Time longest distance between two places

physics watch

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Physics combines the three dimensions in which a person is free to move, with the sequence of moments in his life, into a unified universe of four dimensions.

At the end of *The Glass Menagerie* by Tennessee Williams, Tom claims to have traveled much farther by standing still on the fire escape than if he had gone to the moon, "for time is the longest distance between two places."

It's an amazing quote from a playwright whose life shows no evidence of interest nor particular aptitude in matters technical. It's amazing because it is exactly in line with the understanding of modern physics.

Modern physics combines the three dimensions in which a person is free to move from place to place, with the unfolding sequence of moments in his life, into a unified universe of four dimensions.

We can call the points in this four-dimensional universe place-moments, in order not to confuse them with places in three-dimensional space.

The method of measuring distances between place-moments in this four-dimensional universe is similar to, but a little different from, the method that works in the three-dimensional space in which we move around.

If you hold two rulers together at right angles with their zero marks touching, the distance between the 3-inch mark on one and the 4-inch mark on the other is five inches.

In general, the distance between two points on either ruler is never shorter than the distance from the zero marks to either point — for example, five is bigger than either four or three.

In technical terms, this is stated by Pythagoras' theorem: the square of the distance between two places is equal to the sum of the squares of the distances along any two perpendicular directions leading from one point to the other.

In the four-dimensional world of place-moments, the rule is almost the same, but with a twist.

First, you get the three-dimensional space distance in the same way as before. Then you combine the square of the space distance with the square of the time distance, but instead of adding them, you take their difference!

The result of taking the difference between the squares of the space and time distances, instead of their sum, is that the net distance in the four-dimensional world of place-moments is *never longer* — instead of never shorter — than either the space distance or the time distance.

A further result is that it is possible to have the distance between two different place-moments equal zero!

If the time distance between the two place-moments is the same as their space distance, then their net distance in the four-dimensional world of space-time is nil.

Now, why is time the longest distance between two place-moments?

Suppose you walk out on the fire escape, climb down the stairs, then turn around and come back — a trip that takes you 10 minutes. Now instead of that, suppose you come out on the landing and stand there leaning on the railing for 10 minutes. In which case have you traveled a farther distance through space-time?

In the first case, with every step you climbed, your net space-time travel distance is calculated from the difference between the square of the space distance between the two stairs and the square of the time distance you took to climb the step.

In the second case, your wristwatch simply counted off one unit of time distance after another, and there were no space distances whose squares were to be subtracted off. By simply standing still on the fire escape, you moved farther through space-time than had you climbed down the stairs and back up again in the same length of time.

Indeed, as Tom understood, by simply standing still on the fire escape, he traveled much farther through space-time than had he flown to the moon and back in the same length of time.