel of intelligence and exquisite tact. A living work of art! In my opinion he was the most intelligent of the theorists present".[31]

Robert Shankland records that,

"[Einstein] repeatedly praised H. A. Lorentz and at our last meeting he told me: 'People do not realize how great was the influence of Lorentz on the development of physics. We cannot imagine how it would have gone had not Lorentz made so many great contributions.'"[32]

In 1912, shortly after Poincaré's untimely death, Vito Volterra wrote in a tribute to Poincaré,

"But a celebrated experiment was performed by Michelson and Morley which kept account of the terms depending on the square of the aberration, and even this experiment, as is well known, gave a negative result.

In a famous paper of 1904 Lorentz showed that this result could be explained by introducing the hypothesis that all bodies are subjected to a contraction in the direction of the motion of the earth.

This paper was the point of departure for the later investigations. The results of Poincaré, Einstein and Minkowski followed closely that of Lorentz. In 1905 Poincaré published a summary of his ideas in the "Comptes Rendus" of the French Academy of Sciences. An extended memoir on the same subject appeared shortly afterwards in the "Rendiconti" of Palermo.

The basic idea in this set of investigations is founded upon the principle that no experiment could show any absolute motion of the earth. That is what is called the *Postulate of Relativity*. Lorentz showed that certain transformations, called now by his name, do not change the equations that hold for an electromagnetic medium; two systems, one at rest, the other in motion, are thus the exact images each of the other, in such a way that we can give every system a motion of translation without affecting any of the apparent phenomena [*Emphasis found in the original*]."[33]

In 1913, Arthur Gordon Webster wrote in his memorial to Poincaré,

"The development of Maxwell's electromagnetic theory that has taken place in the last twenty-five years has led to a theory that has attracted the greatest interest among mathematical physicists and has, in fact, become in certain parts of the world no less than a mania. I refer to the so-called principle of relativity, a name which was given to it first, if I am not mistaken, by Poincaré. This principle is no less than a fundamental relation



between time and space, intended to explain the impossibility of determining experimentally whether a system, say the earth, is in motion or not. In an elaborate paper published in 1905 in the *Palermo Rendiconti* entitled, 'Sur la dynamique de l'électron,' he defines the principle of relativity by means of what he calls the Lorentz transformation. If the coordinates and the time receive the following linear transformation [*Lorentz Transformation equations deleted*] the function $x^2 + y^2 + z^2 - t_1^2$ and the equations of electric propagation will remain invariant. From this follows the impossibility of determining absolute motion. Poincaré then submits the Lorentz transformation, which he shows belongs to a group, to an examination with regard to the principle of least action, which he shows holds for the principle of relativity. He further shows that by aid of certain hypotheses gravitation can be accounted for and shown to be propagated with the velocity of light."[34]

In 1913, Ernst Gehrcke wrote,

"The theory of relativity is nothing but a completely novel interpretation of the theory of the electrodynamics and optics of bodies in motion, which Lorentz had already developed. The theory of relativity is *not* distinguished by the creation of substantially new equations, but by a substantially new *interpretation* of the known transformation equations of Lorentz. The arguments made against this *interpretation* condemn it, not the equations themselves, which, as was stated, are not Einstein's, but rather Lorentz' equations, and still stand intact today [*Emphasis found in the* *original*]."

"Die Relativitätstheorie ist nichts anderes, als eine völlig neuartige Interpretation einer schon von LORENTZ entwickelten Theorie der Elektrodynamik und Optik bewegter Körper. Das Charakteristikum der Relativitätstheorie besteht *nicht* in der Aufstellung wesentlich neuer Gleichungen, sondern in der Aufstellung einer wesentlich neuen *Interpretation* der bekannten Transformationsgleichungnen von LORENTZ. Gegen diese *Interpretation* richten sich die gemachten Einwände, nicht gegen die Gleichungen selbst, die, wie gesagt, keine EINSTEINschen, sondern LORENTZsche Gleichungen sind und die bis heute unangegriffen dastehen."[35]

Alfred Arthur Robb spoke to the issue in 1914,

"Although generally associated with the names of Einstein and Minkowski, the really essential physical considerations underlying the theories are due to Larmor and Lorentz."[36]

Harry Bateman asserted his priority over Einstein, in 1918,

"The appearance of Dr. Silberstein's recent article on 'General Relativity without the Equivalence Hypothesis'[37] encourages me to restate my own views on the subject. I am perhaps entitled to do this as my work on the subject of General Relativity was published before that of Einstein and Kottler,[38] and appears to have been overlooked by recent writers."[39]



Charles Nordmann averred, in 1921,

"The only time of which we have any idea apart from all objects is the psychological time so luminously studied by M. Bergson: a time which has nothing except the name in common with the time of physicists, of science.

It is really to Henri Poincaré, the great Frenchman whose death has left a void that will never be filled, that we must accord the merit of having first proved, with the greatest lucidity and the most prudent audacity, that time and space, as we know them, can only be relative. A few quotations from his works will not be out of place. They will show that the credit for most of the things which are currently attributed to Einstein is, in reality, due to Poincaré. [***] I venture to sum up all this in a sentence which will at first sight seem a paradox: in the opinion of the Relativists it is the measuring rods which create space, the clocks which create time. All this was maintained by Poincaré and others long before the time of Einstein, and one does injustice to truth in ascribing the discovery to him."[40]

In 1921, Wolfgang Pauli set the record straight in the *Encyklopädie der mathematischen Wissenschaften*,

"The metamorphoses in physical concepts brought about by the theory of relativity was a long time in the making. As far back as 1887, Voigt observed in one of his works [***] that it is mathematically possible to introduce a time of position $t'$ into a moving reference system, whose origin is a linear function of the spatial coordinates, while the unit of time, however, is taken to be constant. Whereby, one can assert, of course, that the wave equation

$$\Delta \phi - \frac{1}{c^2}\frac{\partial^2 \phi}{\partial t^2} = 0$$

also remains valid in the moving system. [***] We now come to a review of the three works of *Lorentz*, *Poincaré* and *Einstein*, which contain the thoughts and developments which are the foundation of the theory of relativity. Lorentz' work holds priority over the others. Above all, it furnished the proof that Maxwell's equations are invariant under the transformation of coordinates [*Lorentz Transformation equations deleted*] provided that one at the same time suitably selects the field intensity in the primed system."[41]

Pauli argues that Lorentz holds priority for the proof of invariance. Pauli next addresses Poincaré's contribution,

"The formal gaps left by Lorentz's work were filled by Poincaré. He stated the relativity principle to be generally and rigourously valid. Since he, in common with the previously discussed authors, assumed Maxwell's equations to hold for the vacuum, this amounted to the requirement that all laws of nature must be covariant with respect to the 'Lorentz transformation' [The terms 'Lorentz transformation' and 'Lorentz group' occurred for the first time in this paper by Poincaré—*notation found in the original*]. The invariance of the transverse dimensions during the motion is derived in a natural way from the postulate that the transformations which affect the transition from a stationary to a uniformly moving system must form a group which contains as a subgroup the ordinary displacements of the coordinate system. Poincaré further corrected Lorentz's formulae for the transformations of charge density and current and so derived the complete covariance of the field equations of electron theory. We shall discuss his treatment of the gravitational problem, and his use of the imaginary coordinate *ict*, at a later stage (see §§ 50 and 7)."[42]



After giving Poincaré his due credit, and acknowledging that Einstein holds no priority for the special theory of relativity, Pauli, half-heartedly, pays the seemingly obligatory homage to Einstein, the then recently emerged celebrity,

"It was Einstein, finally, who in a way completed the basic formulation of this new discipline."[43]

And it appears that Pauli was forced, or felt compelled, to praise Einstein with additional inappropriate and, evidently, insincere comments.

In 1922, Ludwig Lange, who had fought so hard, for so long, against so many, sought, without success, for acknowledgment of his parentage of the inertial system concept, which he published some twenty years before the Einsteins' absolutism,

"Als ich 1886 meine fünf Jahre lang fortgesetzen Forschungen über den Bewegungsbegriff abgeschlossen, in denen ich die relativistische Weiterentwicklung richtig vorausgesagt, im wesentlichen so, wie sie seitdem sich vollzogen hat, da harrte ich mit große Spannung, aber jahrelang vergeblich auf die werktätige Teilnahme der Physikerwelt. [***] Als ich nunmehr 1902 in der *Wundt-Festschrift* meine Revision des Systems der Inertialbegriffe herausgebracht hatte, überkam mich ein wohltuendes Gefühl der Befreiung, wie ich mir denke, daß es einer umfassenden und dabei nicht im mindesten zerknirschten Beichte auch sonst folgen mag. Von diesem Zeitpunkt an mußten aber immer noch drei weitere Jahre verstreichen, ehe mit Albert Einstein eine Denkrichtung unter den Physikern sich Bahn zu brechen begann, welche, wenn auch nur indirekt, auf verwandten Gedankengängen aufzubauen unternahm, und ein viertes Jahr mußte hinzukommen, bis H. v. Seeliger (1906) in der Astronomie meine Nomenklatur „Inertialsystem" mit dem erfolg einführte, daß sie sich seitdem bei seinen Fachgenossen nahezu völligdurchgesetz zu haben scheint, während in der Physikfreilich erst die Ansätze dazu wahrzunehmen sind; denn Einstein selber und sein Anhang sträuben sich aus unverständlichen Gründen immer noch dagegen, eine so bequeme und charakteristische Bezeichnungsweise anzuwenden. Nun, die Zeit wird kommen, wo man mich als den Vater jener Nomenklatur und als den sorgfältigen Analysator des Sprachgebrauches der Mechanik, der die Wichtigkeit der relativistischen Richtung für die Physik besonders früh erkannte, nach Verdienst schätzen wird."[44]

Friedrich Kottler, author of *Gravitation und Relativitätstheorie*[45] in 1903, revealed on March 31st,



1922, through the prestigious, well-read and well-respected *Encyklopädie der mathematischen Wissenschaften*,

> "*H. Poincaré,* Palermo Rend. Circ. Math. 21 (1906), p. 129-175, especially p. 175, Formula (14). — This work of *Poincaré's* is dated July 23, 1905 and is the elaboration of a memorandum by the same title in the Parisian C. R. 140 (June 5, 1905), pp. 1504-8. The 'postulate' of relativity was enunciated here for the first time, *before Einstein* [*Emphasis found in the original*]."

> "*H. Poincaré,* Palermo Rend. Circ. Math. 21 (1906), p. 129-175, insbes. p. 175, Formel (14). — Diese Arbeit *Poincarés* stammt vom 23. Juli 1905 und ist die Ausarbeit einer Note gleichen Titels aus den Paris C. R. 140 (5. Juni 1905), p. 1504-8. Hier wurde zum erstenmal, *vor Einstein*, das „Postulat" der Relativität ausgesprochen."[46]

In 1927, H. Thirring wrote,

> "H. Poincaré had already completely solved the problem of time several years before the appearance of Einstein's first work (1905). Beginning with an article in Revue de Métaphysique et de Morale which appeared in 1898 (later reprinted in his book "The Value of Science" as a chapter on the concept of time), Poincaré settled the general problem of time from the physical standpoint and had already there referred to the fact that the principle of the constancy of the velocity of light serves as a basis for a definition of time. Poincaré, in his work 'La Théorie de Lorentz

et le Principe de Réaction' [*Relevant citations and quotations found in endnote*[47]], then defined Lorentz' "local time" (Fig. 23) as "time", which time is to be measured with clocks synchronized by light signals."

"Die Klärung des Zeitproblems war schon mehrere Jahre vor dem Erscheinen von EINSTEINS grundlegender Arbeit (1905) durch H. POINCARÉ weitgehend vorbereitet worden. Dieser hatte zunächst in einem im Jahre 1898 in der Revue de Métaphysique et de Morale erscheinenen (später als Kapitel über den Begriff der Zeit in seinem Buche „Der Wert der Wissenschaft" abgedruckten) Artikel das allgemeine Zeitproblem vom physikalischen Standpunkt aus behandelt und hatte dort schon erwähnt, daß sich auf den Satz von der Konstanz der Lichtgeschwindigkeit eine Zeitdefinition gründen läßt. Er hat dann in einer Arbeit „La Théorie de LORENTZ et le principe de réaction" (Arch. Néerland. (2) Bd. 5. 1900, Lorentz-Festschrift) die LORENTZsche Ortszeit (Ziff. 23) als die Zeit definiert, die durch mit Lichtsignalen synchronisierte Uhren gemessen wird."[48]

The *Dictionary of Scientific Biography*, in its article on Lorentz, states,

"Einstein's 1905 special relativity paper provided Lorentz' theory with a physical reinterpretation. [***] Einstein deduced the Lorentz transformations and other results that had first been made known through Lorentz' and others' electron theories. [***] Lorentz admired, but never embraced, Einstein's 1905 reinterpretation of the equations of his electron theory. The observable consequences of his and Einstein's interpretations were the same, and he regarded the choice between them as a matter of taste. [***] Lorentz, and Einstein too, regarded the physical space of general relativity as essentially fulfilling the role of the ether of the older electron theory."[49]



This statement is very significant. It reveals that the ultimate "fiction" (Vaihinger's sense of the term in his *Die Philosophie des Als Ob*) of both Lorentz' and the Einsteins' theories is the same, with any distinctions between the two theories being *metaphysical* (truly just semantic) and not *scientific*—the theories make the same predictions; and are, therefore, *scientifically speaking*, indistinguishable. The Einsteins' theory is a quasi-positivistic mathematical analysis of Lorentz' synthetic physical theory—a "dimensional disguise" for it. As Arthur Eddington explained,

"LET us suppose that an ichthyologist is exploring the life of the ocean. He casts a net into the water and brings up a fishy assortment. Surveying his catch, he proceeds in the usual manner of a scientist to systematise what it reveals. He arrives at two generalisations:

(1) No sea-creature is less than two inches long.

(2) All sea-creatures have gills.

These are both true of his catch, and he assumes tentatively that they will remain true however often he repeats it.

In applying this analogy, the catch stands for the body of knowledge which constitutes physical science, and the net for the sensory and intellectual equipment which we use in obtaining it. The casting of the net corresponds to observation; for knowledge which has not been or could not be obtained by observation is not admitted into physical science.

An onlooker may object that the first generalisation is wrong. 'There are plenty of sea-creatures under two inches long, only your net is not adapted to catch them.' The icthyologist dismisses this objection contemptuously. 'Anything uncatchable by my net is *ipso facto* outside the scope of icthyological knowledge, and is not part of the kingdom of fishes which has been defined as the theme of ichtyological knowledge. In short, 'what my net can't catch isn't fish.' Or—to translate the analogy—'If you are not simply guessing, you are claiming a knowledge of the physical universe discovered in some other way than by the methods of physical science, and admittedly unverifiable by such methods. You are a metaphysician. Bah!'"[50]

The "ether", or "æther", is a hypothetical fluid, which may fill space and conduct electromagnetic waves such as light, and is perhaps an intervening medium between bodies, which causes gravity. Einstein tried to distinguish his work from Lorentz' by calling the æther "superfluous", which assertion Poincaré and countless others had long since enunciated. The existence of this "fluid" has been hotly disputed for thousands of years, but unless we deny dimension as an anthropomorphic delusion of consciousness, "space" as extension without "material" must be *something*. An empty box contains *something*, even if we evacuate the air from it. We can give this *something* any name we like, but changing its name is a matter of semantics, not discovery.



James Mackaye wrote in 1931,

"Einstein's explanation is a dimensional disguise for Lorentz's. [***] Thus Einstein's theory is not a denial of, nor an alternative for, that of Lorentz. It is only a duplicate and disguise for it. [***] Einstein continually maintains that the theory of Lorentz is right, only he disagrees with his 'interpretation.' Is it not clear, therefore, that in this, as in other cases, Einstein's theory is merely a disguise for Lorentz's, the apparent disagreement about 'interpretation' being a matter of words only?"[51]

Lorentz pointed out in 1913,

"The latter is, by the way, up to a certain degree a quarrel over words: it makes no great difference, whether one speaks of the vacuum or of the æther."

"Letzteres ist übrigens bis zu einem gewissen Grade ein Streit über Worte: es macht keinen großen Untershied, ob man vom Vakuum oder vom Äther spricht."[52]

In 1934, Albert Einstein confirmed Mackaye's assertions,

"Then came H. A. Lorentz's great discovery. All the phenomena of electromagnetism then known could be explained on the basis of two assumptions: that the ether is firmly fixed in space—that is to say, unable to move at all, and that electricity is firmly lodged in the mobile elementary particles. Today his discoveries may be expressed as follows: physical space and the ether are only different terms for the same thing; fields are physical states of space."[53]

Obviously, Einstein's efforts to disguise his piracy through semantics and internally inconsistent Metaphysics are nonsense, for physical states compel physical substance, the æther, and Lorentz stated, in 1906,

"We shall add the hypothesis that, though the particles may move, *the ether always remains at rest*. We can reconcile ourselves with this, at first sight, somewhat startling idea, by thinking of the particles of matter as of some local modifications in the state of the ether. These modifications may of course very well travel onward while the volume-elements of the medium in which they exist remain at rest."[54]

Herbert Dingle derided Einstein's numerology, his "dimensional disguise for Lorentz's" physical theory,

"This proposal became known as *the relativity theory of Lorentz*, and certain features of it call for attention here. [***] Like Maxwell, who realised the necessity, if he was to satisfy his mathematical desires, of postulating a 'displacement current' to justify them, so Lorentz, in order to justify his transformation equations, saw the necessity of postulating a physical effect of interaction between moving matter and ether, to give the mathematics meaning. Physics still had *de jure* authority over mathematics: it was Einstein, who had no qualms about abolishing the ether and still retaining light waves whose properties were expressed by formulae that were meaningless without it, who was the first to discard physics altogether and propose a wholly mathematical theory."[55]



As Vaihinger stated,

"Pure mathematical space is a fiction. Its concept has the marks of a fiction: the idea of an extension without anything extended, of separation without things that are to be separated, is something unthinkable, absurd and impossible."[56]

Albert Einstein, who, in 1905, had called the æther "superfluous", stated in 1920,

"To deny the ether is ultimately to assume that empty space has no physical qualities whatever. [***] Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense."[57]

The eminent physicist Oliver Heaviside, in a hand-written letter to Prof. Bjerknes, discussed Einstein's compulsory shift in position from claiming that the æther was superfluous to stating directly that the æther was fundamental to "Einstein's" theories,

"I don't find Einstein's Relativity agrees with me. It is the most unnatural and difficult to understand way of representing facts that could be thought of. His distorted space is chaos [***] The Einstein enthusiasts are very patronizing about the 'classical' electromagnetics and its ether, which they have abolished. But they will come back to it by and by. [***] But you must work fairly, with the Ether, and Forces, & Momentum etc. They are the realities, without Einstein's distorted nothingness. [***] And I really think that Einstein is a practical joker, pulling the legs of his enthusiastic followers, more Einsteinisch than he. He knows the weakness of his 2nd Theory. He only does it to annoy [***] I can't get away from Einstein the Joker. [***] Did such a clever man as Einstein not see the significance of Poisson's theorem? It is said that it was by noticing some of H. A. Lorentz' formulas, and those of Minkowski, led him to the result. Well, we must believe it, if he says so, and like the silent parrot, think the more."[58]

In 1938, Einstein and Infeld, in a co-authored work, averred,

"Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement. We may still use the word ether, but only to express some physical property of space. This word ether has changed its meaning many times in the development of science. At the moment it no longer stands for a medium built up of particles. Its story, by no means finished, is continued by the relativity theory."[59]



Herbert Spencer addressed the root of the problem of confusing pure Mathematics with Physics,

"To sum up this somewhat too elaborate argument:—We have seen how in the very assertion that all our knowledge, properly so called, is Relative, there is involved in the assertion that there exists a Non-relative. We have seen how, in each step of the argument by which this doctrine is established, the same assumption is made. We have seen how, from the very necessity of thinking in relations, it follows that the Relative is itself inconceivable, except as related to a real Non-relative. We have seen that unless a real Non-relative or Absolute be postulated, the Relative itself becomes absolute; and so brings the argument to a contradiction. And on contemplating the process of thought, we have equally seen how impossible it is to get rid of the consciousness of an actuality lying behind appearances; and how, from this impossibility, results our indestructible belief in that actuality."[60]

Surely, the assertion of a physical æther is a scientific hypothesis, which recognizes the need of the real behind the relative, while the abstract set of human rules which constitute "space-time" represent nothing real or imagined.

Sir Edmund Whittaker in his detailed survey, *A History of the Theories of Aether and Electricity*, Volume II, (1953), included a chapter entitled "The Relativity Theory of Poincaré and Lorentz". Whittaker thoroughly documented the development of the theory, documenting the authentic history, and demonstrated through reference to primary sources that Einstein held no priority for the vast majority of the theory. Einstein offered no counter-argument to Whittaker's famous book, in which the following passage appeared,

> "Einstein published a paper which set forth the relativity theory of Poincaré and Lorentz with some amplifications, and which attracted much attention. He asserted as a fundamental principle the *constancy of the velocity of light*, i.e. that the velocity of light *in vacuo* is the same in all systems of reference which are moving relatively to each other: an assertion which at the time was widely accepted, but has been severally criticized by later writers."[61]

Whittaker also wrote a realistic biography of Einstein, in *Biographical Memoirs of Fellows of the Royal Society*, which reiterated the truth, that Einstein did not create the theory of relativity,

> "The aggregate of all the transformations so obtained, combined with the aggregate of all the rotations in ordinary space, constitutes a *group*, to which Poincaré* gave the name the group of *Lorentz Transformations.*
>
> Einstein [***] adopted Poincaré's Principle of Relativity (using Poincaré's name for it) as a new basis for physics and showed that the group of Lorentz transformations provided a new analysis connecting the physics of bodies in motion relative to each other. Notable results appearing in this paper for the first time were the relativist formulae for aberration and also for the Doppler effect."[62]

Even among Einstein's admirers, voices are heard,



which deny Einstein's priority. Max Born averred that,

> "Lorentz enunciated the laws according to which the measured quantities in various systems may be transformed into each other, and he proved that these transformations leave the field equations of the electron theory unchanged. This is the mathematical content of his discovery. Larmor (1900) and Poincaré (1905) arrived at similar results about the same time. It is interesting historically that the formula of transformation to a moving system, which we nowadays call Lorentz' transformation (see vi, 2, p. 200 formula (72)), were set up by Voigt as early as 1877 [*sic*[63]] in a dissertation which was still founded on the elastic theory of light. [***] In the new theory of Lorentz the principle of relativity holds, in conformity with the results of experiment, for all electrodynamic events."[64]

and,

> "As mentioned already, Lorentz and Poincaré have succeeded in doing this by careful analysis of the properties of Maxwell's equations. They were indeed in possession of a great deal of mathematical theory. Lorentz, however, was so attached to his assumption of an ether absolutely at rest that he did not acknowledge the physical significance of the equivalence of the infinite numbers of systems of reference which he had proved. He continued to believe that one of them represented the ether at rest. Poincaré went a step further. It was quite clear to him that Lorentz's viewpoint was not tenable and that the

mathematical equivalence of systems of reference meant the validity of the principle of relativity. He also was quite clear about the consequences of his theory."[65]

and,

"I have now to say some words about the work of these predecessors of EINSTEIN, mainly of LORENTZ and POINCARÉ. [***] H. A. LORENTZ' important papers of 1892 and 1895 on the electrodynamics of moving bodies contain much of the formalism of relativity. [***] POINCARÉ's papers [***] show that as early as 1899 he regarded it as very probable that absolute motion is indetectable in principle and that no ether exists. He formulated the same ideas in a more precise form, though without any mathematics, in a lecture given in 1904 to a Congress of Arts and Science at St. Louis, U.S.A., and he predicted the rise of a new mechanics which will be characterized above all by the rule, that no velocity can exceed the velocity of light. [***] The reasoning used by POINCARÉ was just that, which Einstein introduced in his first paper of 1905 [***] Does this mean that POINCARÉ knew all this before Einstein? It is possible [***] Many of you have looked upon [Einstein's] paper 'Zur Elektrodynamik bewegter Körper' in *Annalen der Physik* [***] and you will have noticed some peculiarities. The striking point is that it contains not a single reference to previous literature. It gives you the impression of quite a new venture. But that is, of course, as I have tried to explain, not true."[66]

Einstein's friend, physicist Peter Gabriel



Bergmann, asserted,

"The Dutch physicist, Hendrik Antoon Lorentz (1853-1928) contrived a theoretical scheme according to which absolute motion of physical objects, including measuring rods, should compress them in such a manner that differences in the speed of light remained undetectable by any conceivable apparatus. Jules Henri Poincaré (1854-1912), the French mathematician, suggested that the consistent failure to identify the frame representing absolute rest indicated that no such frame existed, and that Newton's scheme of the multiplicity of inertial frames was valid after all. In 1905, Einstein combined Lorentz' and Poincaré's ideas into a new approach to the issue of frames of reference and so was able to explain why no experiment had uncovered the absolute motion of the earth, without contradicting Maxwell's theory of electricity and magnetism."[67]

The Einsteins' 1905 paper failed to present references to the work it "combined" of Lorentz and Poincaré. That which was "new" in the "approach" is of minor significance. Poincaré's work was itself the combination of Lorentz' and Poincaré's ideas, which "combination" Mileva and Albert did not create, but simply repeated, parroting Poincaré's earlier works, virtually verbatim.

G. H. Keswani argued that,

"As far back as 1895, Poincaré the innovator had conjectured that it is impossible to detect absolute motion. In 1900 he introduced the 'The principle of relative motion' which he later called by the equivalent terms 'The law of relativity' and 'The principle of relativity' in his book *Science and Hypothesis* published in 1902. He further asserted in this book that there is no absolute time and that we have no intuition of the 'simultaneity' of two 'events' (mark the words) occurring at different places. In a lecture given in 1904, Poincaré reiterated the principle of relativity, described the method of synchronisation of clocks with light signals, urged a more satisfactory theory of the electrodynamics of moving bodies based on Lorentz's ideas and predicted a new mechanics characterized by the rule that the velocity of light cannot be surpassed. This was followed in June 1905 by a mathematical paper entitled 'Sur la dynamique de l'électron' in which the connection between relativity (impossibility of absolute motion) and the Lorentz Transformation given by Lorentz a year earlier was recognized. In point of fact, therefore, Poincaré was not only the first to enunciate the principle, but he also discovered in Lorentz's work the necessary mathematical formulation of the principle. All this happened before Einstein's paper appeared."[68]

How do we account for the striking similarity between Lorentz' and Poincaré's writings and Einstein's words in both the "special" and "general" theories of relativity? Who published what, first? Was it mere coincidence that time after time, Einstein repeated what Poincaré had earlier published? The record indicates that Poincaré held priority, often by many years, over Einstein. Why is it that Albert's last name is a household word and is synonymous with "relativity", and Poincaré's name is substantially more



obscure? Einstein believed,

> "The secret to creativity is knowing how to hide your sources."[69]

The mathematical transformations in relativity theory are called "Lorentz Transformations",[70] an appellation supplied by Poincaré.[71] The record indicates that Voigt,[72] FitzGerald, Larmor, Poincaré and Lorentz began developing the mathematical expressions of the theory of relativity some 18 years before Einstein, and completed them before Einstein published on the subject. The "Lorentz Transformation" is not Lorentz' transformation, as is, and was, widely known,

> "Nor did Lorentz discover these equations. They were first used by Voight[*sic*]."[73]

The *Brockhaus Enzyklopädie* succinctly states,

> "Voigt [***] presented (among the introduction of the term 'Tensor') a theory of elasticity; in the treatment of optical properties, he formulated for the first time in 1887 the formulas, which later became known through the special theory of relativity as the Lorentz-Transformation ."

> "Voigt [***] lieferte (unter Einführung des Begriffes >Tensor<) eine Elastizitätstheorie; bei der Behandlung der opt. Eigenschaften formulierte er 1887 erstmalig die später als Lorentz-Transformation durch die Spezielle Relativitätstheorie bekanntgewordenen Formeln."[74]

Minkowski stated,

"Maxwell's and Lorentz' theory are not really opposites, but rather the rigid and the non-rigid, Zeppelin's and Parseval's electron. In the interest of history, I want yet to add, that the transformations which play the main rôle in the principle of relativity were first mathematically formulated by Voigt, in the year 1887. With the aid of these transformations, Voigt had already drawn conclusions at that time regarding the Doppler Effect."

"Nicht die Maxwellsche und die Lorentzsche Theorie sind die eigentlichen Gegensätze, sondern das starre und das unstarre, das Zeppelinsche und das Parsevalsche Elektron. Historisch will ich noch hinzufügen, daß die Transformationen, die bei dem Relativitätsprinzip die Hauptrolle spielen, zuerst mathematisch von Voigt im Jahre 1887 behandelt sind. Voigt hat damals bereits mit ihrer Hilfe Folgerungen in bezug auf das Dopplersche Prinzip gezogen."

to which Voigt responded,

"Mr. Minkowski recalls an old work of mine. It addressed the application of the Doppler Effect to some special cases which arise due to the elastic theory of light, not the electromagnetic. It had already at that time revealed some of the consequences, which were later arrived at through the electromagnetic theory."

"Herr Minkowski erinnert an eine alte Arbeit von



mir. Es handelt sich dabei um Anwendungen des Dopplerschen Prinzips, die in speziellen Teilen auftreten, aber nicht auf Grund der elektromagnetischen, sondern auf Grund der elastischen Theorie des Lichtes. Indessen haben sich damals bereits einige derselben Folgerungen ergeben, die später aus der elektromagnetischen Theorie gewonnen sind."[75]

Lorentz, himself, acknowledged Voigt's priority, and was uncomfortable with Poincaré's term "Lorentz Transformation". Lorentz wrote to Voigt,

"Of course I will not miss the first opportunity to mention, that the concerned transformation and the introduction of a local time has been your idea."[76]

Lorentz kept his word:

"In a paper „Über das Doppler'sche Princip", published in 1887 (Gött. Nachrichten, p. 41) and which to my regret has escaped my notice all these years, Voigt has applied to equations of the form (6) (§3 of this book) a transformation equivalent to the formulae (287) and (288). The idea of the transformations used above (and in §44) might therefore have been borrowed from Voigt and the proof that it does not alter the form of the equations for the *free* ether is contained in his paper."[77]

"It was these considerations published by me in 1904, which gave rise to the dissertation by Poincaré on the dynamics of the electron, in which he has attached my name to the transformation of which I have just spoken. I am obliged to again note the observation that the same transformation itself was previously hit upon in an article from Mr. Voigt published in 1887, and I did not remove the artifice from it to the fullest extent possible. In fact, for certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski. To discover the 'transformations of relativity', as I will call them now, . . ."

"Ce furent ces considérations publiées par moi en 1904 qui donnèrent lieu à POINCARÉ d'écrire son mémoire sur la Dynamique de l'électron, dans lequel il a attaché mon nom à la transformation dont je viens de parler. Je dois remarquer à ce propos que la même transformation se trouve déjà dans un article de M. Voigt publié en 1887 et que je n'ai pas tiré de cet artifice tout le parti possible. En effet, pour certaines des grandeurs physiques qui entrent dans les formules, je n'ai pas indiqué la transformation qui convient le mieux. Cela a été fait par POINCARÉ et ensuite par M. EINSTEIN et MINKOWSKI. Pour trouver les «transformations de relativité», comme je les appellerai maintenant".[78]

Boscovich wrote of length contraction, time dilatation, relative simultaneity, and the "Principle of Invariance" resulting from these, back in the 1700's.[79] Stallo, Streintz, Everett and Lange, stressed the principle of relativity. The term "principle of relativity" was not original to the Einsteins. It was, in fact, a common term long before they entered the scene. It



was found in German in: Lange,[80] Stallo,[81] Violle,[82] Poincaré,[83] and the German translation, with notes by Felix Hausdorff,[84] of Huyghens' Seventeenth Century seminal paper on relativity theory, "Über die Bewegung der Körper durch den Stoss / Über die Centrifugalkraft"; all before 1905. The term also appeared in many other languages, and was used by many other authors, prior to 1905. Poincaré frequently iterated his electrodynamics-based "principle of relativity" long before the Einsteins repeated the same principle. Rowland had expressed it by 1900.

Though it was an ancient notion, Galileo Galilei made the principle of relativity of mechanics famous,

"When you have observed all these things carefully (though there is no doubt that when the ship is standing still everything must happen in this way), have the ship proceed with any speed you like, so long as the motion is uniform and not fluctuating this way and that. You will discover not the least change in all the effects named, nor could you tell from any of them whether the ship was moving or standing still."[85]

Boscovich argued, in 1763, in the second supplement to his *Natural Philosophy*,

"§ II

*Of Space & Time, as we know them*

18. We have spoken, in the preceding Supplement, of Space & Time, as they are in themselves; it remains for us to say a few words on matters that pertain to them, in so far as they come within our knowledge. We can in no direct way obtain a knowledge through the senses of those real

modes of existence, nor can we discern one of them from another. We do indeed perceive, by a difference of ideas excited in the mind by means of the senses, a determinate relation of distance & position, such as arises from any two local modes of existence; but the same idea may be produced by innumerable pairs of modes or real points of position; these induce the relations of equal distances & like positions, both amongst themselves & with regard to our organs, & to the rest of the circumjacent bodies. For, two points of matter, which anywhere have a given distance & position induced by some two modes of existence, may somewhere else on account of two other modes of existence have a relation of equal distance & like position, for instance if the distances exist parallel to one another. If those points, we, & all the circumjacent bodies change their real positions, & yet do so in such a manner that all the distances remain equal & parallel to what they were at the start, we shall get exactly the same ideas. Nay, we shall get the same ideas, if, while the magnitudes of the distances remain the same, all their directions are turned through any the same angle, & thus make the same angles with one another as before. Even if all these distances were diminished, while the angles remained constant, & the ratio of the distances to one another also remained constant, but the forces did not change owing to that change of distance; then if the scale of forces is correctly altered, that is to say, that curved line, whose ordinates express the forces; then there would be no change in our ideas.

19. Hence it follows that, if the whole Universe within our sight were moved by a parallel motion in



any direction, & at the same time rotated through any angle, we could never be aware of the motion or the rotation. Similarly, if the whole region containing the room in which we are, the plains & the hills, were simultaneously turned round by some approximately common motion of the Earth, we should not be aware of such a motion; for practically the same ideas would be excited in the mind. Moreover, it might be the case that the whole Universe within our sight should daily contract or expand, while the scale of forces contracted or expanded in the same ratio; if such a thing did happen, there would be no change of ideas in our mind, & so we should have no feeling that such a change was taking place.

20. When either objects external to us, or our organs change their modes of existence in such a way that that first equality or similitude does not remain constant, then indeed the ideas are altered, & there is a feeling of change; but the ideas are the same exactly, whether the external objects suffer the change, or our organs, or both of them unequally. In every case our ideas refer to the difference between the new state & the old, & not to the absolute change, which does not come within the scope of our senses. Thus, whether the stars move round the Earth, or the Earth & ourselves move in the opposite direction round them, the ideas are the same, & there is the same sensation. We can never perceive absolute changes; we can only perceive the difference from the former configuration that has arisen. Further, when there is nothing at hand to warn us as to the change of our organs, then indeed we shall count ourselves to have been unmoved, owing to a general prejudice

for counting as nothing those things that are nothing in our mind; for we cannot know of this change, & we attribute the whole of the change to objects situated outside of ourselves. In such manner any one would be mistaken in thinking, when on board ship, that he himself was motionless, while the shore, the hills & even the sea were in motion."

Newton stated, in the fifth corollary to his *Principia*,

> "*The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forwards in a right line without any circular motion.*
>
> For the differences of the motions tending towards the same parts, and the sums of those that tend towards contrary parts, are, at first (by supposition), in both cases the same; and it is from those sums and differences that the collisions and impulses do arise with which the bodies mutually impinge one upon another. Wherefore (by Law II), the effects of those collisions will be equal in both cases; and therefore the mutual motions of the bodies among themselves in the one case will remain equal to the mutual motions of the bodies among themselves in the other. A clear proof of which we have from the experiment of a ship; where all motions happen after the same manner, whether the ship is at rest, or is carried uniformly forwards in a right line."

J. D. Everett expressly stated the principle of



relativity at least as early as 1883, in anticipation of Lange,

> "We cannot even assert that there is any such thing as absolute rest, or that there is any difference between absolute rest and uniform straight movement of translation."[86]

and, in 1895, Everett asserted the principle of relativity as a negative assertion,

> "[T]here is no test by which we can distinguish between absolute rest and uniform velocity of translation".[87]

Poincaré stated, in 1895,

> "Experience reveals an abundance of facts, which can be summed up in the following formula: it is impossible to make manifest the absolute motion of matter, or, more correctly, the relative motion of ponderable matter with reference to the æther; the only thing which can be observed is the motion of ponderable matter with reference to ponderable matter."
>
> "L'expérience a révélé une foule de faits qui peuvent se résumer dans la formule suivante: il est impossible de rendre manifeste le mouvement absolu de la matière, ou mieux le mouvement relatif de la matière pondérable par rapport à l'éther; tout ce qu'on peut mettre en évidence, c'est le mouvement de la matière pondérable par rapport à la matière pondérable."[88]

Poincaré's 1904 principle of relativity states,

"The principle of relativity, according to which the laws of physical phenomena should be the same, whether for an observer fixed, or for an observer carried along in a uniform movement of translation; so that we have not and could not have any means of discerning whether or not we are carried along in such a motion."[89]

Henry August Rowland stated the two "postulates" on October 28th, 1899,

"And yet, however wonderful [the ether] may be, its laws are far more simple than those of matter. *Every wave in it, whatever its length or intensity, proceeds onwards in it according to well known laws, all with the same speed, unaltered in direction, from its source in electrified matter to the confines of the Universe, unimpaired in energy unless it is disturbed by the presence of matter.* However the waves may cross each other, each proceeds by itself without interference with the others. [***] *To detect something dependent on the relative motion of the ether and matter has been and is the great desire of physicists. But we always find that, with one possible exception, there is always some compensating feature which renders our efforts useless.* This one experiment is the aberration of light, but even here Stokes has shown that it may be explained in either of two ways: first, that the earth moves through the ether of space without disturbing it, and second, if it carries the ether with it by a kind of motion called irrotational. Even here, however, the amount of action probably depends upon relative motion of the luminous source to the recipient telescope. So the principle of Doppler depends also on this relative motion and is independent of the ether. The result of the experiments of Foucault on the passage of light through moving water can no longer be interpreted as due to the partial movement of the ether with the moving water, an inference due to imperfect theory alone. The experiment of Lodge, who attempted to set the ether in motion by a rapidly rotating disc, showed no such result. The experiment of Michelson to detect the ethereal wind, although carried to the extreme of accuracy, also failed to detect any relative motion of the matter and the ether [*Emphasis Added*]."[90]



It was Lorentz, who properly phrased the *corollary of relativity* in 1904,

"It would be more satisfactory, if it were possible to show, by means of certain fundamental assumptions, and without neglecting terms of one order of magnitude or another, that many electromagnetic actions are entirely independent of the motion of the system."

