

Disproof of Special Relativity

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Abstract

This article presents a strict logical disproof of Special Relativity based on the invariances of ordering and structure of physical events in linear transforms. By ordering we mean the sequential order of events, and by structure we mean the ratios between time or length intervals. While many paradoxes on Special Relativity have been available, including the famous Twin Paradox and Train Paradox, or their improved versions, these paradoxes only show some contradiction or inconsistency in Special Relativity. And many of the paradoxes have been explained by the “Relativity of Simultaneity” argument. A rigorous disproof of Special Relativity is still absent. In this paper we first observe two fundamental properties of any linear transforms: invariance of event ordering and invariance of event structure. By making using of these two properties, we prove that Length Contraction derived from the Lorentz Transform violates the invariance of event ordering, and therefore gives a rigorous disproof of Special Relativity.

Key Words: Special Relativity, Twin Paradox, Train (Trolley) Paradox, Relativity of Simultaneity, Time Dilation, Length Contraction, Lorentz Transform, General Relativity, Invariance of Event Ordering, Invariance of Event Structure.

1. Introduction

The most renowned science breakthrough in the past century has been attributed to Einstein’s Relativity Theory (RT, [2][3][4]), whose foundation is Special Relativity Theory (SRT, [1][12]). RT is not born without criticisms and oppositions ([7]). But somehow, more and more experimental observations have been reported to support RT, and amazing scientific breakthroughs have been achieved out of RT, including atomic bombs and nuclear energy. Despite all the good things arising from RT, more and more paradoxes and contradictions ([5][6]) have been published.

Contradiction arises simply out of our ignorance of the truth, or out of imperfection of our knowledge organization. As such, contradictions cannot be ignored and should serve as the opening door to a more rigorous, perfect science. As a matter of fact, the most successful Quantum Mechanics is the one without SRT.

SRT is derived from a thought experiment based on two Basic Assumptions ([1]-[4],[10]):

1. The laws of physics are invariant (i.e., same) in all inertial (i.e., with no acceleration) frames of reference.
2. The speed of light in vacuum is the same for all observers, regardless of the motion of the light source or observer.

In this paper, we shall first assume that SRT is correct and then use also a thought experiment

to disprove SRT by contradiction. To this goal, let's first summarize the immediate consequence from the Lorentz Transform (LT) below:

I. **Time Dilation:** Two observers A and B with relative velocity v to each other, would see

each other's time is dilated by a factor of $\gamma = 1/\sqrt{1 - v^2/c^2}$, where c is the speed of light. That is, if t_A and t_B are the times in the clocks held and read by Observer A and B respectively, and t'_A and t'_B are t_A and t_B converted to the reference frames of Observer B and A, then

$$t_A = \gamma t'_B, \quad t_B = \gamma t'_A. \quad (1)$$

II. **Length Contraction:** along the direction of the relative velocity v , two Observers A and B would see each other's length is contracted by a factor of γ . More precisely, assume Observer A and B each carries a stick of the same length (measured statically), and l_A and l_B are the lengths of their own sticks measured by Observer A and B respectively, and l'_A and l'_B are the lengths of the sticks held by Observer A and B but converted to the coordinates of Observer B and A, then

$$l'_B = l_A / \gamma, \quad l'_A = l_B / \gamma. \quad (2)$$

One interesting thing to note is that Equations (1) and (2) do not have much to do with the history of the motion of A or B, as long as the relative speed of them is constant within the measurement interval (time or space).

However, two other more fundamental properties in generic coordinate transforms have been ignored in SRT :

III. **Invariance of Event Ordering (IEO):** Assume $e_i, i = 1, 2, \dots, n$ is a series of events that occurs at location x_i and at time $t_j, i, j = 1, 2, \dots, n$, in reference A, where x_i is a coordinate on reference A that is parallel to the velocity of two inertial references A and B. Let x'_i and $t'_j, i, j = 1, 2, \dots, n$, be the observations of coordinate x_i and time t_j observed by an observer in reference B. Then

$$x_i < x_{i+1} \Leftrightarrow x'_i < x'_{i+1}, \quad t_j < t_{j+1} \Leftrightarrow t'_j < t'_{j+1}, \quad i, j = 1, 2, \dots, n-1, \quad (3)$$

That means, the ordering of events (location and time) is strictly preserved in both reference frames.

