Must Minkowski Spacetime Be Categorized as Pseudoscience?

Revisiting the validity of the Mansouri-Sexl test theory.

Abstract

Here we discuss and hope to solve a problem rooted in the necessity of the study of historical science, the slow deviation of physics education over the past century, and how the loss of crucial contextual tool has debilitated discussion of a very important yet specialized physics sub-topic: the isotropy of the one-way speed of light. Most notably, the information that appears to be most commonly missing is not simply the knowledge of the historical fact that Poincare and Lorentz presented a mathematically equivalent representation of relativity theory contemporary with Einstein's publication, but the most deleterious outcome is a lack of understanding of how that theory worked within a mechanical wave system to give the same results in all known experiments via an instrumentation-based illusion.

Unfortunately those well educated in relativity theory, often haven't been granted the advantage of contrast this history of development of the theory gives and thus some of the most direct and critical implications of modern theory are often lost on even graduate students. Chief among the implications that should be trivial to a student of relativity is the incompatibility of a mechanical wave concept of light with the modern assumptions of relativity. However, one should also be able to expect a graduate student to also easily comprehend the mathematical necessity of conjoining space with time is only descended from the presumption of isotropic constancy specifically, and further that the mechanics are one and the same as the relativity of simultaneity. However, many published papers appear to lack this understanding.

The result is that the modern consensus appears to have arrived at the conclusion that the one-way speed of light is intrinsically untestable and therefore the physics community has accidentally pushed Minkowski spacetime, and most directly, the relativity of simultaneity, into the domain of pseudoscience, leaving only the historical relativistic "ether" described by Mansouri-Sexl test theory (AKA Lorentz Ether Theory) as the only workable alternative. This situation must be re-examined at the lowest possible level to arrive at an appropriate experimental regime.

Introduction:

Many varied crises in modern physics have led to an excitement in the community that new discoveries may be on the horizon, however, the undeniable fact of the success of modern programs in physics have led to the strange dichotomy of a call for revolution with the appearance of no room for it to occur. Thus the only room for true revolution is not one purely based in numerical outcomes, but in the assignment of how we divide and arrange all the numerical outcomes into categories so that they can be exposed to experiment and falsification. It can only be in the reasoning for how to apply the mathematical models that the testing regime can radically change. A modern revolution, within the constraint of undeniable mathematical rigor and unquestionable numerical experimental outcome, can only meaningfully occur in re-interpretation that can change the future of our modeling and experimental expectation.

The prevailing consensus opinion since the latter part of the 20th century appears to have circled around the idea that the one-way speed of light cannot be measured. Unfortunately, however, this opinion puts us in the uncomfortable position of admitting that Minkowski spacetime is not only non-empirical but fundamentally untestable.

The Mansouri-Sexl test theory "ether" was only a more recent re-statement of the well known aspects of "Lorentz Ether Theory" or perhaps better called Lorentz-Poincare

relativistic aether. Namely that said theory is well known to be mathematically indistinguishable from special relativity. Specifically, the difference is one of interpretation, not basic mathematical outcome. The Minkowski convention, on the other hand, very specifically represents an inherent presumption of the one-way isotropic constancy of light's speed which will be highlighted herein.

The basic ideas and mathematics of kinematical relativity only seem to spring into existence ex nihilo to those wholly ignorant of 19th century physics, yet such ignorance can, unfortunately, also lead to directly equating Minkowski spacetime with relativistic effects it quantifies as though they are inseparable. Mansouri and Sexl, however, successfully identify the critical division point between prior aether theory and spacetime, very directly, while explaining the reason for the division and the importance of it, somewhat poorly. This dividing point is found in the relativity of simultaneity and it requires the conjoining of space with time into the well-known spacetime of today.

Minkowski's convention, with the inherent presumption of one-way light speed isotropy, represents a fundamental deviation from prior theory. Lorentz and all those who directly contributed to the kinematical aspects of the Lorentz transform before Minkowski inherently and unambiguously assumed anisotropy in the one-way speed of light for all observers moving with respect to an aether frame and thus also inherently *assume an absolute simultaneity* within the confines of a mechanically realized relativistic aether theory which is as rationally incompatible with *isotropic* constancy as the notion of odd numbered loops of gears is incompatible with those gears being able to turn. It is a simple mechanical incompatibility.

Thus, unlike the many experimental results such as the Fizeau experiment which indicated direct mechanics that would lead to the relativistic conception of Fitzgerald, Larmor, and Lorentz, the notion of spacetime conjoinment found in the Minkowski convention represents a novel and unique 20th century presumption completely in addition to and separate from (yet descended from) the principle of relativity. Specifically it is a positive statement about the isotropy of the one way speed of light.

