

# THE TWIN PARADOX

## A Memorandum

Version V7 100526b  
Jukka T. Seppala  
Helsinki, Finland  
May 10, 2026  
Copyright © 2026 Jukka T. Seppala

### Introduction

This brief memo takes a look at The Twin Paradox that arises in 4-dimensional Minkowskian space-time as a result of Einstein's Special Relativity.

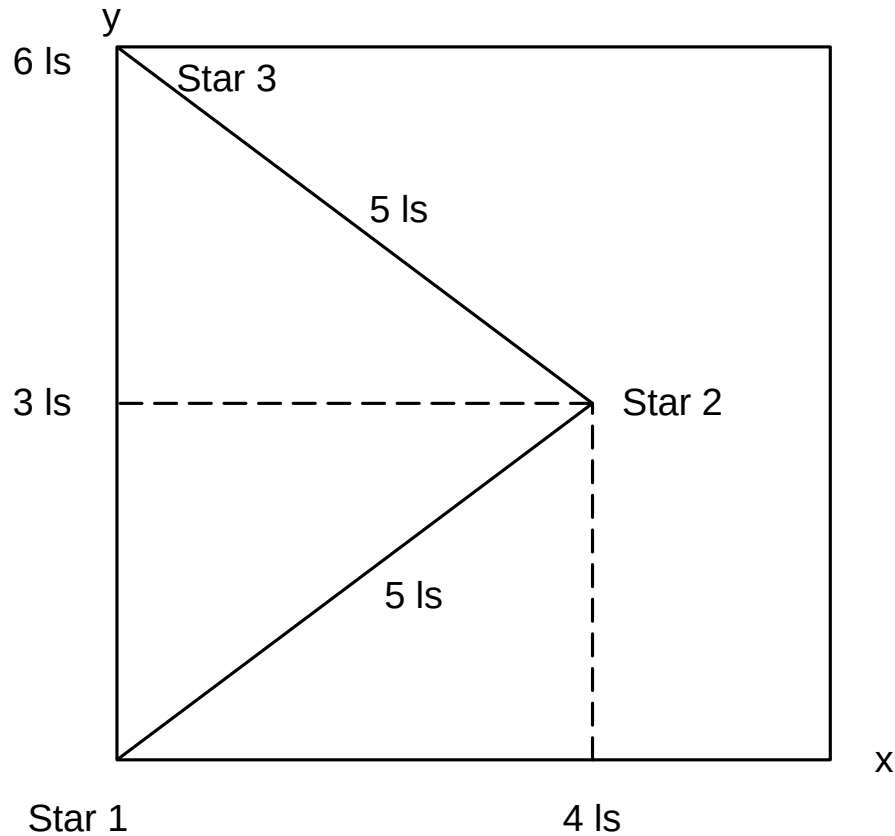
According to the paradox a twin that travels to a distant star and back ages less than a twin that is left behind at the home planet.

This memo aims to show that this paradox is averted with the following four assumptions:

- 1) Einstein was right about Special Relativity and clocks slowing down as velocity approaches the speed of light. This is not in doubt.
- 2) Minkowski was wrong about the 4-dimensional space-time. We only live in a 3-dimensional space and time cannot be regarded as a separate dimension that can be fused with space into space-time. Time is a measure of the rate of change of physical processes.
- 3) Everything in the Universe moves. Nothing stays stationary.
- 4) Motion affects the rate of change of all physical processes, and thus clocks slow down with increased velocity. The gamma-factor is the measure of this time dilation.

With these four assumptions and the help of the figure on the next page it will be shown that The Twin Paradox is averted.

The Twin Paradox in 3D Space with 2 spatial dimensions x and y



Data for travelers A and B (In 3D space with 2 spatial dimensions shown). The values given are approximate values.

▫ A travels from Star 1 to Star 3 along the y axle in a straight line.