The Einsteins wrote, in 1905, without reference to previous authors,

"Examples of a similar kind, as well as the failed attempts to find a motion of the earth relative to the 'light medium', lead to the supposition, that the concept of absolute rest corresponds to no characteristic properties of the phenomena not just in mechanics, but also in electrodynamics, on the contrary, for all systems of coordinates, for which the equations of mechanics are valid, the same electrodynamic and optical laws are also valid, as has already been proven for the magnitudes of the first order."

and,

"The laws according to which the states of physical systems change do not depend upon to which of two systems of coordinates, in uniform translatory motion relative to each other, this change of state is referred.

The Einsteins asserted the "light postulate", in 1905, without reference to previous authors,

1. "[L]ight in empty space always propagates with a determinate velocity *c* irrespective of the state of motion of the emitting body."

"Every ray of light moves in the 'resting' system of coordinates with the determinate velocity *c*, irrespective of whether this ray of light is emitted from a resting or moving body. Such that

velocity = (path of light) / (interval of time) ,

where 'interval of time' is to be construed in the sense of the definition of § 1."

The references in Lorentz' and Poincaré's works to this velocity are too numerous to repeat. In the Einsteins' 1905 paper, this velocity is the absolute velocity of light in its medium, absolute space.



Max Abraham wrote in 1904,

"The electromagnetic theory addresses the absolute motion of light, which light issues forth in every direction with the same velocity (*c*)"

"Die elektromagnetische Theorie spricht von einer absoluten Bewegung des Lichtes, die nach jeder Richtung hin mit derselben Geschwindigkeit (*c*) erfolgt"[91]

The absolute velocity of light was stated numerous times in history, for example, as an observed empirical result, by Cassini and Roemer (ca. 1676) and Bradley (ca. 1729).

Maxwell created his theorem of the velocity of light as a dynamic process in its medium. W. Stanley Jevons wrote in the 1870's,

"In a first subclass we may place the velocity of light or heat undulations, the numbers expressing the relation between the lengths of undulations, and the rapidity of the undulations, these numbers depending only on the properties of the ethereal medium, and being probably the same in all parts of the universe."[92]

The Einsteins argued, in 1905, that the æther is "superfluous", without reference to prior authors,

"The introduction of a 'luminiferous ether' will prove to be superfluous inasmuch as the view here to be developed will not require an 'absolutely stationary space' provided with special properties".

Lorentz stated in 1895,

"It does not suit my purpose to examine more thoroughly such speculations, or to express presumptions about the nature of the æther. I merely wish, as far as possible, to free myself of all preconceived notions regarding this substance and not to ascribe to it, for example, any of the qualities of ordinary liquids and gasses. Should it be shown, that a description of the phenomena is best arrived at through the assumption of absolute permeability, then one must surely in the meantime adopt this sort of hypothesis, and leave it to further research, if possible, to open up a deeper understanding to us.

It stands to reason, that there can be no question of the *absolute* rest of the æther; the phrase would not even have made sense. When I concisely state, the æther rests, it is only meant that one part of this medium does not displace the other, and that all perceptible motions of the heavenly bodies are relative motions in reference to the æther."

"Es liegt nicht in meiner Absicht, auf derartige Speculationen näher einzugehen oder Vermuthungen über die Natur des Aethers auszusprechen. Ich wünsche nur, mich von vorgefassten Meinungen über diesen Stoff möglichst frei zu halten und demselben z. B. keine von den Eigenschaften der gewöhnlichen Flüssigkeiten und Gase zuzuschreiben. Sollte es sich ergeben, dass eine Darstellung der Erscheinungen am besten unter der Voraussetzung absoluter Durchdringlichkeit gelänge, dann müsste



man sich zu einer solchen Annahme einstweilen schon verstehen und es der weiteren Forschung überlassen, uns, womöglich, ein tieferes Verständniss zu erschliessen.

Dass von *absoluter* Ruhe des Aethers nicht die Rede sein kann, versteht sich wohl von selbst; der Ausdruck würde sogar nicht einmal Sinn haben. Wenn ich der Kürze wegen sage, der Aether ruhe, so ist damit nur gemeint, dass sich der eine Theil dieses Mediums nicht gegen den anderen verschiebe und dass alle wahrnehmbaren Bewegungen der Himmelskörper relative Bewegungen in Bezug auf den Aether seien."[93]

Joseph Larmor wrote, in 1900,

"At the same time all that is known (or perhaps need be known) of the aether itself may be formulated as a scheme of differential equations defining the properties of a *continuum* in space, which it would be gratuitous to further explain by any complication of structure; though we can with great advantage employ our stock of ordinary dynamical concepts in describing the succession of different states thereby defined."[94]

In 1900, Paul Drude stated,

"*The velocity of light in space* [***] independent of what is understood by a light vector. [***] The conception of an ether absolutely at rest is the most simple and the most natural,—at least if the ether is conceived to be not a substance but merely space endowed with certain physical properties."[95]

Poincaré asserted, in 1900,

"Does our ether actually exist? We know the origin of our belief in the ether. If light takes several years to reach us from a distant star, it is no longer on the star, nor is it on the earth. It must be somewhere, and supported, so to speak, by some material agency.

The same idea may be expressed in a more mathematical and more abstract form."[96]

Poincaré also asserted, in 1889, that,

"Whether the ether exists or not matters little—let us leave that to the metaphysicians; what is essential for us is, that everything happens as if it existed, and that this hypothesis is found to be suitable for the explanation of phenomena. After all, have we any other reason for believing in the existence of material objects? That, too, is only a convenient hypothesis; only, it will never cease to be so, while some day, no doubt, the ether will be thrown aside as useless."[97]

In 1901, Cohn averred,

"Like Maxwell and Hertz we address a chemically and physically homogenous medium as an entity, which is also completely characterized at all points electromagnetically by the same value of some constants. This type of medium fills each element of our space; it is perhaps a certain ponderable substance, or it may also be the vacuum. In light of this, we will avoid continuing to speak of an 'æther'."



"Wie Maxwell und Hertz behandeln wir ein chemisch und physikalisch homogenes Medium als ein Gebilde, welches auch elektromagnetisch in allen Punkten durch die gleichen Werte einiger Constanten vollständig charakterisiert ist. *Ein* solches Medium erfüllt jedes Element unseres Raumes; es kann eine bestimmte ponderable Substanz oder auch das Vacuum sein. Daneben noch von einem „Aether" zu sprechen, werden wir vermeiden."[98]

Faraday argued, in April of 1846,

"The point intended to be set forth for consideration of the hearers was, whether it was not possible that the vibrations which in a certain theory are assumed to account for radiation and radiant phænomena may not occur in the lines of force which connect particles, and consequently masses of matter together; a notion which as far as it is admitted, will dispense with the æther, which, in another view, is supposed to be the medium in which these vibrations take place.

You are aware of the speculation[2] which I some time since uttered respecting that view of the nature of matter which considers its ultimate atoms as centres of force, and not as so many little bodies surrounded by forces, the bodies being considered in the abstract as independent of the forces and capable of existing without them. In the latter view, these little particles have a definite form and a certain limited size; in the former view such is not the case, for that which represents size may be considered as extending to any distance to which the lines of force of the particle extend: the particle indeed is supposed to exist only by these forces, and where they are it is. The consideration of matter under this view gradually led me to look at the lines of force as being perhaps the seat of the vibrations of radiant phænomena.

[***]

The view which I am so bold as to put forth considers, therefore, radiation as a high species of vibration in the lines of force which are known to connect particles and also masses of matter together. It endeavours to dismiss the æther, but not the vibration. The kind of vibration which, I believe, can alone account for the wonderful, varied, and beautiful phænomena of polarization, is not the same as that which occurs on the surface of disturbed water, or the waves of sound in gases or liquids, for the vibrations in these cases are direct, or to and from the centre of action, whereas the former are lateral. It seems to me, that the resultant of two or more lines of force is in an apt condition for that action which may be considered as equivalent to a *lateral* vibration; whereas a uniform medium, like the æther, does not appear apt, or more apt than air or water.

The occurrence of a change at one end of a line of force easily suggests a consequent change at the other. The propagation of light, and therefore probably of all radiant action, occupies *time*; and, that a vibration of the line of force should account for the phænomena of radiation, it is necessary that such vibration should occupy time also. I am not aware whether there are any data by which it has been, or could be ascertained whether such a power



as gravitation acts without occupying time, or whether lines of force being already in existence, such a lateral disturbance of them at one end as I have suggested above, would require time, or must of necessity be felt instantly at the other end.

As to that condition of the lines of force which represents the assumed high elasticity of the æther, it cannot in this respect be deficient: the question here seems rather to be, whether the lines are sluggish enough in their action to render them equivalent to the æther in respect of the time known experimentally to be occupied in the transmission of radiant force.

The æther is assumed as pervading all bodies as well as space: in the view now set forth, it is the forces of the atomic centres which pervade (and make) all bodies, and also penetrate all space. As regards space, the difference is, that the æther presents successive parts or centres of action, and the present supposition only lines of action; as regards matter, the difference is, that the æther lies between the particles and so carries on the vibrations, whilst as respects the supposition, it is by the lines of force between the centres of the particles that the vibration is continued."[99]

Faraday's ideas were very influential. William Kingdon Clifford speculated in the year of his death and of Einstein's birth,1879, that light may be naught but flickering "space",

"In order to explain the phenomena of light, it is not necessary to assume anything more than a periodical oscillation between two states at any given point of space."[100]

In 1934, Einstein repeated Clifford's idea without an attribution, which idea appeared before Lorentz' theory appeared,

> "Then came H. A. Lorentz's great discovery. All the phenomena of electromagnetism then known could be explained on the basis of two assumptions: that the ether is firmly fixed in space—that is to say, unable to move at all, and that electricity is firmly lodged in the mobile elementary particles. Today his discoveries may be expressed as follows: physical space and the ether are only different terms for the same thing; fields are physical states of space."[101]

Ernst Brücke wrote, in 1857,

> "Let us suppose a portion of the masses which gravitate towards each other to be destroyed; then certainly not only accelerating force, but also, according to circumstances, a portion of the tension or of the vis viva, or of both, would be destroyed: but this only confirms us in our way of viewing the subject. The law of the indestructibility of matter has been proved as universally valid as that of the conservation of force. That the destruction of the one should involve that of the other, only shows us that both stand in intimate connexion with each other, and proves that we are right in placing the cause of the notion of gravity in the masses themselves, and not in the space between them.
>
> Thus in all that has been hitherto said, so far as my consciousness reaches, so far as I am capable of distinguishing true from false, and like from unlike, all known facts are brought into complete harmony with our laws of thought when we suppose forces, as the causes of phænomena, to reside in the masses, the spaces between these masses being traversed by the forces. If the forces could be imagined as existing in space, it must also be conceivable that matter may be annihilated without changing the sum of forces, and this, at least by me, is not conceivable."[102]



Einstein stated, in 1916,

> "If I let all things vanish from the Universe, then, according to Newton, Galileo's space of inertia lingers, but in my opinion, *nothing* remains."

> "Wenn ich alle Dinge aus der Welt verschwinden lasse, so bleibt nach Newton der Galileische Trägheitsraum, nach meiner Auffassung aber *nichts* übrig."[103]

Clifford stated, in 1870, in his lecture, "On the Space Theory of Matter,"

> "RIEMANN has shown that as there are different kinds of lines and surfaces, so there are different kinds of space of three dimensions; and that we can only find out by experience to which of these kinds the space in which we live belongs. In particular, the axioms of plane geometry are true within the limits of experiment on the surface of a sheet of paper, and yet we know that the sheet is really covered with a number of small ridges and furrows, upon which (the total curvature not being zero) these axioms are not true. Similarly, he says although the axioms of solid geometry are true

within the limits of experiment for finite portions of our space, yet we have no reason to conclude that they are true for very small portions; and if any help can be got thereby for the explanation of physical phenomena, we may have reason to conclude that they are not true for very small portions of space.

I wish here to indicate a manner in which these speculations may be applied to the investigation of physical phenomena. I hold in fact

(1) That small portions of space *are* in fact of a nature analogous to little hills on a surface which is on the average fiat; namely, that the ordinary laws of geometry are not valid in them.

(2) That this property of being curved or distorted is continually being passed on from one portion of space to another after the manner of a wave.

(3) That this variation of the curvature of space is what really happens in that phenomenon which we call the *motion of matter*, whether ponderable or ethereal.

(4) That in the physical world nothing else takes place but this variation, subject (possibly) to the law of continuity.

I am endeavouring in a general way to explain the laws of double refraction on this hypothesis, but have not yet arrived at any results sufficiently decisive to be communicated."[104]

Einstein again parroted Faraday, Clifford and Brücke. Einstein changed direction from his materialistic Boscovichian misinterpretation of Mach's theory of inertial space. Einstein adopted, without an attribution, Clifford's complete reification of abstract



geometry, and stated, in 1930,

"We may summarize in symbolical language. Space, brought to light by the corporeal object, made a physical reality by NEWTON, has in the last few decades swallowed ether and time and seems about to swallow also the field and the corpuscles, so that it remains as the sole medium of reality."[105]

and,

"The strange conclusion to which we have come is this—that now it appears that space will have to be regarded as a primary thing and that matter is derived from it, so to speak, as a secondary result. Space is now turning around and eating up matter. We have always regarded matter as a primary thing and space as a secondary result. Space is now having its revenge, so to speak, and is eating up matter. But that is still a pious wish."[106]

Clifford had already stated, in a work published posthumously in 1885, some six years after his death,

"§ 19. *On the Bending of Space*

The peculiar topic of this chapter has been position, position namely of a point P relative to a point A. This relative position led naturally to a consideration of the geometry of steps. I proceeded on the hypothesis that all position is relative, and therefore to be determined only by a stepping process. The relativity of position was a postulate deduced from the customary methods of determining position, such methods in fact always giving relative position. *Relativity of position is thus a postulate derived from experience.* The late Professor Clerk-Maxwell fully expressed the weight of this postulate in the following words:—

All our knowledge, both of time and place, is essentially relative. When a man has acquired the habit of putting words together, without troubling himself to form the thoughts which ought to correspond to them, it is easy for him to frame an antithesis between this relative knowledge and a so-called absolute knowledge, and to point out our ignorance of the absolute position of a point as an instance of the limitation of our faculties. Any one, however, who will try to imagine the state of a mind conscious of knowing the absolute position of a point will ever after be content with our relative knowledge.[107]

It is of such great value to ascertain how far we can be certain of the truth of our postulates in the exact sciences that I shall ask the reader to return to our conception of position albeit from a somewhat different standpoint. I shall even ask him to attempt an examination of that state of mind which Professor Clerk-Maxwell hinted at in his last sentence.

[***]

But we may press our analogy a step further, and ask, since our hypothetical worm and fish might very readily attribute the effects of changes in the bending of their spaces to changes in their own physical condition, whether we may not in like fashion be treating merely as physical variations effects which are really due to changes in the



curvature of our space; whether, in fact, some or all of those causes which we term physical may not be due to the geometrical construction of our space. There are three kinds of variation in the curvature of our space which we ought to consider as within the range of possibility.

(i) Our space is perhaps really possessed of a curvature varying from point to point, which we fail to appreciate because we are acquainted with only a small portion of space, or because we disguise its small variations under changes in our physical condition which we do not connect with our change of position. The mind that could recognize this varying curvature might be assumed to know the absolute position of a point. For such a mind the postulate of the relativity of position would cease to have a meaning. It does not seem so hard to conceive such a state of mind as the late Professor Clerk-Maxwell would have had us believe. It would be one capable of distinguishing those so-called physical changes which are really geometrical or due to a change of position in space.

(ii) Our space may be really same (of equal curvature), but its degree of curvature may change as a whole with the time. In this way our geometry based on the sameness of space would still hold good for all parts of space, but the change of curvature might produce in space a succession of apparent physical changes.

(iii) We may conceive our space to have everywhere a nearly uniform curvature, but that slight variations of the curvature may occur from point to point, and themselves vary with the time. These variations of the curvature with the time may produce effects which we not unnaturally attribute to physical causes independent of the geometry of our space. We might even go so far as to assign to this variation of the curvature of space 'what really happens in that phenomenon which we term the motion of matter.'

We have introduced these considerations as to the nature of our space to bring home to the reader the character of the postulates we make in the exact sciences. These postulates are not, as too often assumed, necessary and universal truths; they are merely axioms based on our experience of a certain limited region. Just as in any branch of physical inquiry we start by making experiments, and basing on our experiments a set of axioms which form the foundation of an exact science, so in geometry our axioms are really, although less obviously, the result of experience. On this ground geometry has been properly termed at the commencement of Chapter II a *physical* science. The danger of asserting dogmatically that an axiom based on the experience of a limited region holds universally will now be to some extent apparent to the reader. It may lead us to entirely overlook, or when suggested at once reject, a possible explanation of phenomena. The hypotheses that space is not homaloidal, and again, that its geometrical character may change with the time, may or may not be destined to play a great part in the physics of the future; yet we cannot refuse to consider them as possible explanations of physical phenomena, because they may be opposed to the popular dogmatic belief in the universality of certain geometrical axioms—a belief which has I arisen from centuries of indiscriminating worship of the genius of Euclid."[108]



In 1905, the Einsteins asserted, without reference to prior authors,

"A rigid body which, measured in a state of rest, has the form of a sphere, therefore has in a state of motion—viewed from the stationary system—the form of an ellipsoid of revolution with the axes

$$R(1 - v^2/c^2)^{1/2}, R, R.$$

Thus, whereas the Y and Z dimensions of the sphere (and therefore of every rigid body of no matter what form) do not appear modified by the motion, the X dimension appears shortened in the ratio

$$1 : (1 - v^2/c^2)^{1/2},$$

i.e. the greater the value of $v$, the greater the shortening. For $v = c$ all moving objects—viewed from the 'stationary' system—shrivel up into plane figures. [That is, a body possessing spherical form when examined at rest.] For velocities greater than that of light our deliberations become meaningless; we shall, however, find in what follows, that the velocity of light in our theory plays the part, physically, of an infinitely great velocity."[109]

Poincaré stated, in 1904,

"From all these results, if they are confirmed, would arise an entirely new mechanics, which would be, above all, characterised by this fact, that no velocity could surpass that of light, any more than any temperature could fall below the zero absolute, because bodies would oppose an increasing inertia to the causes, which would tend to accelerate their motion; and this inertia would become infinite when one approached the velocity of light."[110]

Boscovich argued, in 1763, in the second supplement to his *Natural Philosophy*,

"21. Again, it is to be observed first of all that from this principle of the [invariance] of those things, of which we cannot perceive the change through our senses, there comes forth the method that we use for comparing the magnitudes of intervals with one another; here, that, which is taken as a measure, is assumed to be [invariant]. Also we make use of the axiom, *things that are equal to the same thing are equal to one another*; & from this is deduced another one pertaining to the same thing, namely, *things that are equal multiples, or submultiples, of each, are also equal to one another*; & also this, *things that coincide are equal*. We take a wooden or iron ten-foot rod; & if we find that this is congruent with one given interval when applied to it either once or a hundred times, & also congruent to another interval when applied to it either once or a hundred times, then we say that these intervals are equal. Further, we consider the wooden or iron ten-foot rod to be the same standard of comparison after translation. Now, if it consisted of perfectly continuous & solid matter, we might hold it to be exactly the same standard of comparison; but in my theory of points at a distance from one another, all the points of the ten-foot rod, while they are being transferred, really change the distance continually. For the distance is constituted by those real modes of existence, & these are continually changing. But if they are changed in such a manner that the modes which follow establish real relations of equal distances, the standard of comparison will not be identically the same; & yet it will still be an equal one, & the equality of the measured intervals will be correctly determined. We can no more transfer the length of the ten-foot rod, constituted in its first position by the first real modes, to the place of the length constituted in its second position by the second real modes, than we are able to do so for intervals themselves, which we compare by measurement. But, because we perceive none of this change during the translation, such as may demonstrate to us a relation of length, therefore we take that length to be the same. But really in this translation it will always suffer some slight change. It might happen that it underwent even some very great change, common to it & our senses, so that we should not perceive the change; & that, when restored to its former position, it would return to a state equal & similar to that which it had at first. However, there always is some slight change, owing to the fact that the forces which connect the points of matter, will be changed to some slight extent, if its position is altered with respect to all the rest of the Universe. Indeed, the same is the case in the ordinary theory. For no body is quite without little spaces interspersed within it, altogether incapable of being compressed or dilated; & this dilatation & compression undoubtedly occurs in every case of translation, at least to a slight extent. We, however, consider the measure to be the same so long as we do not perceive any alteration, as I have already remarked.

22. The consequence of all this is that we are quite unable to obtain a direct knowledge of absolute distances; & we cannot compare them with one another by a common standard. We have to estimate magnitudes by the ideas through which we recognize them; & to take as common standards those measures which ordinary people think suffer no change. But philosophers should recognize that there is a change; but, since they know of no case in which the equality is destroyed by a perceptible change, they consider that the change is made equally.

23. Further, although the distance is really changed when, as in the case of the translation of the ten-foot rod, the position of the points of matter is altered, those real modes which constitute the distance being altered; nevertheless if the change takes place in such a way that the second distance is exactly equal to the first, we shall call it the same, & say that it is altered in no way, so that the equal distances between the same ends will be said to be the same distance & the magnitude will be said to be the same; & this is defined by means of these equal distances, just as also two parallel directions will be also included under the name of the same direction. In what follows we shall say that the distance is not changed, or the direction, unless the magnitude of the distance, or the parallelism, is altered."

FitzGerald wrote, in 1889,

"I HAVE read with much interest Messrs. Michelson and Morley's wonderfully delicate experiment attempting to decide the important question as to how far the ether is carried along by the earth. Their result seems opposed to other experiments showing that the ether in the air can be carried along only to an inappreciable extent. I would suggest that almost the only hypothesis that can reconcile this opposition is that the length of material bodies changes, according as they are moving through the ether or across it, by an amount depending on the square of the ratio of their velocity to that of light. We know that electric forces are affected by the motion of the electrified bodies relative to the ether, and it seems a not improbable supposition that the molecular forces are affected by the motion, and that the size of a body alters consequently. It would be very important if secular experiments on electrical attractions between permanently electrified bodies, such as in a very delicate quadrant electrometer, were instituted in some of the equatorial parts of the earth to observe whether there is any diurnal and annual variation of attraction,—diurnal due to the rotation of the earth being added and subtracted from its orbital velocity; and annual similarly for its orbital velocity and the motion of the solar system."[111]

Lorentz had averred the same in 1892, and stated, in 1895,

"The displacement would naturally bring about this disposition of the molecules of its own accord, and thus effect a shortening in the direction of motion in the proportion of

$$1 \text{ to } (1 - v^2/c^2)^{1/2},$$

in accordance with the formulæ given in the above-mentioned paragraph."[112]

In 1904, Lorentz affirmed that,

> "§ 8. Thus far we have only used the fundamental equations without any new assumptions. I shall now suppose *that the electrons, which I take to be spheres of radius R in the state of rest, have their dimensions changed by the effect of a translation, the dimensions in the direction of motion becoming kl times and those in perpendicular directions l times smaller.*
>
> In this deformation, which may be represented by ($1/kl$, $1/l$, $1/l$) each element of volume is understood to preserve its charge."

Boscovich argued, in 1763, in the second supplement to his *Natural Philosophy*,

> "24. What has been said with regard to the measurement of space, without difficulty can be applied to time; in this also we have no definite & constant measurement. We obtain all that is possible from motion; but we cannot get a motion that is perfectly uniform. We have remarked on many things that belong to this subject, & bear upon the nature & succession of these ideas, in our notes. I will but add here, that, in the measurement of time, not even ordinary people think that the same standard measure of time can be translated from one time to another time. They see that it is another, consider that it is an equal, on account of some assumed uniform motion. Just as with the measurement of time, so in my theory with the measurement of space it is impossible to transfer a fixed length from its place to some other, just as it is impossible to transfer a fixed interval of time, so that it can be used for the purpose of comparing two of them by means of a third. In both cases, a second length, or a second duration is substituted, which is supposed to be equal to the first; that is to say, fresh real positions of the points of the same ten-foot rod which constitute a new distance, such as a new circuit made by the same rod, or a fresh temporal distance between two beginnings & two ends. In my Theory, there is in each case exactly the same analogy between space & time. Ordinary people think that it is only for measurement of space that the standard of measurement is the same; almost all other philosophers except myself hold that it can at least be considered to be the same from the idea that the measure is perfectly solid & continuous, but that in time there is only equality. But I, for my part, only admit in either case the equality, & never the identity."



Larmor agreed and set the scale for time dilatation, which Lorentz and the Einsteins later adopted. Poincaré asserted that Lorentz' (Voigt's) "position time" was "time" and that simultaneity is relative, in 1898,

> "XII
>
> But let us pass to examples less artificial; to understand the definition implicitly supposed by the savants, let us watch them at work and look for the rules by which they investigate simultaneity.
>
> I will take two simple examples, the measurement of the velocity of light and the

determination of longitude.

When an astronomer tells me that some stellar phenomenon, which his telescope reveals to him at this moment, happened nevertheless fifty years ago, I seek his meaning, and to that end I shall ask him first how he knows it, that is, how he has measured the velocity of light.

He has begun by *supposing* that light has a constant velocity, and in particular that its velocity is the same in all directions. That is a postulate without which no measurement of this velocity could be attempted. This postulate could never be verified directly by experiment; it might be contradicted by it if the results of different measurements were not concordant. We should think ourselves fortunate that this contradiction has not happened and that the slight discordances which may happen can be readily explained.

The postulate, at all events, resembling the principle of sufficient reason, has been accepted by everybody; what I wish to emphasize is that it furnishes us with a new rule for the investigation of simultaneity, entirely different from that which we have enunciated above.

This postulate assumed, let us see how the velocity of light has been measured. You know that Roemer used eclipses of the satellites of Jupiter, and sought how much the event fell behind its prediction. But how is this prediction made? It is by the aid of astronomic laws, for instance Newton's law.

Could not the observed facts be just as well explained if we attributed to the velocity of light a little different value from that adopted, and supposed Newton's law only approximate? Only



this would lead to replacing Newton's law by another more complicated. So for the velocity of light a value is adopted, such that the astronomic laws compatible with this value may be as simple as possible. When navigators or geographers determine a longitude, they have to solve just the problem we are discussing; they must, without being at Paris, calculate Paris time. How do they accomplish it? They carry a chronometer set for Paris. The qualitative problem of simultaneity is made to depend upon the quantitative problem of the measurement of time. I need not take up the difficulties relative to this latter problem, since above I have emphasized them at length.

Or else they observe an astronomic phenomenon, such as an eclipse of the moon, and they suppose that this phenomenon is perceived simultaneously from all points of the earth. That is not altogether true, since the propagation of light is not instantaneous; if absolute exactitude were desired, there would be a correction to make according to a complicated rule.

Or else finally they use the telegraph. It is clear first that the reception of the signal at Berlin, for instance, is after the sending of this same signal from Paris. This is the rule of cause and effect analyzed above. But how much after? In general, the duration of the transmission is neglected and the two events are regarded as simultaneous. But, to be rigorous, a little correction would still have to be made by a complicated calculation; in practise it is not made, because it would be well within the errors of observation; its theoretic necessity is none the less from our point of view, which is that of a rigorous definition. From this discussion, I wish to emphasize two things: (1) The rules applied are exceedingly various. (2) It is difficult to separate the qualitative problem of simultaneity from the quantitative problem of the measurement of time; no matter whether a chronometer is used, or whether account must be taken of a velocity of transmission, as that of light, because such a velocity could not be measured without *measuring* a time.

XIII

To conclude: We have not a direct intuition of simultaneity, nor of the equality of two durations. If we think we have this intuition, this is an illusion. We replace it by the aid of certain rules which we apply almost always without taking count of them."[113]

Circa 1899, Poincaré clarified the fact that he saw no distinction between "time" and "local time",

"Allow me a couple of remarks regarding the new variable $t'$: it is what Lorentz calls *the local time*. At a given point $t$ and $t'$ will not defer but by a constant, $t'$ will, therefore, always represent the time, but the origin of the times being different for the different points serves as justification for his designation."

"Disons deux mots sur la nouvelle variable $t'$: c'est ce que Lorentz appelle *le temps locale*. En un point donné $t$ et $t'$ ne différeront que par une constante, $t'$ représentera donc toujours le temps mais l'origine des temps étant différente aux différents points: cela justifie sa dénomination."[114]



In 1900, Poincaré stated,

"In order for the compensation to occur, the phenomena must correspond, not to the true time $t$, but to some determined *local time* $t'$ defined in the following way.

I suppose that observers located at different points synchronize their watches with the aid of light signals; which they attempt to adjust to the time of the transmission of these signals, but these observers are unaware of their movement of translation and they consequently believe that the signals travel at the same speed in both directions, they restrict themselves to crossing the observations, sending a signal from $A$ to $B$, then another from $B$ to $A$. The local time $t'$ is the time determined by watches synchronized in this manner.

If in such a case

$$V = 1 / K_0^{1/2}$$

is the speed of light, and $v$ the translation of the Earth, that I imagine to be parallel to the positive $x$ axis, one will have:

$$t' = t - \frac{v x}{V^2}."$$

"Pour que la compensation se fasse, il faut rapporter les phénomènes, non pas au temps vrai $t$, mais à un certain *temps local* $t'$ défini de la façon suivante.

Je suppose que des observateurs placés en différents points, règlent leurs montres à l'aide de signaux lumineux; qu'ils cherchent à corriger ces signaux du temps de la transmission, mais qu'ignorant le mouvement de translation dont ils sont animès et croyant par conséquent que les signaux se transmettent également vite dans les deux sens, ils se bornent à croiser les observations, en envoyant un signal de $A$ en $B$, puis un autre de $B$ en $A$. Le temps local $t'$ est le temps marqué par les montres ainsi réglées.

Si alors

$$V = 1 / K_0^{1/2}$$

est la vitesse de la lumière, et $v$ la translation de la Terre que je suppose parallèle à l'axe des $x$ positifs, on aura:

$$t' = t - \frac{vx}{V^2}."$$ [115]

We know that Einstein had read this paper.[116]

In 1902, Poincaré asserted, and we know, from Solovine's accounts,[117] that Einstein had read this work of Poincaré's,

> "There is no absolute time. When we say that two periods are equal, the statement has no meaning, and can only acquire a meaning by convention. Not only have we no direct intuition of the equality of two periods, but we have not even direct intuition of the simultaneity of two events occurring in two different places. I have explained this in an article entitled "Mesure du Temps."[118]

In Lisbeth and Ferdinand Lindemann's German



translation; *Wissenschaft und Hypothese*, B. G. Teubner, Leipzig, (1904), pp. 286-289; of Poincarés 1902 work, *La Science et l'Hypothèse*; the Lindemanns included the following notation:

> "43) S. 92. In der citierten Abhandlung [ "la Mesure du temps", *Revue de Métaphysique et de Morale*, t. VI, p. 1-13 (janvier 1898).] kommt Poincaré zu folgenden Schlüssen:
>
> „Wir haben keine direkte Anschauung von der Gleichzeitigkeit zweier Zeitdauern, ebensowenig von der Gleichheit.— Wir behelfen uns mit gewissen Regeln, die wir beständig anwenden, ohne uns davon Rechenschaft zu geben. — Es handelt sich dabei um eine Menge kleiner Regeln, die jedem einzelnen Falle angepaßt sind, nicht um eine allgemeine und strenge Regel.— Man könnte dieselben auch durch andere ersetzen, aber man würde dadurch das Aussprechen der Gesetze in der Physik, Mechanik und Astronomie außerordentlich umständlich machen. — Wir wählen also diese Regeln nicht, weil sie wahr, sondern weil sie bequem sind, und wir können sie in folgendem Satze zusammenfassen: Die Gleichzeitigkeit zweier Ereignisse oder die Ordnung ihrer Aufeinanderfolge und die Gleichheit zweier Zeitdauern müssen so definiert werden, daß der Ausspruch der Naturgesetze möglichst einfach wird; mit anderen Worten: Alle diese Regeln und Definitionen sind nur die Frucht eines unbewußten Opportunismus."
>
> Newton (dessen Anschauung man z. B. bei Mach reproduziert findet: Die Mechanik in ihrer Entwicklung, 2. Anfl., Leipzig 1889, S. 207) setzte die Existenz einer „absoluten Zeit" voraus;

d'Alembert, Locke u. a. hoben den relativen Charakter aller Zeitmaße hervor; vgl. die historischen Angaben bei A. Voß in dem Artikel über die Prinzipien der rationellen Mechanik (Enzyklopädie der math. Wissenschaften, IV, 1). Nach de Tillys Angabe (Sur divers points de la philosophie des sciences mathématiques; Classe des sciences de l'Académie R. de Belgique, 1901) definiert z. B. Lobatschewsky die Zeit als eine „Bewegung, welche geeignet ist, die anderen Bewegungen zu messen". Auch eine solche Definition setzt voraus, daß es eine Bewegung gibt, die zum Messen der (also aller) anderen Bewegungen geeignet ist; und wann ist eine Bewegung „geeignet", als Maß anderer zu dienen? Vielleicht kann die folgende analytische Erörterung hier zur Klärung beitragen.

Wir betrachten z. B. das Fallgesetz eines schweren Punktes auf der Erdoberfläche; dasselbe ist bekanntlich durch die Differentialgleichung:

(1)

$$\frac{d^2z}{dt^2} = -g$$

vollständig dargestellt, wenn $z$ eine vertikal nach oben gemessene Koordinate, $t$ die Zeit, $g$ die Beschleunigung der Schwere bedeutet. Führen wir nun ein anderes Zeitmaß $\tau$ ein, so wird $\tau$ eine Funktion von $t$ sein:

$$\tau = \varphi(t), \quad t = \Phi(\tau),$$



und die Gleichung (1) nimmt, wenn wir $\tau$ einführen, folgende Gestalt an:

(2)

$$\left[\frac{1}{\Phi'(\tau)}\right]^2 \left(\frac{d^2z}{d\tau^2} - \frac{dz}{d\tau}\,\Phi''(\tau)\right) = -g,$$

wo $\Phi'$ und $\Phi''$ den ersten und zweiten Differentialquotienten der Funktion $\Phi(\tau)$ nach $\tau$ bezeichnen. Die einfache Form der Gleichung (1) beruht also wesentlich auf der Wahl eines für die Gesetze des Falles „geeigneten" Zeitmaßes; jede andere Art der Zeitmessung würde zu wesentlich komplizierterem Ansatze führen; dadurch ist die Zeit $t$ vor der Zeit $\tau$ ausgezeichnet. Dieses Zeitmaß wird praktisch durch eine Uhr, etwa eine Pendeluhr, gegeben; die Bewegung des Pendels wird selbst wieder durch die Fallgesetze bedingt; wir messen also in (1) eine Fallerscheinung durch eine andere Fallerscheinung, und deshalb ist die Einfachheit desResultates nicht auffällig. Anders ist es, wenn wir eine durch eine Feder getriebene Uhr anwenden; hier ist es eine nicht selbstverständliche Tatsache, daß das Zeitmaß für das Ablaufen der Feder zur Beobachtung des freien Falles geeignet ist; immerhin wird der richtige und gleichmäßige Gang der Federuhr nur durch Vergleichung mit einer Pendeluhr reguliert, und dadurch wird dieses Zeitmaß auf das vorhergehende reduziert. Auf die gewählte Zeiteinheit, die der Rotation der Erde um ihre Achse entlehnt ist, kommt es hierbei nicht an; wir bestimmen allerdings die Länge des Sekundenpendels nach dieser Einheit, könnten aber auch mit gleichem Erfolge umgekehrt eine beliebig gewählte Pendellänge zur Definition der Einheit verwenden. Anders ist es, wenn man zu kosmischen Problemen übergeht. Die Bewegung eines Planeten $(x, y)$ um die im Anfangspunkte stehende Sonne mit der Masse $m'$ wird durch die Gleichungen

(3)

$$\frac{d^2x}{dt^2} = -\frac{m'x}{r^3}, \quad \frac{d^2y}{dt^2} = -\frac{m'y}{r^3}$$

definiert, welche des Newtonische Gravitationsgesetz darstellen

$$(r = \sqrt{x^2 + y^2}).$$

Erfahrungsmäßig genügt such hier dasselbe Zeitmaß, das beim freien Falle eingeführt wurde; denn alle aus den Gleichungen (3) zu ziehenden Folgerungen stimmen (auch wenn man die Störungen der anderen Planeten berücksichtigt) hinreichend mit den Beobachtungen überein, so daß man keine Veranlassung hat, eine andere Zeit $\tau$ einzuführen und die obige Transformation anzuwenden. Analog verhält es sich mit allen bekannten Erscheinungen; es genügt immer, die Komponenten der Beschleunigung durch die



Ausdrücke

$$\frac{d^2x}{dt^2}, \quad \frac{d^2y}{dt^2}, \quad \frac{d^2z}{dt^2}$$

zu messen, und es ist überflüssig, die allgemeineren Ausdrücke

$$\left(\frac{d^2x}{d\tau^2} - \frac{dx}{d\tau}\,\Phi''(\tau)\right)\frac{1}{\Phi'(\tau)^2}, \text{ etc.}$$

statt dessen einzuführen. In diesem Sinne kann man erfahrungsmäßig von einer absoluten Zeit sprechen, d. h. einer Zeit, die zur Beschreibung aller bisher beobachteten Erscheinungen gleichmäßig bequem ist, allerdings mit dem Vorbehalte, diese Vorstellung der absoluten Zeit sofort aufzugeben, wenn nun Tatsachen oder feinere Beobachtung alter Tatsachen dazu führen sollten, für irgendeine Erscheinung durch eine Funktion $\Phi(\tau)$ ein neues Zeitmaß $\tau$ einzuführen, so daß für diese Erscheinung die Beschleunigung durch

$$\frac{d^2s}{d\tau^2} \text{ statt durch } \frac{d^2s}{dt^2}$$

dargestellt wird (d. h. das Produkt aus Masse und

Beschleunigungskomponente

$$\frac{d^2x}{dt^2}$$

sich als Funktion des Ortes des bewegten Punktes und anderer fester oder bewegter Punkte darstellen läßt). Aber auch dann würde man wohl versuchen, die entstehende Schwierigkeit durch Modifikation der anderen Annahmen, eventuell durch Hinzufügung weiterer fingierter Punkte und Kräfte (vgl. weiterhin die analogen Erörterungen auf S. 95 ff. beim Trägheitsgesetz) zu beseitigen, ehe man sich entschließt, bei verschiedenen Erscheinungen verschiedene Zeitmaße anzuwenden. Durch diese Überlegung kommt man zu wesentlich derselben Auffassung, welche Poincaré a. a. O. mit dem Worte Opportunismus charakterisiert."