The assumption of spacetime conjoinment, promotion of each single moment of reality to a four dimensional construct, realizations of block universe, and the various time travel implications are therefore grouped together and inseparable from the concept of relative simultaneity that differentiates the Minkowski convention from relativistic aether in previous theoretical development which requires "anisotropic" mechanics and if this implicit statement about the isotropy of the one-way speed of light, inherent in the Minkowski convention, cannot be falsified, yet is deceptively bundled with all those tests that prove *only the principle of relativity* already proposed previously and separately, such a claim of empiricism is specifically and unambiguously pseudoscience.

Revisitation of this important distinction point between relativistic theories circa 1905 which Mansouri and Sexl referred to will reframe the question of experimental regime and approach in a direction removed from attempting to test the one-way speed of light to the more easily accomplished task of attempting to falsify the spacetime assumption of the isotropy of the one-way speed of light, thus restoring Minkowski spacetime to the realm of legitimate empirical scientific inquiry by clearly defining the empirical line on which two alternative interpretations of relativity can be differentiated.

History of "anisotropic constancy"

"Einstein starts from the hypothesis that the laws will look the same to all observers in uniform motion. This permits a very concise and elegant formulation of the theory, as often happens when one big assumption can be made to cover several less big ones... But in my opinion there is also something to be said for taking students along the road made by FitzGerald, Larmor, Lorentz and Poincaré. The longer road sometimes gives more familiarity with the country." — John Bell

One of the most directly traceable first

expressions of relativity can be found in the 1888-9 Oliver Heaviside papers in which the discussion of the propagation of potential and the electromagnetic effects of a moving charge, he quotes a letter from Kelvin in which Kelvin points out the following: (p 491-2)

When these things are closely examined into, if the facts as regards the propagation of disturbances (electric and magnetic) are agreed on, the only subject of question is the best mode of expressing them, which I believe to be in the terms of the forces, not potentials.

But there really is infinite speed of propagation of potential sometimes; on examination, however, it is found to be nothing more than a mathematical fiction, nothing else being propagated at the infinite speed.

Thus the first indication of mathematically misleading representation (and the familiar "infinite" speed of light in its own frame) first rears its head. Heaviside then goes on to further address how Maxwell's equations behave in considerations below the speed of light, exactly matching the speed, (with equations easily recognized as precursors to the change factor) and finally examines the question of what happens above such a speed and after admitting failure to produce an adequate solution within Maxwell's laws above light's speed continues with a different tack suggested by J.J. Thomson.

In further attempting to address the question of FTL motion in later writing, correspondence with J. J. Thomson is mentioned and Heaviside then modifies his approach with the notion of ether motion with respect to itself in what he opines is possibly somewhere between the opinions of Fresnel and Stokes. (p.497) (though the author of this current text would argue that Fresnel already predicted the middle ground later proved by Fizeau in the coefficient of ether drag) and finally Heaviside argues against Thomson that the fluid motion under consideration need *not* be limited to irrotational contrary to Thomson's insistence.. (p 498)

On the next page (p 499) Heaviside returns to the claim of Kelvin about the misleading "mathematical fiction" problem of using a potential in the context of these various motions with respect to the medium.

Here is the new point. There *is* a potential of a peculiar kind. The displacement due to the moving charge is distributed in precisely the same way as if it were at rest in an eolotropic medium, whose permittivity is c in all directions transverse to the line of motion but is smaller, viz, c(1- u^2/v^2), along that line and parallel to it.

Thus herein we have both one of the earliest recognitions of the constancy postulate of relativity and a direct reference to its misleading nature in an "eolotropic" (anisotropic) medium. So in 1889 the apparent "constancy" of light in a fluid dynamical treatment was identified with having a crucial connection to the one-way speed of light and the ability to produce a mathematical illusion. He then goes on in comparing equation 14 and 15 (p 499) to identify the crucial difference in the isotropic versus "eolotropic" situation for this context.

Observe that although the electric force

in the substituted problem of a charge at rest in an eolotropic medium is the slope of a potential; yet it isn not so when the medium is isotropic, and moves past the fixed charge, or vice versa, although the distributions of the displacement are the same.

Principle of relativity within the confines of aether theory

It is critical, here, to bring again to mind that the situation under consideration, and being described mathematically, is an extension of Maxwell's model of ether flow which, being very gear-like, intuitively refers to the need for fully circular exchange of material medium in the process of mediating electromagnetic phenomena. This mechanic is being examined by Heaviside in the context of a charge sphere moving at various speeds with respect to the medium. Finally, it is also crucial to remember the communal scientific context of discussion with Kelvin to which he repeatedly refers, also includes knowledge of Kelvin's long development of a model of particles as toroidal vortices of ether as one well-known and "likely" (at the time) possibility for explaining the state of the existence of matter itself. It is critical to understand that the other Thomson of this conversation, J.J. Thomson, was also involved in Kelvin's development of ring vortex atoms and had the celebrated success of explaining a mechanical reasoning for valence using Kelvin's vortex atom basis to develop one of the first precursors and useful applications of knot theory.

