Ambiguities in Einstein's Relativity

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Rough draft of a paper that I hope to present at a Physics Conference.

Abstract: Einstein's Relativity is not well-defined; especially special relativity is not well-defined. I will deal with some examples of where it is not well-defined, but there are many other places it is not well-defined. Unfortunately, people seem predisposed that when they encounter a place in Einstein's writings that is vague they then make different guesses as to what they think must have been meant; and so, come up with different interpretations of what they think Einstein's relativity "is" instead of recognizing that it is not well-defined. Thus, when dealing with Einstein's relativity what people engage in is mathematical modelling i.e. Einstein's relativity is more a mathematical model than it is a theory.

1. Introduction

It is problematic to be able to agree what Einstein's relativity "is". My investigations lead me to conclude it is ambiguous, and not a well-defined theory; without it being well-defined it is difficult to agree a foundation with people to start a dialogue about relativity. Even agreeing that Einstein's relativity is not well-defined is difficult, because many people think it is well-defined, but then they go into talking about their personal interpretation; which they don't often recognize is a different interpretation than others. The main example that I will deal with anon is Einstein 1905 theory versus Minkowski theory.

2. N mistakes

In my investigations of Einstein's relativity, I find it ambiguous and one of the issues is then how to define the theory and how to agree upon mistakes, and then how to go about fixing the mistakes. For instance, suppose the following steps:

(1) If person A spots what he claims is a mistake with Einstein's relativity then person B can agree or disagree with it being a mistake, that generates 2 theories:
(2) Person A says there is a mistake with Einstein's relativity that generates his pet theory as a replacement.
(3) Person B can disagree and still stay with relativity.
(4) That's 2 theories.

One criticism of this is: does spotting mistakes really generate additional theories, or merely different interpretations of the existing theory of special relativity. However, modification of the existing theory by correcting its mistakes is equivalent to a theory change, because changing from theory with a mistake to theory without that mistake. So, I will refer to it as “theory”. (Thus "different interpretation" is just same as different theory in the context here.)

Now what if 2 mistakes are spotted in relativity that generates 4 theories:

(1) Theory #1 disagree with both mistakes.
(2) Theory #2 agree with mistake 1 but disagree with mistake 2.
(3) Theory #3 disagree with mistake 1 and agree with mistake 2.
(4) Theory # 4 agree with both mistakes.

So, in the general case: N mistakes generates 2^N pet theories.

According to Roger Rydin [1] Francisco J. Müller has spotted at least 29 mistakes in Einstein's 1905 paper on special relativity (SRT). If it were just say 20 mistakes that would generate 2^{20} = 1,048,576 pet theories. It is because Einstein's relativity is not a well-defined theory that acts as perfect defence, because a critic can then get lost in proposing numerous different replacement theories.

Now back to the issue of different interpretations of SRT versus different theories to SRT:

If a mathematical mistake is spotted in SRT then that presumably makes the theory invalid mathematically, letting relativists get away with correcting mistakes to SRT and still carry on calling it SRT is letting them get away with revising their theory; i.e. transitioning from one theory to another theory, but pretending they haven't changed theory.

In case of Einstein 1905 SRT there is no Minkowski spacetime; when relativists add Minkowski spacetime they then seem to be adding a preferred frame (but of course often try to deny that); this is example of revisionism:

first theory: SRT without spacetime

second theory: SRT with spacetime

Let them get away with not admitting they have changed theory; then give them an inch and they will take a mile (as the saying goes).If one person points out what he perceives as a maths mistakes and wants to correct that mistake, and another person doesn't agree; then those two people are advocating different maths; and if they are advocating different maths then I would take that as meaning they are advocating different theories.

3. Mathematical modelling

I argue with relativists and some seem to start with relativity principle and discard it when they feel like it and still call it “Einstein's relativity”; I would say those people who do that have a different theory to the people who stick with relativity principle and don't want to discard it on a whim. So, pointing out a maths mistake with the relativity principle means nothing to relativists; because some relativists will go with correcting that maths mistake and others won't, and both will still call it “Einstein's relativity”; despite me saying they have different theories under the aegis of “Einstein's relativity”.