Again, in 1904, Poincaré asserted that simultaneity is relative, and elaborated on the light synchronization method the Einsteins copied, in 1905, without citation to Poincaré. Poincaré stated in 1904,

"We come to the principle of relativity: this not only is confirmed by daily experience, not only is it a necessary consequence of the hypothesis of central forces, but it is imposed in an irresistible way upon our good sense, and yet it also is battered.

Consider two electrified bodies; though they seem to us at rest, they are both carried along by the motion of the earth; an electric charge in motion, Rowland has taught us, is equivalent to a current; these two charged bodies are, therefore, equivalent to two parallel currents of the same sense and these two currents should attract each other. In measuring this attraction, we measure the velocity of the earth; not its velocity in relation to the sun or the fixed stars, but its absolute velocity.

I well know what one will say, it is not its absolute velocity that is measured, it is its velocity in relation to the ether. How unsatisfactory that is! Is it not evident that from the principle so understood we could no longer get anything? It could no longer tell us anything just because it would no longer fear any contradiction.

If we succeed in measuring anything, we would always be free to say that this is not the absolute velocity in relation to the ether, it might always be the velocity in relation to some new unknown fluid with which we might fill space.

Indeed, experience has taken on itself to ruin this interpretation of the principle of relativity; all attempts to measure the velocity of the earth in relation to the ether have led to negative results. This time experimental physics has been more faithful to the principle than mathematical physics; the theorists, to put in accord their other general views, would not have spared it; but experiment has been stubborn in confirming it.

The means have been varied in a thousand ways and finally Michelson has pushed precision to its last limits; nothing has come of it. It is precisely to explain this obstinacy that the mathematicians are forced today to employ all their ingenuity.

Their task was not easy, and if Lorentz has gotten through it, it is only by accumulating hypotheses. The most ingenious idea has been that of local time.

Imagine two observers who wish to adjust their watches by optical signals; they exchange signals, but as they know that the transmission of light is not instantaneous, they take care to cross them.

When the station B perceives the signal from the station A, its clock should not mark the same hour as that of the station A at the moment of sending the signal, but this hour augmented by a constant representing the duration of the transmission. Suppose, for example, that the station A sends its signal when its clock marks the hour o, and that the station B perceives it when its clock marks the hour *t*. The clocks are adjusted if the slowness equal to *t* represents the duration of the transmission, and to verify it, the station B sends in its turn a signal when its clock marks o; then the station A should perceive it when its clock marks *t*. The timepieces are then adjusted. And in fact, they mark the same hour at the same physical instant, but on one condition, which is that the two stations are fixed. In the contrary case the duration of the transmission will not be the same in the two senses, since the station A, for example, moves forward to meet the optical perturbation emanating from B, while the station B flies away before the perturbation emanating from A. The watches adjusted in that manner do not mark, therefore, the true time, they mark what one may call the *local time*, so that one of them goes slow on the other. It matters little since we have no means of perceiving it. All the phenomena which happen at A, for example, will be late, but all will be equally so, and the observer who ascertains them will not perceive it since his watch is slow; so as the principle of relativity would have it, he will have no means of knowing whether he is at rest or in absolute motion."[119]



The Einsteins parroted Poincaré's clock synchronization procedures, without acknowledging that Poincaré had stated them first. From the Einsteins' 1905 paper,

"I. KINEMATICAL PART

§ 1. Definition of Simultaneity

[Consider a system of coordinates, in which the Newtonian mechanical equations are valid. In order to put the contradistinction from the [*moving*] systems of coordinates to be introduced later into words, and for the exact definition of the conceptualization, we call this system of coordinates the 'resting system'.]

If a material point is at rest relatively to this system of co-ordinates, its position can be defined relatively thereto by the employment of rigid standards of measurement and the methods of Euclidean geometry, and can be expressed in Cartesian co-ordinates.

If we wish to describe the *motion* of a material point, we give the values of its co-ordinates as functions of the time. Now we must bear carefully in mind that a mathematical description of this kind has no physical meaning unless we are quite clear as to what we understand by 'time.' We have to take into account that all our judgments in which time plays a part are always judgments of simultaneous events. If, for instance, I say, 'That train arrives here at 7 o'clock,' I mean something like this: 'The pointing of the small hand of my watch to 7 and the arrival of the train are simultaneous events.'

It might appear possible to overcome all the difficulties attending the definition of 'time' by substituting 'the position of the small hand of my watch' for 'time.' And in fact such a definition is satisfactory when we are concerned with defining a time exclusively for the place where the watch is located; but it is no longer satisfactory when we have to connect in time series of events occurring at different places, or—what comes to the same thing—to evaluate the times of events occurring at places remote from the watch.

We might, of course, content ourselves with time values determined by an observer stationed together with the watch at the origin of the co-ordinates, and co-ordinating the corresponding positions of the hands with light signals, given out by every event to be timed, and reaching him through empty space. But this co-ordination has the disadvantage that it is not independent of the standpoint of the observer with the watch or clock, as we know from experience. We arrive at a much more practical determination along the following line of thought.

If at the point A of space there is a clock, an observer at A can determine the time values of events in the immediate proximity of A by finding the positions of the hands which are simultaneous with these events. If there is at the point B of space another clock in all respects resembling the one at A, it is possible for an observer at B to determine the time values of events in the immediate neighbourhood of B. But it is not possible without further assumption to compare, in respect of time,



an event at A with an event at B. We have so far defined only an 'A time' and a 'B time.' We have not defined a common 'time' for A and B, for the latter cannot be defined at all unless we establish *by definition* that the 'time' required by light to travel from A to B equals the 'time' it requires to travel from B to A. Let a ray of light start at the 'A time' from A towards B, let it at the 'B time' be reflected at B in the direction of A, and arrive again at A at the 'A time'.

In accordance with definition the two clocks synchronize if

$$t_B - t_A = t'_A - t_B.$$

We assume that this definition of synchronism is free from contradictions, and possible for any number of points; and that the following relations are universally valid:—

1. If the clock at B synchronizes with the clock at A, the clock at A synchronizes with the clock at B.

2. If the clock at A synchronizes with the clock at B and also with the clock at C, the clocks at B and C also synchronize with each other.

Thus with the help of certain imaginary physical experiments we have settled what is to be understood by synchronous resting clocks located at different places, and have evidently obtained a definition of 'simultaneous,' or 'synchronous,' and of 'time.' The 'time' of an event is that which is given simultaneously with the event by a resting clock located at the place of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified stationary clock.

> [We set forth, according to present experience, that the magnitude
>
> $$(2AB)/(t'_A - t_A) = c$$
>
> is a universal constant (the velocity of light in empty space).]
>
> It is essential to have time defined by means of resting clocks in the resting system, and the time now defined being appropriate to the resting system we call it 'the time of the resting system.'"[120]

In the mid-1880's, Ludwig Lange argued for the principle of relativity based on the empirical dynamics of inertial motion, as opposed to the ontological kinematic definitions based on absolute space and absolute time of Galileo, Newton and Neumann,[121] which absolutist notions lingered in the Einsteins' absolutist theory. In 1887, Voigt gave the principle a new mathematical form based on a new concept of time—the mathematical form of the special theory of relativity. Larmor (1894-1900) and FitzGerald (1889) changed scale factors from Voigt's transformation, producing the "Lorentz Transformation", before Lorentz. In 1898, Poincaré argued that simultaneity is relative, based on his light synchronization procedure, which presumes that light speed is invariant in Lange's "inertial systems".

Given the facts that: Galileo popularized the concept of the principle of relativity, Lange took from it absolute space and absolute time, Voigt introduced the relativistic transformation, and Poincaré first demonstrated relative simultaneity; why is the concept popularly referred to as "Einstein's special theory of relativity"? Einstein contributed nothing to the special



principle of relativity. Are the popular misconceptions of Einstein, and his supposed discoveries; which misconceptions are fed by the scientific community and the media; and the factual historic record, itself, at odds? Is exposing the truth counter-productive, if it means the downfall of a hero and the death of a religion?

Einstein, himself, admitted,

> "This rigid four-dimensional space of the special theory of relativity is to some extent a four-dimensional analogue of H. A. Lorentz's rigid three-dimensional æther."[122]

and,

> "I think, that the ether of the general theory of relativity is the outcome of the Lorentzian ether, through relativation."[123]

## 2. Space-Time, or is it "Time-Space"?

"*As I've already said, it is not possible to conceive of more than three* dimensions. *However, a brilliant wit with whom I am acquainted considers duration a fourth* dimension, *and that the product of time multiplied by solidity would, in some sense, be a product of four* dimensions."—D'ALEMBERT

"*This rigid four-dimensional space of the special theory of relativity is to some extent a four-dimensional analogue of H. A. Lorentz's rigid three-dimensional æther.*"—ALBERT EINSTEIN

"*I think, that the ether of the general theory of relativity is the outcome of the Lorentzian ether, through relativation.*"—ALBERT EINSTEIN

Poincaré provided the "four-dimensional analogue"[124] to Lorentz' æther in 1905 and relativized the "Lorentzian ether" in 1895, long before Minkowski or Einstein manipulated credit for his work. The Einsteins' 1905 paper contains no four-dimensional analogue, and is, therefore, a theory of the "unrelativized Lorentzian æther", *per se*. Though Einstein credited Minkowski with the quadri-dimensional analogue,

> "And now let me say just a few words about the highly interesting mathematical elaboration that the theory has undergone, thanks, mainly, to the sadly so prematurely deceased mathematician Minkowski,"[125]

in fact, Minkowski was well aware of Poincaré's earlier work, before Minkowski recited it in 1907, as if it were his own.[126] Roberto Marcolongo,[127] also, in 1906, developed a four-dimensional analysis of the Poincaré-Lorentz theory of relativity, before Minkowski. Einstein's brief evaluation exclusively cites work which was accomplished by Poincaré two years before Minkowski copied it, but Einstein nowhere mentions Poincaré or Marcolongo. Mehmke's work is significant.[128] Hargreaves[129] and Bateman[130] also deserve mention, for their development of the special and the general theories of relativity. In this same lecture, followed by a discussion which is on record,[131] Einstein shamelessly parroted Poincaré's enquiries into the nature of simultaneity[132] and his clock synchronization procedures, without citing Poincaré; and Einstein failed to correct those who credited Einstein with the ideas he repeated, which were not his own.

Consider the psychological import of the attitude of some later writers toward those who actually originated the ideas compared to their attitude toward the *heroes* "Einstein" and "Minkowski", who merely parroted what others had pioneered,

> "All the main ideas, of course, are due to Einstein and Minkowski. [***] It may be mentioned that the historical order of appearance of the ideas of our subject, as so often happens, has been quite different from the order which seems natural and in which we have presented them. First the formulas of transformation involving space coordinates and time were introduced by Lorentz without, however, giving to them the meaning they now have. In Lorentz's theory there exists one universal time $t$, and other times $t'$ play only an auxiliary part. The credit for taking the decisive step recognizing the fact that all these variables are on the same footing is due to Einstein (1905). The four-dimensional point of view, after some preliminary work had been done by Poincaré and Marcolongo, was introduced most emphatically by Minkowski in 1908."[133]



One must wonder how Minkowski "introduced", in 1908, that which was already extant in Poincaré's work of 1905, and in Marcolongo's work of 1906. It was Poincaré who first attacked Lorentz' and Larmor's distinction between local time and time, beginning in 1898, and eliminated said artificial distinction long before 1905—which distinction was not even present in Voigt's formulation of 1887.

There was no novelty in asserting time as a fourth dimension in 1908. In 1906, Cassius J. Keyser wrote,

> "Herewith is immediately suggested the generic concept of dimensionality: *if an assemblage of elements of any given kind whatsoever, geometric or analytic or neither, as points, lines, circles, triangles, numbers, notions, sentiments, hues, tones, be such that, in order to distinguish every element of the assemblage from all the others, it is necessary and sufficient to know exactly n independent facts about the element, then the assemblage is said to be n-dimensional in the elements of the given kind*. It appears, therefore, that the notion of dimensionality is by no means exclusively associated with that of space but on the contrary may often be attached to the far more generic concept of assemblage, aggregate or manifold. For

example, duration, the total aggregate of time-points, or instants, is a simple or one-fold assemblage. [*Emphasis found in the original.*]"[134]

Neither Minkowski, nor the Einsteins, nor Poincaré, hold priority on the concept of four-dimensional space-time. H. G. Wells, in 1894, expressly stated it in a popular novel, *The Time Machine*, long before Minkowski claimed priority,

"'Can a cube that does not last for any time at all, have a real existence?' Filby became pensive. 'Clearly,' the Time Traveller proceeded, 'any real body must have extension in *four* directions: it must have Length, Breadth, Thickness, and—Duration. But through a natural infirmity of the flesh, which I will explain to you in a moment, we incline to overlook this fact. There are really four dimensions, three which we call the three planes of Space, and a fourth, Time. There is, however, a tendency to draw an unreal distinction between the former three dimensions and the latter, because it happens that our consciousness moves intermittently in one direction along the latter from the beginning to the end of our lives.'"

An article by "S." had appeared in *Nature*, Volume 31, Number 804, (March 26, 1885), p. 481, titled, "Four-Dimensional Space", which presented the concepts of "time-space", "four-dimensional solid" ("sur-solid", after Des Cartes), "time area", and "time-line"; which later became "space-time" ("*Zeit-Raum*" is a confusing pun in German with the word "*Zeitraum*"), "absolute world", and "world-line". Here is the work of 1885, which appeared some 23 years before



Minkowski's derivative lecture on the same subject:

**"Four-Dimensional Space**

POSSIBLY the question, What is the fourth dimension? may admit of an indefinite number of answers. I prefer, therefore, in proposing to consider Time as a fourth dimension of our existence, to speak of it as *a* fourth dimension rather than *the* fourth dimension. Since this fourth dimension cannot be introduced into space, as commonly understood, we require a new kind of space for its existence, which we may call time-space. There is then no difficulty in conceiving the analogues in this new kind of space, of the things in ordinary space which are known as lines, areas, and solids. A straight line, by moving in any direction not in its own length, generates an area; if this area moves in any direction not in its own plane it generates a solid; but if this solid moves in any direction, it still generates a solid, and nothing more. The reason of this is that we have not supposed it to move in the fourth dimension. If the straight line moves in its own direction, it describes only a straight line; if the area moves in its own plane, it describes only an area; in each case, motion in the dimensions in which the thing exists, gives us only a thing of the same dimensions; and, in order to get a thing of higher dimensions, we must have motion in a new dimension. But, as the idea of motion is only applicable in space of three dimensions, we must replace it by another which is applicable in our fourth dimension of time. Such an idea is that of successive existence. We must, therefore, conceive that there is a new three-dimensional space for each successive instant of time; and, by picturing to ourselves the aggregate formed by the successive positions in time-space of a given solid during a given time, we shall get the idea of a four-dimensional solid, which may be called a sur-solid. It will assist us to get a clearer idea, if we consider a solid which is in a constant state of change, both of magnitude and position; and an example of a solid which satisfies this condition sufficiently well, is afforded by the body of each of us. Let any man picture to himself the aggregate of his own bodily forms from birth to the present time, and he will have a clear idea of a sur-solid in time-space.

Let us now consider the sur-solid formed by the movement, or rather, the successive existence, of a cube in time-space. We are to conceive of the cube, and the whole of the three-dimensional space in which it is situated, as floating away in time-space for a given time; the cube will then have an initial and a final position, and these will be the end boundaries of the sur-solid. It will therefore have sixteen points, namely, the eight points belonging to the initial cube, and the eight belonging to the final cube. The successive positions (in time-space) of each of the eight points of the cube, will form what may be called a time-line; and adding to these the twenty-four edges of the initial and final cubes, we see that the sur-solid has thirty-two lines. The successive positions (in time-space) of each of the twelve edges of the cube, will form what may be called a time area; and, adding these to the twelve faces of the initial and final cubes, we see that the sur-solid has twenty-four areas. Lastly, the successive positions (in time-space) of each of the six faces of the cube, will form what may be called a time-solid; and, adding these to the initial and final cubes, we see that the sur-solid is bounded by eight solids. These results agree with the statements in your article. But it is not permissible to speak of the sur-solid as resting in 'space,' we must rather say that the section of it by any time is a cube resting (or moving) in 'space.' S. March 16"[135]



This article, "Four-Dimensional Space", was probably a reaction to an earlier one, "Scientific Romances", *Nature*, Volume 31, Number 802, (March12, 1885), p. 431; which discusses Hinton's question, "What is the Fourth Dimension?" and Edwin A. Abbott's book *Flatland: A Romance of Many Dimensions.*[136]

The author of "Four-Dimensional Space" is named as "S.", who may have been Simon Newcomb. Wells' *The Time Machine* includes the following passage,

> "'It is simply this. That Space, as our mathematicians have it, is spoken of as having three dimensions, which one may call Length, Breadth, and Thickness, and is always definable by reference to three planes, each at right angles to the others. But some philosophical people have been asking why *three* dimensions particularly—why not another direction at right angles to the other three?—and have even tried to construct a Four-Dimension geometry. Professor Simon Newcomb was expounding this to the New York Mathematical Society only a month or so ago. You know how on a flat surface, which has only two dimensions, we can represent a figure of a three-dimensional solid, and similarly they think that by models of thee dimensions they could represent one

of four—if they could master the perspective of the thing. See?'"

A bibliography of Newcomb's works on the fourth-dimension is to be found in the endnote.[137] However, Newcomb does not seem to be a believer in *time* as a fourth dimension—so the mysterious "S." may well have been someone else, "S." Tolver Preston, perhaps?

Charles Howard Hinton queried as to what might be the fourth dimension in 1880, and argued that time constitutes a fourth dimension, resulting in an Eleatic universal state of being, without cause or effect,

> "And in the first place, a being in four dimensions would have to us exactly the appearance of a being in space. A being in a plane would only know solid objects as two dimensional figures—the shapes namely in which they intersected his plane. So if there were four-dimensional objects, we should only know them as solids—the solids, namely, in which they intersect our space. Why, then, should not the four-dimensional beings be ourselves, and our successive states the passing of them through the three-dimensional space to which our consciousness is confined?
>
> Let us consider the question in more detail. And for the sake of simplicity transfer the problem to the case of three and two dimensions instead of four and three.
>
> Suppose a thread to be passed through a table cloth. It can be passed through in two ways. Either it can be pulled through, or it can be held at both ends, and moved downwards as a whole. Suppose a thread to be grasped at both ends, and the hands to be moved downwards perpendicularly to the tablecloth. If the thread happens to be perpendicular to the tablecloth it simply passes through it, but if the thread be held, stretched slanting wise to the tablecloth, and the hands are moved perpendicularly downwards, the thread will, if it be strong enough, make a slit in the tablecloth.
>
> If now the tablecloth were to have the faculty of closing up behind the thread, what would appear in the cloth would be a moving hole.
>
> Suppose that instead of a tablecloth and a thread, there were a straight line and a plane. If the straight line was placed slanting wise in reference to the plane and moved downwards, it would always cut the plane in a point, but that point of section would move on. If the plane were of such a nature as to close up behind the line, 'if it were of the nature of a fluid, what would be observed would be a moving point. If now there were a whole system of lines sloping in different directions, but all connected together, and held absolutely still by one framework, and if this framework with its system of lines were as a whole to pass slowly through the fluid plane at right angles to it, there would then be the appearance of a multitude of moving points in the plane, equal in number to the number of straight lines in the system. The lines in the framework will all be moving at the same rate—namely, at the rate of the framework in which they are fixed. But the points in the plane will have different velocities. They will move slower or faster according as the lines which give rise to them are more or less inclined to the plane. A straight line perpendicular to the plane will, on passing through, give rise to a stationary point. A straight line that slopes very

much inclined to the plane will give rise to a point moving with great swiftness. The motions and paths of the points, would b determined by the arrangement of the lines in the system. It is obvious that if two straight lines were placed lying across one another like the letter X, and if this figure were to be stood upright and passed through the plane, what would appear would be at first two points. These two points would approach one another. When the part where the two strokes of the X meet came into the plane, the two points would become one. As the upper part of the figure passed through, the two points would recede from one another.

If the lines be supposed to be affixed to all parts of the framework, and to loop over one another, and support one another, [*figure deleted*] it is obvious that they could assume all sorts of figures, and that the points on the plane would move in very complicated paths. The annexed figure represents a section of such a framework. Two lines X X and Y Y are shown, but there must be supposed to be a great number of others sloping backwards and forwards as well as sideways.

Let us now assume that instead of lines, very thin threads were attached to the framework: they on passing through the fluid plane would give rise to very small spots. Let us cal1 the spots, atoms, and regard them as constituting a material system in the plane. There are four conditions which must he satisfied by these spots if they are to be admitted as forming a material system such as ours. For the ultimate properties of matter (if we eliminate attractive and repulsive forces, which may be caused by the motions of the smallest



particles), are—1, Permanence; 2, Impenetrability; 3, Inertia; 4, Conservation of energy.

According to the first condition, or that of permanence, no one of these spots must suddenly cease to exist. That is, the thread which by sharing in the general motion of the system gives rise to the moving point, must not break off before the rest of them. If all the lines suddenly ended this would correspond to a ceasing of matter.

2. Impenetrability.—One spot must not pass through another. This condition is obviously satisfied. If the threads do not coincide at any point, the moving spots they give rise to cannot.

3. Inertia.—A spot must not cease to move or cease to remain at rest without coming into collision with another point. This condition gives the obvious condition with regard to the threads, that they, between the points where they come into contact with one another, must be straight. A thread which was curved would, passing through the plane, give rise to a point which altered in velocity spontaneously. This the particles of matter never do.

4. Conservation of energy.—The energy of a material system is never lost, it is only transferred from one form to another, however it may seem to cease. If we suppose each of the moving spots on the plane to be the unit of mass, the principle of the conservation of energy demands that when any two meet, the sum of the squares of their several velocities before meeting shall be the same as the sum of the squares of their velocities after meeting. Now we have seen that any statement about the velocities of the spots in the plane is really a statement about the inclinations of the threads to

the plane. Thus the principle of the conservation of energy gives a condition which must be satisfied by the inclinations of the threads of the plane. Translating this statement, we get in mathematical language the assertion that the sum of the squares of the tangents of the angles the threads make with the normal to the plane remains constant.

Hence, all complexities and changes of a material system made up of similar atoms in a plane could result from the uniform motion as a whole of a system of threads.

We can imagine these threads as weaving together to form connected shapes, each, complete in itself, and these shapes as they pass through the fluid plane give rise to a series of moving points. Yet, inasmuch as the threads are supposed to form consistent shapes, the motion of the points would not be wholly random, but numbers of them would present the semblance of moving figures. Suppose, for instance, a number of threads to be so grouped as to form a cylinder for some distance, but after a while to be pulled apart by other threads with which they interlink. While the cylinder was passing through the plane we should have in the plane a number of points in a circle. When the part where the threads deviated came to the plane, the circle would break up by the points moving away. These moving figures in the plane are but the traces of the shapes of threads as those shapes pass on. These moving figures may be conceived to have a life and a consciousness of their own.

Or if it be irrational to suppose them to have a consciousness when the shapes of which they are momentary traces have none, we may well suppose that the shapes of threads have consciousness, and



that the moving figures share this consciousness, only that in their case it is limited to those parts of the shapes that simultaneously pass through the plane. In the plane, then, we may conceive bodies with all the properties of a material system moving and changing, possessing consciousness. After a while it may well be that one of them becomes so disassociated that it appears no longer as a unit, and its consciousness as such may be lost. But the threads of existence of such a figure are not broken, nor is the shape which gave it origin altered in any way. It has simply passed on to a distance from the plane. Thus nothing which existed in the conscious life on the plane would cease. There would in such an existence be no cause and effect, but simply the gradual realisation in a superficies of an already existent whole. There would be no progress, unless we were to suppose the threads as they pass to interweave themselves in more complex shapes.

Can a representation such as the preceding be applied to the case of the existence in space with which we have to do? Is it possible to suppose that the movements and changes of material objects are the intersections with a three-dimensional space of a four-dimensional existence? Can our consciousness be supposed to deal with a spatial profile of some higher actuality?

It is needless to say that all the considerations that have been brought forward in regard to the possibility of the production of a system satisfying the conditions of materiality by the passing of threads through a fluid plane, holds good with regard to a four-dimensional existence passing through a three-dimensional space. Each part of the ampler existence which passed through our space would seem perfectly limited to us. We should have no indication of the permanence of its existence. Were such a thought adopted, we should have to imagine some stupendous whole, wherein all that has ever come into being or will come co-exists, which, passing slowly on, leaves in this flickering consciousness of ours, limited to a narrow space and a single moment, a tumultuous record of changes and vicissitudes that are but to us. Change and movement seem as if they were all that existed. But the appearance of them would be due merely to the momentary passing through our consciousness of ever existing realities.

In thinking of these matters it is hard to divest ourselves of the habit of visual or tangible illustration. If we think of a man as existing in four dimensions, it is hard to prevent ourselves from conceiving him as prolonged in an already known dimension. The image we form resembles somewhat those solemn Egyptian statues which in front represent well enough some dignified sitting figure, but which are immersed to their ears in a smooth mass of stone which fits their contour exactly.

No material image will serve. Organised beings seem to us so complete that any addition to them would deface their beauty. Yet were we creatures confined to a plane, the outline of a Corinthian column would probably seem to be of a beauty unimprovable in its kind. We should be unable to conceive any addition to it, simply for the reason that any addition we could conceive would be of the nature of affixing an unsightly extension to some part of the contour. Yet, moving, as we do in space of three dimensions, we see that the beauty of the



stately column far surpasses that of any single outline. So all that we can do is to deny our faculty of judging of the ideal completeness of shapes in three dimensions.

Our conception of existence in four dimensions need not be confined to any particular supposition. There is no reason why a being existing in four dimensions should not be conceived to be as completely limited in all four directions as we are in three. All that we can say in regard to the possibility of such beings is, that we have no experience of motion in four directions. The powers of such beings and their experience would be ampler, but there would be no fundamental difference in the laws of force and motion.

Such a being would be able to make but a part of himself visible to us. He would suddenly appear as a complete and finite body, and as suddenly disappear, leaving no trace of himself, in space. There would be no barrier, no confinement of our devising that would not be perfectly open to him. He would come and go at pleasure; he would be able to perform feats of the most surprising kind. It would be possible by an infinite plane extending in all directions to divide our space into two portions absolutely separated from one another; but a four-dimensional being would slip round this plane with the greatest ease.

With regard to the possibility of the application of any test to discover whether a fourth dimension does exist or not, all that can be said is that no such test has succeeded. And, indeed, before searching for tests a theoretical point of the utmost importance has to be settled. In discussing the geometrical properties of straight lines and planes, we suppose them to be respectively of one and two dimensions, and by so doing deny them any real existence. A plane and a line are mere abstractions. Every portion of matter is of three dimensions. If we consider beings on a plane not as mere idealities, we must suppose them to be of some thickness. If their experience is to be limited to a plane this thickness must be very small compared to their other dimensions. If, then, we suppose a fourth dimension to exist, either our consciousness itself must consist in a limitation of the knowledge of existence to three instead of four dimensions, or we must be very small in the fourth dimension as compared to others. In such a case it would probably be in the phenomena of the ultimate particles of matter, where the dimensions in all four directions would be comparable, that any indication of the new direction would have to be sought.

It is evident that these speculations present no point of direct contact with fact. But this is no reason why they should be abandoned. The course of knowledge is like the flow of some mighty river, which, passing through the rich lowlands, gathers into itself the contributions from every valley. Such a river may well be joined by a mountain stream, which, passing with difficulty along the barren highlands, flings itself into the greater river down some precipitous descent, exhibiting at the moment of its union the spectacle of the utmost beauty of which the river system is capable. And such a stream is no inapt symbol of a line of mathematical thought, which, passing through difficult and abstract regions, sacrifices for the sake of its crystalline clearness the richness that comes to the



more concrete studies. Such a course may end fruitlessly, for it may never join the main course of observation and experiment. But if it gains its way to the great stream of knowledge, it affords at the moment of its union the spectacle of the greatest intellectual beauty, and adds somewhat of force and mysterious capability to the onward current."[138]

Hinton's and Abbott's works are highly derivative of another *Nature* article by G. F. Rodwell, "On Space of Four Dimensions", *Nature*, Volume 8, Number 183, (May 1, 1873), pp. 8-9. This same volume of *Nature* contains Clifford's translation of Riemann's, "On the Hypotheses which Lie at the Bases of Geometry".[139]

Long before Hinton, Abbott, Rodwell, and even Riemann, was Stallo, who, in 1847, expressed the fundamental "space-time" concept,

"THE Spiritual, the absolute primitive movement within itself, can be real and substantial only in stating itself exteriorly; and we have repeatedly seen that this statement is absolute multiplicity. That the result of the statement, the Exterior, is BUT *a statement*, and the statement of an internal *movement*, implies its transience; the statement is from its very nature transient. This transience must exhibit itself, therefore, in the stated Exterior, wherever we take it; it must appear throughout, for the Exterior is *inherently* transient. Otherwise expressed: the Exterior is but a transience in position; a position *in One* of existence and non-existence,—or a *position* and a *negation* in one. The Exterior can therefore first be taken *as such*, and then it is SPACE, in which the transience, dependency, shows itself as absolute *relativity;* secondly, as *the bearer of its vivifying movement*, and thus it is TIME. Or, the Exterior as an *existence*, as positive, fixed, is *space;* as a *negation, non-existence*, it is *time*. Logically, the first two exteriorations of the Spiritual are therefore *space* and *time*. They are both *abstractions*, i.e. they *are* only, inasmuch as the understanding forcibly keeps them asunder, though their truth is their *being in one*, their inseparability in spite of their distinctness. [***] Time and space, whose *first* reality is their difference, will therefore further state their identity as *real unity;* and this statement is real MOTION. Real motion is the union of space and time. The motion under consideration here, namely, the *primitive motion in the sphere of the Exterior*, is not motion in *any given, definite direction;* it is motion IN ALL DIRECTIONS, to which we have no observable analogon. *It is the pure movement of abstract statement and annulment.* [***] The so-called *dimensions* of space present no difficulty in their deduction, and depend, like all deductions, upon the inherent *references* of space. Space, the absolute extension, as OPPOSED to the Spiritual, is *spatial infinitude, unbounded* (mathematical) *solidity;* as opposed TO THE SPIRITUAL, to the absolute intensity, it is *a point*, —in space, and yet spaceless; as the unity of the two, it is the *line*, —extended intensity or punctuality. If we seek for a spatial analogon of time, it must be the line, for it has been seen that time is the Extensive considered in its ideal bearing, the mediating unity therefore between extension and intensity. Now the absolutely Extensive, the Solid, is from its nature limited, —it



contains the limit; and this limit of solidity is the *surface*. Thus punctuality, solidity, surface, and linearity are inherent in the idea of space; we are logically compelled to see space under this fourfold aspect. The mathematical statement, that the motion of a point generates a line, that of a line a surface, and that of a surface a solid, is true only in the following sense:—Spatiality, extension as such, is the absolute reference to the without, *beyond itself*, absolute relativity. If, then, we ideally isolate a point, we are at the same moment compelled to refer it to ideal adjacent points, and thus the idea of the line starts up in the mind spontaneously. The same takes place with the line and with the surface. The ideas of point, line, surface, &c., from their nature, give birth to each other. The movement of a point, &c., however, *as something real, to which the motion accedes*, is a false assumption.

[*Notation in the original:* Already Hegel has pointed this out. See my exposition of his philosophy of nature.]"[140]

Boscovich stated, centuries ago,

"Hence, the number of other points of space is an infinity of the third order; & thus the probability is infinitely greater with an infinity of the third order, when we are concerned with any other particular instant of time."[141]

Joseph Larmor, in 1900, raised space-time's significance to relativity theory and expressly called it a "*continuum*", long before Minkowski. Larmor is perhaps guilty of pun, using "continuum" with both its mathematical and metaphysical meanings,

> "At the same time all that is known (or perhaps need be known) of the aether itself may be formulated as a scheme of differential equations defining the properties of a *continuum* in space, which it would be gratuitous to further explain by any complication of structure; though we can with great advantage employ our stock of ordinary dynamical concepts in describing the succession of different states thereby defined."[142]

Note the absolutism implicit in the term "continuum", which Minkowski dubbed the "absolute world". The "continuum" is Newton's unchanging God—his myth that the human Self does not change during a lifetime, and, therefore, neither can God—absolute "space-time".

Menyhért (Melchior) Palágyi, in 1901, published *Neue Theorie des Raumes und der Zeit*, in which he argued for an Eleatic quadri-dimensional space-time, and in which he justified the principle of relativity in four-dimensions.[143] Poincaré established the Palágyi-style four-dimensional analysis of the "Lorentz Transformation", before Minkowski, or Einstein. Marcolongo[144] presented his four-dimensional view of the "Lorentz Transformation", before Minkowski. Before Palágyi was Henri Bergson, who wrote in 1888,

> "in a word, we create for them a fourth dimension of space, which we call homogenous time, and which enables the movement of the pendulum, although taking place at one spot, to be continually set in juxtaposition to itself."[145]



Prior to Bergson, Ernst Mach discussed quadri-dimensional position, in 1866,

> "Now, I think that we can go still farther in the scale of presentations of space and thus attain to presentations whose totality I will call *physical space.*
>
> It cannot be my intention here to criticize our conceptions of matter, whose insufficiency is, indeed, generally felt. I will merely make my thoughts clear. Let us imagine, then, a something behind (*unter*) matter in which different states can occur; say, for simplicity, a pressure in it, which can become greater or smaller.
>
> Physics has long been busied in expressing the mutual action, the mutual attraction (opposite accelerations, opposite pressures) of two material particles as a function of their distance from each other—therefore of a spatial relation. Forces are functions of the distance. But now, the spatial relations of material particles can, indeed, only be recognized by the forces which they exert one on another.
>
> Physics, then, does not strive, in the first place, after the discovery of the fundamental relations of the various pieces of matter, but after the derivation of relations from other, already given, ones. Now, it seems to me that the fundamental law of force in nature need not contain the spatial relations of the pieces of matter, but must only state a dependence between the states of the pieces of matter.
>
> If the positions in space of the material parts of the whole universe and their forces as functions of these positions were once known, mechanics could

> give their motions completely, that is to say, it could make all the positions discoverable at any time, or put down all positions as functions of time.
>
> But, what does time mean when we consider the universe? This or that "is a function of time" means that it depends on the position of the vibrating pendulum, on the position of the rotating earth, and so on. Thus, 'All positions are functions of time' means, for the universe, that all positions depend upon one another.
>
> But since the positions in space of the material parts can be recognized only by their states, we can also say that all the states of the material parts *depend upon one another.*
>
> The physical space which I have in mind—and which, at the same time, contains time in itself—is thus nothing other than *dependence of phenomena on one another*. A complete physics, which would know this fundamental dependence, would have no more need of special considerations of space and time, for these latter considerations would already be included in the former knowledge."[146]

I confine the discussion to quadri-dimensional hyperspace in which the fourth dimension signifies time or spiritual motion of some kind in a fourth dimension, whatever that should be interpreted to mean as ghosts retreating into a "fourth dimension" to undo tri-dimensional knots, leaving from one position in our world to return in another; but there was a tremendous body of work involving hyperspace beyond this restriction, with a long history pre-dating the special and the general theories of relativity.

For example, Stewart and Tait, in their widely read *Unseen Universe*, averred, in the then fairly recent



tradition of the transcendental geometers,

> "Just as points are the terminations of lines, lines the boundaries of surfaces, and surfaces the boundaries of portions of space of three dimensions:—so we may suppose our (essentially three-dimensional) matter to be the mere skin or boundary of an Unseen whose matter has *four* dimensions."[147]

This work will be discussed in detail in the volume of this series devoted to the general theory of relativity. The history of four-dimensional spaces is aptly recorded in Henry Parker Manning's *Geometry of Four Dimensions*, Macmillan, (1914), republished by Dover, (1956). Bibliographies appear in Manning's *The Fourth Dimension Simply Explained*, Dover, (1960), pp. 40-41; and in Duncan M'Laren Young Sommerville, *Bibliography of Non-Euclidean Geometry*, Harrison & Sons, London, (1911); reprinted Chelsea Pub. Co., New York, (1970); and William Stewart Halstead, "Bibliography of Hyper-Space and Non-Euclidean Geometry", *American Journal of Mathematics*, Volume 1, (1878), pp. 261ff. and 384ff.. The development of non-Euclidean geometry is outlined by Oswald Veblen, "The Foundations of Geometry", *Popular Science Monthly*, Volume 68, Number 1, (January, 1906), pp. 21-28.

Returning to the concept of *time* as the fourth dimension, Edgar Allen Poe believed, in 1848,

> "A rational cause for the phænomenon, I maintain that Astronomy has palpably failed to assign: — but the considerations through which, in this Essay, we have proceeded step by step, enable us

clearly and immediately to perceive that Space and Duration are one."[148]

Poe was under the spell of Alexander von Humboldt (and opium). Humboldt stated "Mach's Principle" long before Mach, but long before Humboldt, Boscovich stated it. I shall return to Humboldt when I address the general theory of relativity. Humboldt's influence on Stallo, Poe and the general intellectual community toward relativism cannot be emphasized strongly enough!

D'Alembert let us in on a secret back in 1754,

"As I've already said, it is not possible to conceive of more than three *dimensions*. However, a brilliant wit with whom I am acquainted considers duration a fourth *dimension*, and that the product of time multiplied by solidity would, in some sense, be a product of four *dimensions*. This idea is perhaps contestable, but it appears to me to be of some merit, even if it is only that of novelty."[149]

Lagrange, worked out a new mechanics with time as the fourth dimension, ca. 1788,

"We will apply the theory of functions to mechanics. Here, the functions absolutely correspond to time, which we will always designate with $t$, and, since the position of a point in space depends upon the three rectilinear coordinates $x$, $y$, $z$, these coordinates, in the problems of mechanics, will be assumed to be functions of $t$. In this way, we can look upon mechanics as a geometry of four dimensions, and the analysis of mechanics like an extension of the analysis of geometry."