However, Heaviside was a consummate supporter of concise representation where possible so while being well aware of the fluid mechanical basis of curl and divergence central to electromagnetism, he was careful to attempt to divorce physical concept from mathematical representation where possible. This is in the same vein as Maxwell himself who endeavored to develop his theory free from presumptions but eventually came back to the inescapable concept of circuits of incompressible fluid motion. (Bromberg 1967).

Starting on page 497 however Heaviside's consideration of fluid effects upon a charge in motion is brought to the fore.

Prof. Thomson, who otherwise confirms my results, has also extended the matter by supposing that the medium itself is set in motion, as well as the electrification. This is somewhat beyond me. I do not yet know certainly that the ether can move, or its laws of motion if it can.

He continues further down…

But if we consider that the medium supporting the electric and magnetic fluxes is really set moving when a body moves, and assume a particular kind of motion, it is certainly an interesting scientific question to ask what influence the motion exerts on the electromagnetic phenomena. I do not, however, think that any new principles are involved.

He then proceeds to thoroughly examine and apply fluid movement principles to the problem of a moving charge to eventually arrive at the interesting conclusion of the strange difference between equations 14 and 15 on page 499. Thus he finds in his process that contrary to his expectation,

there is, indeed, this one strange “new principle” that needs to at least be noted.

Finally, in the footnotes of 514 and 515, Heaviside then credits Searle of Cambridge for bringing the question of the shape of a closed surface. He restates the question as “What justification is there for terminating the displacement perpendicularly, to make a surface of equilibrium.” in referring to the redistribution of charge from a perfect sphere to an oblate spheroid. He goes on to state that “The condition of equilibrium is that F is perpendicular to the surface where it terminates, this being required to make curl F = 0, or the voltage zero in every circuit”

Here he has encapsulated his discussion of various speeds of a charge that have been his running line of inquiry interspersed throughout the past 15 pages and he has explained the obvious outcome of the mechanics of what we would now associate with the doppler effect: Namely that a source which disturbs a medium, when moving through that medium does not allow a wave peak to escape the same distance forward through said medium before another wave peak is imposed upon the fluid. Though his considerations of v>c are not relevant here, they provide context and reasoning of value. Regardless, a foreshortening in the direction of travel occurs, however the opposite effect occurs behind said disturbing force. To complete a circuit, in context of fluid mechanics, requires an exchange of material and must therefore consider both the forward and rear effects of a doppler-like mechanism within the constraints imposed by a spherical surface consideration which he calls the “condition of equilibrium.” Some of the mechanics of a full circuit of fluid flow are abstracted behind the established science of electromagnetism but are obvious in context.

The “condition of equilibrium” to which he refers is the mechanical maintenance of a circuit within a fluid. That maintenance however, is at the expense of any truly isotropic situation and simplistically, this relates the conversion of an area of a circle to that of an ellipse. He explains this change to shape mathematically in context of equation 15 referred to above. (p499.) and verbally in the footnote as:

> P= constant is therefore the equation to a surface of equilibrium. That is, in the case of a point-charge, the surfaces of equilibrium are not spheres but concentric oblate spheroids whose principles axes are proportional to the square roots of c, c, and c(1-u^2/v^2), the principal permittivities in the eolotropic problem.

Herein Heaviside clearly gives a synopsis of the fluid based investigation and explains the central thesis of the present paper: The difference between relativistic ether theory and Minkowski spacetime is that under the ether interpretation, isotropic assumptions create a “mathematical fiction” to which Kelvin referred. That “fiction” is one specific way of expressing *apparent* light speed constancy, however this is not the isotropic constancy which most of us educated in relativity are familiar with. It is manifestly *anisotropic* and as will be discussed here, has great meaning for relative simultaneity and Minkowski spacetime.

Most notably this is the point at which all the critical differences between the unjustified unitary modern idea of relativity and the

alternative interpretation of relativity deviate. (which various authors have unsuccessfully attempted to communicate and more widely disseminate) This is the “ether” to which Mansouri and Sexl refer, when speaking about absolute simultaneity within a relativistic theory.

Thus we find that the principle of relativity in aether theory is readily explained in a mechanical fashion as the necessary maintenance of cyclical exchange of material in combination with wave mechanics. (“curl F=0”) The result is maintenance of area via deformation in the form of the change factor. This was apparently accomplished by 1893 via the collaboration of Heaviside, J.J. Thomson, Kelvin and others and already at this point in history we see a foreshadowing of the century-long misperception this paper will attempt to clarify.

