

Herbert Dingle Was Correct! Part XI
Adolf Grünbaum's Attack On Herbert Dingle Extending The Epstein-Dingle
Controversy
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1.0 Introduction

This paper is concerned with the renewal of the vociferous attack upon the views of Herbert Dingle, which appeared as a note in a paper titled “Logical And Philosophical Foundations Of The Special theory Of Relativity” by Adolf Grünbaum, which originally appeared in American Journal Of Physics, Vol. 23, 1955. (Hereafter referred to as the first paper or Paper I.). A second nearly identical paper (Hereafter referred to as the second paper or Paper II.) appears in the book Philosophy Of Science, readings selected, edited, and introduced by Author Danto and Sidney Morgenbesser, with the publication date of 1960. It is a revised version of Paper I. (A third, much improved, significantly revised, and updated, version was published two years later in 1962 with the title “The Relevance Of Philosophy To The History Of The Special Theory Of Relativity” which appeared in The Journal Of Philosophy, Vol. LIX, No. 21, p. 561.)

These papers reopen the attack upon Dingle discussed in Part III of this series of papers, which discussed the Epstein-Dingle controversy of the early 1940s. However that paper did not delve deeply into the main source of the disagreements, which were primarily philosophical, although this fact was never brought out into the open during the exchange of viewpoints regarding the special theory of relativity. Here the purpose will be to examine the attack upon Dingle made by Adolf Grünbaum in his two papers, with the purpose of reinforcing the earlier criticism made by Paul Epstein and thereby justifying it. We will take this new criticism as an opportunity to reexamine the controversy from a different perspective. In the process we will examine the principle basis for the fundamental difference in viewpoint between the dogmatic relativists and Herbert Dingle, that eventually led to Dingle's repudiation of the special theory of relativity.

The specific critical comments appear in notes 25 and 26 of Paper I and as notes 29 and 30 of Paper II. The notes are identical in both versions- only the numbers being changed. The first note of the pair addresses the subject of this paper, while the second note accuses Dingle of a “logical blunder” for criticizing the steady state theory “the new cosmology” of Bondi and Gold, which is now considered to have been decisively disproved by the discovery of the cosmic microwave background, but in 1955 was an innovative new cosmological speculation. Dingle drew the ire of the relativity community for his trenchant criticism of their cosmological speculations based on general relativity. For Dingle had become a persistent critic of the new scientific cosmology, which was short on facts and long on inventive speculations. Hence the question arises whether there was any valid reason for criticism of Dingle other than in retaliation for his persistent criticism in opposing the speculations arising from the unrestrained extension of the general theory of relativity in cosmology.

As we saw in the previous paper, Part III of this series, Dingle was skeptical of the foundational basis for the theory of relativity, and had written papers and books in which he presented an alternative philosophical viewpoint, which did not meet with the approval of the now scientifically powerful relativity establishment. By the time of Grünbaum's new attack, the new science of cosmology, based as it was upon the general theory of relativity, was on the verge of uncovering the ultimate secrets of "The Universe", and Dingle's persistent sniping was a constant source of irritation for the establishment's big names like Grünbaum. In the remainder of this paper, we will see that one reason behind the criticism of Dingle was motivated by a dislike of Dingle's philosophical viewpoint, and that this detestation was equally true of Dingle's opinion of the establishment's, then popular, philosophy of science, which was inspired by Einstein's theory of relativity.

2.0 Background

The reader is urged to read the previous paper on the Epstein-Dingle controversy in order to get an idea of the disputed issues. The main theme of this paper is to look beyond the specific disagreements of that dispute and to consider the underlying philosophical conflict that was the main reason for the dispute. Of course, when philosophical viewpoints are being debated, it is usually rare that any agreement can be easily reached when the proponents of one type of philosophy are promoting their beliefs and they are being resisted with a trenchant criticism. This is the situation that existed at the time of the Epstein-Dingle controversy. Let's consider the philosophical background of this dispute.

The specific issue that arose was Dingle's objection to the philosophical method of logical positivism, regarding which Dingle said "There are many surprising and, at first, revolting deductions to be made from this theory, but I have no space to enter upon them." He was not alone in his criticism of that philosophy, but in the middle of the 1930s he was one of the few open critics of that new innovative philosophy. To begin, we will consider the history of how this new philosophy came to be so influential, that it dominated scientific thinking at the time that Grünbaum wrote his attack upon Dingle.

2.1 Logical Positivism

It is clear that, what is today called logical positivism or equivalently logical empiricism, was the result of a failed revolution in philosophy, which attempted to reformulate philosophy in the mould of a positive science. This new kind of philosophy was to be "scientific" in its method, hence it was to become fully a Scientific Philosophy, intended to displace traditional philosophy just as modern Newtonian Science displaced Aristotelian Science in the seventeenth century, and Darwinian Science displaced religion in the nineteenth century. One can visualise it as the attempted third scientific revolution following the Copernican, and Darwinian revolutions in intellectual thought. It was inaugurated by Einstein's theory of relativity, which became its guiding light and symbol of success. Although on the surface it may seem that logical positivism was spawned by Einstein's revolutionary new discoveries, it would be a mistake to interpret it as restricted

in this manner.

It would also be a mistake to see it as primarily a new kind of scientific philosophy, because its most famous adherents were all socialist reformers with big, and often conflicting ambitions. “The movement promoted the task of unifying and coordinating the sciences so that they could be better used as tools for the deliberate shaping and planning of modern life. And it sought to cultivate....a future unified science that would assist society’s collective goals.” It would also be incorrect to view it in exactly these terms, unless we appreciate the fact that what is called logical positivism was probably not a monolithic movement in philosophy, but an ephemeral or passing fashion in scientific philosophy, which has largely faded from the scene, but which has left a rather vivid impression that has exaggerated its importance, while giving a misleading impression of its fundamental ideas. For this reason, here we will concentrate on the Vienna Circle, which can be strictly defined as the logical positivist movement and can be historically shown to be related to the ideas of Einstein’s theory of relativity. It should however, be understood that there was in Britain a parallel of logical positivism, not identical to it but having an affinity with it in many ways, which resulted in the rapid acceptance of the theory of relativity in that country. It is this British version which became known as the operational method, the subject of the disagreement between Epstein and Dingle.

The reason it is probably not accurate to attribute to Einstein the fundamental ideas of the logical positivist movement is that Einstein was probably influenced by the very same ideas as the members of the Vienna Circle. Einstein should be viewed as putting the, then current, intellectual ideas into the practice of physics. The result being the theory of relativity, which possessed a great appeal to the new generation of physicists and other intellectuals because it incorporated the new progressive ideals. The success of the theory made Einstein a hero and champion of the movement.

2.2 Hans Reichenbach And The Vienna Circle Of Logical Positivists

In a review of one of Dr. Reichenbach’s books, Herbert Dingle tells us that “Reichenbach was one of the founders of the logical empiricism school of philosophy which came into being mainly through the philosophical implications of the theory of relativity, and throughout his life he remained one of the ablest and clearest expositors.” The viewpoint that relativity and logical empiricism are intimately related is obvious to any student of the philosophy of science who has read the books published on this subject during its formative period and up until the 1970s. Hans Reichenbach was certainly one of the most successful of the proponents of the new logical positivism and it was this success which led to the publication of one of his most well known books The Rise Of Scientific Philosophy which exemplified the most enduring characteristic of the movement; its arrogant belief in the certainty of scientific method and the certainty of scientific truth such as to supplant all the rest of philosophy and make it subservient to scientific principles.