"Nous allons employer la théorie des fonctions dans la Mécanique. Ici les fonctions se rapportent essentiellement au temps, que nous désignerons toujours par $t$, et, comme la position d'un point dans l'espace dépend de trois coordonnées rectangulaires $x$, $y$, $z$, ces coordonnées, dans les problèmes de Mécanique, seront censées être des fonctions de $t$. Ainsi, on peut regarder la Mécanique comme une Géométrie à quatre dimensions et l'Analyse mécanique comme une extension de l'Analyse géométrique."[150]

John Locke asserted, ca. 1689,

"To conclude: expansion and duration do mutually embrace and comprehend each other; every part of space being in every part of duration, and every part of duration in every part of expansion. Such a combination of two distinct ideas is, I suppose, scarce to be found in all that great variety we do or can conceive, and may afford matter to further speculation."[151]

Henry More asserted, in 1671, that spirits inhabit four dimensions,[152] a belief pursued by astrophysicist Johann Karl Friedrich Zöllner, in the 1870's,[153] and Bernhard Riemann,[154] who used the spiritual concept to explain gravitation; which spiritualistic four-dimensional views were questioned by physicist Ernst Mach,[155] but embraced by physicist A. E. Dolbear[156] and by T. Proctor Hall,[157] who was criticized by Edmund C. Sanford.[158] Hall noted, in 1892, that the fourth dimension is useful; in that,

"the theologian could use it for the world of spirits;

the physicist for forces [***] 'All are but parts of one stupendous whole, Whose body Nature is, and God the soul.' [Alexander Pope, *Essay on Man*] If four-fold space exists, it is evident that it must contain an infinite variety of three-fold spaces, of which we know only one. It must also be everywhere possible for a four-fold being to step out of our space at any point and re-enter it at any other point; for his relation to our space is nearly the same as our relation to a plane. If ghosts are four-fold beings, the erratic nature of their movements may become more comprehensible in the course of time. An ordinary knot could in four-fold space be readily untied by carrying one loop out of our space and bringing it back in a different place. In fact, a knot in our space would be simply a loop or coil in four-fold space. A flexible closed shell could be turned inside out as easily as a thin hoop can with us; and many other apparent impossibilities become mere child's play."

Hermann Schubert attacked Zöllner and the Spiritualists, and their fourth dimension,

"The high eminence on which the knowledge and civilization of humanity now stands was not reached by the thoughtless employment of fanciful ideas, nor by recourse to a four-dimensional world, but by hard, serious labor, and slow, unceasing research. Let all men of science, therefore, band themselves together and oppose a solid front to methods that explain everything that is now mysterious to us by the interference of independent spirits. For these methods, owing to the fact that they can explain everything, explain nothing, and thus oppose dangerous obstacles to the progress of real research, to which we owe the beautiful temple of modern knowledge."[159]



In 1878, P. G. Tait published a polemic against Zöllner, and his fourth dimension, in the journal *Nature*, which evinces the emerging prejudice against Metaphysics, generated by Bacon, and later by the positivists,

"He is, as Helmholtz long ago said, a genuine Metaphysician, and (as such) is a curiosity really worthy of study:—not of course merely because he is a Metaphysician, but because in this nineteenth century he attempts to bring his metaphysics into pure physical science. [***] In conclusion, though I cannot make pretensions to any minute acquaintance with the German language, I think I may venture to suggest to Prof. Zöllner, for his next edition, a title which shall at least more accurately describe the contents of his work than does his present one. I cannot allow that the title 'Scientific Papers' is at all correctly descriptive. But I think that something like the following would suit his book well

Patriotische
METAPHYSIK DER PHYSIK,
für moderne deutsche Verhältnisse.
Mit speciellem Bezug auf die vierte Dimension und den Socialdemokratismus bearbeitet.

With this little hint, which I hope will be taken, as it is meant, in good part, I heartily wish him and his work farewell. P. G. TAIT"[160]

It is ironic, that what was considered metaphysical in the Nineteenth Century, with its belief in an observable reality; is today, with the scientific method turned on its head, considered scientific; *i. e.* unobservable and purely abstract "space-time" is today considered the absolute world, and questioning this internally contradictory ontological "nonsense", is today pejoratively and hypocritically referred to as "Metaphysics".

Just as quadri-dimensional speculation has a long and continuing history, so, too, does opposition to it.[161] Stallo wrote much against it, concluding,

> "If Riemann's argument were fundamentally valid, it could be presented in very succinct and simple form. It would be nothing more than a suggestion that, because algebraic quantities of the first, second, and third degrees denote geometrical magnitudes of one, two, and three dimensions respectively, there must be geometrical magnitudes of four, five, six, etc., dimensions corresponding to algebraic quantities of the fourth, fifth, sixth, etc., degree. [*Stallo notes:* It is not unworthy of remark, here, that the practice of reading $x^2$ and $x^3$ as $x$ square and $x$ cube, instead of $x$ of the second order or third power, is founded upon the silent or express assumption that an algebraic quantity has an inherent geometric import. The practice is, therefore, misleading, and ought to be disused. *Principiis obsta!*]
>
> It is hardly necessary to say, after all this, that the analytical argument in favor of the existence, or possibility, of transcendental space is another flagrant instance of the reification of concepts."[162]

Stallo's and Schubert's foreboding is profound, given the absolutist ontology of the special theory of relativity, which soon followed their admonitions to us.

Edward H. Cutler stated in 1909,

> "The fourth dimension has no real existence in the sense in which the external world that we know by means of our senses has real existence. It is a philosophical and metaphysical conception, whose actual existence cannot be demonstrated by observation or by logical reasoning."[163]

Manning and Whitrow cite Michael Stifel, in 1553, and John Wallis, in 1685, as stigmatizing the conjecture of a fourth or higher dimension, as being *unnatural*, an expression with religious implications in those times.[164]

Aristotle, in contrast to Stewart and Tait, argued for a limitation of three, his favorite number, dimensions,

> "The line has magnitude in one way, the plane in two ways, and the solid in three ways, and beyond these there is no other magnitude because three are all [***] There is no transfer from length to area and from area to a solid."[165]

And then there was Ptolemy,

> "The admirable Ptolemy in his book *On Distance* well proved that there are not more than three distances, because of the necessity that distances should be taken along perpendicular lines, and because it is possible to take only three lines that are mutually perpendicular, two by which the plane is defined and a third measuring depth; so that if

there were any other distance after the third it would be entirely without measure and without definition. Thus Aristotle seemed to conclude from induction that there is no transfer into another magnitude, but Ptolemy proved it."[166]

Galileo questioned on what basis Aristotle drew his conclusion, but did not really dispute it.

The relational image of time to space and motion is an ancient conception. Consider Anaximander's philosophy (ca. 611-546 B.C.), which speaks of the absolute world of "space-time", and hints at "Mach's principle",

"Anaximander, then, was the hearer of Thales. Anaximander was son of Praxiadas, and a native of Miletus. This man said that the originating principle of existing things is a certain constitution of the Infinite, out of which the heavens are generated, and the worlds therein; and that this principle is eternal and undecaying, and comprising all the worlds. And he speaks of time as something of limited generation, and subsistence, and destruction. This person declared the Infinite to be an originating principle and element of existing things, being the first to employ such a denomination of the originating principle. But, moreover, he asserted that there is an eternal motion, by the agency of which it happens that the heavens [Or, 'men.'] are generated; but that the earth is poised aloft, upheld by nothing, continuing (so) on account of its equal distance from all (the heavenly bodies)".[167]

As Dean Turner noted, "space-time", as a concept,



as a quadri-dimensional statue, harkens back to the ancients, to Parmenides and the Eleatics,

"For what is different from being does not exist, so that it necessarily follows, according to the argument of Parmenides, that all things that are are one and this is being."[168]

When Minkowski, in 1908, uttered the infamous words,

"Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a union of the two will preserve an independent reality,"[169]

his words were not only unoriginal, they were trite, and more archaic, than arcane.

Anton Reiser (Rudolf Kayser) proclaimed,

"The universe becomes a four-dimensional continuum in the time-space sense of Minkowski. Physical occurrences are now represented by three spatial coördinates as well as by one time coördinate, or in other words, there is no Becoming, only Being."[170]

One is left to wonder how the "universe Becomes a four-dimensional continuum", if there is "no Becoming, only being".

Hermann Weyl stated,

"The great advance in our knowledge described in this chapter consists in recognising that the scene of action of reality is not a three-dimensional

Euclidean space but rather a **four-dimensional world, in which space and time are linked together indissolubly.** However deep the chasm may be that separates the intuitive nature of space from that of time in our experience, nothing of this qualitative difference enters into the objective world which physics endeavours to crystallise out of direct experience. It is a four-dimensional continuum, which is neither 'time' nor 'space'. Only the consciousness that passes on in one portion of this world experiences the detached piece which comes to meet it and passes behind it, as **history,** that is, as a process that is going forward in time and takes place in space [**Emphasis found in the original**]."[171]

"The objective world simply *is*, it does not *happen*. Only to the gaze of my consciousness, crawling upward along the lifeline of my body, does a section of the world come to life as a fleeting image in space which continuously changes in time."[172]

Ebenezer Cunningham wrote,

"With Minkowski space and time become particular aspects of a single four-dimensional concept; the distinction between them as separate modes of correlating and ordering phenomena is lost, and the motion of a point in time is represented as a stationary curve in four-dimensional space. The whole history of a physical system is laid out as a changeless whole."[173]

and,



"**1.** The main objections urged against the Principle of Relativity are [***] (*iii*) that time and space are such immediate objects of perception that the artificial view which it adopts of them cannot in any sense correspond to reality.

**2.** In respect of the last difficulty little can be said to meet the natural shrinking which the observer of natural phenomena feels from such a calculus as Minkowski's, in which we seem to lose sight of the most obvious distinction between time and space as essentially different modes of ordering events.

It must be remarked, however, that an essential part in the practice of the calculus is the final process of interpreting the analytical result in terms of the ordinary modes of thought. There is perhaps an analogy to be drawn between the analysis which lays out the whole history of phenomena as a single whole, and the things in themselves, the natural phenomena apart from the human intelligence, for which consciousness of time and space does not exist, the laws of which, when expressed for instance by means of a principle of least action, consist in a relation between the whole aggregate of configurations which their history contains; in which, so far as they are mechanically determinate, the past and the future are interchangeable. Such a view of the universe is inseparable from a mechanical determinism in which the future is unalterably determined by the past and in which the past can be uniquely inferred from the present state of the universe. It is the view of an intelligence which could comprehend at one glance the whole of time and space.

But the limitations of the human mind resolve this changeless whole into its temporal and spatial aspects, and the past and future of the physical world is the past and future of the intelligence perceiving it. Only to a being outside the physical universe, free from participation in its phenomena, is time a meaningless term. The human consciousness and the physical universe are inseparably parts of a greater whole. They run parallel to one another, and the brain cannot do otherwise than order physical and external events relative to the internal sequences of its own consciousness.

It is by such a process of correlation that any analytical scheme of relations is constructed for the description of natural processes. When this has been carried out, it is claimed for it that it, at any rate approximately, contains within it the whole history of those processes for the mind to grasp as one whole. Thus the very act of formulating a set of equations which make the present state of the system to contain implicitly within it the whole history, past and to be, is one step, and that the largest, towards eliminating the peculiar characteristic of time as a product of the inner consciousness from its place in physical relations. It is but a small step further to the timeless universe of Minkowski.

It is in fact the sole aim of theoretical physics to distinguish between and disentangle one from the other those factors in perceived events which are dependent upon human consciousness and those which are completely independent of it. The achievements of the past in this direction are quite sufficient to warrant further and continuous effort. That the mind should be able to conceive such a



daring project and to progressively realize it, seems almost in itself sufficient to indicate that the resolution of its own workings into a chain of physically determinate processes is one incapable of complete realization."[174]

Milič Čapek opposed this mystical "myth of the frozen passage."[175]

It was a great injustice to attribute priority for this Eleatic stance to Minkowski. As was shown, Hinton justified the classical principle of relativity in four-dimensions, in 1880 (It is irrational to assert that the principle of relativity compels invariant light speed, on the same grounds that it is irrational to assert that the principle of relativity requires that if I rest in inertial system *A*, I also rest in inertial system *B*, which is in motion relative to inertial system *A*). Palágyi added the German nomenclature, and more precise mathematical formalism; and he also iterated the principle of relativity as a quadri-dimensional Eleatic ideal of a motionless, spaceless and timeless world, in 1901, stating, *inter alia*,

> "However, it would also be, in reality, a spaceless conception of the world, since all points of this four-dimensional space would be given to us at the same time and it would not take up any length of time to grasp this four-dimensional world in all its parts. The four-dimensional conception of space would accordingly actually signify the complete removal of the spatiotemporalness of the world."

> "Es wäre aber im Grunde genommen auch ein raumloses Auffassen der Welt, da alle Punkte dieses vierdimensionalen Raumes uns gleichzeitig

gegeben wären und es keine Zeitdauer in Anspruch nehmen dürfte, diese vierdimensionale Welt in allen ihren Teilen zu überblicken. Die vierdimensionale Raumvorstellung würde sonach eigentlich die völlige Aufhebung der Raumzeitlichkeit der Welt bedeuten."[176]

This belief system is truly archaic. Quoting from Ueberweg, on the ancient Eleatics,

"§ 18. Xenophanes, of Colophon, in Asia Minor (born 569 B. C.), who removed later to Elea, in Lower Italy, combats in his poems the anthropomorphitic and anthropopathic representations of God presented by Homer and Hesiod, and enounces the doctrine of the one, all-controlling God-head. God is all eye, all ear, all intellect; untroubled, he moves and directs all things by the power of his thought. [***] That the God of Xenophanes is the unity of the world is a supposition that was early current. We do not find this doctrine expressed in the fragments which have comedown to us, and it remains questionable whether Xenophanes pronounced himself positively in this sense, in speaking of the relation of God to the world, or whether such a conception was not rather thought to be implied in his teachings by other thinkers, who then expressed it in the phraseology given above. In the (Platonic?) dialogue, *Sophistes* (p. 242), the leading interlocutor, a visitor from Elea, says: 'The Eleatic race among us, from Xenophanes and even from still earlier times, assume in their philosophical discourses that what is usually called All, is One [***]. The 'still earlier' philosophers are probably



certain Orphists, who glorified Zeus as the all-ruling power, as beginning, middle, and end of all things. Aristotle says, Metaph., I. 5: 'Xenophanes, the first who professed the doctrine of unity—Parmenides is called his disciple—has not expressed himself clearly concerning the nature of the One, so that it is not plain whether he has in mind an ideal unity (like Parmenides, his successor) or a material one (like Melissus); he seems not to have been at all conscious of this distinction, but, with his regard fixed on the whole universe, he says only that God is the One.' [***]

§ 19. Parmenides of Elea, born about 515—510 B. C. (so that his youth falls in the time of the old age of Xenophanes), is the most important of the Eleatic philosophers. He founds the doctrine of unity on the conception of being. He teaches: Only being is, non-being is not; there is no becoming. That which truly is exists in the form of a single and eternal sphere, whose space it fills continuously. Plurality and change are an empty semblance. The existent alone is thinkable, and only the thinkable is real. Of the one true existence, convincing knowledge is attainable by thought; but the deceptions of the senses seduce men into mere opinion and into the deceitful, rhetorical display of discourse respecting the things, which are supposed to be manifold and changing.—In his (hypothetical) explanation of the world of appearance, Parmenides sets out from two opposed principles, which bear to each other, within the sphere of appearance, a relation similar to that which exists between being and non-being. These principles are light and night, with which the antithesis of fire and earth corresponds. [***] Truth consists in the knowledge that being is, and non-being can not be; deception lies in the belief that non-being also is and must be. [***] The predicate being belongs to thought itself; that I think something and that this, which I think, *is* (in my thought), are identical assertions; non-being—that which is not—can not be thought, can, so to speak, not be reached, since every thing, when it is thought, exists as thought; no thought can be non-existent or without being, for there is nothing to which the predicate being does not belong, or which exists outside of the sphere of being.—In this argumentation Parmenides mistakes the distinction between the subjective being of thought and an objective realm of being to which thought is directed, by directing his attention only to the fact that both are subjects of the predicate being. [***] Not the senses, which picture to us plurality and change, conduct to truth, but only thought, which recognizes the being of that which is, as necessary, and the existence of that which is not, as impossible. [***] Much severer still than his condemnation of the naïve confidence of the mass of men in the illusory reports of the senses, is that with which Parmenides visits a philosophical doctrine which, as he assumes, makes of this very illusion (not, indeed, as illusion, in which sense Parmenides himself proposes a theory of the sensible, but as supposed truth) the basis of a theory that falsifies thought, in that it declares non-being identical with being. It is very probable that the Heraclitean doctrine is the one on which Parmenides thus animadverts, however indignantly Heraclitus might have resented this association of his doctrine with the prejudice of the masses, who do not rise above the false



appearances of the senses; [***] Parmenides (in a passage of some length, given by Simpl., *Ad Phys.*, fol. 31 a b) ascribes to the truly existent all the predicates which are implied in the abstract conception of *being*, and then proceeds further to characterize it as a continuous sphere, extending uniformly from the center in all directions—a description which we are scarcely authorized in interpreting as merely symbolical, in the conscious intention of Parmenides. That which truly is, is without origin and indestructible, a unique whole, only-begotten, immovable, and eternal; it was not and will not be, but *is*, and forms a continuum. [***] For what origin should it have? How could it grow? It can neither have arisen from the non-existent, since this has no existence, nor from the existent, since it is itself the existent. There is, therefore, no becoming, and no decay [***]. The truly existent is indivisible, everywhere like itself, and ever identical with itself. It exists independently, in and for itself [***], thinking, and comprehending in itself all thought; it exists in the form of a well-rounded sphere [***].The Parmenidean doctrine of the *apparent* world is a cosmogony, suggesting, on the one hand, Anaximander's doctrine of the warm and the cold as the first-developed contraries and the Heraclitean doctrine of the transformations of fire, and, on the other, the Pythagorean opposition of 'limit' and 'the unlimited' [***], and the Pythagorean doctrine of contraries generally. It is founded on the hypothesis of a universal mixture of warm and cold, light and dark. The warm and light is ethereal fire, which, as the positive and efficient principle, represents within the sphere of appearance the place of being; the cold and dark is air and its product, by condensation [***], earth. The combining or 'mixing' of the contraries is effected by the all-controlling Deity [***] at whose will Eros came into existence as first, in time, of the gods [***]. That which fills space and that which thinks, are the same; how a man shall think, depends on the 'mixture' of his bodily organs; a dead body perceives cold and silence [***]. If the verse in the long fragment,[***], could be amended (as is done by Gladisch, who seeks in it an analogue to the Maja of the Hindus) so as to read: [***], Parmenides would appear as having explained the plurality and change attested by the senses, as a dream of the one true existence. But this conjecture is arbitrary; and the words cited in the *Soph.*, p. 242: [***], as also the doctrine of the Megarians concerning the many names of the One, which alone really exists, confirm the reading [***] of the MSS. The sense of the passage is therefore: 'All the manifold and changing world, which mortals suppose to be real, and which they call the sum of things, *is* in reality only the One, which alone truly is.' In the philosophy of Parmenides no distinction is reached between appearance, or semblance, and phenomenon. The terms being and appearance remain with him philosophically unreconciled; the existence of a realm of mere appearance is incompatible with the fundamental principle of Parmenides.

§ 20. Zeno of Elea (born about 490—485 B. C.) defended the doctrine of Parmenides by an indirect demonstration, in which he sought to show that the supposition of the real existence of things manifold and changing, leads to contradictions. In particular,



he opposed to the reality of motion four arguments: 1. Motion can not begin, because a body in motion can not arrive at another place until it has passed through an unlimited number of intermediate places. 2. Achilles can not overtake the tortoise, because as often as he reaches the place occupied by the tortoise at a previous moment, the latter has already left it. 3. The flying arrow is at rest; for it is at every moment only in one place. 4. The half of a division of time is equal to the whole; for the same point, moving with the same velocity, traverses an equal distance (*i.e.*, when compared, in the one case, with a point at rest, in the other, with a point in motion) in the one case, in half of a given time, in the other, in the whole of that time. [***] In the (Platonic?) dialogue *Parmenides*, a prose writing [***] of Zeno is mentioned, which was distributed into several series of argumentations [***], in each of which a number of hypotheses [***] were laid down with a view to their *reductio in absurdum*, and so to the indirect demonstration of the truth of the doctrine that Being is One. It is probably on account of this (indirect) method of demonstration from hypotheses, that Aristotle [***] called Zeno the inventor of dialectic [***]. If the manifold exists, argues Zeno [***], it must be at the same time infinitely small and infinitely great; the former, because its last divisions are without magnitude, the latter, on account of the infinite number of these divisions. (In this argument Zeno leaves out of consideration the inverse ratio constantly maintained between magnitude and number of parts, as the division advances, whereby the same product is constantly maintained, and he isolates the notions of smallness and number, opposing the one to the other.) In a similar manner Zeno shows that the manifold, if it exists must be at the same time numerically limited and unlimited. Zeno argues, further [***], against the reality of space. If all that exists were in a given space, this space must be in another space, and so on *in infinitum*. Against the veracity of sensuous perception, Zeno directed [***] the following argument: If a measure of millet-grains in falling produce a sound, each single grain and each smallest fraction of a grain must also produce a sound ; but if the latter is not the case, then the whole measure of grains, whose effect is but the sum of the effects of its parts, can also produce no sound. (The method of argumentation here employed is similar to that in the first argument against plurality.) The arguments of Zeno against the reality of motion [***] have had no insignificant influence on the development of metaphysics in earlier and later times. Aristotle answers the two first [***] with the observation [***] that the divisions of time and space are the same and equal [***] for both time and space are continuous [***]; that a distance divisible *in infinitum* can therefore certainly be traversed in a finite time, since the latter is also in like manner divisible *in infinitum*, and the divisions of time correspond with the divisions of space; the infinite in division [***] is to be distinguished from the infinite in extent [***]; his reply to the third argument [***] is, that time does not consist of single indivisible points (conceived as discontinuous) or of 'nows' [***]. In the fourth argument he points out what Zeno, as it seems, had but poorly concealed, viz., the change of the standard of comparison [***]. It can be questioned



whether the Aristotelian answers are fully satisfactory for the first three arguments (for in the fourth the paralogism is obvious). Bayle has attacked [***]. Hegel [***] defends Aristotle against Bayle. Yet Hegel himself also sees in motion a contradiction; nevertheless, he regards motion as a real fact. Herbart denies the reality of motion on account of the contradiction which, in his opinion, it involves. [***]

§ 21. Melissus of Samos attempts by a direct demonstration to establish the truth of the fundamental thought of the Eleatic philosophy, that only the One is. By unity, however, he understands rather the continuity of substance than the notional identity of being. That which is, the truly existent, is eternal, infinite, one, in all points the same or 'like itself,' unmoved and passionless. [***] If nothing were, argues Melissus, how were it then even possible to speak of it, as of something being? But if any thing is, then it has either become or is eternal. In the former case, it must have arisen either from being or from non-being. But nothing can come from non-being; and being can not have arisen from being, for then there must have been being, before being came to be (became). Hence being did not become; hence it is eternal. It will also not perish; for being can not become non-being, and if being change to being, it has not perished. Therefore it always was and always will be. As without genesis, and indestructible, being has no beginning and no end; it is, therefore, infinite. (It is easy to perceive here the leap in argumentation from temporal infinity to the infinity of space, which very likely contributed essentially to draw on Melissus Aristotle's reproach of feebleness of thought.) As infinite, being is One; for if it were dual or plural, its members would mutually limit each other, and so would not be infinite. As one, being is unchangeable; for change would pluralize it. More particularly, it is unmoved; for there exists no empty space in which it can move, since such a space, if it existed, would be an existing nothing; and being can not move within itself for then the One would become a *divisum*, hence manifold. Notwithstanding the infinite extension which Melissus attributes to being, he will not have it called material, since whatever is material has parts, and so can not be a unity."[177]

Einstein, together with Jakob Laub, denounced Minkowski's recitation of Poincaré's four-dimensional interpretation of the Lorentzian æther, in 1908, in a paper fraught with mistakes.[178] It wasn't until it was made clear to Einstein that Poincaré's quadri-dimensional interpretation of Lorentz' quasi-rigid æther could be exploited to arrive at Paul Gerber's[179] 1898 formulation of gravitation, that Einstein ended his attack on it, and instead copied it in the general theory of relativity of 1916—though, predictably, Einstein failed to cite either Poincaré or Gerber.

Einstein had read Mach, who paraphrased Gerber's work,

"Paul Gerber alone ("Ueber die räumliche u. zeitliche Ausbreitung der Gravitation," *Zeitschrift f. Math. U. Phys.*, 1898, II), from the perihelial motion of Mercury, forty-one seconds in a century, finds the velocity of propagation of gravitation to be the same as that of light. This would speak in favor of the ether as the medium of gravitation. (Compare W. Wien, "Ueber die Möglichkeit einer elektromagnetischen Begründung der Mechanik," *Archives Néerlandaises*, The Hague, 1900, V, p. 96.)"[180]



"Nur Paul Gerber („Ueber die räumliche u. zeitliche Ausbreitung der Gravitation," Zeitschrift f. Math. U. Phys., 1898, II) findet aus der Perihelbewegung des Mercur, 41 Secunden in einem Jahrhundert, die Ausbreitungsgeschwindigkeit der Gravitation gleich der Lichtgeschwindigkeit. Dies spräche für den Aether als Medium der Schwefre. Vgl. W. Wien, Ueber die Möglichkeit einer elektromagnetischen Begründung der Mechanik, (Archives Néerlandaises, La Haze 1900, V, S. 96.)"[181]

Einstein's admission that the æther of relativity theory is analogous to Lorentz' æther is an admission that Lorentz holds priority on the formalism of the theory, and, further, that Einstein felt forced to switch camps from that of Lorentz to that of Poincaré, *in 1916, much after the 1905 paper appeared*, to a theory which Einstein, himself, together with Laub, had denounced in 1908, only to admit, in 1920, that this "absolute world" of Minkowski "space-time" resulted again in Lorentz' æther. As Einstein stated,

"According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense."

Relativists would counter this citation by pointing out that Einstein's æther differs from that of Lorentz, in that it is ultimately vague, a word without meaning, and no supposition is made as to its fundamental properties, such as the assertion that the æther may be an ideal fluid of particles immersed in a void of empty space.[182] Einstein denied it the property of "motion", an assertion made many decades earlier by Philipp Spiller in a much read work.[183] However, this argument over semantics is one made against a straw man, for Lorentz stated as early as 1895,

> "It does not suit my purpose to examine more thoroughly such speculations, or to express presumptions about the nature of the æther. I merely wish, as far as possible, to free myself of all preconceived notions regarding this substance and not to ascribe to it, for example, any of the qualities of ordinary liquids and gasses. Should it be shown, that a description of the phenomena is best arrived at through the assumption of absolute permeability, then one must surely in the meantime adopt this sort of hypothesis, and leave it to further research, if possible, to open up a deeper understanding to us."

> "Es liegt nicht in meiner Absicht, auf derartige Speculationen näher einzugehen oder Vermuthungen über die Natur des Aethers auszusprechen. Ich wünsche nur, mich von vorgefassten Meinungen über diesen Stoff möglichst frei zu halten und demselben z. B. keine von den Eigenschaften der gewöhnlichen Flüssigkeiten und Gase zuzuschreiben. Sollte es sich ergeben, dass eine Darstellung der Erscheinungen am besten unter der Voraussetzung absoluter Durchdringlichkeit gelänge, dann müsste man sich zu einer solchen Annahme einstweilen schon verstehen und es der weiteren Forschung überlassen, uns, womöglich, ein tieferes Verständniss zu erschliessen."[184]



Compare this with Schubert's views,

> "In mathematics, in fact, the extension of any notion is admissible, provided such extension does not lead to contradictions with itself or with results which are well established. Whether such extensions are necessary, justifiable, or important for the advancement of science is a different question. It must be admitted, therefore, that the mathematician is justified in the extension of the notion of space as a point-aggregate of three dimensions, and in the introduction of space or point-aggregates of more than three dimensions, and in the employment of them as means of research. Other sciences also operate with things which they do not know exist, and which, though they are sufficiently defined, cannot be perceived by our senses. For example, the physicist employs the ether as a means of investigation, though he can have no sensory knowledge of it. The ether is nothing more than a means which enables us to comprehend mechanically the effects known as action at a distance and to bring them within the range of a common point of view. Without the assumption of a material which penetrates everything, and by means of whose undulations

impulses are transmitted to the remotest parts of space, the phenomena of light, of heat, of gravitation, and of electricity would be a jumble of isolated and unconnected mysteries. The assumption of an ether, however, comprises in a systematic scheme all these isolated events, facilitates our mental control of the phenomena of nature, and enables us to produce these phenomena at will. But it must not be forgotten in such reflexions that the ether itself is even a greater problem for man, and that the ether-hypothesis does not solve the difficulties of phenomena, but only puts them in a unitary conceptual shape. Notwithstanding all this, physicists have never had the least hesitation in employing the ether as a means of investigation. And as little do reasons exist why the mathematicians should hesitate to investigate the properties of a four-dimensioned point-aggregate, with the view of acquiring thus a convenient means of research."[185]

Though Schubert allowed for mathematical speculation—useful fictions, he opposed pretending that such four-dimensional fantasies be taken to signify a reflection of physical reality,

"The high eminence on which the knowledge and civilization of humanity now stands was not reached by the thoughtless employment of fanciful ideas, nor by recourse to a four-dimensional world, but by hard, serious labor, and slow, unceasing research. Let all men of science, therefore, band themselves together and oppose a solid front to methods that explain everything that is now mysterious to us by the interference of independent spirits. For these methods, owing to the fact that they can explain everything, explain nothing, and thus oppose dangerous obstacles to the progress of real research, to which we owe the beautiful temple of modern knowledge."[186]



Both Lorentz and Albert Einstein maintained a tri-dimensional privileged frame of "physical space" or "æther", which is the same *physical* hypothesis given two names; and the appellation æther, which more clearly maintains the concept of a physical entity, is the more fitting title. It was Poincaré, Marcolongo and Minkowski, who incorporated Stallo's quadri-dimensional æther into the theory of relativity. Stallo stated, in 1847, in the explicit context of four-dimensional "space-time",

"The abstract totality of extension in itself is devoid of all internal difference and distinction. It is, from its ideal origin and nature, absolutely *moving*; *but this motion is yet perfectly the same as absolute repose*. For there are no distinct particles as yet successively occupying distinct spaces; in every respect there is thorough homogenousness. We have absolute multiplicity, but a multiplicity intimately and completely blended in extensive continuous unity. It is indifferent to me whether this primitive matter be called *ether*, or any other name be given it; the only thing important is, to keep this absence of further material differentiation in view."

## 3. "Theory of Relativity" or "Pseudorelativism"?

*"Einstein's theory of relativity is a misnomer, it should be called a theory of absolutivity."*—WALLACE KANTOR

In one sense, the so-called relativists'—they aren't truly "relativists", as Minkowski noted,

> "This hypothesis [length contraction resulting in light speed invariance] sounds extremely fantastical, for the contraction is not to be looked upon as a consequence of resistances [*sic*] in the ether, or anything of that kind, but simply as a gift from above [***] [T]he word *relativity-postulate* for the requirement of an invariance with the group $G_c$ seems to me very feeble. [***] I prefer to call it the *postulate of the absolute world.* [***] Thus the essence of this postulate may be clothed mathematically in a very pregnant manner in the mystic formula $3 \cdot 10^5 = (-1)^{1/2}$ secs."[187]

Samuel Alexander held that,

> "[I]t is clear that Space-Time takes for us the place of what is called the Absolute in idealistic systems. It is an experiential absolute."[188]

Max Planck stated,

> "Einstein's recognition of the fact that our Newtonian-Kantian conception of space and time possesses in a certain sense only a relative value

because of the arbitrary choice of the system of correlation and methods of measuring, affects the very root of our physical thought. But if space and time have been deprived of their absolute qualities, the absolute has not been disposed of finally, but has only been moved back a step to the measurement of four-dimensional multiplicity which results from the fact that space and time have been fused into one coherent continuum by means of the speed of light. This system of measurement represents something totally independent of any kind of arbitrariness and hence something absolute."[189]

and

" For everything that is relative presupposes the existence of something that is absolute, and is meaningful only when juxtaposed to something absolute. The often heard phrase, "Everything is relative," is both misleading and thoughtless. The Theory of Relativity, too, is based on something absolute, namely, the determination of the matrix of the space-time continuum; and it is an especially stimulating undertaking to discover the absolute which alone makes meaningful something given as relative. [***] Our task is to find in all these factors and data, the absolute, the universally valid, the invariant, that is hidden in them, [*sic*] This applies to the Theory of Relativity, too. I was attracted by the problem of deducing from its fundamental propositions that which served as their absolute immutable foundation. [***] [T]he Theory of Relativity confers an absolute meaning on a magnitude which in classical theory has only a relative significance: the velocity of light. The velocity of light is to the Theory of Relativity [***] its absolute core. The absolute showed itself to be even more deeply rooted in the order of natural laws than had been assumed for a long time."[190]



Bertrand Russell wrote in "The ABC of Relativity",

"In fact, though few physicists in modern times have believed in absolute motion, the [*special* theory of relativity] still embodied Newton's belief in [absolute motion], and a revolution in method was required to obtain a technique free from this assumption. This revolution was accomplished in Einstein's *general* theory of relativity [1916]. [—*redacted, emphasis added*]"[191]

Ebenezer Cunningham averred,

"[I]t will be seen, the old philosophical difficulty as to *absolute direction* or *angular velocity* remains. [***] Thus we do not appear to be brought any nearer to the removal of the old-time difficulty that the physical laws which seem best to describe the phenomena of motion postulate an absolute standard of direction though not of position, while apart from the physical phenomena there is no independent means of identifying such a direction."[192]

Charles Nordmann recognized that,

"Up to this point the theory of Relativity well deserves its name. But now, in spite of it and its very name, there arises something which seems to have an independent and determined existence in the external world, an objectivity, an *absolute* reality. This is the "Interval" of events, which remains constant and invariable through all the fluctuations of things, however infinitely varied may be the points of view and standards of reference. From this datum, which, speaking philosophically, strangely shares the intrinsic qualities with which the older absolute time and absolute space were so much reproached, the whole constructive part of Relativity, the part which leads to the splendid verifications we described, is derived. Thus the theory of Relativity seems to deny its origin, even its very name, in all that makes it a useful monument of science, a constructive tool, an instrument of discovery. It is a theory of a new absolute: the interval represented by the geodetics of the quadri-dimensional universe. It is a new absolute theory."[193]

Melchior Palágyi, from whom Minkowski took much, stated,

"The term introduced by Einstein: 'theory of relativity' is, of course, a most unfortunate choice; we retain it, however, like any arbitrary standard designation, which you can't get rid of, because people have grown accustomed to using it. We restrict the meaning of the theory of relativity to: the new system of the world that arises from the monotheism of space and time and from the unification of mechanics and electrodynamics."

"Die durch Einstein eingeführte Benennung: 'Relativitätstheorie' ist zwar höchst unglücklich gewählt; wir behalten sie aber bei wie irgendeinen beliebigen Eigennamen, den man nicht abändern mag, weil man sich an ihn gewöhnt hat. Relativitätstheorie bedeutet uns immer nur so viel als: das neue Weltsystem, das aus der Einheitslehre von Raum und Zeit und das der Vereinheitlichung von Mechanik und Elektrodynamik entspringt."[194]



Einstein professed, after the general theory was established, that,

"There is no absolute (independent of the space of reference) relation in space, and no absolute relation in time between two events, but there is an absolute (independent of the space of reference) relation in space and time"[195]

and,

"The four-dimensional space of the special theory of relativity is just as rigid and absolute as Newton's space."[196]

and,

"The space-time phenomenon of the special theory of relativity was something absolute in itself, inasmuch as it was independent of the particular state of motions considered in that theory."

Wallace Kantor noted,

"Einstein's absolutivity postulate requires that $c' = c = C'$ for any real values of $v$ and $V$. In a very real sense Einstein's theory of relativity is a misnomer, it should be called a theory of absolutivity."[197]

*The Encyclopedia of Philosophy* discloses,

"The physical theories of Einstein, and the variants developed by others, which have each been called the "theory of relativity" are so named because they have relativized some of the attributes and relations (spatial distance, time interval, mass) which the Newtonian theory had asserted to be invariant (absolute). But the theory of relativity has *not* relativized all of the Newtonian invariants; indeed, it has 'absolutized' the counterparts of some of the attributes and relations which its Newtonian precursor had affirmed to be relative."[198]

Claude Kacser affirmed,

"What is absolute is stated in Einstein's *first relativity postulate*: The basic laws of physics are identical for two observers who have a constant relative velocity with respect to each other."[199]

Joshua N. Goldberg informs us that,

"Minkowski space is an *absolute space-time*."[200]

Robert Resnick concluded that,

"The theory of relativity could have been called the theory of absolutism with some justification. [***] there *are* absolute lengths and times in relativity. [***] Where relativity theory is clearly "more absolute" than classical physics is in the relativity principle itself: the *laws of physics* are absolute."[201]



It is some strange "relativity theory", which is more *absolutist* than classical *absolutism!* . . . In one sense the *pseudorelativists'* caution with respect to the æther is commendable. In another, it is unscientific to refuse to speculate based on the pseudorelativists' pretentious grounds that measurement and mathematical abstraction are the only tools of the scientist, and that their pseudorelativistic subjective comparisons and arguments by analogy are somehow "objective".

By comparing abstract space with bodily extension, and quantifying it, the "relativists" have reified that which they qualify as "void"—they have reified concepts. By insisting upon the physically contradicted notion that inertial motion, rigid rods, clocks, and light waves, each map congruent spaces; they deny the dynamic and relational physical world and substitute in its place absolutist definitions of space and time, and a "space-time", in which these conceptions have a supposed reality beyond the observed relations of which they are physically composed. Boscovich argued against such absolutist beliefs centuries ago.[202]

The list of true relativists is long. To name but a few: Des Cartes, Huyghens, Locke, Leibnitz, Berkeley, Hume, Comte, Spencer, Stallo, Hamilton, Mach, Anderssohn, Avenarius, Petzoldt, etc.. A real relativist, like Stallo, would never have embraced the absolutist "special theory of relativity", with its codified absolute space and time, and absolutist "space-time" and the ontological "universal constant" speed of light and absolute laws of Nature. Stallo wrote,

"There is nothing absolute or unconditioned in the world of objective reality. As there is no absolute standard of quality, so there is no absolute measure of duration, nor is there an absolute system of coördinates in space to which the positions of bodies and their changes can be referred. A physical *ens per se* and a physical constant are alike impossible, for all physical existence resolves itself into action and reaction, and action imports change."[203]

Mach proclaimed, in his *Science of Mechanics*,

"The expression 'absolute motion of translation' Streintz correctly pronounces as devoid of meaning and consequently declares certain analytical deductions, to which he refers, superfluous. On the other hand, with respect; to *rotation*, Streintz accepts Newton's position, that absolute rotation can be distinguished from relative rotation. In this point of view, therefore, one can select every body not affected with absolute rotation as a body of reference for the expression of the law of inertia.