Though it appears to the present author that Heaviside and others should share some significant portion of credit for the principle of relativity via their 1888-9 era correspondence, if for no reason other than the careful development of a physically reasonable explanation that proceeds unambiguously from established electromagnetic theory of the time, credit for first publication, is now often attributed to Fitzgerald via the following reference which has only become well cited by historians in recent years:

> “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 attraction 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.” **- George F. FitzGerald**, “The Ether and the Earth’s Atmosphere”, Science 13, 390 (1889)

Finally, the presumption of the “conspiracy of light” to behave in such a manner as to hide it’s true speeds with respect to a moving observer (anisotropy) is in no way “ad hoc” tuning as has been suggested by later developers of the theory, but proceeds directly from sound mechanical principles of fluid mechanics developed by 19th century physicists like MacCullagh, Maxwell, Heaviside, and the two Thomsons.

Equivalence of the one-way isotropy of light speed and relative simultaneity

Can c vary? Could such a variation be measured? As correctly pointed out by Ellis, within the current protocol for measuring time and space the answer is no. The unit of time is defined by an oscillating system or the frequency of an atomic transition, and the unit of space is defined in terms of the distance travelled by light in the unit of time. We therefore have a situation akin to saying that the speed of light is “one light-year per year”, i.e. its constancy has become a tautology or a definition
But then, within such a framework, neither can the constancy of the speed of light be falsified, thus losing its status as a scientific statement. The constancy of c can only be a scientifically sound concept if its variability is a possibility. - João Magueijo · John W. Moffat “Comments on ‘Note on varying speed of light theories’ ” (2008)

A thorough understanding of the way aether theory leads to the *apparent* constancy of light and thus the Lorentz transform, is necessary to reveal the crucial differences between relativistic aether and Minkowski spacetime. While Mansuori and Sexl directly discuss that the only appreciable difference is the relativity of simultaneity, the context of discussion around clock synchrony does not properly convey the necessary mechanical understanding required for appropriate examination of the topic. Comparative analysis in the synchrony framework has proved utterly unsuccessful. Thus we introduce a novel approach to this communication problem.

Furthermore, because of the loss of critical mechanical context to this discussion, the overarching dialog within the community has digressed into circular reasoning in the latter part of the 20th century.

Namely, if one *first* has faith, via convention, that the relativity of simultaneity is the true situation of the universe then one examines one way speed of light tests via slow clock transport, such a test becomes irrelevant because, regardless of speed, the traversal of space to a distant point intrinsically alters the time in such a way as to negate the synchronization. (since time itself is assumed intrinsically different elsewhere because of spacetime geometry) Ergo proof of falsehood via experiment is invalidated by special pleading or “begging the question” wholly outside of empiricism to the point of literally eschewing empiricism. Such an assumption of relative simultaneity beforehand, however, and the subsequent logic using it. is unsupported and unsupportable. It would be an intolerable embarrassment to the theoretical physics community if such circular reasoning continues to be used to defend an assumption from the very tests that might falsify it.

Those authors which employ this reasoning are usually completely ignorant of the fact that the Lorentz transform holds true even *without* relative simultaneity, (or specifically with only a mathematical illusion thereof) thus their arguments generally take a form

which directly and falsely equates the *supposed* empirical factuality of relative simultaneity to the Lorentz transform's usefulness in describing a wide array of well established phenomena. IE They first, accidentally, presume the truth of the newer interpretation by Minkowski because of being wholly uninformed about the alternative of Lorentz's original interpretation (on the basis of aether) which fully provides the real, actual, and specific physical clock readings which are naturally pushed into error by the workings of the physical system. They are unaware of the historically contextual fact that Lorentz purposely designed a mathematical illusion which is more complicated than SR. There is a false association of the unquestionable empirical basis of relativity, with the empirical basis of Minkowski spacetime.

We must reiterate here, succinctly, that relativity and Minkowski spacetime represent vastly different statements about reality and are easily differentiable once a student understands relativity in the robust fashion granted by the contrast of multiple interpretations..

The most often missing piece of the puzzle not available to those who haven't specialized their study in the history of relativity, is the complex set of circumstances involved in considering the illusory relative simultaneity effect that is present in the relativistic aether context. Not only does the Lorentzian picture presume an illusion of isotropic light speed constancy which it deliberately constructs, it also inherently and subsequently produces an illusion of relative simultaneity as well.