The example I am thinking of is the Twin Paradox. [2] Going by Einstein 1905 paper I would deem that time dilation is symmetric (putting aside the issue that I would prefer to call it clock dilation). This is because for both twins (the stay-at-home twin and the rocket twin) both would be declaring the other twin as moving and themselves as stationary (going by the idealisation that the twins are concentrating only on their relative motions between them and not paying attention to other factors such as the surroundings), then by the relativity principle if the first twin says the second twin's clock is slower than the second twin should say the first twin's clock is slower. However, in the way that the twin paradox is explained is that: the rocket twin's clock turns out to be slower after returning to the stay-at-home twin; this is asymmetric time dilation and contrary to the relativity principle. The way that it is usually explained is that the rocket twin is the twin that experienced acceleration while the stay-at-home twin didn't experience acceleration. So, it is a case of abandoning the relativity principle when the need arises.

I suspect the reason why relativists are acting like this is because their thinking is along lines of mathematical modelling.

Going by Ray D'Inverno in his book on Relativity [3] he says:"Before we start, we should be clear what we are about. The essential activity of mathematical physics, or theoretical physics, is that of modelling or model building."

By which he means: mathematical modelling.He goes on to say:"We should perhaps be discouraged from using words like right or wrong when discussing a physical theory. Remembering that the essential activity is model building, a model should be described as good or bad, depending on how well it describes the phenomena it encompasses."

That's why I think: the relativists - whether they have the relativity principle in the mathematical model they are using OR whether they discard it, they still call it "Einstein's relativity".

They are thinking in terms of maths, and don't care anymore about being accurate in stating when they switch from one theory to another. I would say a theory with relativity principle is a different theory to a theory without it; but they don't care about that issue, and whatever they do with the maths they are still going to call it "Einstein's relativity" i.e. the "theory" called "Einstein's relativity" is thus because of this lax (i.e. not careful) approach then not well-defined.

4. Minkowski theory versus Einstein 1905 theory

Einstein wrote his paper on relativity in 1905 and what Minkowski had to say about spacetime with his diagrams came later. So, we could think of Minkowski diagrams as a development of SRT. However, James Overduin [4]: "Einstein initially dismissed Minkowski's four-dimensional interpretation of his theory as "superfluous learnedness" (Abraham Pais, Subtle is the Lord..., 1982). To his credit, however, he changed his mind quickly."

So, we can think of two versions of SRT that of SRT when Einstein dismissed Minkowski diagrams and an SRT where Minkowski diagrams was accepted. Thus, once again we are presented with a building process; of mathematical modelling, where the initial theory is then added to with extra.

As per John Gribbin [5]: "Minkowski had been one of Einstein's teachers at the Federal Institute of Technology in Zurich at the end of the 19th century. Just a few years before Einstein came up with the special theory, Minkowski had described him as a 'lazy dog' who 'never bothered about mathematics at all'."

Possibly, if Einstein had not been so “lazy” with doing mathematics, he would have made it clearer that what he was doing was mathematical modelling; so, as to emphasize that his theory was being built up.

So, SRT and Minkowski theory weren't originally the same theory; [6] until later Einstein agreed with Minkowski spacetime diagrams, and then suddenly Einstein's SRT appropriated them.Einstein's relativity is not well-defined then in the sense that this mathematical modelling is indeed what is happening.

From Minkowski diagrams it then gets extended from special relativity to general relativity, as explained by JamesOverduin [4] as: “Einstein eventually identified the property of spacetime which is responsible for gravity as its curvature. Space and time in Einstein's universe are no longer flat (as implicitly assumed by Newton) but can pushed and pulled, stretched and warped by matter. Gravity feels strongest where spacetime is most curved, and it vanishes where spacetime is flat. This is the core of Einstein's theory of general relativity, which is often summed up in words as follows: "matter tells spacetime how to curve, and curved spacetime tells matter how to move".” (n.b. I object to the part where he says about space and time being “implicitly assumed by Newton” as flat—it is more a case of the possibility that it was curved, was not investigated. If we are treating Einstein’s relativity as mathematical modelling then there is no reason not to do the same for Newton; then given Newton did not investigate the possibility, Newton’s physics can still be extended to deal with look at such a possibility.)

Thus, we have the mathematical model building process for Einstein’s relativity so far outlined as: from Einstein 1905 paper add to it Minkowski spacetime diagrams treating them first as flat then treating it as curved.

James Overduin [4] goes on to tell us: “The theory does not make spacetime more relative than it was in special relativity. Just the opposite is true: the absolute space and time of Newton are retained. They are merely amalgamated and endowed with a more flexible mathematical skeleton (the metric tensor).”