I cannot share this view. For me, only relative motions exist (*Erhaltung der Arbeit*, p. 48; *Science of Mechanics*, p. 229) and I can see, in this regard, no distinction between rotation and translation. When a body moves relatively to the fixed stars, centrifugal forces are produced; when it moves relatively to some different body, and not relatively to the fixed stars, no centrifugal forces are produced. I have no objection to calling the first rotation "absolute" rotation, if it be remembered that nothing is meant by such a designation except *relative rotation with respect to the fixed stars*. Can we fix Newton's bucket of water, rotate the fixed stars, and *then* prove the absence of centrifugal forces?



The experiment is impossible, the idea is meaningless, for the two cases are not, in sense-perception, distinguishable from each other. I accordingly regard these two cases as the *same* case and Newton's distinction as an illusion (*Science of Mechanics*, page 232)."

Spencer declared,

"THE RELATIVITY OF ALL KNOWLEDGE. [***] The conviction, so reached, that human intelligence is incapable of absolute knowledge, is one that has slowly been gaining ground as civilization has advanced. Each new ontological theory, from time to time propounded in lieu of previous ones shown to be untenable, has been followed by a new criticism leading to a new skepticism."[204]

Comte avowed,

"Everything is relative, that's the only thing absolute"

Leibnitz argued against the Newtonian absolutism of the reification of ontological space and time,

"As for my Own Opinion, I have said more than once, that I hold *Space* to be something *merely relative*, as *Time* is; that I hold it to be of an *Order of Coexistences*, as *Time* is an *Order of Successions*. For *Space* denotes, in Terms of Possibility, *an Order* of Things which exist at the same time, considered as existing *together*; without enquiring into their Manner of Existing. And when many Things are seen *together*, one perceives *That Order* *of Things among themselves."*[205]

Berkeley, also, argued against Newtonian absolutism. From Berkeley's *Principles of Human Knowledge* of 1710,

"97. Beside the external existence of the objects of perception, another great source of errors and difficulties with regard to ideal knowledge is the doctrine of *abstract ideas*, such as it hath been set forth in the Introduction. The plainest things in the world, those we are most intimately acquainted with and perfectly know, when they are considered in an abstract way, appear strangely difficult and incomprehensible. Time, place, and motion, taken in particular or concrete, are what everybody knows, but, having passed through the hands of a metaphysician, they become too abstract and fine to be apprehended by men of ordinary sense. Bid your servant meet you at such a *time* in such a *place*, and he shall never stay to deliberate on the meaning of those words; in conceiving that particular time and place, or the motion by which he is to get thither, he finds not the least difficulty. But if *time* be taken exclusive of all those particular actions and ideas that diversify the day, merely for the continuation of existence or duration in abstract, then it will perhaps gravel even a philosopher to comprehend it.

98. For my own part, whenever I attempt to frame a simple idea of *time*, abstracted from the succession of ideas in my mind, which flows uniformly and is participated by all beings, I am lost and embrangled in inextricable difficulties. I have no notion of it at all, only I hear others say it



is infinitely divisible, and speak of it in such a manner as leads me to entertain odd thoughts of my existence; since that doctrine lays one under an absolute necessity of thinking, either that he passes away innumerable ages without a thought, or else that he is annihilated every moment of his life, both which seem equally absurd. Time therefore being nothing, abstracted from the sucession of ideas in our minds, it follows that the duration of any finite spirit must be estimated by the number of ideas or actions succeeding each other in that same spirit or mind. Hence, it is a plain consequence that the soul always thinks; and in truth whoever shall go about to divide in his thoughts, or abstract the *existence* of a spirit from its *cogitation*, will, I believe, find it no easy task.

99. So likewise when we attempt to abstract extension and motion from all other qualities, and consider them by themselves, we presently lose sight of them, and run into great extravagances. All which depend on a twofold abstraction; first, it is supposed that extension, for example, may be abstracted from all other sensible qualities; and secondly, that the entity of extension may be abstracted from its being perceived. But, whoever shall reflect, and take care to understand what he says, will, if I mistake not, acknowledge that all sensible qualities are alike *sensations* and alike *real*; that where the extension is, there is the colour, too, *i.e.*, in his mind, and that their archetypes can exist only in some other *mind*; and that the objects of sense are nothing but those sensations combined, blended, or (if one may so speak) concreted together; none of all which can be supposed to exist unperceived.

[***]

110. The best key for the aforesaid analogy or natural Science will be easily acknowledged to be a certain celebrated Treatise of *Mechanics*. In the entrance of which justly admired treatise, Time, Space, and Motion are distinguished into *absolute* and *relative*, *true* and *apparent*, *mathematical* and *vulgar*; which distinction, as it is at large explained by the author, does suppose these quantities to have an existence without the mind; and that they are ordinarily conceived with relation to sensible things, to which nevertheless in their own nature they bear no relation at all.

111. As for *Time*, as it is there taken in an absolute or abstracted sense, for the duration or perseverance of the existence of things, I have nothing more to add concerning it after what has been already said on that subject. [*Sect*. 97 and 98] For the rest, this celebrated author holds there is an *absolute Space*, which, being unperceivable to sense, remains in itself similar and immovable; and relative space to be the measure thereof, which, being movable and defined by its situation in respect of sensible bodies, is vulgarly taken for immovable space. *Place* he defines to be that part of space which is occupied by any body; and according as the space is absolute or relative so also is the place. *Absolute Motion* is said to be the translation of a body from absolute place to absolute place, as relative motion is from one relative place to another. And, because the parts of absolute space do not fall under our senses, instead of them we are obliged to use their sensible measures, and so define both place and motion with respect to bodies which we regard as immovable. But, it is said in



philosophical matters we must abstract from our senses, since it may be that none of those bodies which seem to be quiescent are truly so, and the same thing which is moved relatively may be really at rest; as likewise one and the same body may be in relative rest and motion, or even moved with contrary relative motions at the same time, according as its place is variously defined. All which ambiguity is to be found in the apparent motions, but not at all in the true or absolute, which should therefore be alone regarded in philosophy. And the true as we are told are distinguished from apparent or relative motions by the following properties.—First, in true or absolute motion all parts which preserve the same position with respect of the whole, partake of the motions of the whole. Secondly, the place being moved, that which is placed therein is also moved; so that a body moving in a place which is in motion doth participate the motion of its place. Thirdly, true motion is never generated or changed otherwise than by force impressed on the body itself. Fourthly, true motion is always changed by force impressed on the body moved. Fifthly, in circular motion barely relative there is no centrifugal force, which, nevertheless, in that which is true or absolute, is proportional to the quantity of motion.

112. But, notwithstanding what has been said, I must confess it does not appear to me that there can be any motion other than *relative*; so that to conceive motion there must be at least conceived two bodies, whereof the distance or position in regard to each other is varied. Hence, if there was one only body in being it could not possibly be moved. This seems evident, in that the idea I have

of motion doth necessarily include relation.

113. But, though in every motion it be necessary to conceive more bodies than one, yet it may be that one only is moved, namely, that on which the force causing the change in the distance or situation of the bodies, is impressed. For, however some may define relative motion, so as to term that body *moved* which changes its distance from some other body, whether the force or action causing that change were impressed on it or no, yet as relative motion is that which is perceived by sense, and regarded in the ordinary affairs of life, it should seem that every man of common sense knows what it is as well as the best philosopher. Now, I ask any one whether, in his sense of motion as he walks along the streets, the stones he passes over may be said to *move*, because they change distance with his feet? To me it appears that though motion includes a relation of one thing to another, yet it is not necessary that each term of the relation be denominated from it. As a man may think of somewhat which does not think, so a body may be moved to or from another body which is not therefore itself in motion.

114. As the place happens to be variously defined, the motion which is related to it varies. A man in a ship may be said to be quiescent with relation to the sides of the vessel, and yet move with relation to the land. Or he may move eastward in respect of the one, and westward in respect of the other. In the common affairs of life men never go beyond the earth to define the place of any body; and what is quiescent in respect of that is accounted *absolutely* to be so. But philosophers, who have a greater extent of thought, and juster



notions of the system of things, discover even the earth itself to be moved. In order therefore to fix their notions they seem to conceive the corporeal world as finite, and the utmost unmoved walls or shell thereof to be the place whereby they estimate true motions. If we sound our own conceptions, I believe we may find all the absolute motion we can frame an idea of to be at bottom no other than relative motion thus defined. For, as hath been already observed, absolute motion, exclusive of all external relation, is incomprehensible; and to this kind of relative motion all the above-mentioned properties, causes, and effects ascribed to absolute motion will, if I mistake not, be found to agree. As to what is said of the centrifugal force, that it does not at all belong to circular relative motion, I do not see how this follows from the experiment which is brought to prove it. See *Philosophiae Naturalis Principia Mathematica, in Schol. Def. VIII.* For the water in the vessel at that time wherein it is said to have the greatest relative circular motion, hath, I think, no motion at all; as is plain from the foregoing section.

115. For, to denominate a body *moved* it is requisite, first, that it change its distance or situation with regard to some other body; and secondly, that the force occasioning that change be applied to it. If either of these be wanting, I do not think that, agreeably to the sense of mankind, or the propriety of language, a body can be said to be in motion. I grant indeed that it is possible for us to think a body which we see change its distance from some other to be moved, though it have no force applied to it (in which sense there may be apparent motion), but then it is because the force causing the

change of distance is imagined by us to be applied or impressed on that body thought to move; which indeed shews we are capable of mistaking a thing to be in motion which is not, and that is all.

116. From what has been said it follows that the philosophic consideration of motion does not imply the being of an *absolute Space*, distinct from that which is perceived by sense and related bodies; which that it cannot exist without the mind is clear upon the same principles that demonstrate the like of all other objects of sense. And perhaps, if we inquire narrowly, we shall find we cannot even frame an idea of *pure Space* exclusive of all body. This I must confess seems impossible, as being a most abstract idea. When I excite a motion in some part of my body, if it be free or without resistance, I say there is *Space*; but if I find a resistance, then I say there is *Body*; and in proportion as the resistance to motion is lesser or greater, I say the space is more or less *pure*. So that when I speak of pure or empty space, it is not to be supposed that the word "space" stands for an idea distinct from or conceivable without body and motion—though indeed we are apt to think every noun substantive stands for a distinct idea that may be separated from all others; which has occasioned infinite mistakes. When, therefore, supposing all the world to be annihilated besides my own body, I say there still remains *pure Space*, thereby nothing else is meant but only that I conceive it possible for the limbs of my body to be moved on all sides without the least resistance, but if that, too, were annihilated then there could be no motion, and consequently no Space. Some, perhaps, may think the sense of seeing doth furnish them with the idea



of pure space; but it is plain from what we have elsewhere shewn, that the ideas of space and distance are not obtained by that sense. See the Essay concerning Vision."

It is wrong to attribute to Einstein the assertions that time, space and motion are relative, for two reasons: One, Einstein was an absolutist, who could not comprehend relativism; Two, others argued that time, space and motion are purely relative long before Einstein was born.

Galileo, Newton and Einstein were absolutists. Though Galileo is popularly credited as the father of the "principle or relativity"; the "principle of relativity" of Galileo, Newton and the Einsteins, is an absolutist corollary to the metaphysical and ontological notions of the absolute laws of Nature, absolute space, absolute time, absolute rectilinear inertial uniform translations of absolute space, and, in Einstein's case, the æthereal absolute speed of light, which, for Einstein, defines the absolute character of space, time and motion.

Speculations not yet physically contradicted can often be tested and should not be frowned upon. In insisting that any definition of the æther beyond "physical space" is taboo, the pseudorelativists are taking the hypocritical and political stance that the refusal to think is preferable to employing one's imagination, where conditions do yet allow us direct observation of those things we wish to see, but cannot; while they claim the privilege of *a priori* ontological principles and purely abstract dimensions, which have already been physically contradicted—there are no "inertial frames" in "uniform motion" such as would define a congruent time dimension. There is no observable "rectilinear uniform motion" in Nature, other than by abstract and arbitrary absolutist definition, and no arbitrarily selected "rectilinear uniform motion" maps spaces congruent to any other "rectilinear uniform motion" we have yet to observe; such that flat "space-time" is a known absolutist fallacy.

Speculations can and should be criticized, and their value is often best weighed in hindsight. Wrong ideas often inspire right ones, which insights would not likely arise other than as opposition to myth, which is to say that no subjects ought to be taboo in science, for no one can say where they might lead, and it is not wise to close out wonder from science and substitute dogma in its place, which dogma says nothing substantial, on the false premise that it is wisdom to assert nothing and foolishness to propose ideas which have a physical basis. In sum, it is healthy that one dogmatic view of that which constitutes the "æther" was subjected to criticism, but it is most unhealthy that said criticisms were employed to close the subject and substitute meaningless words for otherwise scientific images.

Definitions of the æther ofttimes are somewhat archaic. Thinkers resort to false analogies based on outmoded beliefs, largely because the subject of the æther has so long been taboo, that one feels compelled to resort to those assertions made long ago. The atomists of the Nineteenth Century asserted that the elements are composed of immutable lifeless particles. This left in doubt the nature of force, and the conservation of motion. As Fechner stated,

> "All that is given is what can be seen and felt, movement and the laws of movement. How then can we speak of force here? For physics, force is nothing but an auxiliary expression for presenting the laws of equilibrium and of motion; and every clear interpretation of physical force brings us back to this. We speak of laws of force; but when we look at the matter more closely, we find that they are merely laws of equilibrium and movement which hold for matter in the presence of matter. To say that the sun and the earth exercise an attraction upon one another, simply means that the sun and earth behave in relation to one another in accordance with definite laws. To the physicist, force is but a law, and in no other way does he know how to describe it. . . All that the physicist deduces from his forces is merely an inference from laws, through the instrumentality of the auxiliary word 'force'."[206]



Leibnitz accused Newton of religiously supposing that the universe is a watch, which God winds. As many have noted, Newton, who was far more pantheistic than even Leibnitz suspected, did not conceive of the universe as a watch, for that implied a largely self-sustaining mechanism which only required intermittent divine intervention. Newton saw God as directly active in every action and reaction of bodies. However, many, among them the Newtonians, asserted that God set these bodies in motion and then imparted motion to them as the need arose—in order to keep the watch work universe of Newton all wound up.[207] They further asserted that bodies act upon each other "at a distance", as in the case of gravity or magnetism, by God's will, whether they admitted this mystical exposition, or not. This group believed that motion compelled an absolute empty space in which things could move, and in which motion would have an absolute meaning, and, hence, force, too, would be an absolute quantity.

As a reaction to this belief system, others accepted the misbegotten notion that "atoms" are immutable structures, but concluded that force arose from a pressure in the æther. What, then, is the æther, and what, then, pressurized *it?* A false analogy was often then made to the false understanding of fluids prevalent at the time, that they are supposedly composed of identical and immutable particles. It is a good thing that these highly speculative and somewhat religious notions are today taken as dubious by many. Everything, which we have yet observed, changes. Perhaps, the æther, too, is change. In order to argue for an unchanging and fundamental æther by analogy, analogy should probably be had to something tangible, and to the best of your author's knowledge and belief, no such analogy is yet to be had, other than in our sense of what our own existence, as a religious belief, means to us, *as we change!*

That "empty space" is not "vacuum", is obvious. That it is *not* made of unchanging particles, seems an equally rational conclusion, unless I have missed some known phenomenon, which remains immutable. Perhaps, we have no means to perceive that which does not change. Perhaps, everything changes. Our ears cannot taste, and our tongues cannot see, and if change compels relations, it is rational to expect that the unchanging cannot affect the changing, and, therefore, cannot be perceived; but it seems more probable that we don't yet have the ability to sense the qualities of ephemeral space, directly, than that space is a permanent entity, which exists outside of our consciousness.

## 4. Hero Worship

*"[Einstein's] paper 'Zur Elektrodynamik bewegter Körper' in* Annalen der Physik [***] *contains not a single reference to previous literature. It gives you the impression of quite a new venture. But that is, of course,* [***] *not true."*—MAX BORN

Webster's New World Dictionary defines "relativity" as, *inter alia*,

> "4. *Physics* the fact, principle, or theory of the relative [***] as developed and mathematically formulated by Albert Einstein and H. A. Lorentz in the **special** (or **restricted**) **theory of relativity**".[208]

Grolier's *Encyclopedia International*, states, under "Relativity, Theory of", as follows,

> "To explain this paradoxical result, G. F. FitzGerald and, independently, H. A. Lorentz suggested that the effect of the ether flow on the speed of light was masked by a contraction of the measuring apparatus caused by its motion through the ether. But J. H. Poincaré and Einstein independently realized that, since all efforts to detect the earth's absolute motion had failed, the principle of relativity must somehow be valid after all, despite the ether."[209]

Subsequent to learning of FitzGerald's prior work, Lorentz never failed to acknowledge that FitzGerald had anticipated him, unlike Albert Einstein, who failed to cite Poincaré's work, which we know Einstein had read before 1905, in the Einsteins'1905 paper, or in any of the expositions on the subject, which Einstein later published in 1907, 1910, 1911, 1912 or 1916. Poincaré published his conclusions in 1895, ten years before Einstein, and repeated them often in widely read books and journals.

We know, from Solovine's accounts,[210] that Einstein had read Poincaré. Poincaré stated the principle of relativity ten years before Mileva and Albert parroted it in almost identical form, and certainly not "independently".

Why is Albert Einstein's name associated with the "principle of relativity", and not Poincaré's? Poincaré stated it first, ten years before the Einsteins, and the Einsteins copied it from him.

Who is to blame for this injustice? What could possibly motivate them, other than self-doubt and/or hero worship? The facts are clear to all willing to look. Albert Einstein did not originate the special theory of relativity. That is clear.

Grolier's *Encyclopedia International*, states, under "Poincaré, Jules Henri",

> "In 1905 Poincaré showed that Maxwell's equations suggested a theory different from classical Newtonian mechanics. He thus anticipated an aspect of the theory of relativity derived independently by Einstein in the same year."[211]

Poincaré, Lorentz, Larmor, Langevin, FitzGerald, Lange and Voigt anticipated Einstein on all important aspects of the theory.

Grolier's *Encyclopedia International*, states, under "Lorentz, Hendrik Antoon",



> "By extending Maxwell's electromagnetic theory of light, [Lorentz] incorporated many phenomena that it so far had failed to explain—in particular, the optical and electrical phenomena associated with moving bodies. His name is most widely known for the Lorentz contraction (or the Lorentz-Fitzgerald contraction), which says that a body moving with a velocity near that of light contracts in the direction of its motion. This forms an important part of the special theory of relativity."[212]

The facts stated together record that, as Whittaker stated,

> "Einstein published a paper which set forth the relativity theory of Poincaré and Lorentz with some amplifications, and which attracted much attention. He asserted as a fundamental principle the *constancy of the velocity of light*, i.e. that the velocity of light *in vacuo* is the same in all systems of reference which are moving relatively to each other: an assertion which at the time was widely accepted, but has been severally criticized by later writers."

Instead of proving that Einstein was a pioneer, the facts indicate that, as Max Born stated,

> "[Einstein's] paper 'Zur Elektrodynamik bewegter Körper' in *Annalen der Physik* [***] contains not a single reference to previous literature. It gives you the impression of quite a new venture. But that is, of course, [***] not true."

Since Poincaré and Lorentz developed the theory, why aren't their names not only linked to the theory, but universally linked together? What makes the image of "Einstein" so sacrosanct, that it is today virtually a crime to tell the truth about the history of the special theory of relativity? Why, in the majority of the histories of the special theory of relativity, isn't Einstein, with his minor contribution of the relativistic equations for aberration and the Doppler-Fizeau effect (together with his many blunders), the curious footnote of a persistent copycat, and not the central theme? Certainly, it is more convenient to briefly credit Einstein with everything, but, since the ideas are considered so significant, one would think the originators deserve their due credit.

Many people knew that Einstein did not hold priority for much of what he wrote. He, himself, was keenly aware of it. It is not uncommon for grandiose myths to accrue to overly idealized popular figures, such as Albert Einstein. Theoretical Physics, as a field, was small, and not well known in the period from 1905-1919. Theoretical physicists were not well known, and, since those in the field knew that Einstein was a plagiarist, they largely ignored him.

In 1919, (on dubious grounds[213]) Dyson, Davidson and Eddington, made Einstein famous by affirming that experiment had confirmed, without an attribution to Soldner, Soldner's 1801 hypothesis, that the gravitational field of the sun should curve the path of light from the stars.[214] Shortly after that, Einstein won the Nobel Prize, though it is unclear why he won it, other than as a reward for his new-found fame for reiterating Soldner's ideas, and for his pacificist stance during World War I.

Einstein did not invent the atomic bomb. In fact, he



was ignorant of the concept of the bomb. However, with the help of Alexander Sachs, Einstein was chosen to write a letter to President Roosevelt urging him to instigate what would eventually become the "Manhattan Project", the effort to develop an atomic bomb before the Nazis. Due to his ignorance, Leo Szilard and Eugene Wigner had to explain the concept of the atomic bomb to Einstein, before he could write the letter.[215]

Given Einstein's rôle as a spokesperson for those who knew of the concept of the bomb, one may wonder, did Einstein frequently become the political toy of others? Consider Joffe's description of the man,

> "Einstein's thoughts were far away from political problems and this is why many of Einstein's speeches in this field were poorly thought out. For example: Once in the late twenties, a group of German scientists published an anti-Soviet appeal at the end of which I found Einstein's signature. When I showed this to him, and asked why he did it, he answered that he did not think about it, but he signed it because Planck telephoned him. I asked Einstein if he is on the side of Prussian capitalism in this fight for the new socialistic state against the old. And he replied, 'Of course not, I would not have signed it if I knew about the consequences. In the future, I will not participate in any political movements without consulting you.' And also, in my opinion, Einstein's support of Zionism was ill-conceived. His wife even convinced him to participate in a concert, which Zionists had organized in a synagogue. And one more example is Einstein's fascination with the American idea of a "single state", which idea in essence was created in

> order to discredit each nation's movement toward independence, and to make it easier for big and rich countries to take over and exploit small ones. And Einstein, in the beginning, would only look at the façade of things and not look deeper into their true meaning."[216]

Einstein, according to Joffe, was political "play dough".

Why was Einstein, who had not known of, or understood, the concept of an atomic bomb, chosen to write to the President of the United States in an effort to persuade him to pursue research to make one? Was the popular image of the man more potent than his mind?

When said program to develop an atomic bomb began, Einstein was not asked to participate, but rather was excluded from the research team. Why was Einstein, supposedly the most brilliant human being of all time, not a member of the team, which developed the bomb, and upon whose work the fate of all of humanity might rest? Did Oppenheimer know that Einstein lacked the abilities needed to contribute to the research? It was apparently enough that Einstein's celebrity was exploited to draw attention to the need for research. That was Einstein's only rôle in the development of the atomic bomb. His ideas were not welcomed.

## 5. $E = mc^2$

*"The relation $E = m_M c^2$ was not derived by Einstein."*—HERBERT IVES

Contrary to popular myth, Einstein did not usher in the atomic age, in fact, he found the idea of atomic energy to be silly,[217] nor was Einstein the first to state the mass-energy equivalence, or $E = mc^2$.[218] Myths such as Einstein's supposed discoveries are not uncommon. Newton did not discover gravity, nor did he offer a viable explanation for it, nor did he believe that matter attracted other matter. Consider that few in his time knew that President Roosevelt was severely handicapped, being limited to a wheel chair, and the press cooperated in keeping Roosevelt's disability a secret. Is it difficult to believe that this same press presented Albert Einstein as a super-hero of science, when he was, in fact, less than that, perhaps much less? It was a good story for them to sell. Einstein *rarely* gave filmed interviews, but when he did, he came across as something considerably less than a "genius".

It appears that the physics community and the media invented a comic book figure, "Einstein", with "$E = mc^2$" stenciled across his chest. The media and educational institutions portray this surreal and farcical image as a benevolent god to watch over us. Some modern portraits depict the man with a godly glow and all the other visual cues inspiring reverence, which paintings of Jesus have long exploited. Physics, as an institution, fostered the myth, and countless people in all walks of life have since molded themselves in the comic book image of "Einstein", replete with the Flammarion hairdo and the Twainesque mustachio. "More Einsteinisch than he," they pretend to the great "Einstein's" supposed supernatural powers, and imitate his comic book persona.

To question "Einstein", the god, either "his" theories, or the priority of the thoughts he repeated, has become the sin of heresy. "His" writings are synonymous with truth, the undecipherable truth of a god hung on the wall as a symbol of ultimate truth, which truth is elusive to mortal man—no one is to understand or to question the arcana of "Einstein", but must let the shepherd lead his flock, without objection. Do not bother the believers with the facts!

Consider briefly the mass-energy equivalence. Huyghens and Leibnitz presented the quantity of motion, *vis viva*, energy, $E = mv^2$, as opposed to the Aristotelian-Cartesian-Newtonian quantity of motion, momentum, $\rho = mv$. This mathematical identity between energy and mass, $E = mv^2$, is the mass-energy equivalence, stated as a circle function, and "*celeritas*", "$c$", is simply one state of relative velocity—a particular case of "*velocity*", "$v$".

Isaac Newton asked if mass is convertible into light, and wondered if light might be subject to gravity. J. Soldner[219] answered Newton's queries in the affirmative in 1801, asserting that the gravitational mass of light from a distant star curves its trajectory when it passes near the sun, anticipating Einstein by more than a century.[220]

From Newton's *Opticks*,

> "QUERY 1. Do not bodies act upon light at a distance, and by their action bend its rays; and is not this action (*cæteris paribus*) strongest at the least distance?"

and,

> "QUERY 30. Are not gross bodies and light convertible into one another, and may not bodies receive much of their activity from the particles of light which enter their composition? [***] The changing of bodies into light, and light into bodies, is very conformable to the course of Nature, which seems delighted with transmutations. [***] why may not Nature change bodies into light, and light into bodies?"

S. Tolver Preston also answered Newton's queries with a loud, "Yes!" In anticipation of Thomson, De Pretto and the Einsteins, S. Tolver Preston formulated atomic energy, the atomic bomb and superconductivity back in the 1870's, based on the formula $E = mc^2$, where *celeritas*, "$c$", signifies the speed of light. Pursuing Le Sage's theory, Preston believed that mass could be attenuated into æther, thereby releasing a tremendous store of energy; since æther particles move at light speed—a limiting velocity, the energy store is equal to mass times the square of the speed of light. Albert Einstein never even came close to such insights. Le Sage, in the 1700's, proposed that gravity propagates at light speed, in anticipation of the general theory of relativity,

> "How much less therefore would they be perceived if we assume for the [gravitational] corpuscles the velocity of light, which is nine hundred thousand times as great as that of sound."[221]

Of course, the energy of these corpuscles is $E = mc^2$.

As but one example of Preston's amazing anticipation of 20th Century technology, and the powerful heuristic value of the æther-matter-energy hypothesis,

> "165. To give an idea, first, of the enormous intensity of the store of energy attainable by means of that extensive state of subdivision of matter which renders a high normal speed practicable, it may be computed that a quantity of matter representing a total mass of only one grain, and possessing the normal velocity of the ether particles (that of a wave of light), encloses a store of energy represented by upwards of one thousand millions of foot-tons, or the mass of one single grain contains an energy not less than that possessed by a mass of forty thousand tons, moving at the speed of a cannon ball (1200 feet per second); or other wise, a quantity of matter representing a mass of one grain endued with the velocity of the ether particles, encloses an amount of energy which, if entirely utilized, would be competent to project a weight of one hundred thousand tons to a height of nearly two miles (1.9 miles)." [222]

Albert and Mileva also agreed with Newton's hypothesis, but without realizing its implications,

> "When a body emits the energy $L$ in the form of radiation, it thereby reduces its mass by $L/c^2$."

> "Gibt ein Körper die Energie $L$ in Form von Strahlung ab, so verkleinert sich seine Masse um $L/V^2$."[223]



Maxwell's equations implicitly contain the formula $E = mc^2$. Simon Newcomb pioneered the concept of relativistic energy in 1889.[224] Preston, J. J. Thomson,[225] Poincaré,[226] Olinto De Pretto,[227] Fritz Hasenöhrl,[228] [etc. etc. etc.] each effectively (Albert Einstein, himself, did not expressly state it in 1905), or directly, presented the formula $E = mc^2$, before 1905, and Max Planck[229] refined the concept in 1906-1908, including Newton's,[230] Bessel's[231] and Eötvös'[232] implications that inertial mass and gravitational mass are equivalent—before Albert Einstein.

With respect to Planck's equation from 1906,[233] G. N. Lewis gave us relativistic mass in 1908,[234] and in 1909,

> "drew attention to the formula for the kinetic energy
>
> $$\frac{m_0c^2}{(1 - v^2/c^2)^{1/2}} - m_0c^2$$
>
> and suggested that the last term should be interpreted as the energy of the particle at rest."[235]

Louis Rougier's *Philosophy and the New Physics*[236] contains much useful information on this subject. Max Jammer's *Concepts of Mass*[237] is yet more detailed, and Whittaker's *History* is phenomenal.

Poincaré, merely reiterating a common conception at the time, stated in 1904,

> "The calculations of Abraham and the experiments of Kaufmann have then shown that the mechanical mass, properly so called, is null, and that the mass of the electrons, or, at least, of the negative

electrons, is of exclusively electro-dynamic origin. This forces us to change the definition of mass; we cannot any longer distinguish mechanical mass and electrodynamic mass, since then the first would vanish; there is no mass other than electrodynamic inertia. But, in this case the mass can no longer be constant, it augments with the velocity, and it even depends on the direction, and a body animated by a notable velocity will not oppose the same inertia to the forces which tend to deflect it from its route, as to those which tend to accelerate or to retard its progress."[238]

Alexander Bain expressly stated in 1870 that,

"matter, force, and inertia, are three names for substantially the same fact"

and,

"force and matter are not two things, but one thing"

and,

"force, inertia, momentum, matter, are all but one fact".[239]

For Oliver Heaviside, in 1889, this fact was electromagnetism, the, "electric force of inertia."[240]
Frederick Soddy stated in 1904,

"The work of Kaufmann may be taken as an experimental proof of the increase of apparent mass of the electron when its speed approaches that of light. Since during disintegration electrons are



expelled at speeds very near that of light, which, after expulsion, experience resistance and suffer diminution of velocity, the total mass must be less after disintegration than before. On this view atomic mass must be regarded as a function of the internal energy, and the dissipation of the latter in radio-activity occurs at the expense, to some extent at least, of the mass of the system".[241]

Thomson defined the inertia of his vortex atom based on its energy content. A. E. Dolbear wrote in this context that,

"*Hence, inertia, too, must be looked upon as probably due to motion*",

and,

"It is not *simply* an amount of material, but the *energy* the material has, which gives it its characteristic properties."[242]

Boscovich claimed that inertia is a relative quantity, and is not absolute.[243] These same concepts are to be found in Heraclitus and in Aristotle, for example,

"Wherefore, it is evident, that substance and form are each of them a certain energy. And therefore, according to this reasoning, it is evident that in substance energy is prior to potentiality. And, as we have stated, one energy invariably is antecedent to another in time, up to that which is primarily and eternally the moving cause."[244]

In 1952, Herbert Ives demonstrated by formal proof that,

> "The relation $E = m_u c^2$ was not derived by Einstein."[245]

How has the history become so corrupted as to ignore these facts? Why do we feel the need to perpetuate the comic book legend of "Einstein", as the great discoverer of all physical truths?

## 6. Einstein's *Modus Operandi*

*"Die Relativitätstheorie ist aus einigen mißverstandenen Anregungen des philosophischen Physikers MACH und aus Gedanken des mathematischen Physikers LORENTZ enstanden, die ins Groteske weitergesponnen wurden."*—ERNST GEHRCKE[246]

*"I don't find Einstein's Relativity agrees with me. It is the most unnatural and difficult to understand way of representing facts that could be thought of. [***] And I really think that Einstein is a practical joker, pulling the legs of his enthusiastic followers, more Einsteinisch than he."*—OLIVER HEAVISIDE

*"Einstein simply postulates what we have deduced, with some difficulty and not altogether satisfactorily, from the fundamental equations of the electromagnetic field. [***] I have not availed myself of his substitutions, only because the formulae are rather complicated and look somewhat artificial"*.—HENDRIK ANTOON LORENTZ[247]

Albert Einstein liked to appear wise. One of his ploys was to repeat the principle of logical economy, as if it were his own. Here are but a few examples of many to be found in his writings, and the accounts of others:

> "The aim of science is, on the one hand, a comprehension, as *complete* as possible, of the connection between the sense experiences in their totality, and, on the other hand, the accomplishment of this aim *by the use of a*

> *minimum of primary concepts and relations.* (Seeking, as far as possible, logical unity in the world picture, i.e., paucity in logical elements)."[248]

and,

> "The grand aim of all science is to cover the greatest number of empirical facts by logical deduction from the smallest number of hypotheses or axioms."[249]

and,

> "A theory is the more impressive the greater the simplicity of its premises, the more different kinds of things it relates, and the more extended its area of applicability."[250]

Karl Pearson wrote, long before Einstein, and Einstein had read him,

> "The laws of science are, as we have seen, products of the creative imagination. They are the mental interpretations—the formulæ under which we resume wide ranges of phenomena, the results of observation on the part of ourselves or of our fellow men."[251]

As Joffe noted, Albert Einstein held no priority for the principle of logical economy, could not comprehend it, and certainly did not fulfill it,

> "As regards Einstein's philosophical views, in my judgement, they were as inconsistent as his political positions. Obviously [Einstein] was raised in the period of Mach and so [Einstein] accepted [Mach's] concept of physics, but on the other hand, ideas on the economy of thought such as the justification of theoretical physics, were foreign to [Einstein]. The reality of the outside world and understanding the outside world were the real truths, which called for this need of a single picture of the outside world [Unified Theory of an absolute universe]. It seemed to me that when we touched upon these questions, and that was very rarely and without any interest from Einstein's side, in Einstein one found both a materialist and an admirer of Mach, whose system seemed nicely built to Einstein."[252]



Though Einstein cited Mach as a source of ideas,[253] Mach rejected Einstein's relativity theory and asked not to be associated with the "dogmatic" and "paradoxical" "nonsense", in spite of the fact that Joseph Petzoldt sought to give Mach his due credit for major elements of the theory of relativity.[254] Einstein initially adored Mach, and asked for his guidance and help.[255] When it became known, after Mach's death, that Mach rejected Einstein and his views, Einstein ridiculed Mach.[256]

Following Hume,[257] Mach argued from the 1860's on that,

> "There is no cause nor effect in nature; nature has but an individual existence; nature simply *is*."

Mach, who was not a materialist, a point Einstein missed, wrote,

> "Nature is composed of sensations as its elements.

> [***] In nature there is no *law* of refraction, only different cases of refraction. [***] We must admit, therefore, that there is no result of science which in point of principle could not have been arrived at wholly without methods. But, as a matter of fact, within the short span of a human life and with man's limited powers of memory, any stock of knowledge worthy of the name is unattainable except by the *greatest* mental economy. Science itself, therefore, may be regarded as a minimal problem, consisting of the completest possible presentment of facts with the *least possible expenditure of thought*."[258]

Sir William Hamilton, in 1853, called this the "law of parsimony", and phrased it, as follows,

> "Neither more, nor more onerous, causes are to be assumed, than are necessary to account for the phenomena."[259]

Newton wrote in his *Principia*, encapsulating Aristotle's beliefs, *Rules of Reasoning in Philosophy*,[260]

> RULE I.
>
> *We are to admit no more causes of natural things, than such as are both true and sufficient to explain their appearances.*
>
> To this purpose the philosophers say, that Nature do's nothing in vain, and more is in vain, when less will serve; For Nature is pleas'd with simplicity, and affects not the pomp of superfluous causes.



> RULE II.
>
> *Therefore to the same natural effects we must, as far as possible, assign the same causes.*
>
> As to respiration in a man, and in a beast; the descent of stones in *Europe* and in *America*; the light of our culinary fire and of the Sun; the reflection of light in the Earth, and in the Planets.
>
> RULE III.
>
> *The qualities of bodies, which admit neither intension nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever.*
>
> For since the qualities of bodies are only known to us by experiments, we are to hold for universal, all such as universally agree with experiments; and such as are not liable to diminution, can never be quite taken away. We are certainly not to relinquish the evidence of experiments for the sake of dreams and vain fictions of our own devising; nor are we to recede from the analogy of Nature, which uses to be simple, and always consonant to itself. We no other ways know the extension of bodies, than by our senses, nor do these reach it in all bodies; but because we perceive extension in all that are sensible, therefore we ascribe it universally to all others also. That abundance of bodies are hard we learn by experience; and because the hardness of the whole arises from the hardness of the parts, we therefore justly infer the

hardness of the undivided particles not only of the bodies we feel but of all others. That all bodies are impenetrable, we gather not from reason, but from sensation. The bodies which we handle we find impenetrable, and thence conclude impenetrability to be an universal property of all bodies whatsoever. That all bodies are moveable, and endow'd with certain powers (which we call the *vires inertiæ*) of persevering in their motion or in their rest we only infer from the like properties observ'd in the bodies which we have seen. The extension, hardness, impenetrability, mobility, and *vis inertiæ* of the whole, result from the extension, hardness, impenetrability, mobility, and *vires inertiæ* of the parts: and thence we conclude the least particles of all bodies to be also all extended, and hard, and impenetrable, and moveable, and endow'd with their proper *vires inertiæ*. And this is the foundation of all philosophy. Moreover, that the divided but contiguous particles of bodies may be separated from one another, is matter of observation; and, in the particles that remain undivided, our minds are able to distinguish yet lesser parts, as is mathematically demonstrated. But whether the parts so distinguish'd, and not yet divided, may, by the powers of nature, be actually divided and separated from one another, we cannot certainly determine. Yet had we the proof of but one experiment, that any undivided particle, in breaking a hard and solid body, suffer'd a division, we might by virtue of this rule, conclude, that the undivided as well as the divided particles, may be divided and actually separated to infinity.

Lastly, If it universally appears, by experiments and astronomical observations, that all bodies



about the Earth, gravitate towards the Earth; and that in proportion to the quantity of matter which they severally contain; that the Moon likewise, according to the quantity of its matter, gravitates towards the Earth; that on the other hand our Sea gravitates towards the Moon; and all the Planets mutually one towards another; and the Comets in like manner towards the Sun; we must, in consequence of this rule, universally allow, that all bodies whatsoever are endow'd with a principle of mutual gravitation. For the argument from the appearances concludes with more force for the universal gravitation of all bodies, than for their impenetrability; of which among those in the celestial regions, we have no experiments, nor any manner of observation. Not that I affirm gravity to be essential to bodies. By their *vis insita* I mean nothing but their *vis inertiæ*. This is immutable. Their gravity is diminished as they recede from the Earth.

RULE IV.

