LENGTH CONTRACTION DID NOT START WITH EINSTEIN

Lorentz Contraction in Absolute Time and Space of Newton and Galileo

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Abstract

All it takes is a simple train, a railway track, a camp situated perpendicular to the track, and an "Army of Couriers" who jump off the train at regular intervals, to observe fundamental phenomena of wave physics within pure Newtonian mechanics. Depending on the ratio of the train's speed to the courier's speed, the geometry of the experiment generates either the length contraction known from Special Relativity, or the giant trace elongation (Mach cone) known from aerodynamics. Both effects are described by a single, universal formula with a modulus under the square root. It turns out that Lorentz contraction is not an "invention" of Relativity, but an inevitable consequence of having an absolute, invariant, maximum signal propagation speed, regardless of whether we call this speed c or simply the "courier's speed."

PART I: THEORY AND GEOMETRIC STRATEGY

1 Introduction

Imagine an ideally classical world. Time flows the same everywhere (Newton's absolute time), space is rigid, and clocks are perfectly synchronized. In this world, we conduct a precise measurement experiment that leads us to surprising conclusions.

2 System Data and Equipment

For the purpose of the experiment, we have prepared the following research setup:

1. **The Train:** Has a rest length of $L = 100$ meters. It moves along a straight track at a speed of $v_{\text{train}} = 5$ km/h.
2. **The Couriers:**
   - Couriers in **White Shirts** are waiting in the first wagon.
   - Couriers in **Red Shirts** are waiting in the last wagon.
   - Each of them moves at the same constant speed $v_{\text{courier}} = 20$ km/h (independent of direction, acting like particles in a medium).
3. **Stationary Measurement Infrastructure:**
   - A long **ruler** is laid out along the track.

- Synchronized **stopwatches** are placed every meter, indicating the same absolute time ($t_{\text{track}} = t_{\text{train}}$).
- **Gathering Point (Target):** Located exactly 50 km from the track, on a line perpendicular to it.

3 Task: Measurement Instruction and Protocol

The goal is to identify the "Fastest Pair" — one White and one Red courier who reach the target in the absolute shortest possible time. To calculate the result of the experiment, each courier must execute a rigorous data recording procedure at the moment of departure.

Each courier is equipped with a permanent marker. Their instruction reads as follows:

> *"In the fraction of a second that you jump off the train, look immediately at the infrastructure by the track. Read the indication of the nearest stopwatch and the number on the ruler directly beneath your feet. You must write these two values in large digits on your shirt."*

As a result:

- **The Fastest White (front of the train):** His shirt displays the start time T_{white} and the jump coordinate X_{white}.
- **The Fastest Red (rear of the train):** His shirt displays the start time T_{red} and the jump coordinate X_{red}.

Our task is to calculate the "apparent length of the train" (L'), defined as the difference between the ruler indications written on the shirts of this fastest pair:

$$L' = |X_{\text{white}} - X_{\text{red}}| \tag{1}$$

4 Derivation and Calculation

4.1 Step 1: Determining the Geometric Strategy

For a courier to reach the target 50 km away as quickly as possible, they must maximize their velocity in the direction of that target (perpendicular to the tracks). However, the courier starts from a moving object.

According to the rules of velocity addition in classical mechanics, we construct a **Velocity Triangle** (a right-angled triangle):

1. **Hypotenuse ($v_{\textbf{courier}}$):** This is the total speed of the courier (20 km/h). This is their "total kinematic potential".
2. **Horizontal Leg ($v_{\textbf{train}}$):** To maintain an optimal trajectory relative to the train (compensating for drift), the horizontal component of the courier's velocity must match the train's speed (5 km/h).
3. **Vertical Leg ($v_{\textbf{target}}$):** This is the effective speed at which the courier actually approaches the gathering point.

Using the Pythagorean theorem, we calculate the effective speed:

$$v_{\text{target}} = \sqrt{v_{\text{courier}}^2 - v_{\text{train}}^2} \tag{2}$$

4.2 Step 2: Deriving the Formula from Shirt Data

When the "Fastest Pair" reaches the target, we take the shirts off them and analyze the recorded coordinates X. The value L' we are looking for is the distance on the ruler between the points where they had to jump to execute the geometric strategy described above.

Geometrically, the train length L is the hypotenuse in a spatial triangle, and the sought length L' (the difference between X_{white} and X_{red} from the shirts) is the leg projected onto the direction of effective motion. The angle of inclination of the velocity vector α determines this projection.

The cosine of the deviation angle is the ratio of the effective speed to the total speed:

$$\cos(\alpha) = \frac{v_{\text{target}}}{v_{\text{courier}}} = \frac{\sqrt{v_{\text{courier}}^2 - v_{\text{train}}^2}}{v_{\text{courier}}} = \sqrt{1 - \left(\frac{v_{\text{train}}}{v_{\text{courier}}}\right)^2} \tag{3}$$

Thus, the difference in coordinates recorded on the shirts (L') is expressed by the formula (provided $v_{\text{courier}} \neq 0$):

$$L' = |X_{\text{white}} - X_{\text{red}}| = L \cdot \cos(\alpha) \tag{4}$$

$$L' = L \cdot \sqrt{1 - \left(\frac{v_{\text{train}}}{v_{\text{courier}}}\right)^2} \quad (\text{for } v_{\text{courier}} \neq 0) \tag{5}$$

4.3 Step 3: Actual Data from Shirts (Reconstruction)

Let us assume a realistic scenario where the experiment takes place after 12 minutes of travel (720 seconds), when the train has passed the first kilometer mark. To achieve the optimal geometric strategy, the couriers had to synchronize their jumps in a specific way.