Understanding this secondary deeper illusion provides crucial differential analysis insights to understanding the equivalence of isotropic constancy and spacetime conjoinment. Furthermore it gives us a novel perspective of understanding that isotropic light speed leads directly to "anisotropic" simultaneity, (relative simultaneity) whereas anisotropic light speed leads to "isotropic" simultaneity. (absolute simultaneity) These two very different understandings are exchangeable and mathematically equivalent, but unlike the bulk of prior authors to date, we will provide adequate conceptual differentiation to lead to experimental differentiation.

A Mechanical Wave Illusion of Constancy

Second, this consequence shows that the law of the constancy of the speed of light no longer holds, according to the general theory of relativity, in spaces that have gravitational fields. As a simple geometric consideration shows, the curvature of light rays occurs only in spaces where the speed of light is spatially variable. From this it follows that the entire conceptual system of the theory of special relativity can claim rigorous validity only for those space-time domains where gravitational fields (under appropriately chosen coordinate systems) are absent. The theory of special relativity, therefore, applies only to a limiting case that is nowhere precisely realized in the real world. - Albert Einstein from "The Collected Papers of Albert Einstein," Volume 7: The Berlin Years: Writings, 1918-1921 (English translation supplement), p 140

It is critical for any student of this subject matter to start from a well-established comprehension of the fact that *isotropic* constancy and mechanical wave phenomena are not physically compatible in three dimensions. However, the creation of an illusion which relies upon two-way

experiments and upholds the concept of constancy - even in an anisotropic situation - *is* possible with only three spatial dimensions.

Because other explanations via simplified and highly abstracted formulas have been thoroughly explored by Reichenbach, Mansouri-Sexl and others, but have failed to elicit widespread understanding of this issue for over a century, we will now approach the topic from a high-school level of discussion with more specific and simplified examples.

The first goal is to return to the first principles approach of those who preceded Einstein which initially designed the illusion of light speed constancy, so that relativity in only three dimensions, while more mechanically intuitive, can be very deeply understood to be a more complex (and arguably more "clunky") set of puzzle pieces which those familiar with the modern relativity practice are usually unfamiliar with. This protracted approach should be assumed to be an absolute necessity for achieving a good grasp of the difference and dividing line between the precursor relativity and later *interpretations* of relativity theory; specifically elucidating the factual nature of the existence of valid alternative interpretations of relativity in which the scientific preference is currently undecided empirically.

Now that the we have established that concepts such as relativistic wave shortening via medium-based wave mechanics were already a consideration of some great import contemporary with the Michelson-Morley experiment, the mechanical wave nature of relativity and the state of relativity theory during the period nearly twenty years prior to the publication of "On the Electrodynamics of Moving Bodies," can be examined from first principles that do not assume, or in any way surreptitiously infer, modern relativistic assumptions which are laden with conflation of important differentiable theoretical points.

It is valuable to re-state concisely, at this point in discussion, the very simple fact that the familiar factor of change achieves a solution to the Michelson null in three dimensions, fully within the assumption of light as a mechanical wave transmitted within, and therefore affected by, the motion of a presumed moving medium.(v+/-c) It is accomplished by assuming objects are physically shortened in the direction of travel. This produces an illusory version of light-speed constancy in a three dimensional world which we will build upon for the purpose of building re-education tools for modern audiences which can introduce the original version of two fundamentally different interpretations of relativity that have been repeatedly called "mathematically equivalent" by many authors and historians. Hopefully this methodology will give an easily grasped point of differentiation very crucial to any future discussion addressing the questions surrounding the isotropy of light's speed and the validity of considering spacetime conjoinment to be real empirical science.

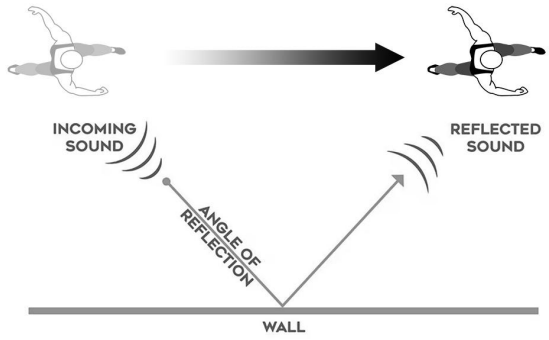
The Michelson null as a simple geometry problem

Let us temporarily disregard the fluidic considerations of electromagnetism discussed thus far and start from the observation that the most significant starting point of relativity is merely a simple geometry problem and the familiar formula for the change factor sqrt(1-v^2/c^2) can be written in terms high school geometry as the formula sin(cos^-1(v)) where velocity is expressed as a decimal of the speed of light.