- Velocity  $0.6 c = 1.8 \cdot 10^8 \text{ m s}^{-1}$
- Travel distance 6 ls (light seconds) =  $1.8 \cdot 10^9 \text{ m}$
- $t = 10$  seconds
- $\gamma = 1.25$  (Gamma shows the time dilation.)
- Travel time in A's Clock = 8 seconds

▫ B travels from Star 1 to Star 3 via Star 2 that is 4 light seconds away in the direction of x axle.

- Velocity  $0.78 c = 2.34 \cdot 10^8 \text{ m s}^{-1}$
- Travel distance 10 ls (light seconds) =  $3.0 \cdot 10^9 \text{ m}$
- $t = 12.821$  seconds
- $\gamma = 1.598$  (Gamma shows the time dilation.)
- Travel time in B's Clock = 8 seconds

▫ If B wants to meet A at Star 3 their clocks must show the same time!

▫ The Twin Paradox is thus solved in the ordinary 3D space with Special Relativity.

▫ There is no way that traveler B can travel to the future or the past of traveler A.

The Figure on the previous page shows us how The Twin Paradox is averted in ordinary 3D space.

The first thing to notice about the figure is that it shows two spatial dimensions (x and y). In the standard spacetime diagrams the x-axle represents the spatial dimension in meters and the y-axle represents the temporal dimension in seconds.

In the spacetime diagrams of 4D space-time the longest path from Star 1 to Star 3 would be the straight line taken by traveler A, and the shorter path would be the path taken by traveler B via Star 2.

Now, there is nothing wrong about the mathematics of these space-time diagrams as they are used to analyze 4D spacetime. But one may ask the question whether our real Universe is 4D or 3D with relativistic time?

The position taken in this memo is that we live in ordinary 3D space with just three spatial dimensions. Einstein's Special Relativity (SR) is right about time dilation and the slowing down of clocks with increased velocity.

However, in this 3D space each point in this space has a unique time as measured by clocks. This time is the function of the gravitational field at this point. Also, for moving objects, the clocks slow down.

The Twin Paradox is averted in the figure on the previous page. This is because we do not use the Minkowskian metric to describe the spacetime interval of travelers A and B.

The Minkowskian metric is as follows for a spacetime interval:

$$-s^2 = c^2 t^2 - \Delta x^2 \quad \text{The space-time interval in 4D space-time.}$$

In the figure on the previous page we have not calculated this interval. Instead we use the gamma factor to calculate the time dilation, and it shows that if travelers A and B wish to meet at Star 3 at the same time, then they have to move at relative velocities in such a way that their clocks agree about the elapsed time when they meet again.

I have used 3 stars to describe the situation to make it more realistic. According to our assumption 3) nothing stays stationary. And if we want to compare the relative velocities of travelers A and B we need some references in 3D space.

So we imagine a space with three stars. Both travelers A and B begin their journey from Star 1. A travels directly to Star 3, and B takes a route via Star 2 to Star 3 with a greater velocity.

A and B thus travel different distances with different velocities, but their clocks will agree on the elapsed time when they meet at Star 3!

- Otherwise B will either overshoot or undershoot the Meeting Point at Star 3.
- If B travels faster B will arrive at Star 3 before A and overshoot given A's velocity.
- If B travels slower B will arrive at Star 3 after A and undershoot given A's velocity.

We thus arrive at a general conclusion:

- If B wants to travel faster, B will have to travel along a different route so that B arrives at a new meeting point in such a way that the clocks of both A and B agree and show less time.
- If B wants to travel at a slower velocity, B will have to travel along a different route so that B arrives at a new meeting point in such a way that the clocks of both A and B agree and show more time.
- There is no way that B can travel to the past or future of A.
- Thus there is no Twin Paradox in the ordinary 3D space where time is not fused with space into a 4D space-time.
- Also, it must be emphasized that both A and B move. They move along different routes and different velocities, because nothing stays stationary in the Universe, and in the end there is a unique meeting point for them in the future such that their clocks will agree about the elapsed time.
- This does not prove that 4D space-time does not exist. It only shows that The Twin Paradox can be averted if we assume ordinary 3D space instead of 4D space-time.