Here is exactly what the Record-Holders wrote on their shirts after finishing the run:

- **WHITE SHIRT (Front of the train):**
  - Stopwatch Time: T_{white} = **720.0000 s**
  - Ruler Position: X_{white} = **1000.0000 m**
- **RED SHIRT (Rear of the train):** To maintain the optimal angle of attack (the same formation as in Special Relativity), the courier at the rear had to jump slightly later.
  - Stopwatch Time: T_{red} = **722.2863 s**
  - Ruler Position: X_{red} = **903.1754 m**

Plugging this hard measurement data into our definition of the apparent length of the train:

$$L' = |1000.0000 - 903.1754| = \mathbf{96.8246} \text{ m} \tag{6}$$

This result perfectly matches the theoretical prediction:

$$L' = 100 \cdot \sqrt{1 - \left(\frac{5}{20}\right)^2} \approx 96.8246 \text{ m} \tag{7}$$

5 Key Insight

The entire calculation was performed in an inertial frame, using exclusively Galilean transformations and ordinary trigonometry. Neither the postulate of the constancy of the speed of light nor Einstein synchronization was used. Despite this, the exact same formula appeared that Fitzgerald and Lorentz introduced independently in 1895, and which Einstein derived from electrodynamics in 1905.

Contraction is not a result of "curved spacetime" or "relative time flow." It is a simple geometric consequence of the condition: **"Two signals with a constant, maximum speed $v_{\mathbf{max}}$ must reach the same point at the same instant."** If signals cannot slow down (just as photons cannot slow down below c), then the starting points of these signals (the front and rear of the train) must be closer to each other than at rest, by exactly the Lorentz factor. In classical mechanics, it is enough to simply introduce such a "rigid" speed limit, and contraction appears automatically.

6 Conclusions: The Illusion of Contraction

Our experiment, conducted entirely within the domain of classical physics, led to a result smaller than 100 meters. What conclusions can be drawn from this?

1. **Geometric Origin:** The result of 96.82 m on the ruler does not stem from the train shrinking physically. It stems solely from the **geometry of vectors**. The couriers had to sacrifice part of their speed for the horizontal component, which caused the projection of their positions onto the ruler to be "compressed."
2. **Proof from the Shirts:** The records on the shirts are hard measurement evidence. They show that the effective operational distance between the front and rear of a moving train (for objects with a finite speed v_{courier}) is different from the rest length.
3. **Mathematical Identity:** The formula derived is mathematically identical to the formula for Lorentz contraction. In the Newtonian world, it signifies a change in the effective geometry of motion in a medium, not a change in the structure of spacetime.

Relativity did not invent contraction. If Newton or Galileo had invented couriers who cannot run slower than a certain constant speed, we would have had the full Lorentz-FitzGerald formula already in the 17th century – only with $v_{\mathbf{max}}$ instead of c. Length contraction is older than Einstein. It is simply an unavoidable property of any physics where there exists a rigid, maximum speed of signal propagation used for measurement – regardless of whether we live in 1687 or 1905.

PART II: EMPIRICAL VERIFICATION AND THE MACH EFFECT

7 Introduction

In the first part of our article, we demonstrated that to achieve the absolute best travel time, couriers would have to apply a precise geometric strategy. This might suggest that length contraction requires "intelligent" planning.

In this part, we will show that this is not the case. Nature makes the selection itself. It is enough for an "Army of Couriers" to jump off the train at dense time intervals, and measurement statistics will automatically generate a result consistent with the theory. Furthermore, by introducing a small mathematical correction (the modulus), we will see that the same mechanism is responsible for the shock wave phenomenon.

8 Equipment and "Brute Force" Procedure

Crucial for this experiment is that the measurement is objective and independent of the train.

- **Stationary Infrastructure:** A long ruler lies along the track, and **stationary stopwatches** stand every meter. All stopwatches are synchronized relative to the track (not the train!).
- **Army of Couriers:** Crowds of couriers wait in the first and last wagons. The doors are open.
- **Principle:** Couriers jump one after another at a rigid interval of **0.3 seconds**.
- **No Calculations:** The courier does not calculate. At the moment of the jump, he looks under his feet and at the nearest platform stopwatch. He writes the time (T) and position (X) from the **stationary instruments** on his shirt, and then runs to the target.

There is one goal: judges at the base select from thousands of shirts only those two (one White and one Red) belonging to the couriers with the **best total time**.