Said again, let us return to the simple Michelson-Morley null experimental result with an assumption that the effects of motion on a real mechanical wave in a

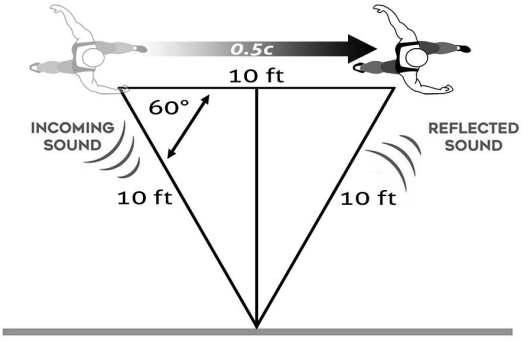
medium is cleverly hidden by shortening of objects. Thus the Michelson null is a simple problem of geometry in motion. In this mindset the familiar spatial intuitions of how redistribution of area occurs in triangles can be recovered within a reader or student.

The familiar trigonometry functions are simply representations of ratios and relationships between sides and angles and the Lorentz factor is simply an extension of this very reasoning. A mechanical wave is constrained to move in its medium thus the Michelson experiment in a medium has a crucial feature of note we will now examine in analogy: Let us presume a listener running beside a wall shouts. Even though the wave is circular in two dimensions, when emanated from their mouth, there is only one angle of reflection from the wall which will reach them along their moving path.



Only one specific angle of reflection returns to a moving “origin” This creates a triangle or more aptly, two right triangles in which the hypotenuse length is dependent upon the relationship between the speed of sound and the speed of the runner. This ratio is directly and exactly the factor of change. The factor of change, expressed geometrically, is the only angle at which the runner’s voice will return to the moving origin and is therefore dependent upon the relationship between the two speeds that define two of the three triangle sides.

Let us take a simple example of a 2:1 ratio found at half the speed of sound. Putting aside comic-book powers required, for the shouting runner to hear their own voice at a 2:1 ratio of speeds this means that they must move half the distance the sound does which maintains a consistent perpendicular relationship with the wave traveling to the wall and back.



That is, the speed of the runner is related to the speed of sound like the length of the adjacent to that of the hypotenuse. We are setting the sound’s path to the hypotenuse “side C” and the runner’s path to along “side A” while the distance to the wall is “side B” in this right triangle example. Cosine is simply the relationship between these two sides of the runner path and sound signal path. Therefore if we want to find the angle we use cos^-1 and the arccos function gives us an angle of 60 degrees for this 2:1 relationship.

Note here that this is another way to compare and find information about sides that is equivalent to v^2/c^2 in our normal change factor calculation where we note that the runner is v and the sound is c. Thus relativity is also using adjacent over hypotenuse.

Finally if we use sine on this angle we are able to find the relationship of the third leg

(side B or the distance between wall and runner) to the hypotenuse (the path of sound) and we have defined a relationship for all three sides. Unfortunately this is *still* a little misleading to start from the concept of the "distance to the wall" related to the sound's path being the factor of change as it could be falsely interpreted as indicating a need to alter the distance between the wall and the runner. This mistake actually occurred in the early history of relativity It should be noted, however, that the shape of the triangle represents the immutable "pythagorean" relationships of the physical situation caused by motion between objects moving two different speeds with respect to one *specific* frame.

In commonplace relativity, because we lack the method of the arccos function as our normal procedure, we must proceed from "adjacent over hypotenuse" (v^2/c^2) to then invert this ratio we've found, (1-) and find the square root of that number. This is obviously the shortened version of using pythagorean theorem to find side B by subtracting A^2 from C^2 to find B^2 and finally rooting it to find the side's length.

This is a great little shortcut because we know pythagorean theorem is a relationship of a fixed area. If we know the relationship of the hypotenuse to one side then we know the remainder of the area must come from the third side. So in the 2:1 example, knowing that the hypotenuse is the target area size (c^2) dividing one into the other gives us the ratio of area sizes. If we grant sound a speed of 10 and the runner a speed of 5 that gives us the squares areas of C=100 and A=25 respectively. So side A^2 divided by C^2 gives us .25 and tells us that side A only grants 25% of the area needed to equal C^2.

Therefore we invert it to get .75 knowing we now are speaking about 75% of the area of C^2. If we then find the square root of this number, as a representative side B (still in ratio form), we find that we get .866. This is the ratio of side B's length to side C's length. It is not the amount side B has shrunk, it is a ratio that tells us how much side C has grown.

Here we have now re-explained the central calculation of relativity in terms of interaction with mechanical waves in a physical medium and related each of the familiar change factor operations to being equivalent to finding the relationships between sides of a right triangle.

The geometric basis for transformation

If we now further think of this in terms of the Michelson experiment however, we know that what we've found is the relationship between light's previous perpendicular path and its new path crosswind. Because this situation of angles is an immutable aspect of the physical relationships we can easily solve for the relationship between the new crosswind leg and the new downwind leg required for the signals to meet upwind of the emission point. We simple make our "side C" into "side B."