IV. **Invariance of Event Structure (IES):** Assume $e_i, i = 1, 2, \dots, n$ is a series of events on in reference A that occurs at position x_i at time t_i (in the coordinates of Reference A), $i = 1, 2, \dots, n$, and an observer in reference B observes them at position x'_i at time t'_i (in the coordinates of reference B), $i = 1, 2, \dots, n$, respectively, then, for any $i \neq j, k \neq m$, with $i, j, k, m \in \{1 \dots n\}$, we have

$$(x_i - x_j) / (x_k - x_m) = (x'_i - x'_j) / (x'_k - x'_m), \quad (t_i - t_j) / (t_k - t_m) = (t'_i - t'_j) / (t'_k - t'_m) \quad (4)$$

That means, the ratios between location and time intervals are strictly preserved in two reference frames.

IES is preserved by any coordinate transform of a (positive) linear nature, while IEO is preserved in any coordinate transform that preserves the order. A nonlinear but elastic transform may preserve IEO but not IES. IEO is more general and fundamental than IES. Lorentz Transform is a linear transform, therefore, both the IEO and IES should be preserved in LT. Because IEO and IES do not make any assumptions about light speed, while Time Dilation and Length Contraction depends on the second assumption of SRT on light speed, IEO and IES are more general and fundamental than Time Dilation and Length Contraction.

In the next section we shall show, through a so-called Missile-Well paradox, that the Length

Contraction property violates the Invariance of Event Ordering property, which is more fundamental.

2. The “Missile-Well” Paradox

The Missile-Well paradox is a more structured version of the Train Paradox that puts the ordering of collision events into consideration, as shown in Fig. 1. The Missile has three parts, Missile Head, Missile Body, and Missile Tail. Correspondingly, the Well has three blocking parts, the Well Mouth, the Well Waist, and Well Bottom. The Missile Head can pass through only the Well Mouth and Well Waist, not the Well Bottom, and the Missile Body can pass through Well Mouth only, not the Waist, while Missile Tail is blocked by Well Mouth. The combined length of Missile Head and Body and the length from Well Mouth to Well Bottom are all L , when measured statically. The Missile Head has a length of $0.8L$, Missile Body has a length of $0.2L$, and the Well Waist is in center of the Well, having a distance to of $0.5L$ to each of Well Mouth and Well Bottom.

Now Missile enters the Well at speed $v = 0.8c$. The length contraction factor is

$$k = 1/\gamma = \sqrt{1 - v^2/c^2} = 0.6.$$

A Meter M is set up to record the collision time ordering (assume Meter error can be neglected) of the Well Mouth, Well Waist, and Well Bottom. Meter can also be mounted on the Missile, but this does not change anything, because the ordering of collisions should be the same in both reference frames, due to the fact that collision is a bi-party event, both should be measured with the same ordering.