9 Universal Formula with Modulus (The Key to the Puzzle)

Before analyzing the results from the shirts, we must supplement our theoretical formula. To make it work in every situation (even when the train is faster than the courier), we introduce the absolute value under the square root (assuming $v_{\text{courier}} \neq 0$):

$$L' = L \cdot \sqrt{\left|1 - \left(\frac{v_{\text{train}}}{v_{\text{courier}}}\right)^2\right|} \quad (\text{for } v_{\text{courier}} \neq 0) \tag{8}$$

Why the modulus? The number **1** is the courier's "total kinematic potential".

- When the train is slow, we subtract a small number from one – the result is a fraction (shortening/contraction).
- When the train is very fast, we subtract a large number from one. The result is negative, which in mathematics usually implies an error. However, in wave physics, this signifies a transition to another mode: **trace elongation (Mach Cone)**. The modulus allows us to calculate this value.

10 Task 1: Subcritical Train (Classical Contraction)

Data: Train 5 km/h, Couriers 20 km/h. (Courier faster). Scenario after 12 minutes of travel (train passes the 1st kilometer).

The judges analyze thousands of shirts from the Army of Couriers.

10.1 A. The Fastest White (Front)

The winner is the one who hit the moment when the target was perpendicular to the track. Thanks to dense sampling (every 0.3 s), one of the couriers hit it perfectly.

- **Shirt:** $T = 720.0$ s, $X = 1000.00$ m.

10.2 B. The Fastest Red (Rear)

Natural selection works here. Couriers jumping at the 720th second had too far to go. Those jumping at the 725th second were carried too far. The ideal jump time (theoretically) is +2.28 s. In our army, no one jumps at such a fraction.

- Courier #7 (jump +2.1 s): Not bad, but had to compensate.
- Courier #8 (jump +2.4 s): **Winner!** He was closest to the geometric ideal.

During these 2.4 seconds, the train traveled approx. 3.33 meters. Since the rear was at the 900th meter, the jump position is 903.33 m.

- **Shirt:** $T = 722.4$ s, $X = 903.33$ m.

RESULT OF TASK 1:

$$L'_{\text{apparent}} = |1000.00 - 903.33| = \mathbf{96.67} \text{ m} \tag{9}$$

(Theoretical value from Lorentz formula: 96.82 m). Even with "blind" jumping, the result converges to classical Lorentz contraction.

11 Task 2: Supercritical Train (Mach Effect)

Data: Train 20 km/h, Couriers 5 km/h. (Train faster!). Here the situation changes. The couriers are too slow to chase the train.

We plug into our formula with modulus:

$$L' = 100 \cdot \sqrt{\left|1 - \left(\frac{20}{5}\right)^2\right|} = 100 \cdot \sqrt{|1 - 16|} = 100 \cdot \sqrt{15} \approx \mathbf{387.3} \text{ m} \tag{10}$$

What does this mean for the Army of Couriers? The judges at the base are shocked. For the signals from White and Red to reach them at the same moment (creating a coherent front), the couriers had to jump at diametrically different places.

- **White Record-Holder:** If he jumped at the 1000th meter...
- **Red Record-Holder:** ...then his colleague at the rear of the train could not jump a moment later (as in Task 1). He had to jump **much, much earlier**, before the train even reached that vicinity. He had to jump around the 612th meter!

The difference on the ruler between the jump points of these two record-holders is a massive **387 meters**.

Conclusion from Task 2: When an object moves faster than the measurement signal, the apparent length (L') undergoes giant **elongation**. What we measured is actually the geometry of a **shock wave (Mach Cone)**. The Red courier had to start so early for his slow run to sync with the White's fast passage.

12 Summary of Part II

The experiment with the Army of Couriers and the modulus formula demonstrates the beautiful unity of classical physics:

1. When the train is slower than the courier $\rightarrow$ We observe **Contraction** (Task 1, result ≈ 96 m).
2. When the train is faster than the courier $\rightarrow$ We observe **Elongation/Shock Wave** (Task 2, result ≈ 387 m).

Key Conclusions:

- **Illusion of Results:** It must be emphasized strongly that both obtained results (96 m and 387 m) are **apparent** values. The physical train welded from steel did not change its rest length of 100 meters for a moment. What we read from the ruler is merely an "effective operational footprint" – a geometric projection resulting from velocity relations, not a physical deformation of the object.
- **Inviolability of Causality:** In both cases – even in Task 2, where the train is faster than the signal (courier) – **causality is not violated**. Clocks on the platform tick in one direction. No courier went back in time, no effect preceded the cause. The fact that at supercritical speeds we observe a reversed order of signal arrival (hearing the plane after it has passed) is only an illusion of perspective, not an error in the structure of reality.

Open Question: Since in classical mechanics the existence of a speed limit for the courier (e.g., speed of sound) does not lead to paradoxes, but only changes the geometry of the phenomenon from "contraction" to "Mach cone", a fundamental question arises regarding our reality:

> **Is the limiting speed of light (c) recognized in physics actually a barrier protecting causality, the crossing of which would shatter the logic of the universe? Or is it just a great misunderstanding, and crossing c would not send us back in time, but would merely result in the formation of a "luminal Mach cone" and the apparent elongation of observed objects?**