Einstein and the logical empiricists were closely connected in academic circles. Philipp Frank, one of the leading lights of the movement, was Einstein's friend, and probably owed his first professorship to the influence of this relationship. Frank, was one of the leading promoters of the Universal Science movement and was an influential promoter of Einstein and his theories through his books. Moritz Schlick another major figure in the Vienna Circle was also an ardent propagandist for the theory of relativity. Whether there actually is a casual relationship, such that the theory of relativity was a proximate cause or stimulus for the emergence of logical empiricism, is a question that is far more problematical. It is certainly true that the theory of relativity was a new and exciting young scientific field that offered great opportunity for the application of the principles of the new logical positivist philosophy of science. Hans Reichenbach seized this opportunity and made his reputation building the philosophical foundations for the theory of relativity which Einstein had only sketched out in an outline form.

Einstein was however, an enigmatic figure to take as the leader of a movement designed to banish God and metaphysics. He frequently made pronouncements about God and the universe, and propounded scientific ideas as a kind of quasi-religion. All of this being opposed to the ideal of the logical positivists, who sought to ban metaphysics from philosophy and despised religion and all religious concepts.

Therefore, it is a difficult and complex question whether the theory of relativity provided an example of a direct application of the new philosophical principles to science as many logical positivists seem to have believed. This is an open problem, although many traditional philosophers and scientists continue to believe that the theory of relativity is indisputably true, and is a beautiful example of the application of the philosophy of logical positivism in scientific practice. However, this opinion is not generally accepted as valid. The theory of relativity has certainly survived the downfall of logical positivism, and if there is an intimate philosophical connection, then the demise of logical positivism should logically entail the downfall of the theory of relativity. But, this has not occurred, yet.

In the Dingle-Epstein debate, it appears that Epstein, with the sanction of logical positivism behind him, sought to condemn Dingle's little book The Special Theory of Relativity, which was not logical positivist in philosophical orientation. Hence, we can see the issues to be discussed here as a collision of philosophical viewpoints. Dingle versus the new philosophical majority of logical positivists. (Note that this majority was temporary, by the 1970s, the logical positivist movement was waning.)

2.3 Adolf Grunbaum

Adolf Grunbaum, who was born in Germany in 1923, is one of the most influential of the modern philosophers of science. This is the result of many years of building up a reputation in what was in the 1950s a embryonic field of endeavor. It seems that he must have been a logical positivist as he endeavored to re-interpret the theory of relativity upon the work of Hans Reichenbach.

As a Jew, he experienced persecution in his native Germany and was compelled to flee, to the U.S. Along with Carl Hempel, a logical positivist, Grünbaum built a Philosophy Department of great renown at the University of Pittsburgh. He shared with Hempel an enormous respect for Hans Reichenbach whose work was central to how logical positivists interpreted the revolution in physics. Reichenbach had been a student of Einstein, and Hempel had been a student of Reichenbach's. In 1963, Prof. Grünbaum published the work for which he is probably most well known, "*Philosophical Problems of Space and Time*."

3.0 Introduction To Grünbaum's Paper II: "Logical And Philosophical Foundations Of The Special Theory Of Relativity"

Here we will take up a discussion of Paper II first, because it reveals more about the author's purpose than Paper I, which was less controversial in its style of presentation. In the introduction of Paper II, after praising Hans Reichenbach's "books on the philosophy of the theory of relativity", Adolf Grünbaum announces that his intention is to include an appraisal of the work of E.T. Whittaker, P.W. Bridgeman, H.E. Ives, D.C. Miller, P. Moon, D.E. Spencer, and finally Herbert Dingle. This is a polite way of saying he intended to attack each of them for transgressions against the established dogma of the special theory of relativity. The list is interesting because not all of the individuals named were critics of relativity. In actual fact none were outspoken critics, as Dingle later was, but they were independent thinkers, who in exercising their freedom of scientific investigation uncovered reasons to suspect the traditional dogma of the special theory of relativity.

Whittaker was singled out for his temerity to write a history in which he failed to give to Einstein the credit for the discovery of the special theory of relativity. This is a case in which correct history was criticized because it failed to perpetuate the Einstein myth. Whittaker's crime was daring to credit Poincare and Lorentz with the true invention of the theory. As we now know, and Einstein himself stated, his theory was a modification of the ideas of Poincare and Lorentz. Einstein's only contribution being the relativity of simultaneity--which was based on an idea borrowed from Poincare. The unnecessary pettiness of Grünbaum's petulant criticism of Whittaker is underlined, when it is remembered that Whittaker's book was a history of ether theories and Einstein's theory was certainly not an ether theory.

The criticism of P. W. Bridgman is explained by the fact that his interpretation, based as it was upon his operational method, led to an unsatisfactory philosophical interpretation. In Grünbaum's view it gave "...support to the homocentric and subjectivistic.." interpretations of relativity, such as advanced by Herbert Dingle.

Herbert E. Ives became a subject of Grünbaum's ire because he dared to suggest that "...Einstein's principle of the constancy of the speed of light is a paradox..." Ives had persisted with the idea that his experiments confirmed his own ether theory, despite the

fact that the relativity establishment claimed that his experiments confirmed special relativity. This is a theme which we will see pervades the establishment dogma of relativity. Every experiment claimed to support an alternative interpretation is instead co-opted by the relativists as support for their theory. This is a major theme in Grünbaum's paper, as we will discover, he claims that all experiments support relativity, when in actual fact many do not confirm it. In fact no experiment has ever been performed that uniquely confirms relativity, without not also being consistent with an ether theory. Hence there is no actual experimental confirmation of the truth claims of relativity, and it is impossible there ever could be such an experimental confirmation of special relativity.

This explains Grünbaum's attack on D.C. Miller's fringe shift measurements. These results could not be co-opted as support for relativity, since they suggested that an absolute motion relative to the ether had been detected. Miller's measurements remain controversial today, despite the fact that it has become established relativistic dogma, as repeated by Grünbaum, that Millers' results are invalid because they result from experimental errors.

Likewise Moon and Spencer come in for criticism, because they questioned the traditional establishment dogma regarding the experimental support for relativity based upon double stars. Grünbaum singles them out for their "...challenge of the relativistic interpretation of the data furnished by double stars (DeSitter) and of the other experimental results generally adduced as evidence for the truth of relativity." How dare they? Grünbaum is outraged that some scientists actually view science as a process of verification by a continuous process of examining and reevaluation of experimental data. How dare anyone question the validity of a theory established by the pure logical method of thought experiment? Once a theory has been proven logically correct and therefore true, it is clear that all experimental facts must fall into line with that interpretation. This is the real method of the logical positivists, experiments be damned.

Herbert Dingle comes in for criticism because of his recurring assertion that Einstein's theory has rendered untenable the view that "physics is the description of the character of an independent external world." We will see that this is also his reason for criticism of P.W. Bridgeman. Altogether, however, the criticism, which one would have expected to be central to his arguments since Dingle had by this time repudiated the theory of relativity as false, is lacking in passion and effectiveness, having been buried in an obscure note.