*In experimental philosophy we are to look upon propositions collected by general induction from phænomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phænomena occur, by which they may either be made more accurate, or liable to exceptions.*

This rule we must follow that the argument of induction may not be evaded by hypotheses."

Newton wrote, in his *Opticks*,

> "As in Mathematicks, so in Natural Philosophy, the Investigation of difficult Things by the Method of Analysis, ought ever to precede the Method of Composition. This Analysis consists in making Experiments and Observations, and in drawing general Conclusions from them by Induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiments, or other certain Truths. For Hypotheses are not to be regarded in experimental Philosophy. And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of, and may be looked upon as so much the stronger, by how much the Induction is more general."

William of Occam (ca. 1285-1348) iterated "Occam's Razor",

> "Entia non sunt multiplicanda praeter necessitatem."

> "Pluralitas non est ponenda sine neccesitate."

> "Frustra fit per plura quod potest fieri per pauciora."

And from the Scholasticism of the medieval period, we have,

> "Principia non sunt cumulanda."

> "Natura horret superfluum."



Today, we simply say, "Keep it simple, stupid!"

Einstein was fond of copying Clifford and Poincaré, when Einstein wished to play the rôle of savant. Poincaré averred,

> "This principle of physical relativity can serve to define space; it provides us, so to speak, with a new measuring instrument. [***] Moreover, the new convention not only defines space, it also defines time. It teaches us what two simultaneous instants are, what two equal intervals of time are or what double an interval of time is of another. [***] Only then does the principle present itself as a convention, and this removes it from the attacks of experience. [The principle of physical relativity] is a convention which is suggested to us by experience, but which we freely adopt."[261]

Clifford, who died in 1879, held that,

> "§ 19. *On the Bending of Space*
>
> The peculiar topic of this chapter has been position, position namely of a point P relative to a point A. This relative position led naturally to a consideration of the geometry of steps. I proceeded on the hypothesis that all position is relative, and therefore to be determined only by a stepping process. The relativity of position was a postulate deduced from the customary methods of determining position, such methods in fact always giving relative position. *Relativity of position is thus a postulate derived from experience.* The late Professor Clerk-Maxwell fully expressed the weight of this postulate in the following words:—

All our knowledge, both of time and place, is essentially relative. When a man has acquired the habit of putting words together, without troubling himself to form the thoughts which ought to correspond to them, it is easy for him to frame an antithesis between this relative knowledge and a so-called absolute knowledge, and to point out our ignorance of the absolute position of a point as an instance of the limitation of our faculties. Any one, however, who will try to imagine the state of a mind conscious of knowing the absolute position of a point will ever after be content with our relative knowledge.[262]

It is of such great value to ascertain how far we can be certain of the truth of our postulates in the exact sciences that I shall ask the reader to return to our conception of position albeit from a somewhat different standpoint. I shall even ask him to attempt an examination of that state of mind which Professor Clerk-Maxwell hinted at in his last sentence."[263]

In typical fashion, Einstein would later repeat these ideas, without citation to Clifford or Poincaré,

"In the previous paragraphs we have attempted to describe how the concepts of space, time and event can be put psychologically into relation with experiences. Considered logically, they are free creations of the human intelligence".[264]

"The most satisfactory situation is evidently to be found in cases where the new fundamental hypotheses are suggested by the world of experience itself."[265]



and Einstein stated, with Infeld,

"Physical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world."[266]

Einstein's arguments were almost always fallacies of *Petitio Principii*. In order to hide his piracy, he would irrationally state the experimental results others had obtained before him—the phenomena, *per se*, as his "first principles" or "postulates". He would then conduct an analysis of the problem, as if he were proposing a synthesis of the solution—he knowingly confused induction with deduction, and analysis with synthesis. Then he would slip in the hypotheses of others in the middle of his theories, as "derivations", or "natural consequences", of the phenomena, which he had also proposed as "postulates", in order to deduce the same "postulates/phenomena" as conclusions, in an *Argumentum in Circulo*.

Einstein wanted it to appear that he was following Newton's fourth rule, but Einstein was really simply disguising his piracy of the hypotheses of others, through illogical fallacies. In so doing, Einstein would claim the priority that he had "derived", what his predecessors were forced to "hypothesize". Einstein turned the synthetic scientific theories of his predecessors on their heads, rendering them bizarre metaphysical delusions, in order to steal credit for them. Einstein avowed that all scientists should abandon induction, state phenomena as premises, and use his method of divine inspiration, instead of induction—but even here, he plagiarized another's thoughts.

Einstein disclosed his *modus operandi* for manipulating credit for the synthetic theories of others, when he stated in 1936,

> "There is no inductive method which could lead to the fundamental concepts of physics. Failure to understand this fact constituted the basic philosophical error of so many investigators of the nineteenth century. [***] Logical thinking is necessarily deductive; it is based upon hypothetical concepts and axioms. How can we expect to choose the latter so that we might hope for a confirmation of the consequences derived from them? The most satisfactory situation is evidently to be found in cases where the new fundamental hypotheses are suggested by the world of experience itself."[267]

Einstein wanted people to believe that it is irrelevant that his predecessors induced the theories he later copied, because Einstein just invented them, *sua sponte*, irrationally, after he had read them, and therefore deserved credit for them,

> "Invention is not the product of logical thought, even though the final product is tied to a logical structure."[268]

Jevons, in the Nineteenth Century, in response to Mill's admiration for induction, provided us with a more lucid and prior statement regarding the deductive aspect of induction, and keep in mind that he was busying himself with the invention of the computer, a machine without creative reasoning powers,



> "In a certain sense all knowledge is inductive. We can only learn the laws and relations of things in nature by observing those things. But the knowledge gained from the senses is knowledge only of particular facts, and we require some process of reasoning by which we may collect out of the facts the laws obeyed by them. Experience gives us the materials of knowledge: induction digests those materials, and yields us general knowledge. When we possess such knowledge, in the form of general propositions and natural laws, we can usefully apply the reverse process of deduction to ascertain the exact information required at any moment. In its ultimate foundation, then, all knowledge is inductive—in the sense that it is derived by a certain inductive reasoning from the facts of experience. It is nevertheless true,—and this is a point to which insufficient attention has been paid, that all reasoning is founded on the principles of deduction. I call in question the existence of any method of reasoning which can be carried on without a knowledge of deductive processes. I shall endeavor to show that *induction is really the inverse process of deduction*. There is no mode of ascertaining the laws which are obeyed in certain phenomena, unless we have the power of determining what results would follow from a given law. Just as the process of division necessitates a prior knowledge of multiplication, or the integral calculus rests upon the observation and remembrance of the results of the differential calculus, so induction requires a prior knowledge of deduction. An inverse process is the undoing of the direct process. A person who enters a maze must either trust to chance to lead him out again, or he must carefully notice the road by which he entered.

> The facts furnished to us by experience are a maze of particular results; we might by chance observe in them the fulfilment of a law, but this is scarcely possible, unless we thoroughly learn the effects which would attach to any particular law. Accordingly, the importance of deductive reasoning is doubly supreme. Even when we gain the results of induction they would be of no use unless we could deductively apply them. But before we can gain them at all we must understand deduction, since it is the inversion of deduction which constitutes induction. Our first task in this work, then, must be to trace out fully the nature of identity in all its forms of occurrence. Having given any series of propositions we must be prepared to develop deductively the whole meaning embodied in them, and the whole of the consequences which flow from them."[269]

Jevons asserts that, "An inverse process is the undoing of the direct process. [***] The facts furnished to us by experience are a maze of particular results; we might by chance observe in them the fulfilment of a law, but this is scarcely possible, unless we thoroughly learn the effects which would attach to any particular law."

The particular results cited in the 1905 paper on the "principle of relativity" are the failure of experiments to detect the æther wind on Earth, viz. the Michelson experiments, and the symmetry of phenomena in alleged violation of Maxwell's equations. In other words, the alleged particular results are the phenomenon of invariant light speed, and the phenomena of the identity of inertial systems.

These phenomena are automatically taken to be



general in science, because,

> "from a series of similar events we may infer the recurrence of like events under identical conditions [***] all science implies generalization."[270]

In the tradition of Plato's call for a search for the one among the many, the identities of Nature, Jevons asserted,

> "The general principle of inference, that what we know of one case must be true of similar cases, so far as they are similar, prevents our asserting anything which we cannot apply time after time under the same circumstances."[271]

It is irrational to assert the phenomena as causes of the same phenomena. There is no inverse process in "postulating" that light speed is invariant, and that under like conditions like results ensue; in order to "deduce" that light speed is invariant and that under like conditions like results ensue, for such is a redundancy, not a deduction. In a truly scientific approach to the problem, one must induce the postulates which then deduce the phenomenon of invariant light speed and deduce the like conditions and like results, from these same postulates of length contraction, time dilatation, relative simultaneity, inertial motion, etc.. Jevons is not telling us to abandon induction, but to realize that it has an eye toward deduction, *i. e.* that it must be rational, and that our minds draw from experience. In Einstein's case, the experience of reading the writings of his predecessors, and then restating them in irrational terms, without citation to the prior works.

Jevons,

"It cannot be said that the Inductive process is of greater importance than the Deductive process already considered, because the latter process is absolutely essential to the existence of the former. Each is the compliment and counterpart of the other. The principles of thought and existence which underlie them are at bottom the same, just as subtraction of numbers necessarily rests upon the same principles as addition [both deduction and induction must be rational]. Induction is, in fact, the inverse operation of deduction [Jevons contradicts himself again with his wavering analogies. Both induction and deduction rely upon the same principles of rationality. They are really convertible. Induction is not, in practice, the inverse process undoing prior direct deduction. Induction is a method in science of discovering more general truths from particular ones, which, if the more general truths were already known, it would not be necessary to induce them. Of course, when presenting a theory *after it has been created*, it is not necessary to demonstrate the induction, but simply the deduction to phenomena from first principles.], and cannot be conceived to exist without the corresponding operation, so that the question of relative importance cannot arise [Jevons' conclusion is a *non sequitur*. Induction is of greater importance, because it delves into the unknown, developing rational inferences, *a posteriori*. Deduction truly is the inverse process undoing prior direct induction, and should not proceed *a priori*, without prior induction. However, should deduction predict as yet unobserved, but observable, phenomena, it then becomes quite significant, though yet relying on the induction which preceded it.]. Who thinks of asking whether addition or subtraction is the more important process in arithmetic? But at the same time much difference in difficulty may exist between a direct and inverse operation; the integral calculus, for instance, is infinitely more difficult than the differential calculus of which it is the inverse. Similarly, it must be allowed that inductive investigations are of a far higher degree of difficulty and complexity than any questions of deduction".[272]



Einstein lacked the insight and reasoning skills needed to induce hypotheses, so he condemned the practice. He was forced, due to his inability to cope with the "higher degree of difficulty and complexity" needed to induce hypotheses, to copy hypotheses from others, but sought to disguise the fact. Einstein insisted that empirical results be argued as first principles, in order to *deduce* the same phenomena as results, which are argued as first principles, in a fallacy of *Petitio Principii*. This is the method he used in his "theories" in order to assume credit for the induced hypotheses of others, which he then slipped into the theories somewhere in the middle, without rational justification, calling them "derivations".

It was necessary for Einstein to discourage scientists from using proper method, lest they discover the irrationality of his unoriginal works. In so doing, he converted the scientific method into a method of redundancy, whereby an empirical fact is deduced from itself. The Michelson experimental result of invariant light speed was irrationally taken as a postulate to "derive" (in fact, induce) the Lorentz Transformation *hypotheses*, which general *a priori* hypotheses then deduce *all* velocity comparisons, not just invariant light speed. The Einsteins irrationally argued that invariant light speed deduces invariant light speed, in order to disguise the Lorentz Transformation *hypotheses* as "derivations", which general hypotheses are, in truth, induced *a posteriori*, not deduced *a priori*, from the specific speed of invariant light speed.

Herbert Ives published a paper in 1952, which argued that Einstein employed the same irrational method of *Petitio Principii* in "deriving" the mass-energy equivalence. This evinces a repeated pattern of Einstein's irrationality, on top of his pattern of unoriginality, each signifying one goal—plagiarism,

> "In 1905 Einstein published a paper with the interrogatory title "Does the Inertia of a Body Depend upon its Energy Content?", [A. Einstein, Ann. Physik **18**, 639 (1905).] a question already answered in the affirmative by Hasenöhrl. This paper, which has been widely cited as being the first proof of the "inertia of energy as such," describes an emission process by two sets of observations, in different units, the resulting equations being then subtracted from each other. It should be obvious *a priori* that the only proper result of such a procedure is to give 0 = 0, that is, no information about the process can be so obtained. However the fallacy of Einstein's argument not having been heretofore explicitly pointed out, the following analysis is presented: [***] What Einstein did by setting down these equations (as "clear") was to *introduce* the relation
>
> $$L / (m - m')\,c^2 = 1.$$
>
> *Now this is the very relation the derivation was supposed to yield.* It emerges from Einstein's manipulation of observations by two observers because it has been slipped in by the assumption which Planck questioned. The relation $E = m_M c^2$ was not derived by Einstein."[273]



Again, in the "general theory of relativity", we have Einstein claiming priority based on his quasi-positivistic, and irrational, metaphysical analysis of others' earlier synthetic scientific theories, while acknowledging that others had enunciated the scientific theories before him. Here again, as with the special theory, all the relevant theories make the same *scientific* predictions, and differ only ontologically. Ironically, though not coincidentally, the ontology of the general theory returns to the æther the special theory had allegedly dismissed.

Einstein avowed, with respect to the equivalence of inertial and gravitational mass, which Newton and Planck had defined, and which Bessel and Eötvös had demonstrated before him,[274]

> "I was in the highest degree amazed at its existence and guessed that in it must lie the key to a deeper understanding of inertia and gravitation. I had no serious doubts about its strict validity even without knowing the results of the admirable experiments of Eötvös, which—if my memory is right—I only came to know later."[275]

Einstein irrationally argued known empirical results as first principles to "prove" phenomena by themselves, slipping in the "derivations" (induced hypotheses) in the middle, *Petitio Principii*.

Paul Gerber established the scientific theory which predicted the perihelion of Mercury, in 1898.[276] David Hilbert published the field equations of general relativity, before Einstein.[277] When Ernst Gehrcke confronted Einstein with the fact that Gerber had published the *scientific* theory, first, Einstein again sought priority, based on his absurd Metaphysics, not on the science, in a frantic and arrogant hand-waving attack,

> ". . .Gerber, who has given the correct formula for the perihelion motion of Mercury before I did. The experts are not only in agreement that Gerber's derivation is wrong through and through, but the formula cannot be obtained as a consequence of the main assumption made by Gerber. Mr. Gerber's work is therefore completely useless, an unsuccessful and erroneous theoretical attempt. I maintain that the theory of general relativity has provided the first real explanation of the perihelion motion of mercury. I have not mentioned the work by Gerber originally, because I did not know it when I wrote my work on the perihelion motion of Mercury; even if I had been aware of it, I would not have had any reason to mention it."[278]

The theory of relativity is internally inconsistent in its ontology,

> "With *Lorentz* [the ether] was rigid and it embodied the 'resting' coordinate system, a preferred state of motion in the world. According to the special theory of relativity there was no longer any preferred state of motion; this meant denial of the ether in the sense of the previous theories. For if an ether existed, it would have to have at every space-time point a definite state of motion, which would have to play a role in optics. But such a preferred state of motion does not exist, as shown by the special theory of relativity and therefore there also does not exist any ether in the old sense. The general theory of relativity, as well, knows of no preferred state of motion of a point, which one could possibly interpret as the velocity of an ether. But while according to the special theory of relativity, a portion of space without matter and without an electromagnetic field appears as simply empty, i.e., characterized by no physical quantities whatever, according to the general theory of relativity space that is empty in this sense also has physical qualities, which are characterized mathematically by the components of the gravitational potential, which determine the metric behavior of this portion of space, as well as its gravitational field. One can very well conceive this state of affairs by speaking of an ether, whose state varies continuously from point to point But one must be on one's guard not to attribute to this 'ether' matter-like properties (e.g., a definite velocity at every place)."[279]



The special theory of relativity requires that masses in inertial motion relative to each other map, by their mutual motion, Galileo's equal spaces in equal times—spaces and times congruent to distance and times mapped by rigid rods and clocks. According to the general theory of relativity, this is a condition which cannot be met.

The theory of relativity is self-contradictory in many other ways, as well. The theory of relativity depends upon "resting clocks". A clock must move in order to be a clock, and, therefore, cannot be a "resting clock". The theory of relativity depends upon "resting rigid rods". A "rod" is a mental abstraction of moving particles. No rod is rigid or resting. The theory of relativity pretends to be "kinematic", but requires that "inertial systems" be those in which Newton's laws attain their simplest form. Newton's laws are dynamic, not kinematic. In order to define an "inertial motion", *masses* must be *dynamically* set into motion—there is no kinematics in the theory of relativity, lest it be Newtonian absolutism with absolute space and absolute time as a substratum and uniform translations of absolute space as a kinematic *absolutist* definition. While the general theory compels an æther, the special theory is incompatible with the concept. The theory requires that light signal clock synchronization procedures be performed, which cannot be performed. The theory irrationally requires that *dynamic* measurement procedures, which do not, and cannot, take place, cause rigid rods, which do not exist, to "kinematically" contract, and relatively resting clocks, which cannot relatively rest, to "kinematically" desynchronize and dilate. In order for light speed to be a *measured* unit, length and time must first be *measured*, because light speed is a derived unit; but, in the theory, length and time cannot be *measured* until light speed is known—totally unworkable method, which precludes *measurement*.

Just as the pseudorelativists pretend that the dynamics of moving and accelerated masses signifies "relativistic kinematics", they confound unilateral dynamic effects, with pretend "reciprocal" "kinematic" effects. There is yet to be an experiment which tests, let alone establishes, *reciprocal or kinematic* length contraction, *reciprocal or kinematic* time dilatation, or *reciprocal or kinematic* relative simultaneity.

## 7. History

Historians all too often look to the conclusions of previous historians, rather than to the *complete* historic record, itself.[280] Historians record their impressions and not history itself. They are politically motivated. Later historians all too often record the works of earlier historians, and the truth is lost in the process.

Bias is a double-edged sword, which cuts both ways. Many who are aware that Einstein was not an original thinker wrongfully attribute the special theory of relativity to Hendrik Antoon Lorentz, often believing that Minkowski first set in cement the notion of the uniform translation of space and the concept of four-dimensional being. Many worship Hendrik Antoon as a hero, just as many worship Einstein as a hero. However, Lorentz and Minkowski deserve little more credit than does Albert Einstein.

The real "credit" for the relativistic notions of space and time substantially belongs to Boscovich, Lange, Voigt, FitzGerald, Hertz, Larmor, Poincaré, Cohn[281] and Laub, who are, with the possible exceptions of FitzGerald and Poincaré, almost never cited in the popular literature as contributors to the theory.

The so-called "Lorentz Transformation" is by no means proprietary to Lorentz. The much touted modern "Principle of Relativity"—the belief that absolute space is, in principle, undetectable—was nothing more than one very common interpretation of the negative result of Michelson's experiment, though not the conclusion Michelson, himself, reached. He believed his experiment discredited the then standard explanation of aberration via a resting æther. Michelson turned to Stokes' theory of aberration[282] and a "dragged æther" to explain the negative result of his experiments.[283] Michelson was disciplined enough to realize that $c' = c$ amongst the two pencils of light passing through his interferometer on Earth was a particular case of velocity comparison in a unique system, not an inductively arrived at, synthetic general principle.

We observe a phenomenon and try to come up with rational possibilities as to how it occurs. This is an analysis of the problem which induces our first principles, which are better the more general and fundamental they are. This methodical process is not a theory, but is an inductive analysis. The synthesis comes in forming the theory and arguing from the principles, which were arrived at through induction, deductively to the known phenomenon, such as the supposed phenomenon of the supposed observation that light speed is invariant. If the 1905 paper, as it is popularly interpreted to be a deduction of the Lorentz Transformation, truly were a synthetic theory, we would have to assume that it was the Lorentz Transformation which was observed, and not invariant light speed. We would have to assume that observed Lorentz Transformations led us through analysis to the unobserved, but induced, "principle of the invariance of light speed." That is not what occurred. We supposedly observed invariant light speed, and given that science assumes Nature is predictable and universal, and since no experiment was taken to contradict the supposed observation of invariant light speed, this observed *phenomenon* was analyzed; and the analysis induced, as one approach, the Lorentz Transformation, the elements of which are the true postulates of the synthetic Poincaré-Lorentz theory of relativity. The Einsteins simply disguised Lorentz' synthetic theory as a positivistic analysis, using Poincaré's dynamics and nomenclature.



The events which led to Einstein's rise to fame are a fascinating story of hero worship and historic revisionism. The ongoing disclosure of documents related to Einstein's life raise many new questions. Was the man we are led to envision, with the Mark Twain persona and charisma, in fact a stumbling sadistic brute, who wrested his fame from his wife Mileva's misery?[284]

## 8. Mileva Einstein-Marity

*"We have recently completed a very important work, which will make my husband world-famous."*—MILEVA EINSTEIN-MARITY

*"The author of these articles—an unknown person at that time, was a bureaucrat at the Patent Office in Bern, Einstein-Marity (Marity—the maiden name of his wife, which by Swiss custom is added to the husband's family name)."*—ABRAM JOFFE

*"How happy and proud I will be, when we two together have victoriously led our work on relative motion to an end!"*—ALBERT EINSTEIN

In 1905, several articles bearing the name of Albert Einstein appeared in a German physics journal, *Annalen der Physik*. The most fateful among these, was a paper entitled *Zur Elektrodynamik bewegter Körper; von A. Einstein*, Einstein's supposedly breakthrough paper on the "principle of relativity". Though it was perhaps submitted as coauthored by Mileva Einstein-Marity and Albert Einstein, or solely by Mileva Einstein-Marity, Albert's name appeared in the journal as the exclusive author of their work.[285]

Abram Fedorovich Joffe (Ioffe) recounts that the paper was signed "Einstein-Marity". "Marity" is a variant of the Serbian "Marić", Mileva's maiden name. Joffe, who had seen the original 1905 manuscript, is on record as stating,

> "For Physics, and especially for the Physics of my generation—that of Einstein's contemporaries,

Einstein's entrance into the arena of science is unforgettable. In 1905, three articles appeared in the 'Annalen der Physik', which began three very important branches of 20th Century Physics. Those were the theory of Brownian movement, the theory of the photoelectric effect and the theory of relativity. The author of these articles—an unknown person at that time, was a bureaucrat at the Patent Office in Bern, Einstein-Marity (Marity—the maiden name of his wife, which by Swiss custom is added to the husband's family name)."

"Для физиков же, и в особенности для физиков моего поколения — современников Эйнштейна, незабываемо появление Эйнштейна на арене науки. В 1905 г. в «Анналах физики» появилось три статьи, положившие начало трём наиболее актуальным направлениям физики XX века. Это были: теория броуновского движения, фотонная теория света и теория относительности. Автор их — неизвестный до тех пор чиновник патентного бюро в Берне Эйнштейн-Марити (Марити — фамилия его жены, которая по швейцарскому обычаю прибавляется к фамилии мужа)."[286]

Again, in 1962, we find Daniil Semenovich Danin stating,

"The unsuccessful teacher, who, in search of a reasonable income, had become a third class engineering expert in the Swiss Patent Office, this yet completely unknown theoretician in 1905 published three articles in the same volume of the famous 'Annalen der Physik' signed 'Einstein-



Marity' (or Marić—which was his first wife's family name)."

"Невезучий школьный учитель, в поисках сносного заработка ставший инженером-экспертом третьего класса в Швейцарском бюро патентов, еще никому не ведомый теоретик опубликовал в 1905 году в одном и том же томе знаменитых «Анналов физики» три статьи за подписью Эйнштейн-Марити (или Марнч—это была фамилия его первой жены)."[287]

If "Einstein-Marity" refers to a sole person, that person is Mileva Einstein-Marić, not Albert Einstein.

Desanka Trbuhović-Gjurić's interpretation of the facts are found in her book, *Im Schatten Albert Einsteins, Das tragische Leben der Mileva Einstein-Marić*, (*In the Shadow of Albert Einstein, The Tragic Life of Mileva Einstein-Marić*), in which she discusses Mileva's rôle in the development of the special theory of relativity, and states, *inter alia*,

"The distinguished Russian physicist [***] Abraham F. Joffe (1880-1960), pointed out in his 'In Remembrance of Albert Einstein', that Einstein's three epochal articles in Volume 17 of 'Annalen der Physik' of 1905 were originally signed 'Einstein-Marić'. Joffe had seen the originals as assistant to Röntgen, who belonged to the Board of the 'Annalen', which had examined submitted contributions for editorial purposes. Röntgen showed his *summa cum laude* student this work, and Joffe thereby came face to face with the manuscripts, which are no longer available today."

"Der hervorragende russische Physiker [***] Abraham F. Joffe (1880-1960), machte in seinen «Erinnerung an Albert Einstein» darauf aufmerksam, dass die drei epochemachenden Artikel Einsteins im Band XVII der «Annalen der Physik» von 1905 im Original mit «Einstein-Marić» gezeichnet waren. Joffe hatte die Originale als Assistent von Röntgen gesehen, der dem Kuratorium der «Annalen» angehörte, das die bei der Redaktion eingereichten Beiträge zu begutachten hatte. Zu dieser Arbeit zog Röntgen seinen summa cum laude-Schüler Joffe bei, der auf diese Weise die heute nicht mehr greifbaren Manuskripte zu Gesicht bekam."[288]

Joffe was no bumbling fool. He knew that his statement would be noticed. Though Joffe's statement superficially indicates that it was Albert who went by the name of "Einstein-Marity", such a claim, and the parenthetical explanation it compelled, were extraordinary! Joffe was probably, as imperceptibly as his conscience would allow, disclosing to the world that Albert was not the author, or, at least, not the sole author, of the works in question. Joffe's statements appeared fifty years after he had read the 1905 papers. It stuck with him all those many years that the papers were indelibly signed "Einstein-Marity". How could Joffe have known that Mileva *Marić* went by the name of Einstein-*Marity*, if the name had not appeared on the 1905 papers? Joffe could not have known that Albert went by the name of "Einstein-Marity", because Albert Einstein never did.

Perhaps, Mileva even introduced herself to Joffe as the Einstein-Marity who wrote the papers. Joffe recorded his attempts to discuss the 1905 papers with their author,

"I did not come to know Albert Einstein, until I met him in Berlin. [***] I wanted very much to talk to Einstein [***] and visited him in Zurich together with my friend Wagner. But we did not find him home, so we did not have a chance to talk, and his wife told us that, according to his own words, he is only a civil servant in the patent office, and he has no serious thoughts about science, much less about experiments."[289]

Joffe states that he wanted to visit Albert in Zurich, but met with Mileva and gave up on meeting Albert; but did he, in fact, travel to Zurich to meet Mileva? Why would not Joffe have sought Albert out? After all, Joffe *and Wagner*, supposedly went out of their way to visit him in Zurich. Why not make any further effort? Why would Joffe, upon meeting with Mileva, simply have abandoned his quest to meet Albert? Would it have been so difficult to find Albert at the patent office, or the local bar? Joffe does not state that Albert was "out of town", but was merely "not home".

Why weren't they shocked by Mileva's comments? Did Mileva have all the answers to their questions? Why, after having read the original papers of 1905, and likely other published articles, would Joffe have accepted Mileva's account that Albert was a nothing? Was *Mileva* really something? Would not the natural reaction to Mileva's statements have been, "Then, who wrote the papers?" Or, did Joffe already know? Perhaps, if the story is true, Joffe wanted to confront both Mileva and Albert with the fact that their papers were unoriginal. Perhaps, Albert was hiding from them. The only thing certain is that Joffe's story, as he told it, makes no sense, other than as odd images, which stuck with Joffe for many, many years and were fundamental to his vision of "Einstein".

There is no Swiss custom by which the husband automatically adds his wife's maiden name to his, and even if there were, neither Albert nor Mileva were Swiss. Albert Einstein never signed his name "Einstein-Marity". Swiss law permits the male, the female, or both, to use a double last name, but this must be declared before the marriage, and it was Mileva, not Albert, who opted for the last name "Einstein-Marity". A married person may use the hyphenated "Allianzname" in everyday use, but it was Mileva who went by "Einstein-Marity", not Albert. Albert signed his marriage records simply "Einstein". Mileva's death notice reads "Einstein-Marity".

Joffe, who had handled the original manuscripts, recounts that,

> "The author of these articles [***] was [***] Einstein-Marity".

It was perhaps subtly amusing to Joffe to point out that it was unknown that Albert's wife had written, or coauthored, the *Annalen* papers. There is apparently no other plausible reason for Joffe to have made this allusion. Even if Joffe had encountered Mileva's name "Einstein-Marity" elsewhere, perhaps when first they met, there is no grounds for his associating it with the work of 1905, other than the name's having appeared on the work.

Did Mileva loose her nerve in the end and ask not to be named as the author of the unoriginal works? Did Mileva have moral objections to the plagiarism? Were the works submitted as coauthored works, but the



couple was persuaded that it would be better to have a male name in print? Was there a printing error? Why, after fifty years, would Joffe come out with the disclosure that the papers were submitted by "Einstein-Marity"? Why did that fact nag him for fifty years, and why did he feel compelled to publicly express it, after Albert Einstein had died?

Einstein confessed to Abraham Pais,

> "I am not a mathematician."[290]

Einstein also stated,

> "Since the mathematicians have attacked the relativity theory, I myself no longer understand it anymore."[291]

Anton Reiser (Rudolf Kayser) records that, while Einstein was studying,

> "He showed very little love for [the] study [of mathematics], which seemed to him rather limitless in relation to other sciences. No one could stir him to visit the mathematical seminars."[292]

While still a child, Albert's parents and teachers suspected that he was mentally retarded.[293]

We have direct evidence from Albert's own pen that the work on relativity theory was a collaboration between Mileva and him,

> "How happy and proud I will be, when we two together have victoriously led our work on relative motion to an end!"

"Wie glücklich und stolz werde ich sein, wenn wir beide zusammen unsere Arbeit über die Relativbewegung siegreich zu Ende geführt haben!"[294]

and,

"As my dear wife, we will want to engage in a quite diligent scientific collaboration, so that we don't become old Philistines, isn't it so?"

"Bis Du mein liebe Weiberl bist, wollen wir recht eifrig zusammen wissenschaftlich arbeiten, daß wir keine alten Philistersleut werden, gellst."[295]

John Stachel, who claims that a "true collaboration" never developed between Albert and Mileva, quotes the following translations of the above, as follows,

"I'll be so happy and proud when we are together and can bring our work on relative motion to a successful conclusion!"[296]

and,

"When you're my dear little wife, we'll diligently work on science together so we don't become old philistines, right?"[297]

Evan Harris Walker, who argued that Mileva was co-author, or sole author, of the 1905 papers, quoted some of Albert's words, as found in the *The Collected Papers of Albert Einstein*, and bear in mind that the vast majority of Mileva's letters to Albert were destroyed, with there being no more likely reasons for



their destruction, than to hide her contribution and the fact that the works were unoriginal,

"I find statements in 13 of [Albert's] 43 letters to [Mileva] that refer to her research or to an ongoing collaborative effort—for example, in document 74, 'another method which has similarities with yours.'

In document 75, Albert writes: 'I am also looking forward very much to our new work. You must now continue with your investigation.' In document 79, he says, 'we will send it to Wiedermann's *Annalen*.' In document 96, he refers to 'our investigations'; in document 101, to 'our theory of molecular forces.' In document 107, he tells her: 'Prof. Weber is very nice to me. . . . I gave him our paper.'"[298]

Though some have suggested that Albert was condescending to Mileva, by referring to the works as "theirs"; it is far more likely, from a sociological point of view, that the opposite occurred, and Albert was Mileva's lackey, fetching notes for her. In order to spare Albert's male ego, and in order to further Albert's career, Mileva perhaps referred to the work as "theirs"—just as female nurses have been observed to instruct male doctors on the diagnosis and viable treatment, only to have the male doctor then pretend that the ideas were his, and lecture the female nurse with her own words. It does not seem plausible, most especially in that era, that Albert would call the work joint, if it were not—*and it was absolutely against Albert's nature to award due credit to others, unless forced to do so.* Albert professed,

"Man usually avoids attributing cleverness to somebody else—unless it is an enemy."

Albert may have lacked the mathematical skills and intellectual abilities needed to have written the 1905 paper alone. On the other hand, Mileva was exceptionally bright, and all indications are that those who knew her throughout her life found her the more intelligent one of the pair. She probably had the needed intellectual prowess to have written the 1905 paper on the principle of relativity. Given the many blunders in the paper, it is safe to assume that neither one of them was a superlative mathematician, or logician. It also appears that publication of the paper may have been rushed—perhaps the couple had corresponded with Poincaré, and he had informed them of his results, and when he would publish them.

Mileva and Albert had coauthored papers before[299] and Albert had assumed credit for that which Mileva had accomplished.[300] Senta Troemel-Ploetz presented a thorough account of Albert's shameless appropriation of Mileva's work and of Mileva's acquiescence.[301] Troemel-Ploetz' insights into the cultural barriers Marić faced, and the reasons for Marić's lack of success at the ETH, form a persuasive argument that Mileva was discriminated against, and faced other enormous challenges, which must be taken into account when comparing Mileva's accomplishments with those of her *fellow* students.

Albert would often simply agree with whomever he had last spoken,[302] and it is within the realm of possibilities that he was in some sense a mere parrot. Upon meeting with colleagues, he would often grill them for information on *their* theories, seemingly soaking it all in, perhaps to repeat it later as his own.

Certain anecdotal accounts paint Einstein in a bad light. Upon refusing to brush his teeth, Einstein allegedly proclaimed that, "pigs' bristles can drill through diamond, so how should my teeth stand up to them?"[303] Explaining why he didn't wear a hat in the rain, he asserted that hair dries faster than hats, and irritably asserted that such was obvious. It apparently eluded him that the objective was, in the first place, to keep the hair dry. Explaining why he didn't wear socks, Einstein commented, "When I was young I found out that the big toe always ends up by making a hole in the sock. So I stopped wearing socks"[304] and "What use are socks? They only produce holes."[305] He also wasn't too handy around the house, and seemingly had a difficult time conceptualizing geometric problems.[306] Einstein insisted that two holes be bored through his front door, one larger than the other, so that both the large cat, *and the small cat*, could pass through the door.



After meeting Einstein, Max von Laue found it difficult to believe that Einstein had written the 1905 paper,

> "[T]he young man who met me made such an unexpected impression on me, that I did not believe him to be capable of being the father of the theory of relativity."

> "[D]er junge Mann, der mir entgegen kam, machte mir einen so unerwarteten Eindruck, daß ich nicht glaubte, er könne der Vater der Relativitätstheorie sein."[307]

Minkowski, who had been Einstein's professor, found it difficult to believe that "lazy" Einstein had written the 1905 paper. Minkowski didn't think Einstein capable of it.[308] As both Heaviside and Born record, Minkowski anticipated Einstein.

Charles Nordmann, who chauffeured the Nobel Prize holding Einstein around France, sarcastically described him as a vacant-eyed simian clod.[309] Nordmann sarcastically ranked him with Newton, Des Cartes *or Henri Poincaré*—from whom Einstein had copied the principle of relativity.[310] Like Rabelais and Voltaire before him, Nordmann lavished sarcastic praise on the new hero and derided him in ways which would elude the unsophisticated, but which were clear to those knowledgeable of the facts. Nordmann was careful not to be too blunt, for he wished to advocate the theory of relativity, and it was politically expedient for him to ride on Einstein's coat tails, but Nordmann never failed to get his digs in.

In Germany, scientists rallied against relativity theory and published *Hundert Autoren gegen Einstein* ("A Hundred Authors against Einstein").[311]

Einstein once asked,

> "Do I have something of a charlatan or a hypnotist about me that draws people like a circus clown?"[312]

Paul Weyland[313] and Ernst Gehrcke[314] asserted that Einstein's rise to fame was a "mass suggestion" fed by the insecurities of some of the authorities, and by the press, who would frequently misrepresent the facts, and misrepresented the views of many leading authorities, who were in reality mostly opposed to relativity theory. Gehrcke addressed Einstein to his face, in the Berlin Philharmonic, on August 24th, 1920, and stated, *inter alia*,

> "Die EINSTEINsche Relativitätstheorie nimmt ihren Ursprung aus einer Theorie des holländischen Physikers LORENTZ. Die



> übereinstimmung mit der LORENTZschen Theorie geht so weit, daß die *mathematische* Form der EINSTEINschen Theorie vom Jahre 1905 wesentlich dieselbe ist, wie die von LORENTZ, die Gleichungen dieser EINSTEINschen Theorie sind die Gleichungen von LORENTZ. Neuartig erschien die *Deutung* der Theorie, die *Interpretation* der Grundbegriffe Zeit und Raum. EINSTEIN hat mit dieser Interpretation etwas getan, von dem seine Bewunderer gesagt haben, es stelle alles bisher Dagewesene in den Schatten. Die Interpretation EINSTEINs war aber gleichfalls weit weniger neu, als es den Anschein hatte. Schon im jahre 1901 hat der ungarische Philosoph MELCHIOR PALAGYI in ENGELMANNs Verlag in Leipzig eine Schrift in deutscher Sprache erscheinen lassen, die wesentliche Gedanken EINSTEINs und MINKOWSKIs, des begeisterten, mathematischen Anhängers EINSTEINs, vorwegnahm: so besonders die Idee der „Union zwischen Zeit und Raum", die Auffassung der „Welt" in 4 Koordinaten, von denen die eine, die Zeit, mit der imagären Einheit $\sqrt{-1}$ multiplizert auftritt usw. Den Physikern waren diese Vorgänge — zum Teil heute noch—unbekannt, sie nahmen die Relativitätslehre EINSTEINs teils kopfschüttenld, teils abwartend auf. Als aber anerkannte Autoritäten sich begeistert für die Relativitätstheorie einsetzten, trat auch im Publikum Begeisterung auf, und nun nahm die Entwicklung ihren unaufhaltsamen Gang. Bei der Verknüpfpfung mathematischer, physikalischer und philosophischer Gedanken in der Relativitätstheorie war es den Fachleuten in unserer Zeit des hochgesteigerten, wissenschaftlichen Spezialistentums sehr schwer

gemacht, zu einem selbständigen Urteil über die Theorie zu gelangen, zumal EINSTEIN sein Werk mit Geschichlichkeit zu verteidigen wußte und den Physikern ihre Bedenken mit mathematischen und philosophischen, den Mathematikern ihre Bedenken mit physikalischen und philosophischen, den Philosophen ihre Bedenken mit mathematischen und physikalischen Gegengründen zerstreute: jeder Fachmann beugte sich vor der Autorität des Kollegen im andern Fach, jeder glaubte das, was er nach andern Fachautoritäten als für bewiesen halten zu sollen vermeinte. **Niemand wollte sich dem Vorwurf aussetzen, er verstände nichts von der Sache!** Und so wurde eine Lage geschaffen, ähnlich der von ANDERSEN geschilderten in seinem Märchen „Des Kaisers neue Kleider": hier sieht ein Kaiser mit seinen Ministern und Untertanen dem Weben eines Gewandes zu, das die Eigenart hat, von denjenigen Menschen *nicht* gesehen zu werden, die dazu nicht klug genug sind, und schließlich stehen *alle* staunend vor den leeren Webstühlen, weil niemand sich getraut zu bekennen, daß er nichts sieht. So hat auch die Relativitätstheorie die Geister gefesselt, sie ist zur Massensuggestion geworden. Aber eine Massensuggestion ist an sich nichts Verwerfliches, die Ausschaltung des klaren Verstandes braucht durchaus kein Beweis dafür zu sein, daß das Streben der Masse ein törichtes ist. Alles hing bei der Relativitätstheorie davon ab, ob sie in ein erkenntnistheoretisch annehmbares Fahrwasser geleitet werden konnte.