Because of the relationships of a right triangle, in the course of a frame transformation, any amount we alter side B (as we transform C into B) will require we alter side A by the same amount if side C is to be the basis of transformation. IE when we convert side C into side B, side A will have to change to maintain the geometric shape relationships.

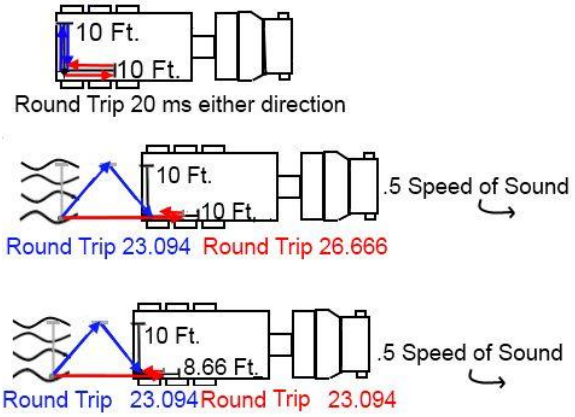
So, now if we want to experience the world from the perspective of the runner who looks at waves from the naive expectation of galilean relativity which perceives a sound wave as an inertia carrying object independent of its medium, we can virtually (in our mind's eye) label a bit of sound that appears to be co-moving because we, as the runner, perceive it go away straight at the wall and reflect in a straight line back from the wall. (a faulty perception of sound's actual path)

Thus a transform which alters one's frame perspective from the medium frame to the frame in motion will trade side C for side B which makes side C at the current 11.547 side, shrink down to 10 (multiplied by ,866) and of course, we then conceive that we are supposedly stationary as a runner in our favored frame of reference. Does this reduce side A to zero? No, because we are dealing with ratios and conserved quantities under transformation. For us to hear the same sound reflect back to us at the same moment from any co-moving sound reflective surface, which perceive as also stationary along with us as the runner, the distance to that surface will have to also be transformed by the same amount we shrank side C. For objects ahead and behind, that amount is .866, thus objects interacting with sound must be brought closer to the origin by this amount. Side A is shrunken as much as side C to preserve the relationships. We, however, are using the speed of sound as a basic fact of reality during this logic.

Restated in different terms, what has been described is the fact that if there were some material which would automatically shrink along the direction of wind, according to the change factor with respect to the speed of wind passing across it, the speed of sound would appear to be a universal constant in all experiments that used such a material for device construction.

Therefore if one were to construct an experiment like the Michelson-Morley using sound reflectors and apparatus made of this substance which was conveyed by trucks at high speeds, the same hiding of the truck's movement would occur in the experiment. Sound projected forward and to the side would always return at the same moment regardless of speed. In fact, sound clocks could be built which rely upon sound reflection, similar to a light clock, and their time-keeping would be altered by the change factor with respect to the speed of sound as a constant.

"Relativity of sound" experiment shown stationary, without shortening and with shortening.



(My young son's diagram)

The notable situation for this paper is that we've completely abstracted the fact that there is still an "unexpected" hidden upstream and downstream difference. By using the tools above we were able to ignore the one-way speed of sound and only use the two-way speed of sound to make sound appear to be a constant. All we've done is find the whole length of the full path required and abstracted it away

through the use of ratios etc which surprisingly still hold true in the mechanics of mixed upstream-downstream considerations. Further it should be obvious to the reader that the *perception* of the wave's angle of incidence across the wind is factually faulty for the co-moving observer because angle of incidence is defined by the medium, not just any given frame of reference. The angle of incidence of the sound traveling out to the side of the wind, in this case, which appears to a co-moving observer to be 90 degrees, is actually 60.

Though we have revealed the unfamiliar fact that relativity can work geometrically for a mechanical wave in a medium if objects shrink in the direction of travel, we must now revisit Heaviside's reasoning for discovering such a behavior. Though we have provided a solution to the Michelson null which supports an aether medium, the mechanism of shortening and the reasoning for its appearance in a mechanical system is paramount in developing a fully realized theory. We must now return to the reasoning for his finding such a set of immutable geometric relationships.

Fluid flow surfaces of equilibrium

In the context of cycling fluid motion which was initially described by Maxwell and was the context of the discussion between Heaviside and the Thomsons we must return to Heaviside's surface of equilibrium which was defined by curl=0. For simplification and remaining within the high-school communication regime, this can easily be described as the fact that if a bedsheet is laid out and pulled from one corner without pulling the adjacent corner at the same speed, a rotation in the sheet is created. This is similar to curl.