In conclusion, Grünbaum's paper was a dogmatic defense of the traditional truth claims of the special theory of relativity, which was justified by a revisionist reinterpretation of the usual arguments and experimental judgments, familiar to any student of the theory, with the aim of rebuffing new criticism. The revisionist theory had its fundamental justification established upon the analysis of the relativity of simultaneity following the work of Hans Reichenbach. The primary justification for this seems to be that Reichenbach, being an undisputed expert in the revered tradition of the logical positivists, was the pre-eminent expert most qualified to pass judgment upon the validity of the

theory as a logical positivist. Hence the theory was fully passed as valid by the then most advanced and expert of philosophers in all of science and philosophy. This explains why the paper appears in a book whose subject matter is the philosophy of science which in those days meant logical positivism.

But it is based upon the philosophy of logical positivism, a philosophy which is now suspect in the philosophy of science, and considered quite old fashioned and naïve. When we read Grünbaum's paper we can see why. It is logical analysis that has pride of place in this philosophy, and all experimental evidence must fall into line with its conclusions or face being rejected as false. In logical positivism, or as it is also known, logical empiricism, it is always the logical part that comes first, and the empiricism follows later to justify the judgments deduced logically.

3.1 Grünbaum's Attack On Dingle

This section discusses the negative comments made by Grünbaum in note 25 of Paper I and in note 29 of Paper II. The context in which the note is placed is in the discussion which justifies the conception of length as follows: "And it is inherent in this definition of length as a ratio that the unit rod be at rest relative to AB when performing its metrical function." This is followed by the footnote symbol referring to note 29. In this discussion, Grünbaum is claiming that the length which is to be measured, denoted by AB, is in the same state of motion as the unit rod which defines unit of length. There is a fallacy involved in this since in relativity it is explicitly assumed, without any justification whatsoever, that the length of the unit rod is the same as a rod at rest. We will return to this later, and now proceed to the attack upon Dingle's viewpoint.

Grünbaum argues that a ratio is an objectively real entity because "It is perfectly clear that relations or relational properties of physical objects (which are expressed numerically as ratios) are fully as objective physically and exist just as independently of the human mind as simple properties of individual objects." Following this metaphysical statement, which is a formal embrace of the metaphysics of mathematical realism, he goes on to make the following claim: "In a futile attempt to defend a mentalist metaphysics on the basis of relativity theory, Herbert Dingle denies this fact." Apparently he means that Dingle denies that ratios are metaphysically valid mathematical objects. This is of course a perfectly valid philosophical position in the philosophy of mathematics. But this is not what Grünbaum is attacking at all. He is after a bigger target which becomes clear in a long quotation from Dingle's book The Sources Of Eddington's Philosophy which Grünbaum gives at length.

At this point it is clear that Dingle's quotation is largely irrelevant to the issue at hand and that this is simply an opportunity to get a snide comment at Dingle. What Dingle means is a function of the context of the comment. What he is saying is that in relativity, because there is no absolute rest frame, and because reality is thereby a determinate function of the observers relative velocity, which is of course indeterminate in general, that what the observer records in general is indeterminate and hence "Physics is therefore

not the investigation of the external world.”

To make this entire argument moot, it is only necessary to point out that Grünbaum takes an extreme metaphysical realist position while Dingle is taking the view that since the interpretation of the physical measurements of the world are dependent upon the relative velocity of different observers, then it is impossible to claim that they conform to a realist metaphysics. In section 4.5, this issue will be addressed in more complete detail. In it we will attempt to separate Dingle’s views from those of Eddington, which he is describing in the specific instance with which Grünbaum took issue.

3.2 Grünbaum’s Modification’s To The 1955 Paper

As stated in the introductory note of Grünbaum’s Paper II, it was a modified version of Paper I published in 1955 in *The American Journal Of Physics*. This explains the confusing organization, and the dated content of the presentation of Paper II. The basic paper was changed by inserting a new introduction giving notice of his theme giving specific criticism of the authors cited in the above section. The revised paper, discussed here, differs primarily from the original in that its introduction explicitly gives notice to the reader that the intention is to criticise the viewpoints of other scientists, while in the original, these attacks were incidental to the theme of the paper. Section 2.0 was expanded by the addition of new material. Section 3.0 remained substantially unchanged, there were some minor changes, but the attack upon Ives was unaltered. Section 4.0 was also substantially unchanged, suffering only a few minor changes. section 5.0, where the attack on Dingle, Whittaker, and Bridgeman occurs, was relatively unchanged as well.

With regard to the specifics of the criticism of the views of Herbert Dingle, all the statements remained unchanged in the revised paper with the exception that a mention is made in the introduction and the specific criticisms were contained in notes 25 and 26 instead of notes 29 and 30. The wording of the attacks is unchanged from the original version published in 1955.

3.3 The Original 1955 Version Of Grünbaum’s Paper

This section discusses Grünbaum’s Paper I of 1955, with the objective of understanding his point of view at that time. The reader who manages to read the entire paper, if not exhausted by the effort, and frustrated beyond caring because of the turgid and dull style of its presentation, may have discovered, if he could stay awake while reading it, that it is a revisionist interpretation of Einstein’s special theory of relativity. However, that discovery may not have had any significance outside the elite circle of experts, capable of understanding it. For the average reader, it is an arcane and obtuse paper, filled with tortuously difficult reasoning and completely unfamiliar claims about Einstein’s special theory of relativity. This later characteristic is explained by its revisionist interpretation, which deviates from relativistic orthodoxy.

However, Grünbaum does not deviate very far. He firmly upholds the main truth claims

of the theory, although his reasons differ in terms of the specific arguments used to justify his agreement with it. Fundamentally, Grünbaum upholds relativistic dogma as scientific truth, but he deviates with respect to the specific chains of reasoning that inevitably reach the same conclusions as the traditional established approach found in the relativity textbooks. One conclusion is clear, few textbook writers followed his revisionist lead in re-interpreting the philosophical foundations of relativity. The modern textbooks continue to teach relativity in the old fashioned manner, replete with the misconceptions, which Grünbaum decried as false and tried to eliminate in his revised version of special relativity.

3.3.1 Grünbaum's 1955 Introduction

In the introduction, Grünbaum presents the surprising thesis that the traditional textbook interpretation of relativity, which is based upon the Michelson-Morley experiment, is not the proper foundation for Einstein's special theory of relativity. He goes on to state that the experimental basis for the theory was not actually empirically established until the Kennedy-Thorndike experiment performed in 1932, and that time dilation was not empirically established until the Ives-Stillwell experiment of 1938. When reading this, one is tempted to ask: What then was the basis for the acceptance of Einstein's special theory of relativity before its empirical verification was actually accomplished in the 1930s?

It becomes clear, in light of Paper II of 1960, that the motivation for this claim is the attempt to establish an entirely new foundational basis for the truth claims of the special theory of relativity in the face of the new critical attacks, which Grünbaum labels as misconceptions, coming from the individuals named in the introduction of the revised paper discussed in section 3.0. This suggests that the criticisms of Herbert E. Ives and Herbert Dingle had hit a sensitive nerve and exposed the weakness of the theory on certain critical points.

It was Grünbaum's intention to fix these difficulties by a revisionist re-interpretation before the weaknesses became generally recognized. It is clear that Grünbaum was alone in this perception, because his revisionist modifications were not adopted by the writers of relativity textbooks and the teaching of relativity has remained relatively unaltered since the publication of Grünbaum's revisions. One reason for this is the turgid style of his writing and another is that the theory which he presents is not Einstein's but Hans Reichenbach's.