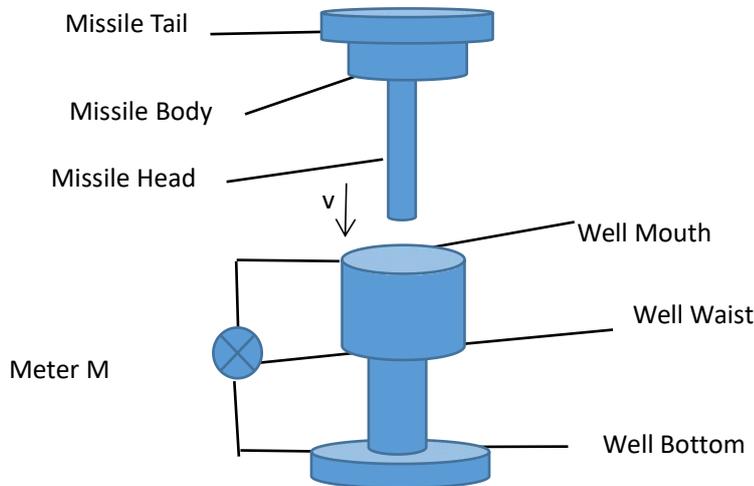


Fig. 1. The Missile-Well Paradox

First, we assume that the blocks on the Well is so weak, they do not affect the velocity of the Missile meaningfully after collision. The blocks are used only to enable measurement. So, when the Missile enters the Well, in the view point of the Missile, as in Fig. 2, the lengths of Missile Head and Missile Body are still $0.8L$ and $0.2L$ respectively, while due to Length Contraction and IES, the Well has a Length of only $1L * k = 1L * 0.6 = 0.6L$ and the Well Waist has a distance of $0.6L / 2 = 0.3L$ to either the Well Mouth or the Well Bottom. So Missile will see the following order of collisions: (I) Missile Head hits the Well Bottom first; (II) Missile Tail hits the Well Mouth second (because Missile Body has only a length of $0.2L$, smaller than the distance $0.3L$ of

Well Waist to Well Mouth); and (III) Missile Body will hit the Well Waist at last. Let's call this the Missile's ordering of I-II-III.

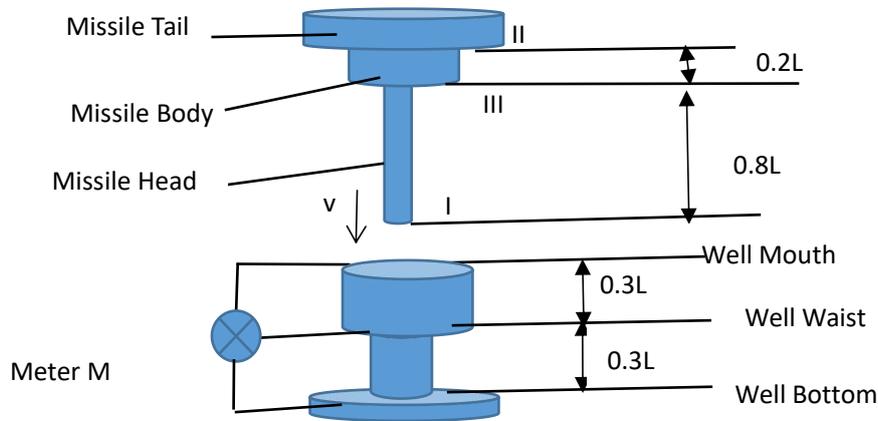


Fig. 2. Observation by the Missile

Now, from the point of the Well, as shown in Fig. 3, when Missile approaches with $v=0.8c$, the Well still has a length of L and the Well Waist still has a distance of $0.5L$ to each of the Well Mouth and Well Bottom, while due to Length Contraction and IES, Missile head this time has only a length of $0.8L * 0.6 = 0.48L$, and the Missile Body has only a length of $0.2L * 0.6 = 0.12L$. So the Well will see the following ordering of collisions: (A) Missile Tail hits the Well Mouth first; (B) Missile Body to hit the Well Waist second (because Missile Head has a length of $0.48L$, smaller than the distance of Well Waist to Well Bottom and hence can be fully contained in the space between Well Waist and Well Bottom before Missile Body hits Well Waist); and (C) Missile Head to hit Well Bottom last. Let's call this the Well's ordering of A-B-C.

