Re: Twin paradox revisited ll

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cosmosco@xxxxxxxxxxxxxxx says...

> So I take it that nobody openly supports the idea that the earth bound twin physically ages at a faster rate than the traveler and that this only occurs during acceleration following turn around?

Let me give you an analogy. Suppose I take a clean white sheet of paper and draw a dot in the middle. Call that dot the "origin". Then I draw a straight line coming out of the origin with a blue pen. Then I draw a second line coming out of the origin using a red pen, making sure that the second line is at a 60 degree angle relative to the first. Which line is longer?

Here's a way to think about it: Turn the paper so that the blue line runs horizontal, left−to−right. Now, if we move 1 inch along the blue line, and consider the point on the red line that is directly above it, then that point is a distance of 2 inches along the red line. So as you move horizontally, the red line increases its length faster than the blue line−−−twice as fast, as a matter of fact. So it must be that the red line is twice as long as the blue line, right?

Of course not. The same argument applies equally well if we orient the paper so that the red line is horizontal. Then if we go 1 inch along the red line, then the corresponding point above it on the blue line is 2 inches away from the origin. So from this perspective, it seems that as we move horizontally, the length of the blue line is increasing twice as fast as the length of the red line. So it must be the the blue line is twice as long as the red line.

We are talking about the quantity dL/dx = the rate at which the length of a line changes as a function of the horizontal distance x. If we take the blue line to be horizontal, then we get dL/dx = 1 for the blue line, and dL/dx = 2 for the red line. If we take the red line to be horizontal, then we get dL/dx = 2 for the blue line, and dL/dx = 1 for the blue line. It's

completely symmetric.

But now, suppose that we don't continue the red line
in a straight line. Instead, we draw the red line
so that it goes away from the blue line at 60 degrees
for 3 inches, then makes a sharp turn to come back
to join the blue line. So the red line with its turn
forms two sides of an equilateral triangle, and the
blue line forms the third side. Now, where the two
lines get back together, draw a second dot, called
the endpoint. We can unambiguously say that the
blue line runs 3 inches from the origin to the endpoint,
while the red line runs 6 inches. Everyone agrees that
the red line is twice as long as the blue line. There
is no symmetry between the two cases.

What broke the symmetry? The fact that the red line
made a turn. The blue line is straight, while the
red line is not. In Euclidean geometry, a straight
line connecting two points is shorter than a bent
line connecting the same two points.

A similar thing happens in the twin paradox. While
the two twins are traveling inertially at constant
velocity, each twin can consider himself to be "at rest"
(in the same way that the blue line and the red line
can be considered to be "horizontal"). But when one
twin turns around, that breaks the symmetry. When
the two twins get back together, one twin will have
aged more than the other. In Special Relativity,
the twin that took the inertial (constant velocity)
path ages the most.

It isn't that the acceleration *causes* the differential
aging, it is just that the acceleration is what makes
one path noninertial (corresponding to the bent line
on the piece of paper). Acceleration is a "bend" in
a spacetime path.

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