One practical result was that Grünbaum effectively nullified any criticism of the theory based upon its traditional interpretation. This had the effect of undercutting the effectiveness of the critical attacks, since the theory was no longer established on the suspect principles. The reader is urged to read Grünbaum's paper to discover the specific aspects of the traditional approach to special relativity which Grünbaum saw as leading to misconceptions, which led to critical attacks.

3.3.2 Grünbaum's Re-interpretation of The Relativity Of Simultaneity

In section 2. Grünbaum gives a re-interpretation of the Relativity Of Simultaneity in Einstein's special theory of relativity. He presents the surprising and peculiar assertion that "The relativity of simultaneity arises, in the first instance, *within a single* Galilean frame." This statement is clearly oxymoronic since by definition, the relativity of simultaneity means a comparison between reference frames, and is therefore sure to lead to cognitive dissonance, as it did for this writer. The section concludes with the following statement: "Only a philosophical obfuscation of this state of affairs can make plausible the view that the relativity of simultaneity (or, for that matter, any of the other philosophical innovations of the relativity theory) lends support to the homocentric operationism or of phenomenalist positivism".

Here we see the main thrust of his argument, although it is obscured by the verbal bombast. It is that the operationism approach of P.W. Bridgman in the hands of Herbert Dingle leads to uncomfortable philosophical conclusions, so a new philosophical foundation of relativity is in order, and that is provided in Hans Reichenbach's version of relativity as interpreted in Grünbaum's section 2.

3.3.3 Grünbaum's Re-interpretation of The Principle Of The Constancy Of The Speed Of Light ("Light Principle")

In section 3. Grünbaum gives his re-interpretation of Einstein's "Light Principle". Here there is a change in the interpretation of the famous Michelson-Morley experiment of 1887, and a consequent revision of Einstein's principle of the constancy of light speed. As a consequence, the arguments presented are difficult to understand, given that the reader is conditioned to think in terms of the traditional interpretation of special relativity.

Grünbaum's first claim is that the Michelson-Morley experiment only demonstrates the following: "...within an inertial system, light rays...emitted ...in different directions...will return together to their common point of emission." In other words, the motion through the ether, if it exists, has no effect upon the light travel path, irrespective of the direction of the path with respect to the direction of motion through the ether. He then goes on to make the claim that the constancy of light speed principle entails three theses, or lesser principles. Viewing it as mathematicians might express it, we can view these lesser principles as lemmas or corollaries relate to a theorem. They can entail the main principle inductively or follow from it as consequences deductively.

The three lesser principles are:

- The clock axiom- The round trip travel times of the light rays perform the same function as a clock, by measuring the round trip light time.
- Light velocity Limit- This is the familiar claim that light velocity c is a maximum limit for any physical process. Grünbaum calls it the "maximal character of the velocity of light."
- Light velocity independence- This is the claim, taken from the ether theory and

Maxwellian electromagnetic theory, that the light velocity is independent of its source velocity, and implies that there is a light medium, which establishes the value of the velocity of light. However, as a good relativist, Grünbaum neglects to mention the last implication.

At this point, the weakness of Grünbaum's thesis becomes apparent, because he fails to explain exactly how these lesser principles, are entailed by the light velocity principle. Although he gives a reasonable attempt at it, this writer did not find it convincing, because its reasoning was obscure and difficult to follow.

The key argument however is contained in the first lesser principle called the "clock axiom". Grünbaum asserts that this important lesser principle was not tested by the Michelson-Morley experiment, but that it was successfully tested by the Kennedy-Thorndike experiment. Hence, it is the latter experiment which provides the proper experimental foundation for the light speed principle of the special theory of relativity. The implications derived from this claim are significant. In the first place, it asserts that the Kennedy-Thorndike experiment was able to demonstrate that the "light clocks" gave the same round trip travel times in different inertial frames, which the Michelson-Morley experiment was unable to do. This is a very important claim, and it is important to understand that it implies that clocks in different inertial frames run at the same rate, since there were no significant fringe shifts detected over a period of a year. This implied that as the earth traveled around the sun, its inertial reference frame would have different inertial velocities, and therefore the inertial frames would be different at different times of the year. But no changes in the light clocks were observed. This is one of the justifications for Grünbaum's claims advanced in the paper.

The section ends with an attack on Herbert Ives. Grünbaum says: "The importance of complete clarity on the logical status of the light principle is apparent from the fact the misunderstandings of it still issue in misconceived and irrelevant attacks upon it. A very recent case in point is a paper by the noted experimental physicist H. E. Ives, who rests his proposed revisions of the Lorentz transformations on the following argumentation, whose unsoundness is evident from the analysis given above...". This is followed by a very long quotation from Ives paper which terminates the discussion without any further explanation. However, this writer would have preferred to have a detailed discussion of exactly wherein Ives arguments were mistaken, in view of the fact that Grünbaum's arguments were not at all understandable.

In conclusion the reader should notice that this section appears mainly to be justified as an argument for undercutting the viewpoint advanced by Herbert Ives. But, it also implies an embarrassing conclusion. The experimental verification of the light clock axiom that demonstrates that there is no difference in inertial clock times for different inertial frames, undercuts the claim of Einstein's theory that clocks in relative motion run slow. The Kennedy-Thorndike experiment disproves this. But Grünbaum fails to take notice of this experimental contradiction to the most well known of all the truth claims of the special theory of relativity.

3.3.4 The Experimental Confirmation Of The Kinematics Of The Special theory Of Relativity

Section 4 of Grünbaum's paper addresses the issue raised at the end of the previous section. It demonstrates the peculiar method of reasoning whereby relativists always manage to find support for the kinematics of the theory of relativity, even though logic demands the opposite conclusion. Here the specific problem is to explain how it is possible to obtain the time dilation truth claim from the experimental fact of the Kennedy-Thorndike experiment which indicates that the light clocks in different inertial frames run at the same rate.

Grünbaum begins by emphasizing this conclusion. He discusses why the results of the Kennedy-Thorndike experiment leads to this conclusion and why the Michelson-Morley experiment does not. There are two parts to this conclusion based upon the results of the Kennedy-Thorndike experiment which distinguish it from the Michelson-Morley experiment. First, that there is no Lorentz contraction effect, and second that the 'clock axiom' is verified. He says of the result that in: "...the de facto null outcome of the Kennedy-Thorndike experiment, there is good reason to attribute the absence of variation in the time-difference between the two partial beams to a constancy, as between the different inertial systems, in the time required by each of the partial beams to traverse its own closed path. And thus we are entitled to say that the Kennedy-Thorndike experiment has provided empirical sanction for the clock axiom." Notice that the claimed result asserts that there is no Lorentz contraction or any time difference between inertial frames indicated by the null results. This seems to contradict the two truth claims of relativity which assert that space contracts and time dilates. However, Grünbaum has a clever way to avoid any problems arising from that line of reasoning.