So, the mathematical modelling of Einstein’s relativity that starts with his SRT model which discards Newton’s absolute space and absolute time, eventually gets added back to the model those concepts, in a more complicated piece of mathematics. So, for a return to Newtonian physics then the extension to that was by Boscovich,[7 -8] and the mathematics developed and by such people as Clifford. [9]

And the modelling update does not stop there, next needs to be considered adding quantum effects, James Overduin [4] says: “If one goes beyond classical physics and into modern quantum field theory, then questions of absolute versus relational spacetime are rendered anachronistic by the fact that even "empty space" is populated by matter in the form of virtual particles, zero-point fields and more.”

But of course, adding quantum effects to Einstein’s relativity in its GRT form has been deemed problematic. Part of the problem being Einstein in 1905 discarding aether with a few words [10]: “The introduction of a “luminiferous ether” willprove to be superfluous inasmuch as the view here to be developed will notrequire an “absolutely stationary space” provided with special properties, norassign a velocity-vector to a point of the empty space in which electromagnetic processes take place.” The re-introduction of a medium for electromagnetism then gets resisted by many people, but I think makes sense of many of the issues of combining relativity to quantum physics. [11]

So, back to the issue of the N mistakesspotted with Einstein, does it remain Einstein's relativity when those N mistakes are corrected (?), because in another way of talking about things we are dealing with mathematical modelling and starting from a model that we are keep updating.

5. Lightspeed constancy is ambiguous

The postulate of lightspeed constancy as stated in Einstein 1905 paper and in subsequent SRT papers is ambiguous.

Many take it to mean: lightspeed constant (in vacuum) = c in inertial frames. So, let us form inertial frames S and S': (x,y,z,t) and (x',y',z',t') in both lightspeed is supposed to be c. But what if we form a frame of reference from part of S and part of S' say from x,y,z with t' to form (x,y,z,t') is the speed of light c in that frame; is it even an internal frame (?) Einstein just has not provided enough information; what he has not said is as important as what he has said; and what he has not said has left things ambiguous. When he makes the claim of lightspeed constancy, I would expect him give some mathematics – to show what it means in mathematics; but he doesn't.

Given distance travelled by light in S frame as L and distance light travels as L' in S' frame, we can be lightspeed constancy postulate: L/T = L'/T'= c

Where T = time taken in S frame and T' as time taken in S' frame. But we are not told what L'/T and L/T' form.

We are not even told if (x',y',z',t) and (x,y,z,t') form inertial frames. If they do form inertial frames then by lightspeed constancy postulate: L'/T = L/T'= c

That would be nonsense (putting aside the possibility of v=0 case). Many people who are opposed to relativity, I suspect think relativity is making that nonsense claim and conclude SRT is nonsense. Whereas my position is that: SRT is not well-defined; inertial frames of reference have not been well-defined, lightspeed constancy postulate has not been well-defined etc. Einstein had the option of clearly defining SRT and didn't.

Going by the mathematics as presented to us, one relativist (I was in contact with) [12] starts from:

$$x' = \gamma(x - vt)$$

$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

Object moving with velocity u:

$$x' = \gamma((u - v)t$$

$$t' = \gamma\left(1 - \frac{uv}{c^2}\right)t$$

$$u' = \frac{x'}{t'} = \frac{\gamma((u - v)t}{\gamma\left(1 - \frac{uv}{c^2}\right)t} = \frac{u - v}{1 - \frac{uv}{c^2}}$$

This is the formula for SR velocity transformation. For $u = c$ the above gives

$$c' = \frac{c - v}{1 - \frac{cv}{c^2}} = \frac{c - v}{1 - \frac{v}{c}} = c$$

That is, if the t' time reference is used in the primed frame the speed of light will be measured as c.

The relativist then chooses to call the S and S' frames as Lorentz reference frames; and says that: Instead of using a Lorentz reference system we could describe physics in terms of a reference system that uses the spatial coordinates of the primed frame and the time reference of the unprimed frame:

$$x" = \gamma(x - vt)$$

$$t" = t$$

With that we will get the following for the object moving with velocity u:

$$x" = \gamma(u - v)t$$

$$t" = t$$

$$u" = \frac{x"}{t"} = \frac{\gamma((u - v)t}{t} = \gamma(u - v)$$

and the velocity of light in the double-primed frame is found to be $\gamma(c - v) \neq c$ if $v \neq 0$.