EINSTEIN hat die Schwächen seiner Theorie öfters zu verbessern und den Einwänden auszuweichen gesucht, er hat z. B. das



Relativitätsprinzip hin und hergeworfen (s. oben S. 57 ff.), er hat schließlich geglaubt, den sicheren Hafen erreicht zu haben und im jahre 1915 erklärt, daß endlich die Relativitätstheorie als logisches Gebäude abgeschlossen sei. Ein Punkt bei all diesen Wandlungen ist noch besonders wichtig, hervorgehoben zu werden: so wenig neuartig die mathematische Form der *ersten* Relativitätstheorie EINSTEINs ist, die mit der älteren LORENTZschen Theorie übereinstimmt, so wenig ist auch die im weiteren Verlauf der Entwicklung durch EINSTEIN vollzogene *Veränderung* des mathematischen Gewandes der Theorie besonders neuartig gewesen: daß die Relativitätstheorie in die Formeln der nichteuklidischen Geometrie hineinführt, zeigte zuerst der Mathematiker VARICAK; daß die mathematische Komplikation der nichteuklidischen Kontinua von den Mathematikern formal bereits seit langem gelöst war, erkennt sogar EINSTEIN an. Inwieweit EINSTEIN die neueste von WEYL u. a. eingeschlagene, relativitätstheoretische Richtung überhaupt noch mitmacht, ist nicht recht klar. Jedenfalls verbreiten Anhänger von EINSTEIN Nachrichten, die für die WEYLschen Arbeiten ungünstig lauten.

Wenn es also feststeht, daß EINSTEIN in seiner Relativitätstheorie keine mathematisch ungewöhnlichen Formen entdeckt hat, wenn die philosophisch-erkenntnistheoretische Grundlage des ganzen Gebäudes unbefriedigend ist, wenn endlich die Experimente der Physiker und Astronomen die Theorie night beweisen können, so wird man fragen, was denn überhaupt noch übrig bleibt, um in der Relativitätstheorie ein Werk zu

> erblicken, das über die Taten von KOPERNIKUS, KEPLER und NEWTON hinausgeht. Diese Frage werden die heutigen Anhänger und Gegner der Theorie, je nach ihrem persönlichen Gefühl, verschieden beantworten. Eine Antwort, die alle befriedigt, wird sich erst erzielen lassen, wenn die Suggestion der Reklame und der Druckerschwärze, mit welcher die „revolutionäre Relativitätstheorie" arbeitet, von allen als solche erkannt ist. Zu dieser Aufklärung beitragen zu helfen mögen die obigen Zeilen dienen."

Gehrcke effectively accused Einstein of plagiarizing the mathematical formalisms of Lorentz, the space-time concepts of Palágyi,[315] and the non-Euclidean Geometry of Varičak[316] (Marić would have been able to have read *all* of Varičak's works); and of masking his plagiarism and the weaknesses of the theory with irrational Metaphysics. Gehrcke stood up and declared that, "the Emperor has no clothes!"

Einstein's only response came days later,[317] in a frantic, inappropriately emotional, and irrational "hand-waving" *ad hominem* attack against Lenard, Weyland and Gehrcke, in which Einstein simply appealed to authority—his hangers-on, and those from whom he had plagiarized. It is obvious that Einstein could not defend himself, or his position, other than to change the subject to a personal attack against his opponents. He pouted and whined like a spoiled brat, in order to avoid the bulk of accusations made against him and the theory of relativity. Einstein wanted, instead, to wait for others to speak in defense of the theory. He apparently could not.

Gehrcke seemingly decided to fight propaganda with thoroughly documented fact, but came up on the



losing side. Einstein's persona, as depicted in the press, was perhaps too endearing to be successfully countered by the facts.

Is there any evidence that Einstein wrote unoriginal works as a pattern?

By 1905, before the appearance of *his* first paper on "special relativity", Albert Einstein had already demonstrated a knack for repeating the work of others, as though he had somehow thought of it independently, later, and nevertheless deserved credit for his supposedly independent inspiration.[318] His early papers were thoroughly unoriginal, and it is within the realm of possibilities that he may have derived them from the works of Gibbs and Boltzmann (the relevant works will be addressed in another volume of this series), without giving them their due credit. Einstein's writings would often repeat, virtually verbatim, the writings of others, but Einstein's papers were often virtually devoid of footnotes. The 1905 paper on relativity wanted for a single reference.

Is it possible that Einstein could have simply copied the then famous papers of scientists? Could Einstein have acted like a teenager, who opens an encyclopedia article, changes a few words and copies the rest, then submits the finished forgery as his own term paper?

Perhaps, the question is moot. The priorities, however, are clear. The repeated occurrences of the repetition evince a pattern, though, perhaps, some might argue, a coincidental pattern. In any event, the credit belongs to those who published first, and Einstein was rarely, if ever, amongst them.

Was it Albert who was fitting the formulæ others had published before him into a new dress to call his own, or was it his brilliant wife, Mileva? In my opinion, and this is certainly a debatable question, and my opinion is not a fact, Albert's supposed genius seems to have diminished after his divorce from Mileva in 1919. Why would that be so? He died in 1955, and produced nothing extraordinarily significant after his divorce, in my opinion, and other authorities would almost certainly contest this opinion, though many who were closest to Albert have agreed. This is a subjective question.

After winning the Nobel Prize (expressly not for relativity theory, by the way, but allegedly for an unoriginal paper of *relatively* minor importance, and for being an all-round divinely inspired fellow) in 1922, Albert paid his former wife the money which he had won in the prize, but why?

Why pay Mileva the winnings? Was Albert overly generous in the support of his family? Many accounts indicate that he was not.

Why did the Nobel committee not award Einstein the Nobel Prize for his work on relativity theory? Could it have been that all who were familiar with the facts, knew that Einstein did not originate the major concepts behind relativity theory? It is supposedly unclear, but many parts of the puzzle present an image of political motivation, and not merit, being the impetus behind Einstein's award.

Some ten years prior, Wilhelm Wien had recommended that the Nobel Prize be given to both Lorentz and Albert Einstein in 1912, on the grounds that,

> "While Lorentz must be considered as the first to have found the mathematical content of the relativity principle, Einstein succeeded in reducing it to a simple principle. One should therefore assess the merits of both investigators as being comparable".[319]



However, Einstein's half of the pie by all rights belonged to Poincaré, who died in 1912, and it would have been in exceedingly bad taste to have exploited his death in order to award the Nobel Prize to Einstein; and Voigt, FitzGerald and Larmor had rights to Lorentz' share. Wien knew Poincaré's work well, and, thus, knew that Einstein had done little but parrot Poincaré.[320]

Ernst Gehrcke[321] demonstrated that Paul Gerber[322] had anticipated the general theory of relativity, making a Nobel Prize for that theory impossible. Wien, in recommending Lorentz *and* Einstein for the special theory, effectively disclosed that Einstein held no priority for it, as everyone knew that Poincaré stated the principle of relativity long before Einstein. It is clear that the Nobel committee simply manufactured an excuse to award the then celebrity, Albert Einstein, and in some minds traitor to the German cause in World War I, a prize, merely mentioning the photo-electric effect, for which Einstein held no priority, as a possible excuse, which "white lie" apparently offended few.

Could the Nobel Prize monies Albert paid Mileva have been "hush money"? Though the payment was made pursuant to a divorce agreement, would not a divorce agreement typically stipulate that the male was indebted to the female and must pay her, *regardless of the means by which the money was obtained?* Mileva had children to feed, Albert's children. When the divorce agreement was reached, it was far from certain that Albert would ever win the Nobel Prize. Why would Mileva roll the dice with the future of her children?

Why would they reach an agreement, which stipulated that the monies be paid *if and only if* Albert might someday win the Nobel Prize? It was far from certain that Albert would ever win the Nobel Prize. Could the agreement have related not to the responsibilities of marriage, but to potential monetary gain *derived from Mileva's efforts?* Is it possible that if it were Mileva's work, and that work paid off, Albert would pay her off, and then only to keep her silent? It seems an extraordinary proposition. Could it have been Mileva's way of saying, "Hey, if you ever get any serious money out of my work, I deserve the money, because it was my work!"

Mileva once hinted to Albert that she was contemplating publishing her memoirs. Albert told her to keep her mouth shut, and may have intimated that he, an innocent idiot, would suffer less than she, the incorrigible plagiarist. That is but one of many plausible interpretations of Albert's words, which were nebulous in the sense that threats often are.[323] Albert believed,

> "If A equals success, then the formula is A equals X plus Y plus Z. X is work. Y is play. Z is keep your mouth shut."[324]

Why didn't Mileva come forward with the fact that she was the one who had written the work, if in fact she had? Did Albert buy Mileva's silence? Even if he had, was there more to hold Mileva back from exposing Albert, than the desperate need for monies?

Hypothetically speaking, would Albert have been able to prove to the world that the theory was not completely original when *Annalen der Physik* first published the 1905 paper, if Mileva herself had merely condensed the works of Lange, Voigt, Hertz, FitzGerald, Larmor, Cohn, Langevin, Lorentz and Poincaré? If so, what would Mileva have stood to gain by revealing that Albert had taken credit for her work, when she herself had merely repeated what others had already published?



Would it then have been the case that neither of the Einsteins, not Albert, not Mileva, "thought God thought's", as popular myth now holds? Might they have read scientists' papers and books, rewrote them, and attached Albert's name to what was not his? Is such a thing possible? Did Albert demonstrably repeat, again and again, what others had published before him, mirroring their words in virtually identical form?

Did it ever happen to Albert, that someone would repeat what he had earlier published, and then claimed priority for thoughts which Albert had first published? Would Albert have tolerated such misbehavior? He was aggressive in response to challenges to his priority. Albert stated that it is wrong not to give credit where credit is due,

> "That, alas, is vanity. You find it in so many scientists. You know, it has always hurt me to think that Galileo did not acknowledge the work of Kepler."[325]

If one thief steals a stolen purse from another thief, then offers to split the purse, what option does either thief have, but to keep silent and spend the money? What might have happened, if, hypothetically speaking, Mileva knew that she had written the work for which Albert took credit? What if, hypothetically speaking, Albert knew that Mileva had copied the ideas, examples, explanations, equations and phrases, from Lange, Voigt, Hertz, FitzGerald, Larmor, Cohn, Langevin, Lorentz and Poincaré? In such a hypothetical scenario, what could Mileva have done? What would have been in her self-interest?

Did Mileva begin hoping that Albert would rise to fame and she would lead a charmed life with her famous husband? Her words might indicate that she did,

> "We have recently completed a very important work, which will make my husband world-famous."
>
> "Vor kurzem haben wir ein sehr bedeutendes Werk vollendet, das meinen Mann weltberühmt machen wird."[326]

Serbian women had little chance at fame in those days, other than as ornaments attached to their husbands' arms. Tesla, a Serb born in Croatia, was unfairly treated in the West. What chance did Mileva stand?

Albert was cruel to Mileva. Her self-confidence may have been destroyed. Albert once demanded in writing that Mileva obey his cruel and degrading orders, in a letter which can only be described as shocking and revolting.[327] If Mileva had hoped that Albert would someday acknowledge her, she was mistaken. Albert, a misogynist, degraded her in a letter to Michele Besso,

> "We men are deplorable, dependent creatures. But compared with these women, every one of us is king, for he stands more or less on his own two feet, not constantly waiting for something outside of himself to cling to. They, however, always wait for someone to come along who will use them as he sees fit. If this does not happen, they simply fall to pieces."[328]



It is a myth that Albert was a gentle and kind person. Brutality was nothing new to Albert. He physically abused his sister, and attacked his violin instructor,

> "Albert resisted, throwing a chair and a tantrum—which sent his teacher scurrying for the nearest exit. [***] Albert was still liable to express his discontent with the nearest weapon at hand [***] Maja escaped serious and frequent injury [***] because she would run for cover. [***] Once she barely missed getting a concussion from a bowling ball Albert aimed at her head.[ ***] He closed in for the attack and smashed Maja over the head with a garden hoe."[329]

Is it possible that Marić may have believed that her only hope for fame and fortune was to build up Albert and use him for her ends? Did Albert have strong morals? Under such hypothetical conditions, would Albert have been fit for the rôle as cohort to plagiarism, if plagiarism were ever to occur? By many accounts, he may have been incontinent, perhaps even an incestuous adulterer.[330] According to some accounts, Einstein was perhaps even a foul-mouthed[331] syphilitic whore monger.[332]

Did Albert have no choice but to copy what others had published before him, if indeed he ever actually did? Was he of sub-average intelligence?[333] Given that this issue is controversial, I'll give Albert the benefit of the doubt and regard the 1905 paper as a coauthored work. However, that which was new in the paper, the "relativistic" equations for aberration and the Doppler-Fizeau Effect, were likely accomplished by Mileva, the superior mathematician of the two. If the Einsteins had properly referenced their work, and claimed priority only for that which was new in the paper, one wonders if Mileva, who evidently had far more character than Albert—she cared for their children, while he largely abandoned them—would have insisted that her rôle be acknowledged.

## 9. Politics and Anecdotes

*"Einstein's thoughts were far away from political problems and this is why many of Einstein's speeches in this field were poorly thought out. [***] And Einstein, in the beginning, would only look at the façade of things and not look deeper into their true meaning."*—ABRAM JOFFE

From whence came Einstein's idealistic politics? If his claims to priority in physics were phoney, were his politics then as phoney as his claims to priority in physics? One can only speculate. He repeated much of what H. G. Wells had accomplished, both in physics and politics. Wells holds priority on the concept of four-dimensional space-time, the atomic bomb, and many other innovations of thought. Poincaré and Minkowski also addressed some of these topics, but somehow, they are today associated almost exclusively with "Einstein", even though he had nothing to do with creating them.

I do not mean to belittle much of what Einstein *said* in terms of politics, but find it within the realm of possibilities that he may have merely parroted, and been a spokesperson for, the thoughts of others, some of which were quite noble aspirations. Of course, it may have been purely coincidental that he restated the words of others, usually the same others in the same context.

Even some of Einstein's quaint scientific anecdotes have their prior cousins. He told a story of his supposed fantasy of traveling at light speed,[334] the so-called "Aarau Question". This story is used as an example of Einstein's supposed independence from Lorentz. Albert Einstein,

> "After ten years of reflection such a principle resulted from a paradox upon which I had already hit at the age of sixteen: If I pursue a beam of light with the velocity $c$ (velocity of light in a vacuum), I should observe such a beam of light as a spatially oscillatory electromagnetic field at rest. [***] One sees that in this paradox the germ of the special theory of relativity is already contained."[335]

However, this fantasy was the subject of a novel popular among physicists of Einstein's day written by a famous astronomer, *Lumen*, by Camille Flammarion. The story of *Lumen*, filled with the positivistic dogma Einstein would later parrot throughout his career, was first published many decades before Einstein claimed credit for the story, before Einstein was even born, and discusses not only travel at luminal and superluminal velocities, but the complete relativity of simultaneity, time and space, *and the use of light speed as a measurement of relative distance, time and simultaneity!*

As a small example from *Lumen*,

> "{The magnifying power of time.—*Notes in "{}" are margin notes found in the original.*} It is this: If you set out from the Earth at the moment that a flash of lightning bursts forth, and if you travelled for an hour or more with the light, you would see lightning as long as you continued to look at it. This fact is established by the foregoing principles. But if, instead of travelling *exactly* with the velocity of light, you were to travel with a little less velocity;



> note the observation that you might make. I will suppose that this voyage away from the Earth, during which you look at the lightning, lasts a minute. I will suppose also, that the lightning lasts a thousandth part of a second. You will continue to see the lightning during 60,000 times its duration. In our first supposition this voyage is identical with that of light. Light has occupied 60,000 tenths of seconds to go from the Earth to the point in space where you are. Your voyage and that of light have co-existed. Now if instead of flying with just the same velocity as light, you had flown a little less quickly, and if you had employed a thousandth part of a second more to arrive at the same point, instead of always seeing *the same moment of the lightning*, you would have seen, successively, the different moments which consulted the total duration of the lightning, equal to 1000 parts of a second. In this whole minute you would have had time to see first the beginning of the flash of lightning, and could analyse the development of it, the successive phases of it, to the very end. You may imagine what strange discoveries one could make in the secret nature of lightning, increased 60,000 times in the order of its duration, what frightful battles you would have time to discover in the flames! what pandemonium! what unlucky atoms! what a world hidden by its volatile nature from the imperfect eyes of mortals!
>
> {Vision of the analysing eye.}
>
> If you could see by your imagination sufficiently, to separate and count the atoms which constitute the body of a man, that body would disappear before you, for it consists of thousands of millions of atoms in motion, and to the analysing eye it would

be a nebula animated by the forces of gravitation. Did not Swedenborg imagine that the universe by which he was surrounded, seen as a whole, was in the form of an immense man? That was anthropomorphism. But there are analogies everywhere. What we know most certainly is, that things *are not* what they appear to be, either in space or in time. But let us return to the delayed flash of lightning.

When you travel with the velocity of light, you see constantly the scene which was in existence at the moment of your departure. If you were carried away for a year, at the same rate, you would have before your eyes the same event for that time. But if, in order to see more distinctly an event which would have taken only a few seconds, such as the fall of a mountain, an avalanche, or an earthquake, you were to delay, to see the commencement of the catastrophe (in slackening a little, your steps on those of light), you would see the progress of the catastrophe, its first moment, its second, and so on successively, in thus nearly following the light, you would only see the end after an hour of observation. The event would last for you an hour instead of a few seconds. You would see the rocks, or the stones suspended in the air, and could thus ascertain the mode of production of the phenomenon, and its incidental delays. Already your terrestrial scientific knowledge enables you to take instantaneous photographs of the successive aspects of rapid phenomena, such as lightning, a meteor, the waves of the sea, a volcanic eruption, the fall of a building, and to make them pass before you graduated in accordance with their effect on the retina. Similarly you can, on the contrary, photograph the pollen of a flower, through each stage of expansion to its completion in the fruit, or the development of a child from its birth to maturity, and project these phases upon a screen, depicting in a few seconds the life of a man, or a tree."[336]



The concept of relative simultaneity appears repeatedly in the Nineteenth Century as a French conception, inspired by Fizeau and Flammarion, furthered by Bergson in his *Time and Free Will, an Essay on the Immediate Data of Consciousness*, and brought to fruition in Poincaré's *The Measurement of Time*, and, *Science and Hypothesis*, and his 1904 St. Louis lecture, *The Principles of Mathematical Physics*. However, it was the Croatian Jesuit Boscovich who had the profoundest, and prior, insight regarding relative simultaneity.[337]

The equating of light speed to length and time was placed in the consciousness of physicists by Roemer, whose calculations of light's finite speed underpin the definition of simultaneity in modern physics. Fizeau defined space as isotropic with regards to light speed and assumed that:

$$c = ( 2AB ) \div ( t'_A - t_A ),$$

where $c$ = *celeritas*, the wave speed of light, $AB$ is the length of the path of light from point $A$ to point $B$, and $( t'_A - t_A )$ is the time interval of the round trip path of reflected light from $A$ to $B$ and back to $A$.

Fizeau thereby presented a new circular definition of time. Poincaré demonstrated that, since $c$ was supposedly a universal constant between systems in relative motion to each other, this new circular definition of time rendered simultaneity relative and that the presumption of an isotropic light speed was the presumption of a measurement of time. Time was previously defined by the circular definition of uniform motion supplied by Galileo, where equal *spaces* are defined to be traversed in equal *times*.

In Einstein's famous lecture of 1922 in Japan,[338] he recounts that he derived inspiration from "Michelson's experiment". Then, years later, Einstein denied having known of the experiment before the 1905 paper appeared.[339] He may have had grounds to lie. Einstein rarely cited papers, which appeared before the 1905 paper, and which presented the image of "relativity", as did Michelson's papers, *The relative motion of the Earth and the Luminiferous ether*, and, *On the Relative Motion of the Earth and the Luminiferous Ether*. Einstein pretended that he invented the concept of relative motion, and by this, I mean $c' = c$. But that, on its own, is a trivial matter. Significantly, admitting to a knowledge of Michelson's work, was an admission that Mileva and Albert based their supposedly deductive theory, which tacitly and incorrectly takes $c' = c$ as a general principle, on a particular case, the Michelson result, thereby admitting that their theory was in truth an inductive argument for Lorentz' deductive synthesis of 1904, and that $c' = c$ was a particular case of a given velocity comparison in a given static system, not a general principle; the actually held general principles being the hypotheses of the Lorentz Transformation, which deductively result in the particular case of Michelson's $c' = c$, whether there is relative motion in Michelson's experiments, or not. Furthermore, there is a tenuous connection between Michelson's experiments and the special theory of relativity, for pointing to said experiments as evidence in support of the theory admits of absolute space, for without absolute space, and given the supposedly superfluous nature of the æther, there is no relative motion in the Michelson experiments. Where is the "resting system" in the experiment? Where is the "moving system" in the experiment?



The Michelson-Morley experiment only signifies relative motion in Lorentz' theory, despite the fact that it has long been cited as supporting the Einsteins' theory.[340] Of course, Albert's expressed policy was, "If the facts don't fit the theory, change the facts."

After more than one hundred years, noted experts in the field are still in a quandary to establish any relative motion in the Michelson experiments, such as would place the same events in two systems in relative motion to each other *in the same experiment*, in order to justify Poincaré's notion of relative simultaneity. Others take a different approach. The book *Spacetime Physics*,[341] by Edwin F. Taylor and John Archibald Wheeler, which is perhaps the most respected introductory text to the field, argues for at least two separate experiments, but such is not a test of the special theory of relativity, *per se*, but is, in fact, more likely to detect or disprove any relative motion between the æther and the Earth.

From *Spacetime Physics:*

> "The Michelson-Morley experiment and its modern improvements tell us that in every inertial frame the round-trip speed of light is the same in every direction—the speed of light is *isotropic* in both laboratory and rocket frames as predicted by the principle of relativity."

How can such a limited set of experiments, which can be explained in so many other ways with greater logical economy, tell us what happens at all times in all places in the universe? This is clearly "too hasty a generalization". Where is the "laboratory frame" and the "rocket frame" in the Michelson-Morley experiment? Unless one supposes a resting æther, as did Lorentz; or an absolute space, as did Mileva and Albert; there is only the effectively static frame of the laboratory.

From *Spacetime Physics:*

> "(1) The round-trip speed of light measured on earth is the same in every direction—the speed of light is isotropic. (2) The speed of light is isotropic not only when Earth moves in one direction around Sun in, say, January (call Earth with this motion the 'laboratory frame'), but also when Earth moves in the opposite direction around Sun six months later, in July ( call Earth with this motion the 'rocket frame')."

Are we to assume that we have the "resting system" in one experiment, and the "moving frame" in an entirely different experiment? Where is the "resting frame" and where is the "moving frame" in any given experiment, such that there is a transformation of coordinates, which would compel or give evidence of the Lorentz Transformation and relative simultaneity? Where are the observers positioning events, the clocks, and the relatively moving rods?

From *Spacetime Physics:*

> "(3) The generalization of this result to any pair of inertial frames in relative motion. . ."

How are the lab and rocket frames, which are not inertial frames if they rest on the Earth, in relative



motion, when they are the same laboratory at two distinct periods of time? The "frame" is composed of the laboratory equipment, not translations of absolute space, through absolute time. Not only is their argument a fallacy of "too hasty a generalization"; the premises, themselves, are false. There is no "pair of inertial frames in relative motion" in the experiment, from a relativistic perspective, which perspective denies the æther. A train leaving Chicago is not moving relative to the same train arriving in Denver.

From *Spacetime Physics:*

> ". . .in relative motion is contained in the statement, The round-trip speed of light is isotropic both in the laboratory frame and in the rocket frame."

Which are the same laboratory with two names at two different times.

From *Spacetime Physics:*

> "An experiment to test the assumption of the equality of the round-trip speed of light in two inertial frames in relative motion was conducted in 1932 by Roy J. Kennedy and Edward M. Thordike."

This experiment, likewise, contains no "resting system" and no "moving system" without the assumption of an absolute space, or a "resting" æther.

Einstein claimed that he arose from bed once and wondered if events were absolutely simultaneous.[342] Was Einstein reading Poincaré, who had already expressly written that events are not absolutely simultaneous, in bed, before Einstein fell asleep? Einstein had read Poincaré's work on relative simultaneity. Einstein also told an Eureka-like story of his enlightenment of the special theory of relativity—a story which is suspiciously similar to Archimedes' story.[343] He was compelled to invent these childish fairy tales of his divine inspiration, as if they accounted for his "research", for there is no record of his having developed the theory, while there is a substantial record of others having published it before him.

Einstein may have been a phoney. He may not have been a phoney. The question of priority is one which can be settled based on the historic record. The question of inspiration is perhaps more obscure. To some, the answers may appear obvious.

When his fame increased, Albert divorced Mileva, and entered into an incestuous marriage with his cousin (with whom he was a blood relative through both his mother *and* his father[344]), though Albert may have felt that he had the option to choose between a marriage with his cousin, or one of her young daughters. He once referred to his wife-cousin and her two daughters, as his "small harem".[345]

Do the facts present Einstein as a perverse being, sadistically cruel to his family? If they were to, should it be considered the benefit of his genius, and a sacrifice he made for the good of mankind? Would it be an indication that the popular image of the man is a myth? Might there be other myths, or truths which have been covered up?

Einstein told the general public that only twelve men in the world were capable of understanding the theory of relativity.[346] After that proclamation, any person who dared contest Einstein's priority was susceptible to being labeled as outside the 12 and incapable of understanding the theory. This *ad*



*hominem* retort to challenges to the theory continues today, when pseudorelativists avoid addressing the substance of arguments against the theory and avoid addressing the facts, but instead attempt an *ad hominem* argument against those who question their beliefs, in an effort to discredit the critic, instead of addressing his or her complaints. There are many fatal flaws in the special theory of relativity. When pressed for a substantial response, the response is too often, "What you say is true, but so what?"

When it was realized that Einstein repeated what others had written far earlier, some regarded it as an amazing coincidence that someone had already written what Einstein and others would later publish. For instance,

> "[Boscovich's] theory also suggests curious—almost uncanny—intimations of general relativity and quantum mechanics."[347]

The lack of footnotes in Einstein's writings was not seen as an attempt at plagiarism, but as evidence that Einstein conceived the whole soup from scratch, even though the factual record proves that the principle of relativity via the "Lorentz Transformation" was a traditional, well-known recipe. The absurdity of assuming that a lack of references indicates the absence of a knowledge of an other's works degenerates into mysticism, and we are asked to accept that Einstein did not read what was famously in print in his pet field, but was inspired,

> "if not [by] God, [then by] some otherworldly source".[348]

Is it not clear that Einstein's silly and childish "Eureka!" stories are fabrications meant to establish a record of priority, where no record in fact exists? For the first originators (a redundancy compelled by the subject matter) of relativity theory, the development was slow, progressive and well documented. It was an evolution, not a holy revelation.

Of course, the indoctrinated habit of scientists is to research the scientific literature before developing a theory. Why wouldn't Einstein have done so? The history of science was, after all, Einstein's passion.

Could Einstein have researched the literature on the electrodynamics of moving bodies, the relative motion of bodies and the failure to detect the motion of the Earth relative to the æther and missed the relevant works of Michelson, Larmor, Cohn, Langevin, Poincaré and Lorentz? Did God really tap Einstein on the shoulder and whisper these men's thoughts to Einstein, but didn't let Einstein in on the poorly kept *secret* that these men had already published "God's thoughts"?

Einstein is known to have read Poincaré,[349] and was aware of Lorentz' work, but denied knowledge of the so-called "Lorentz Transformation". Is it plausible to believe that Einstein, a supposed genius and master scientist, was completely unaware of Poincaré's, Lorentz' and Larmor's works containing the so-called "Lorentz Transformation", and the principle of relativity, which were the talk of the physics community,[350] and the then current literature on the subject of Poincaré's "principle of relativity", and that it is coincidental that Einstein repeated much of what they wrote? Is it a coincidence that Einstein repeated the same formulæ, in the same context, based on the same explanations, and experiments? Is it a coincidence that the relativity well largely ran dry after Poincaré's untimely death?



Why did Albert's supposed genius appear only after his marriage to Mileva, and why did he not accomplish major breakthroughs, on the level of the special and general theories of relativity, after he divorced her?

David Hilbert, on whom Einstein went calling for help, published the general theory of relativity before Einstein.[351] Why, after many years of failure, did Einstein suddenly realize, within a few days after David Hilbert's work was public, the equations which Hilbert published before him, and then submit his, Einstein's, identical formulations?

Should we believe that Einstein came up with the same equations independently of Hilbert, after Einstein's long and tortuous, fruitless years of struggling in vain, after asking Hilbert for help, within days of Hilbert's public release? Who was the better mathematician of the two? Who presented the theory first? Who had the better understanding of the principle of least action?[352] Who went calling on whom for help, after years of failure?

Which one of the two had evinced a pattern of repeating the work of others, supposedly independently, later, again and again and again? What was Poincaré's contribution to the general theory of relativity, was it not in large part his conception?[353] And what of the non-Euclidean geometry of al-Khayyāmī (Omar Khayyam),[354] al-Tūsī (Naṣīr al-Dīn),[355] Saccheri,[356] Gauss,[357] Bolyai,[358] Lobatschewsky,[359] Seguin,[360] Riemann,[361] Helmholtz,[362] Beltrami,[363] Lie,[364] etc.? And what of the contributions toward the general theory of relativity of Locke,[365] Berkeley,[366] Hume,[367] Kant,[368] Boscovich,[369] Soldner,[370] Laplace,[371] Reich,[372] Bessel,[373] Herbart,[374] Fechner,[375] Hundhausen,[376] Bentham[377] and Vaihinger,[378] Humboldt,[379] Mayer,[380] Boucheporn,[381] Poe,[382] Le Verrier,[383] Hall,[384] Bruns,[385] Tisserand,[386] Souchon,[387] Erdmann,[388] Christoffel,[389] Waterston,[390] Chapin,[391] Salmon,[392] Fiedler,[393] Lehmann,[394] Holzmüller,[395] Neumann,[396] Green,[397] Bertrand,[398] Scheibner,[399] Zöllner,[400] Clausius,[401] Love,[402] Stallo,[403] MacGregor,[404] Clifford,[405] Servus,[406] Liman,[407] Lévy,[408] Epstein,[409] Richard Beez,[410] Cayley,[411] de Tilly,[412] Lindemann,[413] Schering,[414] Cox,[415] Klein,[416] Heath,[417] Buchheim,[418] Killing,[419] de Francesco[420] Le Sage,[421] Herapath,[422] Pasley,[423] Saigey,[424] Leray,[425] Boisbaudran,[426] Guthrie,[427] Preston,[428] Guyot,[429] Faraday,[430] Zalewski,[431] Du Bois-Reymond,[432] Secchi,[433] Chase,[434] Lamé,[435] Brücke,[436] Challis,[437] Glennie,[438] Croll,[439] Crookes,[440] Isenkrahe,[441] Schramm,[442] Fritsch,[443] Anderssohn,[444] Rysának,[445] Stroh,[446] Spiller,[447] Avenarius,[448] Robert Stawell Ball,[449] Oppolzer,[450] Streintz,[451] Mach,[452] Dühring,[453] Cohn,[454] Bauschinger,[455] Newcomb,[456] Lehmann-Filhés,[457] Hepperger,[458] Harkness,[459] W. W. Rouse Ball,[460] Budde,[461] Günther,[462] argumentation between Vicaire and Mansion,[463] Schütz,[464] König,[465] Couturat and Delboeuf,[466] Frege,[467] Wundt,[468] Pearson,[469] Schott,[470] Petzoldt,[471] Most,[472] Mossotti,[473] Wilhelm Weber,[474] Seegers,[475] Weber,[476] Härdtl,[477] Johannesson,[478] Jewell,[479] Engelmeyer,[480] Backlund,[481] Harzer,[482] Eötvös,[483] Benedict and Immanuel Friedlaender,[484] Bucherer,[485] Hasenöhrl,[486] Drude,[487] Schulhof,[488] Kleinpeter,[489] Höfler,[490] Wulf,[491] Larmor,[492] Volkmann,[493] Schwarzschild,[494] Voss,[495] Föppl,[496] Wiechert,[497] Mie,[498] FitzGerald,[499] Seeliger,[500] Schuster,[501] Gerber,[502] Pringsheim,[503] Julius,[504] Ricci, Levi-Civita,[505] Oppenheim,[506] Kottler[507] (father of the "Relativitätstheorie" in 1903), Brown,[508] Anding,[509] Liebmann,[510] Zenneck,[511] Wilkens,[512] Planck,[513] Mosengeil,[514] Noether,[515] Ignatowsky,[516] Varičak,[517] Gans,[518] Wacker,[519] Hecker,[520] Charlier,[521] Ritz,[522] Hofmann,[523] Gehrcke,[524] Ehrenfest,[525] de Sitter,[526] Hargreaves,[527] Bateman,[528] Silberstein,[529] Cunningham,[530] Minkowski,[531] Hayford and Bowie,[532] Helmert,[533] Reissner,[534] Frank,[535] de Tunzelmann,[536] Schweydar,[537] Lorentz,[538] Le Bon,[539] Wilson, Tolman and Lewis,[540] Hupka,[541] Herglotz,[542] Lamla,[543] Burton,[544] Nordström,[545] Behacker,[546] Bottlinger,[547] Abraham,[548] Pavanini,[549] Caldonazzo,[550] Kretschmann,[551] Jaumann,[552] Evershed,[553] James,[554] Freundlich,[555] Gyllenberg,[556] Grossmann,[557] Huntington,[558] Brillouin,[559] Conway,[560] Lense[561], Brill,[562] Ishiwara,[563] St. John,[564] Droste,[565] [Copernicus, Kepler, Galileo, Des Cartes, Huyghens, Newton, Leibnitz, Lagrange, Lipschitz, Poisson, Hamilton, Jacobi, etc.]?

For histories on, discussions of, and references for, the general theory of relativity, see: Pauli, *Encyklopädie der mathematischen Wissenschaften*, 5, 2, 19, pp. 539-775, English translation by G. Field, *Theory of Relativity*, Pergamon Press, (1958); Oppenheim and Kottler, *Encyklopädie der mathematischen Wissenschaften*, 6, 2, 22 and 22a, pp. 81-237; Whittaker's *History*, Volume 2; and Roseveare's *Mercury's Perihelion, from Le Verrier to Einstein*, Oxford University Press, (1982).

One may rightly ask, what, exactly, did Einstein contribute to the theory? Where, in the historic record, do we find Einstein's contribution with established priority? Is the priority Einstein's, merely because he claimed it, in spite of the dates of publication? Given the above list of names, which, while long, is by no means complete, why did Einstein pretend that he created the general theory of relativity? Why didn't Einstein provide references to at least a handful of the above authors and their works? Your author intends to publish a properly referenced version of the Einsteins' major papers on the theory of relativity. There is very little that is novel in their efforts—certainly *nothing* revolutionary.

Why did Einstein submit a nonsensical paper after the divorce, which confused renowned scientists? Was he not a great, independent thinker? Is it possible, hypothetically speaking, that Einstein wasn't a genius and became so full of himself that he attempted to go it alone, and failed miserably?

Of course, the "great man", as he once called himself,[566] was never short of material to steal, should he ever choose to plagiarize. People from around the world wrote to him with their ideas.[567] If he were a plagiarist, then the thief would have held the keys to the vault!

Einstein evinced a career long pattern of publishing "novel" theories and formulæ after others had already published similar words, then claimed priority for himself. He did it with $E = mc^2$. He did it with the so-called special theory of relativity and he did it with the general theory of relativity. Did Einstein simply change the names for terms, and claim that he had created a new theory, as if Einstein had called red, "blue", and claimed to have discovered a new color? Did Einstein build a career out of hype and plagiarism? Is there a test to determine when a pattern evolves which defies the laws of probability? Without objective proof, the possibilities perhaps remain subjective and unprovable. It would depend, in large part, on the standard of proof which is employed in coming to judgement. However, the priorities remain clear.

Was Einstein an honest man? Did he state that he had never known of the Michelson-Morley report? Was



he aware of it, before 1905? Did Einstein state that he had never read Poincaré's paper on the dynamics of the electron? Had he read it? Was his memory faulty? Was he easily confused? Was he a liar?

Did Einstein become a hero to many and in their minds a demi-god, seemingly the Holy Ghost incarnate, communicating God's thoughts to man? Did the scientific community and the media promote Einstein as the genius who figured it all out? Do we need such heroes? Einstein is seemingly awarded credit for every scientific advancement and theory from the time of Newton up until Einstein's death. Does Einstein deserve that credit?

**Notes:**

1. *See:* Sir Edmund Whittaker, *A History of the Theories of Aether and Electricity*, Volume II, Philosophical Library Inc., New York, (1954), *especially* pp. 27-77; and "Albert Einstein", *Biographical Memoirs of Fellows of the Royal Society*, Volume 1, (1955), pp. 37-67.

*See also*, H. Ives, D. Turner, J. J. Callahan, R. Hazelett, *The Einstein Myth and the Ives Papers*, Devin-Adair Co., Old Greenwich, Connecticut, (1979).

*See also*, W. Kantor, *Relativistic Propagation of Light*, Coronado Press, Lawrence, Kansas, (1976).

*See also*, J. Mackaye, *The Dynamic Universe*, Charles Scribner's Sons, New York, (1931).

*See also*, G. B. Brown, "What is Wrong with Relativity?", *Bulletin of the Institute of Physics and the Physical Society*, Volume 18, Number 3, (March, 1967), pp. 71-77.