He proceeds to discuss how the Lorentz transformation equations are derived, and how the empirical results of the Kennedy-Thorndike experiment allow all but three of the sixteen coefficients to be obtained from it. Then the Ives-Stillwell experiment is bought in to justify the determination of these last three coefficients. Hence the claim that this experiment is the empirical warrant for the time dilation effect because "the laboratory work of Ives and Stillwell (1938) furnished the lacking data by observations on high speed canal rays. And it was their confirmation of the transverse Doppler effect that constituted the first experimental proof of the clock retardation affirmed by the Lorentz transformations. Additional confirmation has been provided by data on the rate of disintegration of mesons." We now see the reason for the attack upon Ives given in the previous section. It was to negate his claim that the results of the Ives-Stillwell experiment supported the ether theory advanced by Ives, thereby permitting the experimental results to be co-opted by the claim that they provided the experimental warrant for claim that the special theory of relativity was valid. This bit of dishonesty does not reflect well upon the claim of relativity.

There is here another very fine and difficult point, which Grünbaum fails to place in front of his readers. That is that his claims of experimental warrant for the empirical validation

does not comport with the facts. This is because the disintegration of mesons is inconsistent with the clock axiom. If the clock axiom as demonstrated by the Kennedy-Thorndike experiment is valid, then the clocks, as represented by rest and moving mesons, being in different inertial frames, should not run at different rates. Hence there is a contradiction in the claimed experimental evidence, which Grünbaum conveniently ignores or perhaps merely sidesteps by failing to give a complete explanation of this apparent contradiction. It is obvious that there is a problem. But it can be avoided, as we will see in the next section.

Before we leave this section, it should be noted that this section includes an incidental attack upon D.C. Miller's interferometer results which is included in a note.

3.3.5 The Philosophical Issue Between Lorentz And Einstein

In the final section, 5, Grünbaum reveals how he reconciles the contradictions raised in previous sections. It passes out of the realm of experimental physics into the arcane realm of philosophy of space and time. As a result it exceeds the other sections in obtuseness and obscurity of meaning. It also contains an attack upon Herbert Dingle, which is hidden in an obscure note. There are also attacks upon E. T. Whittaker, and P. W. Bridgman. As expected from the title, and the usual orientation of ardent relativists, it attacks the theory of Lorentz, while justifying the peculiar and illogical claims made by Einstein. Since much of the argument is based upon philosophy, in order to justify why Einstein has the most valid claim to being correct, it employs reasoning unfamiliar to a physical scientist. In essence, we are expected to believe and accept the claim, that it is because of Einstein's philosophical innovation in the conceptualization of space-time that he was able to make a great and revolutionary breakthrough in physical theory. All of this being consistent with the hero worship connected with the advancement of the philosophy of logical positivism. Which, as it turns out, was the dominate scientific philosophy of the 1950s era.

The reader who has managed to read as far as section 5, without giving up the effort of puzzling through the obscurities and difficult reasoning, will discover that this section should have been read first, because it reveals the main purpose of the paper as a philosophical justification of Einstein's special theory of relativity. It does this by attacking the traditional interpretation of the special theory of relativity, and replacing it with a different one. The first item on the agenda is the claim that Lorentz's theory is *ad hoc* because "It is a widespread error to suppose that Einstein nonetheless furnished an explanation for the Fitzgerald-Lorentz contraction by exhibiting the contraction of a moving rod to be a consequence of the relativity of simultaneity as between different frames on the basis of the Lorentz transformations."

He explains this deviation from orthodoxy as follows: "Unlike the Lorentz-Fitzgerald contraction, this "Einstein contraction" is a *symmetrical* relation between the measurements made in any two inertial frames and is a consequence of the intersystem relativity of simultaneity, because it relates lengths determined from *different* inertial

perspectives of measurement, instead of contrasting conflicting claims concerning the results obtained under the *same* conditions of measurement . What Einstein did explain, therefore, is this “metrogenic” contraction a phenomenon which poses no greater logical difficulties than the differences in the angular sizes of bodies that are observed from different distances.”

This is followed by an attack upon E. T. Whittaker, who he accuses of having been guilty of exactly this confusion. This accusation is however entirely unfair. Why not cite a typical relativity or general physics textbook? This error was abundant in them, because it was, and still is, the established dogma of physics. A perfectly good example is Essential Relativity by Rindler which was published long after Grünbaum’s paper, and has no excuse for making such a blatant error. The same error is also present in Paul Epstein’s attack upon Dingle. In the ensuing controversy, Epstein accuses Dingle of claiming that the Lorentz contraction effect is not real.

The second item on the agenda is to give an equivalent interpretation of time dilation such that it is consistent with the “metrogenic” interpretation of length contraction. However, this was not an easy task, and Grünbaum did not accomplish it. Grünbaum proceeds to compare Lorentz’s supposed reasoning with Einstein’s supposed reasoning. This part being rather hypothetical, because it was not based upon actual historical evidence. Thus it is an *ex post facto* inference, concerning what should have been the reasoning used, in order for Einstein to be right and Lorentz wrong. But before Grünbaum can accomplish this task, his paper loses its focus and degenerates into a polemical argument disguised as philosophy.

A side attack is directed at Herbert Dingle attached as a note. It occurs within a discussion of the problem of a unit rod, or put in more modern terms, the definition of the standard unit of length measure. This problem is never resolved, but it is Grünbaum’s thesis that Lorentz’s argument about the cause of the physical contraction is false. His reasoning at this point degenerates into a discussion of Aristotelian physics, relativistic cosmology (in which a second attack upon Dingle occurs), and an obscure criticism of religion. He then gives his main conclusion as follows: “The basis for Einstein’s philosophical objection to...Lorentz’ reasoning...is now at hand: it was an error on Lorentz’ part to persist, in the face of mounting contrary evidence, in regarding classically expected behavior as the natural behavior. It was this persistence which forced him to *explain* the observed deviations from the classical laws by postulating the operation of a physically non-designatable ether as a perturbation cause. Having used the relational theory of length to reject the conclusion of the first step in Lorentz’ reasoning, Einstein was able to see that the unexpected results of the Michelson-Morley experiment do not require any perturbation causes at all, because they are integral to the “natural” behavior of things.”

This *ex post facto* interpretation, having ignored the historical facts, is basically absurd, but it suits the requirement to re-interpret history to justify the validity of Einstein’s theory as required. As a good logical positivist, he interprets the historical record so that

the required empirical warrant for Einstein's theory is produced as required, even if he has to contradict the historical facts. This is the theme of his paper. The facts are re-interpreted to provide support for the scientific claims to be advanced, which to no ones surprise, inevitably justifies Einstein's philosophical viewpoint. Along the way, any discomfoting evidence must be explained away, or labeled as based on a misconception or simply declared as false. This explains why the main purpose is to attack viewpoints which do not adhere to, or contradict, the new dogma. Grünbaum's purpose was simply to supplant the old dogma with a new one.

3.4 Final Comments On Grünbaum's Paper

For this writer, reading Grünbaum's paper was like eating glass. Each paragraph of every page was a pain to plod through. Yet what kept me going was the expectation that at some point, the effort would pay off in some kind of revelation of the hidden meaning concealed behind Einstein's special theory of relativity. Unfortunately there is no meat in the sandwich, because one arrives at the end of his paper, no better able to understand the explanation than before the start of the effort. In the end, all that one obtains from reading it is a pseudo-explanation, that doesn't begin to explain anything at all about the logical foundations of the theory of relativity.