So, the relativist is saying that lightspeed is not constant for such a frame of reference; but the point is the constancy of lightspeed postulate is not stating one way or the other whether it is supposed to apply to this type of reference frame; thus when he forms this bit of mathematics it is not the lightspeed constancy postulate stating whether it is valid or not!

6. Conclusion

There are numerous other areas where Einstein's relativity is ambiguous, resulting in it not being well-defined, which then means that it can be adjusted/modified to anything that the relativists like and said to be relativity.

What we have been presented by Einstein is him engaged in mathematical modelling, and he has not clearly stated that was what he was doing; thus, it leads to all these confusions when the mathematical model is modified/adjusted.

The Physics Establishment needs to tidy up their presentation of Einstein's relativity, as to precisely what modifications they are making at every step.

References

[1] Critique ofScientific Discoveries that Changed the World, by Roger A. Rydin, cites: Francisco J. Müller, "The Anomalous Origins of Einstein's Relativity Theory", preliminary edition, 2005.http://gsjournal.net/Science-Journals/Research%20Papers-Relativity%20Theory/Download/4109

And also:
http://wiki.naturalphilosophy.org/index.php?title=The_Anomalous_Origins_of_Einstein%27s_Relativity_Theory

[2] There are too numerous accounts of the Twin Paradox. Unfortunately, none of the accounts as far as I am concerned deal with the subject adequately and go into sufficient detail. For an introduction, see for example: The Twins Paradox Primer (Rotating TIME!), Minute physicshttps://www.youtube.com/watch?v=Bg9MVRQYmBQ

[3] Introducing Einstein's Relativity, Ray D'Inverno, Clarendon Press 1992 ISBN 0-19-859686-3 p. 15

[4] Einstein's Spacetime, James Overduin, November 2007

https://einstein.stanford.edu/SPACETIME/spacetime2.html

[5] Pay attention, Albert Einstein!By JOHN GRIBBINNew Scientist issue 1854, published 2 January 1993 https://www.newscientist.com/article/mg13718543-900-pay-attention-albert-einstein/

[6] As per Walter:"Minkowski was ultimately unable to detach his theory from that of Einstein, ..." -- i.e. Minkowski was trying to convince people that his theory was different to Einstein's theory. Walter continues:"...because even if he convinced some mathematicians that his work stood alone, ..." --stood alone i.e. as a different theory. Walter continues: "...the space-time theory came to be understood by most German physicists as a purely formal development of Einstein's theory.Einstein, too, seemed to share this view. " -- So, Minkowski tried to convince people that he had a different theory to Einstein's theory, but most people decided it was the same theory.It is quite a big mistake to equate two theories that are different; but having done that then forces the theory to become a mathematical model to be updated.

Minkowski, Mathematicians, and the Mathematical Theory of Relativity, Scott Walter, Published inH. Goenner, J.Renn, J.Ritter, T.Sauer (eds.), The Expanding Worlds of General Relativity (Einstein Studies, volume 7), pp. 45–86. Boston/Basel: Birkhauser, 1999.

ref: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.404.8829&rep=rep1&type=pdf

[7] Roger Boscovich - The Founder of Modern Science, Dragoslav Stoiljkovich, trans. Roger J Anderton, 2014, ISBN 978-1-326-04254-7.

[8] Boscovich's comprehensions of relativity see: Dragoslav Stoiljkovich and Roger Anderton: https://www.researchgate.net/publication/274640923_Relative_movement_of_two_bodies_Hubble's_law_expanding_Universe_and_Newton's_laws_controversies ; and https://www.researchgate.net/publication/321623953_BOSCOVICH'S_COMPREHESION_OF_ABSOLUTE_AND_RELATIVE_MOVEMENT

[9] John Gribbin says: "Clifford was just one of many researchers who studied non-Euclidean geometry in the second half of the 19th century – albeit one of the best." As per earlier cited article.

[10] ON THE ELECTRODYNAMICS OF MOVINGBODIESbyA. EINSTEINJune 30, 1905

http://hermes.ffn.ub.es/luisnavarro/nuevo_maletin/Einstein_1905_relativity.pdf

[11] See: Omissions in Special Relativity https://www.youtube.com/watch?v=P5c3M_XIzeM

[12] E-mail communications.

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