Thus, in the case of fluid motion falling down upon a sphere we can think of a single simple giant wind blowing down from the north pole, going across Europe down to the equator and simultaneously blowing down across the Americas to the equator. The wind is just like the bedsheet in that, if it reaches the equator faster in one place than in the other, a rotation is induced in between.

Now, looking at a Michelson-type experiment as an analogy, we know that a signal propagating into the wind and back is slowed more than a signal propagating across the wind, thus in the consideration of electrical phenomena as requiring ether cycling, the surface of equal propagation is the surface of equilibrium, which Heaviside refers to, at which there is no rotation aka curl. This is, of course, an oblate spheroid defined by the relativistic factor of change as Heaviside explained.

Furthermore, this interaction of waves with fluid motion described, which defines a possibly reflective border surface, extends the claims of the present author elsewhere that the factor of change describes a mechanism of creating resonant chambers in motion necessary for the maintenance of Kelvin's ring vortex atom model, but further such discussion of modernizing aether theory and the "Neoclassical Interpretation" will be limited to other papers.

A final note on this "pythagorean geometry" of relative motion

Finally we must examine the last geometric consequences of note which may grant additional physical intuition about the pythagorean relationship between frames

and relativity theory prior to 1905.

If we consider a reflection experiment like the Michelson, but only consider the arm facing into the wind and consider what is necessary to restore the experiment to its original run-time/distance we find familiar consequences. In the 2:1 relationship of wave speed to experiment speed, let us assume the experiment at rest is a length of 10. With the wave speed set to 1 we find that the normal round trip time would classically be extended by a factor of 1.333 if there were no shortening effect. This means that, to restore the round trip to the normal 20 we would need to shorten the co-moving leg by a factor of .75. The square root of each of these numbers represent the two versions of the change factor, 1.1547 and .866 respectively. This interesting comparison to classical expectation is true for all speeds.

Therefore gamma^2 will always result in either the unshortened “classical” path length or the amount one would need to shorten it to return the experiment to the stationary normative distance and time for the experiment. In this way we see that the change factor is a happy middle between these two operations, mediated by squared redistribution of area. Therefore the larger version of the change factor divided by the smaller will always equal the amount of the longer “classical” expectation of the path length into the wind. I draw attention to these simple mechanical relationships to point out the nature of the symmetries which could be extended, like any superstitious numerology, to be interpreted to have more meaning than they factually do if the mechanical facts were too abstract, which may indeed be the case in the empirically unsupported supposition of space-time conjoinment.

The maintenance of the area of an ellipse under deformation defined by speed ratio is what is accomplished by the factor of change in Heaviside’s treatment which is a simple derivative use of pythagorean theorem during the 19th century development of relativity theory.

Time as a purely geometric consequence

It should now be obvious that even though this methodology will allow reflected signals such as the Michelson experiment to return to the moving origin at the same time, regardless of speed, the full cycle of the experiment time required, for a signal to go out and come back, has increased by the factor of change.

However, given that the theory in question infers that all interaction between particles and fields is mediated by the electromagnetic considerations being discussed, the only reasonable conclusion is to assume that time appears to run slower for those objects which are in motion with respect to the medium.

Now that such familiar concepts have been built from mechanical framework, we must now endeavor to show how this theoretical framework not only radically deviates in ontological consideration and interpretation, but also in numerical outcome and experimental consideration while still retaining the long established categorization of “mathematically equivalent.”

Relative simultaneity

Working notes:

[Divorcing relative simultaneity from clock rates: reified physicality of time]
[Minkowski diagrams in lorentzian relativity with time *contraction* and length *dilation*]

[Alteration of stellar distance estimation based upon minkowski vs neoclassical]

[*decide if/what needs to be separated out to go in next paper instead*]

[reuse old presentations to explain compensatory mechanism between simultaneity and the conventional to assumption of time dilation for both observers]

[selleri paradox (sagnac) and show the demonstrable ignorance of recent authors about the compatibility of relativity with one-way speed of light
https://aapt.scitation.org/doi/10.1119/1.4755950]

[Grazing incidence interferometer: Brief mention or full exploration?]

[investigate the angle above vs below 45 deg in special interferometer experiment. Explore the two types of experiment Miller explains (moving one end versus the other): Maybe next paper?]

[Einstein quotes on constancy]
[successful one-way experiment references and papers.]

[summarize with testability of light speed anisotropy instead of “speed” of light]

References:

Heaviside, 1888-9, in: Electrical Papers, 1892, vol. 2, Macmillan, London, Repr Copley Publishers, Boston, MA, 1925, pp. 490, 514.

Bromberg, J. (1967). Maxwell’s displacement current and his theory of light. Archive for History of Exact Sciences, 4(3), 218–234. doi:10.1007/bf00412961