The advertised title, which leads one to believe that the foundations of relativity will be explained, is never fulfilled. The foundations are never really made clear, and the degeneration into polemic, merely caps what is an entirely disappointing paper. If this was an example of logical positivism at its best, it was certainly a bad example of that philosophy, unless the paper actually represents all that there actually is to it, in which case, as a philosophy it amounts to nearly nothing. It is all just a pseudo-philosophy. Not worthy of being taken seriously as a philosophy of science.

4.0 The Renewed Attack Upon Herbert Dingle

The purpose of this section is to address Grünbaum's resumption of the controversy initiated by Paul Epstein in the early 1940s, by an attack upon Dingle's then newly published book, The Special theory Of Relativity. This was itself a continuation of an attack made by J. W. Campbell upon a paper written by Dingle which disputed the thesis that the Kennedy-Thorndike experiment had experimentally established the relativity of time. Dingle's primary thesis was that the establishment of the relativity of time was effectively impossible absent a rigorous definition of time and that the current definition did not quality as sufficiently rigorous. He exhibited an analysis of several different types of clock, and showed that it was possible to define a clock that conformed to the established definition of time when at rest, but when placed in motion failed to exhibit the required time dilation effect. The resulting denial of this claim by J. W. Campbell was the proximate cause of the ensuing acrimonious controversy. As the controversy developed, Dingle's objection to the claim that the Kennedy-Thorndike experiment established the relativity of time was forgotten.

4.1 Dingle's Conundrum

This section discusses a problem posed by Dingle, which is essential to the understanding of his position in contrast to the official position taken by his opponents. It does not explicitly involve a difference of philosophy, but addresses the problem of scientific method. Dingle states the problem this way while in the process of explaining his viewpoint regarding the reality of the Lorentz contraction: "...it is certainly not real in the operational sense of the word. To find if a rod has contracted we must compare its length now with its length before the contraction was supposed to have happened, and this is of course an operational impossibility." This is essentially Dingle's conundrum. He gives a different version of it in his book The sources Of Eddington's Philosophy, which is the subject of Grünbaum's attack as discussed previously in paragraph 3.1.

It is clear that Dingle's viewpoint was completely incomprehensible to Epstein, he responded by stating "I found myself confronted by the following cryptic statement" and here he gives the above mentioned quotation. Epstein thinks Dingle is disputing the reality of the Lorentz contraction, by insisting that it is unreal. He attributes the difficulty to "Professor Dingle's psychology", and then proceeds to give a long exposition on the relativistic version of the proof that the ether doesn't exist, and by implication accuses Dingle of harboring old hoary ideas long dispelled by Einstein's theory.

It is clear that neither Epstein, Infield, or Grünbaum clearly understood the significance of Dingle's statements, as he never made them an explicit foundation for his arguments. His purpose was to defend his book The Special Theory Of Relativity, when it was attacked by Epstein, for not being based upon the operational point of view. The debate became embroiled in a number of contentious issues, which while relating to the central issue, did not recognize its significance. The debate degenerated into a discussion regarding the legitimacy of clocks and the reality of the Lorentz contraction. Along the way the central difference of viewpoint was never realized. Dingle's opponents consistently attributed to him opinions and views which he never held, and he repeatedly denied the false allegations. Hence little progress was ever made. In the end Leopold Infield declared victory for the traditional viewpoint expressed by himself and Epstein, and ended by referring to Dingle's viewpoint as a philosophy of idealism and contrasted this with his own, much more preferable philosophy, of realism in physics.

Dingle's conundrum is as follows. If we insist upon an operational method of physics, then the special theory of relativity becomes solipsistic, and incomprehensible, if not just plain meaningless, because by the operational method its fundamental truth claims are unverifiable. Hence the theory must be false by the criterion of an operational physics. To resolve this problem, Dingle developed his interpretation without using the operational method as its foundation. It is very important to understand the following. Dingle had seen that the traditional approach to teaching the theory had serious flaws. Having discovered them, he did not reject the theory, but attempted instead to "save the appearance" of the theory by a re-interpretation. This attempt ran up against the relativity establishment which was not understanding and sought to suppress Dingle's unauthorized

version of the theory of relativity.

Before we proceed to the next topic, I want to stress the essential point that Dingle's revisions to the traditional truth claims of relativity were not intended to refute or prove relativity to be false, but were intended to resolve the difficulty that under the aegis of the operational method, as advocated by the philosophy of logical positivism, the theory of relativity was rendered meaningless in the technical sense of logical positivism. This was surely not a conclusion which would be perceived as congenial by the logical positivists who revered Einstein and his theory. So they rejected this conclusion with the most vociferous criticism. In the next section we will see an example of the problem as exposed by Dingle with regard to the rate of moving clocks.

4.2 Dingle's Refutation Of The Relativistic Truth Claim Regarding The Rate Of Moving Clocks

In the 1930s, Dingle discovered what in hindsight can be understood as a refutation of the relativistic truth claim that: All clocks in relative motion run slow according to the Lorentz time dilation formula. Dingle discovered as a result of a theoretical analysis, based on the accepted transformation rules of relativity, that a certain type of hourglass clock failed to conform to the above stated claim. When his conclusion was published it was subjected to a vicious attack which claimed his analysis was false and that his "contraption", as it was referred to by Dingle's critics, was not really a clock.

The writer of this claim, J. W. Campbell failed to recognize that Dingle never asserted that relativity was false, but that instead Dingle had said that this particular truth claim was inconsistent with the physical process used in the implementation of the particular type of clock considered by Dingle in his analysis. Dingle to "save the appearance" of the theory, or in other words to fix the contradiction, had advanced the idea that it was the time scale of physics that was changed by the relative motion of coordinate systems and not the rate of a particular type of clock. This suggestion was rejected on the basis that the credibility of the theory of relativity was being questioned, and that the theory required that all clocks be subject to the truth claim that all moving clocks run slow, and that since in this case Dingle's clock example did not conform to the rule, then Dingle's example was not really a legitimate clock. The argument remained unresolved when Epstein revived it by repeating the claim in his attack upon Dingle's recently published book The Special Theory Of Relativity which briefly discussed the clock problem.

It is clear that Dingle failed to understand that he had presented a refutation of the theory of relativity and that this was the way it was perceived by his critics. In fact the example cited by Dingle clearly exposed a contradiction which had no suitable resolution within the theory as Dingle proposed. However, it is doubtful that relativists actually saw the problem, but interpreted it as an attack upon relativity by demonstrating the falsity of one of its central truth claims.

To see how Dingle's analysis disproved relativity consider the following. The truth claim

is applicable for all clocks, since it asserts that all clocks in motion run slow. In fact it asserts that all physical processes are subject to the time dilation law. The analytical fact that a physical process fails to conform to the law is certainly a refutation of relativity. This explains the attempt to dispute Dingle's claim. But why assert that Dingle's clocks were illegitimate clocks? Why not assert that his calculations were wrong? This must have been tried by the critics, and the result is that they failed to make the claim that Dingle's analysis was false, faulty, or simply mistaken, because they could not find a mistake in his analysis.

We must conclude that he correctly used the transformation formulas as derived from the theory. It is clear however, that these formulas do not conform to the relativistic truth claim, hence either the theory is wrong, because it produces false transformation formulas, or the truth claim is false. In either case, the theory of relativity is falsified or disproved. In other words, there is something in the theory that is false and leads to a conclusion which contradicts other conclusions of the theory. Hence, it must be internally inconsistent. When one understands that this is certainly a true conclusion, then it can be appreciated why Dingle's conclusions in this case were fiercely attacked.