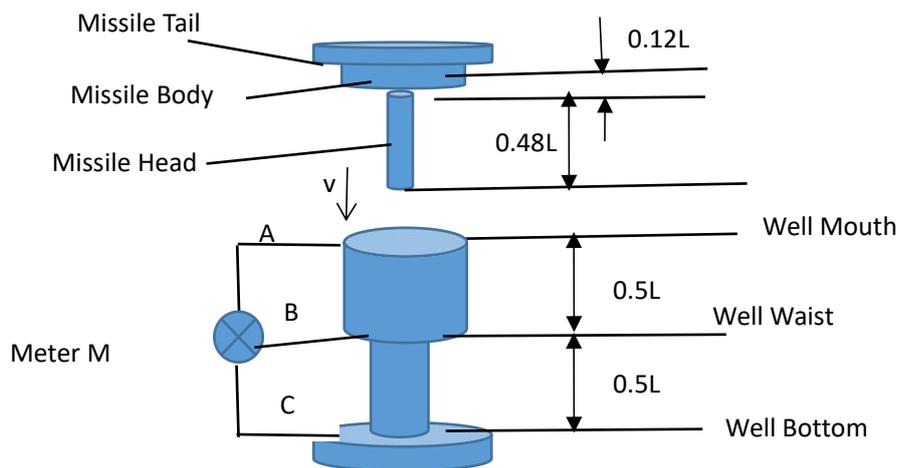


Fig. 4. Observation by the Well

But, collisions A, B, C seen by the Well are exactly the same as the collisions of II, III, I seen by the Missile respectively, so the ordering of collisions in the view of the Well, would be II-III-I, compared to the ordering of I-II-III as observed by the Missile. This means that **the ordering of events is not preserved by Length Contraction**. Length of Missile Head/Body h] or position of

Well Waist can change the the ordering of collisions seen by Missile and Well.

On the other hand, if there is no Length Contraction, then both the Missile and Well will see the following Collision ordering I/II-III, where Collision I and II happen at the same time. **As a matter of fact, this Missile-Well Paradox can actually serve as an experiment design to be used to disprove SRT.**

Because Collision is an event involving both parties, if Well Mouth has collision, it means Missile Tail also has collision, and son on. The opening sizes of Well Mouth/Waist, and the sizes of Missile Head/Body/Tail have determined that Missile Head can only collide with Well Bottom, Missile Body with Well Waist, and Missile Tail with Well Mouth. **That means, the collisions of the Missile have a fixed 1-1 relation with the collisions of the Well.** Therefore, physically, there can be only 1 single ordering of collisions. Changing reference frame cannot change the fact that collision involves two parties at the same time.

Since IEO is a more fundamental property than Length Contraction, this concludes that Missile and Well can have only a common ordering of collisions. **This is a direct proof that the ordering of events is invariant: Lorentz Transform cannot change the ordering of events.** In any of the orderings, whether it is I-II-III or II-I-III, SRT runs into self-contradiction. If we want to uphold our logic principles used in all human wisdom and in all sciences, then we have to conclude that SRT is invalid.

That means, in the Missile-Well Paradox above, we resolved the Relativity of Simultaneity issue by measuring the ordering of collision sequences at three places (assuming measuring error negligible). This avoids any ambiguities or time discrepancies that may be associated with different observers. The events of collision happen simultaneously on both Missile and Well, just different place of the Well at different time, but the ordering of collisions observed by both Missile and Well must be the same.

Lorentz Transform cannot change the Ordering of Events (like collisions) happened in either reference frame, because IEO is more general than Lorentz Transform, which depends on the assumption of light speed. And the measurement of ordering does not depend on simultaneity of measurements, as long as the clock keeps the good working order.

The new Missile-Well paradox is a higher level Paradox than the classic Train Paradox, and Lorentz transform cannot reverse the ordering of times (events) so as to avoid contradiction.

3. Conclusion

In this paper, we have shown that the Invariance of Event Ordering is a more general and fundamental property that has to be strictly observed in all inertial reference frames, whether light speed is constant or not. If the second assumption of SRT about light speed is correct, the Length Contraction derived from Lorentz Transform should also strictly preserve the IEO. Now that the Missile-Well Paradox proves that Length Contraction violates the IEO, this proves that the second assumption of SRT about light speed is wrong, and hence the whole SRT and General Relativity Theory are invalid.

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