*See also*, G. H. Keswani, "Origin and Concept of Relativity, Parts I, II & III", *The British Journal for the Philosophy of Science*, Volume 15, Number 60, (February, 1965), pp. 286-306; Volume 16, Number 61, (May, 1965), pp.19-32; Volume 16, Number 64, (February, 1966), pp. 273-294; and Volume 17, Number 2, (August, 1966), pp. 149- 152; Volume 17, Number 3, (November, 1966), pp. 234-236.

*See also*, Enrico Gianetto, "The Rise of Special Relativity: Henri Poincaré's Works before Einstein", *ATTI DEL XVIII CONGRESSO DI STORIA DELLA FISICA E DELL'ASTRONOMICA*, pp. 172-207; URL:

http://www.brera.unimi.it/Atti-Como-98/Giannetto.pdf

*See also, as noted by* Enrico Gianetto, H. Thirring, "Elektrodynamik bewegter Körper und spezielle Relativitätstheorie", *Handbuch der Physik*, Volume 12 ("Theorien der Elektrizität Elektrostatik"), Springer, Berlin, (1927), pp. 245-348, *especially* 264, 270, 275, 283.

*See also*, H. A. Lorentz, "Deux memoirs de Henri Poincaré", *Acta Mathematica*, Volume 38, (1921) p. 293; reprinted in *Œuvres de Henri Poincaré*, Volume XI, Gautier-Villars, (1956), pp. 247-261.

*See also*, W. Pauli, "Relativitätstheorie", *Encyklopädie der mathematischen Wissenschaften*, Volume 5, Part 2, Chapter19, B. G. Teubner, Leipzig, (1921), pp. 539-775; English translation by G. Field, *Theory of Relativity*, Pergamon Press, London, Edinburgh, New York, Toronto, Sydney, Paris, Braunschweig, (1958).

*See also*, P. Langevin, "Le Physicien", *Revue de Métaphysique et de Morale*, Volume 20, Number 5, (September, 1913), pp. 675-718.

For counter-argument, *see:*

R. Dugas, *A History of Mechanics*, Dover, New York, (1988), pp. 463-501.

*See also*, S. Goldberg, *Understanding Relativity*, Birkhäuser, Boston, Basel, Stuttgart, (1984).

*See also*, A. Pais, *Subtle is the Lord*, Oxford University Press, Oxford, New York, Toronto, Melbourne, (1982).

*See also*, A. I. Miller, "A Study of Poincaré's 'Sur la Dynamique de l'Électron'", *Archive for History of Exact Sciences*, Volume 10, (1972), pp. 207-328; *American Journal of Physics*, Volume 45, Number 11, (November, 1977), pp. 1040-1048; and *Albert Einstein's Special Theory of Relativity. Emergence (1905) and Early Interpretation (1905-1911)*, Addison-Wesley Publishing Company, Inc., (1981).

*See also*, W. Rindler, *American Journal of Physics*, Volume 38, (1970), pp. 1111-1115.

*See also*, G. Holton, "On the Origins of the Special Theory of Relativity", *Thematic Origins of Scientific Thought*, Harvard University Press, Cambridge, Massachusetts, London, (1973 revised 1988), pp. 191-236; and "On the Origins of the Special Theory of Relativity", *American Journal of Physics*, Volume 28, Number 7, (October, 1960), pp. 627-636, *especially* 633-636; Volume 30, Number 6, (June, 1962), 462-469; and *Special Relativity Theory: Selected Papers*, American Institute of Physics, New York, (1963), pp. 1-8.



2. Lange introduced the term "Inertialsystem" and defined the concept:

L. Lange, "Über die wissenschaftliche Fassung der Galilei'schen Beharrungsgesetzes", *Philosophische Studien*, Volume 2, (1885), pp. 266-297, 539-545;

L. Lange, "Ueber das Beharrungsgesetz", *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig, mathematisch-physische Classe*, Volume 37, (1885), pp. 333-351.

L. Lange, *Die geschichtliche Entwickelung des Bewegungsbegriffes und ihr voraussichtliches Endergebniss. Ein Beitrag zur historischen Kritik der mechanischen Principien von Ludwig Lange*, Wilhelm Engelmann, Leipzig, (1886).

and "Die geschichtliche Entwicklung des Bewegungsbegriffes und ihr voraussichtliches Endergebniss", *Philosophische Studien*, Volume 3, (1886), pp. 337-419, 643-691;

and "Das Inertialsystem vor dem Forum der Naturforschung: Kritisches und Antikritisches", *Philosophische Studien*, Volume 20, (1902), pp. 1-71.

L. Lange, *Das Inertialsystem vor dem Forum der Naturforschung*, Wilhelm Engelmann, Leipzig, (1902).

L. Lange, "Mein Verhältnis zu Einstein's Weltbild" ("My Relationship to Einstein's Conception of the World"), *Psychiatrisch-neurologische Wochenschrift*, Volume 24, (1922), pp.

116, 154-156, 168-172, 179-182, 188-190, 201-207.

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B. Thüring, "Fundamental-System und Inertial-System", *Methodos; rivista trimestrale di metodologia e di logica simbolica*, Volume 2, (1950), pp. 263-283; and *Die Gravitation und die philosophischen Grundlagen der Physik*, Duncker & Humblot, Berlin, (1967), pp. 75-77, 234-240;

M. v. Laue, "Dr. Ludwig Lange", *Die Naturwissenschaften*, Volume 35, Number 7, (1948), pp. 193-196.

E. Mach, *The Science of Mechanics*, Open Court, (1960), pp. 291-297.

E. Gehrcke, *Kritik der Relativitätstheorie*, Hermann Meusser, Berlin, (1924), pp. 17, 30-34.

E. Gehrcke, "Über den Sinn der Absoluten Bewegung von Körpern", *Sitzungsberichten der Königlichen Bayerischen Akademie der Wissenschaften*, Volume 12, (1912), pp. 209-222.

E. Gehrcke, "Über die Koordinatensystem der Mechanik", *Verhandlungen der Deutschen Physikalischen Gesellschaft*, Volume 15, (1913), pp. 260-266.

H. Seeliger, "Kritisches Referat über Lange's Arbeiten", *Vierteljahrsschrift der Astronomischen Gesellschaft*, Volume 22, (1886), pp. 252-259.

*For Lange's immediate predecessors, see:*

William Thomson and P. G. Tait, *Treatise on Natural Philosophy*, Volume 1, Part 1, §§§ 245, 249, 267, CUP, (1879),

James Thomson, "On the Law of Inertia; the Principle of Chronometry; and the Principle of Absolute Clinural Rest, and of Absolute Rotation", *Proceedings of the Royal Society of Edinburgh*,



Volume 12, (November 1883-July 1884), pp. 568-578;

P. G. Tait, "Note on Reference Frames", *Proceedings of the Royal Society of Edinburgh*, Volume 12, (November 1883-July 1884), pp. 743-745.

3. W. Voigt, "Ueber das Doppler'sche Princip", *Nachrichten von der Königlichen Gesellschaft der Wissenschaften und der Georg-Augusts-Universität zu Göttingen*, (1887), pp. 41-51; reprinted *Physikalische Zeitschrift*, Volume 16, Number 20, (October15, 1915), pp. 381-386; English translation, as well as very useful commentary, are found in A. Ernst and Jong-Ping Hsu (W. Kern is credited with assisting in the translation), "First Proposal of the Universal Speed of Light by Voigt in 1887", *Chinese Journal of Physics* (The Physical Society of the Republic of China), Volume 39, Number 3, (June, 2001), pp. 211-230; URL's:

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*See:* H. A. Lorentz, *Theory of Electrons*, B. G. Teubner, Leipzig, (1909), p. 198 footnote; and H. A. Lorentz, "Deux memoirs de Henri Poincaré", *Acta Mathematica*, Volume 38, (1921), p. 295; reprinted in *Œuvres de Henri Poincaré*, Volume XI, Gautier-Villars, (1956), pp. 247-261.

Minkowski also acknowledged Voigt's priority:

*See: The Principle of Relativity*, Dover, New York, (1952), p. 81; and *Physikalische Zeitschrift*, Volume 9, Number 22, (November 1, 1908), p. 762.

For further discussion of Voigt's relativistic transformation, *see:*

R. Dugas, *A History of Mechanics*, Dover, New York, (1988), pp. 468, 484, 494;

A. Pais, *Subtle is the Lord*, Oxford University Press, Oxford, New York, Toronto, Melbourne, (1982), pp. 121-122.

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and "On the Ascertained Absence of Effects of Motion through the Æther, in Relation to the Constitution of Matter, and the FitzGerald-Lorentz Hypothesis", *Philosophical Magazine*, Series 6, Volume 7, (June, 1904), pp. 621-625.



6. H. A. Lorentz, "De l'Influence du Mouvement de la Terre sur les Phénomènes Lumineux", *Koninklijke Akademie van Wetenschappen, Afdeeling Natuurkunde, Verslagen en Mededeelingen* (Amsterdam), Volume 2, (1886), pp. 297-372; and *Archives Néerlandaises des Sciences Exactes et Naturelles*, First Series, Volume 21, (1887), pp. 103-176; reprinted *Collected Papers*, Volume 4, M. Nijhoff, The Hague, (1935-1939), pp. 153-214.

and "Over de terugkaatsing van licht door lichamen die zich bewegen", *Verslagen der Zittingen de Wis- en Natuurkundige Afdeeling der Koninklijke Akademie van Wetenschappen* (Amsterdam), Volume 1, (1892), pp. 28-31; reprinted in English "On the Reflection of Light by Moving Bodies", *Collected Papers*, Volume 4, pp. 215-218;

and "De relatieve beweging van de aarde en den aether", *Verslagen der Zittingen de Wis- en Natuurkundige Afdeeling der Koninklijke Akademie van Wetenschappen* (Amsterdam), Volume 1, (1892), pp. 74-79; translated in English, "The Relative Motion of the Earth and the Ether", *Collected Papers*, Volume 4, pp. 219-223;

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and *Versuch einer Theorie der electrischen und optischen Erscheinungen in bewegten Körpern*, E. J. Brill, Leiden, (1895); unaltered reprint by B. G. Teubner, Leipzig, (1906); reprinted *Collected Papers*, Volume 5, pp. 1-137;

and "Concerning the Problem of the Dragging Along of the Ether by the Earth", *Verslagen der Zittingen de Wis- en Natuurkundige Afdeeling der Koninklijke Akademie van Wetenschappen* (Amsterdam), Volume 6, (1897), p. 266; reprinted *Collected Papers*, Volume 4, pp. 237-244;

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*See also:* A. Fölsing, "Keine 'Mutter der Relativitätstheorie'", *Die Zeit*, Number 47, (November 16, 1990), p. 94.

*See also:* A. Pais, *Einstein Lived Here*, Oxford University Press, New York, (1994), pp. 14-16.

14. M. Planck, "Das Prinzip der Relativität und die Grundgleichungen der Mechanik", *Verhandlungen der Deutschen Physikalischen Gesellschaft*, Volume 8, (1906), pp. 136-141.

15. W. Kaufmann, "Über die Konstitution des Elektrons", *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, (1905), pp. 949-956, *especially* p. 954; and "Über die Konstitution des Elektrons", *Annalen der Physik*, Volume 19, (1906), pp. 487-553; " Nachtrag zu der Abhandlung: 'Über die Konstitution des Elektrons'", *Annalen der Physik*, Volume 20, (1906), pp. 639-640.

16. P. Ehrenfest, "Die Translation deformierbarer Elektronen und der Flächensatz", *Annalen der Physik*, 23, (1907), pp. 204-205.

17. J. Laub, "Zur Optik der bewegten Körper", *Annalen der Physik*, 23, (1907), pp. 738-744.

18. M. v. Laue, "Die Mitführung des Lichtes durch bewegte Körper nach dem Relativitätsprinzip", *Annalen der Physik*, 23, (1907), pp. 989-990.



19. A. Einstein, "Über das Relativitätsprinzip und die aus demselben gezogenen Folgerung", *Jahrbuch der Radioaktivität und Elektronik*, 4, (1907), pp. 411-462.

20. A. H. Bucherer, "Messungen an Becquerelstrahlen. Die experimentelle Bestätigung der Lorentz-Einstein Theorie", *Physikalische Zeitschrift*, Volume 9, Number 22, (November 1, 1908), pp. 755-762.

21. *Physikalische Zeitschrift*, Volume 9, Number 22, (November 1, 1908), p. 762.

22. *The Principle of Relativity: Original Papers by A. Einstein and H. Minkowski Translated into English by M. N. Saha and S. N. Bose*, University of Calcutta, (1920), H. Minkowski, "Principle of Relativity", translated by Dr. Meghnad N. Saha, p. 2.

23. H. Minkowski, *Annalen der Physik*, 47, (1915), p. 928.

24. M. Planck, *Verhandlungen der Deutschen Physikalischen Gesellschaft*, Volume 8, (1906), p. 136.

25. H. Poincaré, *Dernières Pensées*, Flammarion, Paris, (1913); English translation *Mathematics and Science: Last Essays*, Dover, New York, (1963), pp. 15, 23, 75, 99.

Poincaré makes clear his attribution of the formulation, which he completed and corrected, stems from Lorentz in "Sur la Dynamique de l'Électron", *Comptes rendus hebdomadaires des séances de L'Académie des sciences*, Volume 140, (1905), pp. 1504-1508; reprinted *Œuvres de Henri Poincaré*, Volume IX, Gautier-Villars, (1954), pp. 489-493;

and "Sur la Dynamique de l'Électron", *Rendiconti del Circolo matimatico di Palermo*, Volume 21, (1906, submitted July 23rd, 1905), pp. 129-176; reprinted *Œuvres*, Volume IX, pp. 494-550; English trans. by H. M. Schwartz, *American Journal of Physics*, 39, (November, 1971), 1287-1294; 40, (June, 1972), 1282-1287; 40, (September, 1972), 1282-1287; reprinted *Œuvres*, Volume IX, pp. 494-550;

and "La Dynamique de l'Électron", *Revue Générale des Sciences Pures et Appliquées*, Volume 19, (1908), pp. 386-402; reprinted *Œuvres*, Volume IX, pp. 551-586;

Note that in the latter two papers, Poincaré address relativistic gravitation, the propagation of gravitation at *celeritas*, and the perihelion of Mercury, long before Einstein published his version of the general theory of relativity in 1916. In this context *see also:*

H. A. Lorentz, "Alte und neue Fragen der Physik", *Physikalische Zeitschrift*, Volume 11, Number 26, (December 15, 1910), pp. 1234-1257; reprinted in part in H. A. Lorentz, A. Einstein, and H. Minkowski, *Das Relativitätsprinzip: eine Sammlung von Abhandlungen*, B. G. Teubner, Leipzig & Berlin, (1913), pp. 74-89, though not in later editions; *see also: Das Relativitätsprinzip, Drei Vorlesungen gehalten in Teylers Stiftung zu Haarlem*, B. G. Teubner, Leipzig, Berlin, (1914/1920), pp. 19-20.

26. P. Frank, "Die Stellung des Relativitätsprinzips im System der Mechanik und der Elektrodynamik", *Sitzungsberichte der Mathematisch-Naturwissenschaftliche Classe der Kaiserlichen Akademie der Wissenschaften in Wien* (Wiener Sitzungsberichte), Volume 118, (1909), pp. 373-446, at 376, 420.

27. M. v. Laue, *Die Relativitätsprinzip der Lorentztransformation*, Friedr. Vieweg & Sohn, Braunschweig, (1921), pp. 12, 48.

28. H. A. Lorentz, "Deux memoirs de Henri Poincaré", *Acta Mathematica*, Volume 38, (1921) p. 293; reprinted in *Œuvres de Henri Poincaré*, Volume XI, Gautier-Villars, (1956), pp. 247-261; taken from H. E. Ives' translation, "Revisions of the Lorentz Transformation", *Proceedings of the American Philosophical Society*, Volume 95, Number 2, (April, 1951), p. 125; reprinted R. Hazelett and D. Turner Editors, *The Einstein Myth and the Ives Papers, a Counter-Revolution in Physics*, Devin-Adair Company, Old Greenwich, Connecticut, (1979), p. 125.

Contrast Lorentz' statement of Poincaré's priority, with the fact that Lorentz participated in the production of: H. A. Lorentz, A. Einstein, and H. Minkowski, *Das Relativitätsprinzip: eine Sammlung von Abhandlungen*, B. G. Teubner, Leipzig & Berlin, (1913), which did not include any work by Poincaré, and Lorentz' statement published in 1913,



"The principle of relativity, for which we have Einstein to thank, . . ."

"Das Relativitätsprinzip, welches wir Einstein verdanken, . . ."

H. A. Lorentz, *Das Relativitätsprinzip; drei Vorlesungen gehalten in Teylers Stiftung zu Haarlem*, B. G. Teubner, Leipzig-Berlin, (1920). p. 1;

"Het relativiteitsbeginsel, dat wij aan EINSTEIN te danken hebben, . . ."

H. A. Lorentz, *Het Relativiteitsbeginsel; drie Voordrachten Gehouden in Teyler's Stiftung*, Erven Loosjes, Haarlem, (1913), p. 1,

and it appears that Lorentz succumbed to some pressure, real or perceived, to award Einstein undeserved credit, while on other occasions, he told the truth.

29. H. A. Lorentz, *The Einstein Theory of Relativity*, Brentano's, New York, (1920), p. 11-12.

30. A. Einstein, quoted in *The Expanded Quotable Einstein*, Princeton University Press, Princeton, Oxford, (2000), p. 91.

31. A. Einstein, quoted in *The Expanded Quotable Einstein*, Princeton University Press, Princeton, Oxford, (2000), p. 91.

32. R. Shankland, *Einstein, a Centenary Volume*, Harvard University Press, (1979), p. 39.

33. V. Volterra, "Henri Poincaré", a lecture delivered at the inauguration of The Rice Institute, *The Book of the Opening of the*

*Rice Institute*, Volume 3, Houston, Texas, (1912), pp. 919-920; reprinted in: *The Rice Institute Pamphlets* Volume 1, Number 2, (May, 1915), pp. 153-154; reprinted in: *Saggi scientifici*, N. Zanichelli, Bologna, (1920), pp. 119-157.

34. A. G. Webster, "Henri Poincaré as a Mathematical Physicist", *Science*, Volume 38, Issue 991, (December 26, 1913), p. 907.

35. E. Gehrcke, "Die gegen die Relativitätstheorie erhobenen Einwände", *Die Naturwissenschaften*, Volume 1, Number 3, (January 17, 1913), pp. 62-66; reprinted in *Kritik der Relativitätstheorie*, Hermann Meusser, Berlin, (1924), p. 20.

36. A. A. Robb, *A Theory of Time and Space*, CUP, (1914), p. 1.

37. L. Silberstein, "General Relativity without the Equivalence Hypothesis", *Philosophical Magazine*, Series 6, Volume 36, (July, 1918), pp. 94-128.

38. F. Kottler, "Über die Raumzeitlinien der Minkowski'schen Welt", *Sitzungsberichte der Mathematisch-Naturwissenschaftliche Klasse der Akademie der Wissenschaften in Wien* (Wiener Sitzungsberichte), Volume 121, (1912), pp. 1659-1759;

and "Relativitätsprinzip und beschleunigte Bewegung", *Annalen der Physik*, Volume 44, (1914), pp. 701-748;

and "Fallende Bezugssysteme vom Standpunkt des Relativitätsprinzip", *Annalen der Physik*, Volume 45, (1914), pp. 481-516;

and "Beschleunigungsrelative Bewegungen und die konforme Gruppe der Minkowski'schen Welt", *Sitzungsberichte der Mathematisch-Naturwissenschaftliche Klasse der Akademie der Wissenschaften in Wien* (Wiener Sitzungsberichte), Volume 125, (1916), pp. 899-919;

and "Über Einsteins Äquivalenzhypothese und die Gravitation", *Annalen der Physik*, Volume 50, (1916), pp. 955-972;



and "Über die physikalischen Grundlagen der Einsteinschen Gravitationstheorie", *Annalen der Physik*, Series 4, Volume 56, (1918), pp. 401-462;

and F. Kottler, *Encyklopädie der mathematischen Wissenschaften*, 6, 2, 22a, pp. 159-237;

and "Newton'sches Gesetz und Metrik", *Sitzungsberichte der Mathematisch-Naturwissenschaftliche Klasse der Akademie der Wissenschaften in Wien* (Wiener Sitzungsberichte), Volume 131, (1922), p. 1-14;

and "Maxwell'schen Gleichungen und Metrik", *Sitzungsberichte der Mathematisch-Naturwissenschaftliche Klasse der Akademie der Wissenschaften in Wien* (Wiener Sitzungsberichte), Volume 131, (1922), pp. 119-146.

39. H. Bateman, "On General Relativity", *Philosophical Magazine*, Series 6, Volume 37, (1919), pp. 219-223, at 219;

*See:* H. Bateman, "The Conformal Transformations of a Space of Four Dimensions and their Applications to Geometrical Optics", *Proceedings of the London Mathematical Society*, Series 2, Volume 7, (1909), pp. 70-89;

and *Philosophical Magazine*, Volume 18, (1909), p. 890;

and "The Transformation of the Electrodynamical Equations", *Proceedings of the London Mathematical Society*, Series 2, Volume 8, (1910), pp. 223-264, 375, 469;

and "The Physical Aspects of Time", *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, Volume 54, (1910), pp. 1-13;

and *American Journal of Mathematics*, Volume 34, (1912), p. 325;

and *The Mathematical Analysis of Electrical and Optical Wave-Motion on the Basis of Maxwell's Equations*, CUP, (1915);

and *The Physical Review*, Volume 12, (1918), p. 459;

and *Proceedings of the London Mathematical Society*, Series 2, Volume 21, (1920), p. 256.

*Confer:* E. Whittaker, *Biographical Memoirs of Fellows of the Royal Society*, Volume 1, (1955), pp. 44-45; and *History*, Volume 2, pp. 8, 64, 76, 94, 154-156, 195;

W. Pauli, *Theory of Relativity*, Pergamon Press, New York, (1958), pp. 81, 96, 199.

E. Besselhagen, *Mathematische Annalen*, Volume 84, (1921), p. 258;

F. D. Murnaghan, *The Physical Review*, Volume 17, (1921), p. 73;

G. Kowalewski, *Journal für reine und angewandte Mathematik*, 157, (1927), p. 193.

40. C. Nordmann, *Einstein et l'universe*, (1921), translated by Joseph McCabe as *Einstein and the Universe*, Henry Holt & Co., New York, (1922), pp. 10-11, 16.

41. W. Pauli, *Encyklopädie der mathematischen Wissenschaften*, Volume 5, Part 2, Section 19, B. G. Teubner, Leipzig, (1921), pp. 539-775, at 543-545.

42. W. Pauli, *Theory of Relativity*, Pergamon Press, London, Edinburgh, New York, Toronto, Sydney, Paris, Braunschweig, (1958), p. 3.

43. W. Pauli, *Theory of Relativity*, Pergamon Press, London, Edinburgh, New York, Toronto, Sydney, Paris, Braunschweig, (1958), p. 3.

44. L. Lange, "Mein Verhältnis zu Einstein's Weltbild", *Psychiatrisch-neurologische Wochenschrift*, Volume 24, Number 29/30, (1922), pp. 188-189.



45. S. Oppenheim and F. Kottler, *Kritik des Newton'schen Gravitationsgesetzes; mit einem Beitrag: Gravitation und Relativitätstheorie von F. Kottler*, Deutsche Staatsrealschule in Karolinenthal, Prag, (1903).

46. *Encyklopädie der mathematischen Wissenschaften*, 6, 2, 22a, p. 171, note (13).

47. H. Poincaré, "La Théorie de Lorentz at le Principe de Réaction", *Archives Néerlandaises des Sciences Exactes et Naturelles*, Series 2, Volume 5, *Recueil de travaux offerts par les auteurs à H. A. Lorentz, professeur de physique à l'université de Leiden, à l'occasion du 25me anniversaire de son doctorate le 11 décembre 1900*, Nijhoff, The Hague, (1900), p. 272:

"In order for the compensation to occur, the phenomena must correspond, not to the true time *t*, but to some determined *local time* *t'* defined in the following way.

I suppose that observers located at different points synchronize their watches with the aid of light signals; which they attempt to adjust to the time of the transmission of these signals, but these observers are unaware of their movement of translation and they consequently believe that the signals travel at the same speed in both directions, they restrict themselves to crossing the observations, sending a signal from *A* to *B*, then another from *B* to *A*. The local time *t'* is the time determined by watches synchronized in this manner.

If in such a case

$$1 / K_0^{1/2}$$

is the speed of light, and *v* the translation of the Earth, that I imagine to be parallel to the positive *x* axis, one will have:

$$t' = t - vx / V^2$$

"Pour que la compensation se fasse, il faut rapporter les phénomènes, non pas au temps vrai *t*, mais à un certain *temps local*

$t'$ défini de la façon suivante.

Je suppose que des observateurs placés en différents points, règlent leurs montres à l'aide de signaux lumineux; qu'ils cherchent à corriger ces signaux du temps de la transmission, mais qu'ignorant le mouvement de translation dont ils sont animès et croyant par conséquent que les signaux se transmettent également vite dans les deux sens, ils se bornent à croiser les observations, en envoyant un signal de $A$ en $B$, puis un autre de $B$ en $A$. Le temps local $t'$est le temps marqué par les montres ainsi réglées.

Si alors

$$1 / K_0^{1/2}$$

est la vitesse de la lumière, et $v$ la translation de la Terre que je suppose parallèle à l'axe des $x$ positifs, on aura:

$$t' = t - vx / V^2\text{''}$$

and *Electrité et Optique*, Gauthier-Villars, Paris, (1901), p. 530:

"Allow me a couple of remarks regarding the new variable $t'$: it is what Lorentz calls *the local time*. At a given point $t$ and $t'$ will not defer but by a constant, $t'$ will, therefore, always represent the time, but the origin of the times being different for the different points serves as justification for his designation."

"Disons deux mots sur la nouvelle variable $t'$: c'est ce que Lorentz appelle *le temps locale.* En un point donné $t$ et $t'$ ne différeront que par une constante, $t'$ représentera donc toujours le temps mais l'origine des temps étant différente aux différents points: cela justifie sa dénomination."

and from 1902, *Science and Hypothesis*, Dover, New York, (1952), p. 90:

"There is no absolute time. When we say that two periods are equal, the statement has no meaning, and can only acquire a meaning by convention. Not only have we no direct intuition of the equality of two periods, but we have not even direct intuition of the simultaneity of two events occurring in two different places. I have explained this in an article entitled "Mesure du Temps."



48. H. Thirring, "Elektrodynamik bewegter Körper und spezielle Relativitätstheorie", *Handbuch der Physik*, Volume 12, "Theorien der Elektrizität Elektrostatik", Springer, Berlin, (1927), p. 270, *footnote.*

49. *Dictionary of Scientific Biography*, Volume 8, Charles Scribner's Sons, New York, (1981), p. 498.

50. A. Eddington, *The Philosophy of Physical Science*, Ann Arbor Paperbacks, The University of Michigan Press, Second Printing, (1967), p. 16.

51. J. Mackaye, *The Dynamic Universe*, Charles Scribner's Sons, New York, (1931), pp. 42-43, 100-101.

52. H. A. Lorentz, *Das Relativitätsprinzip; drei Vorlesungen gehalten in Teylers Stiftung zu Haarlem*, B. G. Teubner, Leipzig-Berlin, (1920). p. 23.

53. A. Einstein, *Ideas and Opinions*, Crown Publishers, Inc., (1954), p. 281.

54. H. A. Lorentz, *Theory of Electrons*, , B. G. Teubner, Leipzig, (1909), p. 11; reprinted Dover, New York, (1952). *See also:* pp. 30-31.

55. H. Dingle, *Science at the Crossroads*, Martin Brian & O'Keeffe, London, (1972), pp. 165-166.

56. H. Vaihinger, *Philosophy of the 'As if'*, Barnes & Noble, Inc., New York, (1966), p. 232. Vaihinger also pointed out that many scientists considered the hypothesis of the æther nothing more than a useful fiction, at page 40; and, at page 41, "In all modern science there is a tendency to depose hypotheses hitherto regarded as firmly established and to degrade them to the position of useful fictions."

57. A. Einstein, *Sidelights on Relativity*, translated by: G. B. Jeffery and W. Perret, Methuen & Co., London, (1922); *republished, unabridged and unaltered:* Dover, New York, (1983), pp. 16, 23.

58. Taken from a letter from Oliver Heaviside to Vilhelm Frimann Køren Bjerknes dated "8/3/20". Reprinted courtesy of Mike Gibson, with his full permission. Thank you, Mr. Gibson!

59. A. Einstein and I. Infeld, *The Evolution of Physics*, Simon & Schuster, New York, London, Toronto, Sydney, Tokyo, Singapore, (1966), p. 153.

60. H. Spencer, *First Principles of a New System of Philosophy*, Second American Edition, D. Appelton and Company, New York, (1874), pp. 96-97.

61. Sir Edmund Whittaker, *A History of the Theories of Aether and Electricity*, Volume II, Philosophical Library Inc., New York, (1954), p. 40.

62. *Biographical Memoirs of Fellows of the Royal Society*, Volume 1, The Royal Society, Headley Brothers LTD., (1955), pp. 37-67, at 42.

63. W. Voigt, "Ueber das Doppler'sche Princip", *Nachrichten von der Königlichen Gesellschaft der Wissenschaften und der Georg-Augusts-Universität zu Göttingen*, (1887), p. 41-51; reprinted *Physikalische Zeitschrift*, Volume 16, Number 20, (October 15, 1915), pp. 381-386.

64. M. Born, *Einstein's Theory of Relativity*, Methuen & Co. Ltd., London, (1924), p. 188.

65. M. Born, *Einstein's Theory of Relativity*, Dover, New York, (1962), p. 224.

66. M. Born, *Physics in my Generation*, 2nd rev. ed., Springer-Verlag, New York, (1969), pp. 101-103, "Physics and Relativity"



67. P. G. Bergmann, *The Riddle of Gravitation*, Scribner, New York, (1968), p. 29.

68. G. H. Keswani, "Origin and Concept of Relativity, Part I", *The British Journal for the Philosophy of Science*, Volume 15, Number 60, (February, 1965), pp.286-306, at 293-295.

69. This quote was brought to my attention in an anonymous e-mail—thank you, whoever you are!

70. M. v. Laue, *Das Relativitätsprinzip der Lorentztransformation*, Friedr. Vieweg & Sohn, Braunschweig, (1921), p. 48.

A. Einstein, *Relativity, The Special and the General Theory*, Crown Publishers, Inc., New York, (1961), p. 33.

71. J. H. Poincaré, "Sur la Dynamique de l'Électron", *Comptes rendus hebdomadaires des séances de L'Académie des sciences*, 140, pp.1504-1508.

72. W. Voigt, "Ueber das Doppler'sche Princip", *Nachrichten von der Königlichen Gesellschaft der Wissenschaften und der Georg-Augusts-Universität zu Göttingen*, (1887), pp. 41-51; reprinted *Physikalische Zeitschrift*, Volume 16, Number 20, (October 15, 1915), pp. 381-386. Voigt demonstrated the invariance of the Group *celeritas* twenty years before Minkowski.

73.A. Henderson, A. W. Hobbs, J. W. Lasley, Jr., *The Theory of Relativity*, The University of North Caroline Press, Chapel Hill, North Carolina, Oxford University Press, (1924), p. 16, footnote.

74. *Brockhaus Enzyklopädie*, F. A. Brockhaus, Wiesbaden, Volume 19, (1974), p 697.

75. *Physikalische Zeitschrift*, Volume 9, Number 22, (November 1, 1908), p. 762. While some believe that Voigt was expressing his modesty, it might also be that he was pointedly asserting the primacy of the *elastic* theory of light.

76. Lorentz' letter as quoted and translated by A. Ernst and Jong-Ping Hsu (W. Kern is credited with assisting in the translation), "First Proposal of the Universal Speed of Light by Voigt in 1887", *Chinese Journal of Physics* (The Physical Society of the Republic of China), Volume 39, Number 3, (June, 2001), pp. 211-230, at 214. The authors note that the concept of general and local time was Lorentz' idea, not Voigt's. In other words, Voigt's concept was kinematic, and Einstein held no priority over Voigt for the idea of relativistic "time". The Lorentz to Voigt letter is cited as "Deutsches Museum München, Archives, HS 5549".

77. H. A. Lorentz, *Theory of Electrons*, B. G. Teubner, Leipzig, (1909), p. 198 footnote; reprinted Dover, New York, (1952).

78. H. A. Lorentz, "Deux memoirs de Henri Poincaré", *Acta Mathematica*, Volume 38, (1921) p. 293; reprinted in *Œuvres de Henri Poincaré*, Volume XI, Gautier-Villars, (1956), pp. 247-261; "for certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski," taken from H. E. Ives' translation, "Revisions of the Lorentz Transformation", *Proceedings of the American Philosophical Society*, Volume 95, Number 2, (April, 1951), p. 125; reprinted R. Hazelett and D. Turner Editors, *The Einstein Myth and the Ives Papers, a Counter-Revolution in Physics*, Devin-Adair Company, Old Greenwich, Connecticut, (1979), p. 125.

79. R. J. Boscovich, *A Theory of Natural Philosophy*, M.I.T. Press, Cambridge, Massachusetts, London, (1966), pp. 197-205;

*Cf.* H. V. Gill, *Roger Boscovich, S. J. (1711-1787) Forerunner of Modern Physical Theories*, M. H. Gill and Son, LTD., Dublin, (1941).

80. L. Lange, "Das Inertialsystem vor dem Forum der Naturforschung: Kritisches und Antikritisches", *Philosophische Studien*, Volume 20, (1902), p. 18.



81. J. B. Stallo, *Die Begriffe und Theorieen der modernen Physik*, Johann Ambrosius Barth, Leipzig, (1901), pp. 205, 331.

82. J. Violle, *Lehrbuch der Physik*, Julius Springer, Berlin, (1892), p. 90; *cited in* J. Stachel, Ed., *The Collected Papers of Albert Einstein*, Volume 2, Princeton University Press, (1989), p. 255, Note 13.

83. H. Poincaré, *Wissenschaft und Hypothese*, B. G. Teubner, Leipzig, (1904), pp. 113-114, 119, *especially* 243, 340.

84. F. Hausdorff, translator, annotator, *Über die Bewegung der Körper durch den Stoss / Über die Centrifugalkraft*, Ostwald's Klassiker der exakten Wissenschaften, Nr. 138, Wilhelm Engelmann, Leipzig, (1903), pp. 64, 73.

85. Galileo Galilei, translated by S. Drake, *Dialogue Concerning the Two Chief World Systems—Ptolemaic & Copernican*, University of California Press, Berkeley, Los Angeles, London, (1967), p. 187.

86. J. D. Everett, *Elementary Treatise on Natural Philosophy by A. Privat Deschanel*, 6th Ed., D. Appelton and Company, New York, (1883), p. 43.

*See also:* H. Streintz, *Die physikalischen Grundlagen der Mechanik*, B.G. Teubner, Leipzig, (1883).

87. J. D. Everett, "On Absolute and Relative Motion", *Report of the Sixty-Fifth Meeting of the British Association for the Advancement of Science*, Volume 65, (1895), p. 620.

88. H. Poincaré, *Œuvres de Henri Poincaré*, Volume IX, Gautier-Villars, (1954), p. 412; *reprinted from:* "A Propos de la Théorie de M. Larmor", *L'Éclairage électrique*, Volume 5, (October 5th, 1895) pp. 5-14.

89. H. Poincaré's St. Louis lecture from September of 1904, *La Revue des Idées*, 80, (November 15, 1905); "L'État Actuel et l'Avenir de la Physique Mathématique", *Bulletin des Sciences Mathématique*, Series 2, Volume 28, (1904), p. 302-324; English

translation, "The Principles of Mathematical Physics", *The Monist*, Volume 15, Number 1, (January, 1905), pp. 1-24.

90. H. A. Rowland, *The Physical Papers of Henry August Rowland*, The Johns Hopkins Press, Baltimore, Maryland, (1902), pp. 673-674.

91. M. Abraham, "Zur Theorie der Strahlung und des Strahlungsdruckes", *Annalen der Physik*, Series 4, Volume 14, (1904), p. 238.

92. W. S. Jevons, *The Principles of Science*, 2[nd] Ed., Macmillan, London, (1877), p. 331.

93. H. A. Lorentz, *Collected Papers*, Volume 5, Martinus Nijhoff, (1937), pp. 3-4; reprint of *Versuch einer Theorie der Electrischen und optischen Erscheinungen in bewegten Körpern*, E. J. Brill, Leiden, (1895); unaltered reprint by B. G. Teubner, Leipzig, (1906).

94. J. Larmor, *Aether and Matter*, CUP, (1900), p. 78.

95. P. Drude, *The Theory of Optics*, Longmans, Green and Co., London-New York-Toronto, (1902), pp. 261, 457.

96. H. Poincaré, *Science and Hypothesis*, Dover, New York, (1952). p. 169; quoting, "RELATIONS ENTRE LA PHYSIQUE EXPÉRIMENTALE ET LA PHYSIQUE MATHÉMATIQUE", *RAPPORTS PRÉSENTÉS AU CONGRÈS INTERNATIONAL DE PHYSIQUE DE 1900*, Gauthier-Villars, Paris, (1900), Volume I, p. 21.

97. H. Poincaré, *Sceince and Hypothesis*, Dover, New York, (1952). pp. 211-212.

98. Emil Cohn, *Nachrichten von der Königlichen Gesellschaft der Wissenschaften zu Göttingen. Mathematisch-physikalische Klasse*, (1901), p. 74; *Annalen der Physik*, 7, (1902), p. 30.

99. M. Faraday, "Thoughts on Ray-vibrations", *Philosophical Magazine*, Series 3, Volume 28, Number 188, (May, 1846), pp. 345-350; reprinted in *Experimental Researches in Electricity*, Three



Volumes Bound as Two, Volume 3, Dover, New York, (1965), pp. 447-452.

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"How happy and proud I will be, when we two together have victoriously led our work on relative motion to an end!"

"Wie glücklich und stolz werde ich sein, wenn wir beide zusammen unsere Arbeit über die Relativbewegung siegreich zu Ende geführt haben!"

"As my dear wife, we will want to engage in a quite diligent scientific collaboration, so that we don't become old Philistines, isn't it so?"

"Bis Du mein liebe Weiberl bist, wollen wir recht eifrig zusammen wissenschaftlich arbeiten, daß wir keine alten Philistersleut werden, gellst."

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"Endlich sei an dieser Stelle dankbar meines Freundes, des Mathematikers Grossmann, gedacht, der mir durch seine Hilfe nicht nur das Studium der einschlägigen mathematischen Literatur ersparte, sondern mich auch beim Suchen nach den Feldgleichungen der Gravitation unterstützte."

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