The reader should realize that this dispute was not really the central issue, but was a different problem that became embroiled in the arguments. However, it did reinforce Dingle's view that the operational method could not be upheld with respect to the theory of relativity. In Dingle's view of it, the solution was to apply a correction factor to the resulting dial readings of the clock. Now the truth claim of the theory could be upheld.

However, it would not be possible to claim that in all cases the operational method was applicable. In fact Dingle believed that this method was a mistake, because it asserted a verification principle that could not be used to establish a universal law of physics. This was simply because by the fallacy of induction, one can not establish a universal law based upon a verification principle which is limited to a specific and finite number of physical implementations of the principle, which is what the operational method requires. Hence the dispute was really about different viewpoints regarding the efficacy of the operational method, but this became so obscured that at the end Infield was prompted to falsely assert that Dingle held an idealist philosophy of physics, simply because he argued that the operational method was defective and was able to give examples which backed up this claim.

To conclude this discussion. It is a curious irony that Dingle, who eventually decided that relativity was self contradictory, did not reach this conclusion on the basis of his analysis of the issues discussed here, but upon an entirely different basis. He failed to realize that his analysis demonstrated that relativity was false and hence failed to fully appreciate the bitter controversy which he had precipitated.

4.3 Epstein Accuses Dingle Of Mentalistic Physics

The main point which Grünbaum brings to bear against Dingle is his repetition of the

claim made by Epstein that Dingle's interpretation of relativity is "mentalistic". Before we bring up this point, let's go back to Paul Epstein's original attack on Dingle's book The Special Theory Of Relativity, that was the cause of the controversy. Epstein takes Dingle to task because he, "neglects to bring out the operational tendencies of relativity but flatly denies them by implication." Now the reader may be puzzled by the fact that it is exactly this operational tendency of relativity, as expressed by P. W. Bridgman, which Grünbaum asserts in his paper must be false.

It is Dingle's fundamental claim, that this operationalism is a physical impossibility, because the required operations of measurement can not ever be preformed, hence they are purely abstract mental constructions. Dingle's approach is to make this an explicit part of the presentation, rather than pretend that the logic of the thought experiments is actually physically possible as an implementation of measurement. Furthermore, its fundamental assumption, that a standard unit of length measurement, or a physical scale of length, remains unchanged when it is imagined to be traveling at relativistic velocities is an impossibility to actually prove. This, as it turns out, is the fundamental point at issue in the debate. Dingle's position is that the standard of length measure is arbitrary, or more specifically fixed by a free choice of the thinker, while Epstein and Grünbaum, following Einstein's method, assert that the standard of length measure is preserved by the transfer from a rest frame into a moving frame. As it turns out, this claim, which is fundamentally an unjustified assumption, is at the heart of the problem of the theory of relativity.

Returning to the theme of this section, Epstein accuses Dingle of "confusing the reader" by "his repeated insistence that the relativistic contraction of solid bodies is *not real*" but, according to Epstein's interpretation of Dingle, it is due only to "the mental attitude of the observer". After a long digression which recounts the metaphysics of special relativity, Epstein concludes by saying: "At any event, the physicist possesses a complete dynamical explanation of the mechanism of the Lorentz contraction, which is thus *real* in the ordinary sense of the word." This is an astonishing conclusion, since Einstein never said anything like this, but left the issue confused and ambiguous. Now Epstein is saying that the Lorentz contraction effect in relativity is a real, physically meaningful, concept. However, the reader of Grünbaum's paper, is told that this real Lorentz contraction of space is empirically refuted by the Kennedy-Thorndike experiment. Now that is confusion for the reader! It would seem that Dingle is vindicated by the Kennedy-Thorndike result that there is no physical Lorentz contraction effect at all, hence it must be mental.

To conclude this section, we see that Grünbaum's attack upon Dingle is entirely without foundation because his claims support Dingle's position against Epstein, and not the reverse as implied by Grünbaum. In the next section we will explore the fundamental disagreement which Grünbaum has with Dingle's approach.

4.4 The Fundamental Basis Of Grünbaum's Attack

The reason for Grünbaum's attack upon Dingle is his desire to justify the argument,

which turns out to be a fundamentally unjustified assumption, that it is possible to define a universal standard of measure for all inertial reference frames, including those having “relativistic” relative velocities. This is the basis for the Einstein approach to the interpretation of the Lorentz transformation equations for spatial coordinates.

The assumption is simply that the same, or more precisely a universally reproducible, absolutely identical, coordinate system having the same standards of measure of space and time exists, which has a “relativistic” relative velocity with respect to a stationary coordinate system. Hence there is the assumption that all coordinate systems are universally identical in an absolute scale of measurement. After this assumption is made, the Lorentz transformation equations are solved and it is claimed that rigid “objects--viewed from the stationary system--shriveled up into plane figures”. In other words they exhibit a contraction in their appearance. This of course depends upon the rather crucial fact that the comparison used to justify this claim assumes that there is no change in the standards of measure of the coordinate system which is in motion. As we noted above, Dingle asserts that a verification of this is an operational impossibility. Grünbaum, of course asserts that this is false, because it is the basis for the conclusions of Einstein’s theory. Hence he is compelled to attack Dingle’s viewpoint, and cite authorities who refute Dingle’s position.

Before we leave this issue, let’s recap the discussion. Dingle claimed that it was an impossibility to demonstrate that universal absolute standards of measure applied to all inertial reference frames, while the relativists, such as Grünbaum, claimed that there was an absolute standard of measure for all inertial frames and used this assumption to “prove” the reality of the Lorentz contraction and time dilation effects of relativity. Since Dingle’s viewpoint repudiated a claim fundamental to this unjustified assertion, his book and his opinions were subjected to severe criticism for not adhering to the accepted relativistic interpretation.

4.5 The Sources Of Eddington’s Philosophy

Before ending the topic of Grünbaum’s attack on Dingle, we need to discuss the role played by Dingle’s book, The Sources Of Eddington’s Philosophy, which was published in 1954. It contains the text of Dingle’s Arthur Stanley Eddington Memorial Lecture given November 2, 1954. It was well known at the time of the lecture, that Dingle was a critic of Eddington’s philosophy of science. Many thought that this was the result of a personal animosity, but Dingle denies this in a letter to Nature where he says: “In no sense was there ever any “instinctive antagonism” between Eddington and me. With his outlook I had such fundamental sympathy as to have considerable confidence in my perception of what had perverted it. I could not feel that confidence concerning a view to which I was instinctively antagonistic.” Needless to say, Dingle had expressed on many occasions his fundamental disagreement with Eddington’s views.

Grünbaum’s ire is directed at a specific passage where Dingle is describing how the theory of relativity led to Eddington’s philosophical worldview. According to

Grünbaum's interpretation Dingle says: "The view that physics is the description of the character of an independent external world was simply no longer tenable...Every relativist will admit that if two rods, A and B, of equal length when relatively at rest, are in relative motion along their common direction, then A is longer than B, or equal to it, exactly as you please. It is therefore [sic!] not the investigation of the nature of the external world." Notice where Grünbaum has inserted the mistake symbol with an exclamation mark. Grünbaum proceeds to comment on this as follows: "Far from having demonstrated that relativity physics is subjective, Professor Dingle has merely succeeded in exhibiting his unawareness of the fact that properties of relations do not cease to be *bona fide* objective properties just because they belong to *relations* between individuals rather than directly to individuals themselves. Only such unawareness can lead to his primitive thesis that the relations of physical entities to one another cannot constitute "the character of an independent external world."

This then is Grünbaum's attack upon Dingle. It is partly philosophical and partly physical. The physical part was discussed in the previous sections. It is based upon the idea that the comparison of the "unit rod" with an unknown length has a definitive measure result. The fallacy, as discussed above, is that this comparison with the "unit rod" assumes that the physical nature of the unit rod is unchanged when it is transferred from a stationary frame to the moving frame. This despite the fact that relativity asserts that rigid objects subject to this comparison are measured to be contracted. Therefore, it is impossible to determine if the unit rod has changed its length, or the object measured has changed its length. This is Dingle's conundrum. Dingle's solution, which is not as clear as it can be expressed today, was that it is the unit rod that changes and that this can be arbitrarily defined in any way we please, since we are at liberty to select any relative velocity we desire as the rest frame.

To make this clear, this writer's approach will be described briefly. Simply put, there is no unit rod at all, but a standard of measure that is defined in the stationary frame. The standard or unit rod in a relatively moving frame is then defined by the Lorentz transformation of the basis of measurement. This makes the unit rod longer in the moving frame than in the stationary frame. Hence, when the standard or unit of measure is used in the moving frame, the measured length is contracted, relative to the length obtained in the stationary frame. But this is not because the length of the measured object changed, it is because the scale of measurement changed.

We now discuss the philosophical part. Dingle is discussing the origin of Eddington's view, so that Grünbaum is being critical of Dingle's interpretation of Eddington. Now it is possible that Dingle's discussion of Eddington's view may be faulty, but this does not seem to justify saying that Dingle's view is false, for it is not Dingle's view that is being discussed, but Eddington's. However, it is also possible that Dingle's description of that view may be faulty. It is clear from other sources that Dingle's interpretation of Eddington's philosophy is generally correct. Hence the attack is rather pointless, unless it can be shown that it is really Dingle's view which is expressed. In fact, it is not, and that is about all that needs to be said on this point. The attack misses because it is directed

towards the wrong target. The conclusion which Dingle gives, and towards which Grünbaum directs his attack, is not his own viewpoint, but what Dingle believes is Eddington's viewpoint.

5.0 Summary and Conclusions

5.1 Summary

Grünbaum's attempted re-interpretation of the foundations of Einstein's special relativity had the following objectives:

1. Establish the Kennedy-Thorndike experiment as the empirical warrant for the special theory of relativity in place of the Michelson-Morley experiment.
2. Establish the logical foundation upon a rigorous presentation of the relativity of simultaneity, using Reichenbach's method, justified empirically by the Kennedy-Thorndike experiment.

Grünbaum's argument for the replacement of the Michelson-Morley experiment was that it "could hardly be regarded as empirical proof for the "clock axiom" contained in the light principle". But the fact of the matter was that the Kennedy-Thorndike failed to do this as well. As noted before. The experiment failed to confirm either the time dilation or the Lorentz contraction truth claims of special relativity. In no case was a fringe shift observed. Hence there was no evidence of a real time dilation or length contraction effect.

For a traditionalist Grünbaum's re-interpretation of Einstein's special theory of relativity was bound to cause some discomfort. The claim that the true experimental foundation is to be found in the Kennedy-Thorndike experiment of 1932 and the Ives-Stillwell experiment of 1938 raises the question of why the theory was accepted prior to these results. It means that the theory was originally founded on false principles and false experiments. This being unpalatable, it was better to not change the traditional interpretation. This was what happened.

From Dingle's point of view, the revisions completely destroyed his philosophical interpretation, hence, he was forced to deny the Kennedy-Thorndike experiment was the true foundation of relativity. His position was certainly more vulnerable than the traditionalists, who could take refuge in the fact that the traditional interpretation remained secure in its dogmatic version. But, and this is the ironic point, by shifting to a idealistic "mentalistic" interpretation, Dingle's system could be saved. But this was not Dingle's viewpoint. In fact the results of the experiments appeared to support the idea that all of the claimed relativistic effects were merely an artifact of the definition of an inertial coordinate system, and had no objective reality at all.

It is clear that traditional relativists were not enthusiastic about Grünbaum's re-interpretations for the basic reason that they undercut the traditional mythology. The Michelson-Morley experiment traditionally being the justification for the claim that there is no ether. This was combined with the argument that Lorentz's theory was ad hoc. Hence Einstein's theory was presented as a superior theory. But Grünbaum disputed this

analysis and claimed Lorentz's theory was not ad hoc. So we see that Grünbaum, a relativist, was working to undermine the establishment propaganda, and this explains why the mythology, which Grünbaum sought to replace with Reichenbach's approach to relativity, remains in the relativity textbooks.

This brings us to the reasons for the attacks upon Dingle and others. This is easily explained by the fact that they are not adhering to the relativity propaganda. But, neither is Grünbaum. This suggests that there might be a larger philosophical difference. Perhaps it is that Dingle rejects logical positivism and Grünbaum embraces it.

6.2 Conclusions

The reader who is looking for a determination of who is right and who is wrong will be disappointed to discover that such a determination within the context of the special theory of relativity is not very easy. This is because it is difficult to ascertain any definitive truth which can be used as a yardstick for comparison with the arguments of the participants. Grünbaum has made the task much more difficult by suggesting that the old relativity myths should be discarded and replaced by new mythologies. But how are we to understand the new propaganda that relativity is the truth? Because the experiments of Kennedy-Thorndike and Ives-Stillwell fully confirm it empirically? Because the old propaganda was incomprehensible and the new revisionism is comprehensible? Can this be believed, given the fact that it is not any more comprehensible than the old propaganda was?

We continue to be faced by truth claims that assert that time dilation and length contraction are "real", despite the fact that these effects are not confirmed by the Kennedy-Thorndike experiment, and that time dilation is "seemingly" confirmed by the Ives-Stillwell experiment. (These results contradict each other.) The pro-relativity experts can not agree on the specific substance of the relativistic truth claims, and the experimental evidence that justifies them, so why should we expect that critics would be in agreement with them on these same points? No, we would expect to encounter disagreement. What is curious about Grünbaum's papers, is that he attacks critics. He does this despite that fact that his revised relativity is obviously contradictory. Grünbaum himself can't seem to present a logically consistent argument. But that is not unusual when dealing in the theory of relativity.

The reader should understand that Grünbaum's viewpoint is the world according to relativity and logical positivism. It is a world of contradiction, that attempts to justify the inconsistencies. It is a world in which absurd ideas are advanced as true. Where contradictory experimental evidence is twisted into confirming conclusions. Where all truth claims in the name of relativity are held to be true, despite the very evident fact that not one of its proponents knows what it is really about. The critics clearly have the upper hand. They at least are sure that the prevailing established opinion is wrong. Relativists on the other hand are absolutely convinced that the theory of relativity is true, they just have to agree on what the theory claims is true, and stop confusing each other with

misleading truth claims that they can't agree upon.