Re: Length "contraction" and time "dialation" bad language.

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- *From*: Baugh <baconbaugh@xxxxxxxxxxx>
- *Date*: Sun, 08 May 2005 15:00:16 −0400

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Dr *** wrote:


       dr
       Yes but you are either arguing for simultaneity across the tape or your not.


I am pointing out that the meaning of simultaneity as defined by the
viewing card depends on orientation. Put two dots on a card at exactly
the same height. Then turn the card and no longer to the dots occur
at the same height.

When you imagine two events happening "at the same time" you are
visualizing all of space at a given instant. This "all of space at
an instant" is the slot in the card.


In SR boosts are pseudo−rotations.  The fact that different observers
disagree as to whether two events occur "at the same time" is exactly
analogous to the above where two rotated persons will disagree as
to whether two dots occur "at the same height".



       in the immediate case above your presumably claiming that with
       a rotated
       card the marker across the card is not viewable simultaneously
       which makes
       the width of the tape a major significance as it appears to
       define how far
       into the past and future you can see or how far in space you
       can see.


For the simultaneity issue remember the tape is the analogue of a meter
stick existing forever. So yes, likewise in considering simultaneous
events occurring *on the meter stick* the length will be "a major
significance". But ignore the tape and work with an infinite sheet of
paper her. The point is this:
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How much two events, simultaneous in one frame, occur at different times in another frame is proportional to how far apart they are in the one frame. In the dots on paper analogue, how vertically separated the two points become when you rotate depends on how far apart they are horizontally when you look at them level.

> ... So that with the card rotated so the slit was parallel to the tape you could see the maximum distance into the future and past simultaneously or with the card rotated across the tape you are able to see the spatial width of the card simultaneously.

You are labeling future independently of the viewer here. That is the point. My future is your "future plus some displacement" when your time-distance frame is rotated relative to mine. (you are moving relative to me.)

But as I said, this is an analogy and it breaks down when you rotate 90deg (equivalent to boosting all the way to speed of light, an infinite pseudo-angle). Rotations are periodic, returning to where you started after 360 deg. Pseudo-rotations just keep goin and goin and goin.

> So in one case we have length contraction and time expansion and in the other length expansion and time contraction ...

Yes but this is "because" in one case cos(0.1) < cos(0) and in the other cosh(0.1) > cosh(0).

> ...both case being inversely proportionate

Yes relative to the ratio \gamma = 1/cos(a).
But this is because you are looking at a cross section.

If you compare two points (and the rectangle you draw with these points at opposite corners)
you get:
new width = cos(a) old width - sin(a) old height
new height = sin(a) old width + cos(a) old height.

Things are different when you deal with infinite height boxes (analogues of infinite duration measuring rods).

* The cross section width when you lean the box gets larger. It is the hypotenuse of a triangle with one side the old width.

* The new cross section will be 1/cos(a) * old cross section. (bigger)
This is the gamma factor \gamma = sec(a).

* The "velocity" will be the reciprocal slope: \beta = tan(a).

Recalling your trig identities sec^2(a) − tan^2(a) = 1 you get
an Euclidean formula:

\gamma = \sqrt(1 + \beta^2) (rotations)

** For space−time it is sech(a) = 1/cosh(a) (smaller since cosh(a) > 1).
The "gamma factor" is \gamma = sech(a).

** The (normalized) velocity will be \beta = v/c = tanh(a).

** The hyperbolic trig identity: sech^2(a) + tanh^2(a) = 1 gives:

\gamma = \sqrt(1 − \beta^2) (pseudo−rotations)

> so they are difficult to observe accept by
> comparison of real clock ticks after being returned to one
> place as per
> experimental fact.

If I follow correctly then, Yes. We can't pseudo−rotate our velocity
around to its negative to "go back" and see what happened in past.
We have to visualize the pseudo−Euclidean space−time by keeping records
and going back and plotting it out on Euclidean paper. To do relativity
transformations we can't just rotate the paper. We have to work out
the transformations on the components and re−visualize by plotting on
a fresh sheet of paper. That's what makes it so darned difficult to
get an intuitive grasp of it.

> So I see the rotation as factual and not pseudo although
> you can clearly rotate the pseudo into the factual and then claim the
> factual is pseudo.{:−)

Pardon me, I used pseudo−rotation in a strict mathematical sense.
If it helps replace my "pseudo−rotation" with "hyperbolic rotation".

For the benefit of other readers I'll give the details:

An orthogonal rotation preserves a positive definite (or negative definite) metric.
e.g. distance^2 = b^2x^2 + c^2y^2.
bx' = bx cos(a) − cy sin(a)
cy' = bx sin(a) + cy cos(a)

A pseudo−orthognal transformation or pseudo−rotation preserves
an indefinite metric.
e.g. duration^2 = c^2 t^2 − b^2x^2.
bx' = bx cosh(a) + ct sinh(a)
ct' = bx sinh(a) + ct cosh(a)

(e.g. let c = 3x10^8 m/s and b = 1 m/m)

Recall the hyperbolic trig functions:
cosh(a) = [e^a + e^−a]/2, sinh(a) = [e^a − e^−a]/2
with the others, tanh, sech, csch, coth by the analogous ratios,
e.g. tanh = sinh/cosh.

The principle hyperbolic trig identity is
cosh^2(a) − sinh^2(a) = 1,
corresponding to an indefinite metric
dx^2 − dt^2 = ds^2 (c = 1 units)

If you like, you can also define "parabolic trig" with
cosp(a) = 1 (= secp(a))
sinp(a) = a (= tanp(a))

Use these in place of the above and you get the non−relativistic transformations.

They are in fact the first terms in the
power series expansion:
cosh(a) = 1 + a^2/2! + a^4/4! ...
sinh(a) = a + a^3/3! + a^5/5! ...
and also:

$$\cos(a) = 1 - a^2/2! + a^4/4! - \dots$$
$$\sin(a) = a - a^3/3! + a^5/5! - \dots$$

Thus for very small "rotation" angles we cannot distinguish between parabolic, hyperbolic, and elliptic. We will see only the parabolic contribution because a^2 is so small. This is the domain in which we usually experience nature, velocities $\ll 1$ ($c=1$ units) so we didn't notice Einstein's (or rather Lorentz's) version, growing up.

By the same token we don't notice that walking on the Earth is really a rotation about its center of very small angle. We assume the Earth was flat because we only saw the parablolic terms in the transformations. But we did notice some pecular behavior, ships disappear over the horizon. Before that if you measure their distance via parallex you will notice the same "height contraction" I described.
This simply due to the fact that their masts rotate away from us as they move around the curved Earth.

This is all that time dialation is. The fact that clocks moving relative to us have their tick intervals pseudo-rotated away from us (or toward us).

Finally. All this I've said doesn't really "explain" the behavior. It rather *describes* it. Theories don't explain they describe/predict.

If that description fails to be what we observe then we are justified in trashing the theory. Explainations are like mathematical proofs from axioms. They only push the problem of "what is true" from the theorem onto the axiom, or from the phenomena onto a model.

Just as different axioms may yet lead to the same theorem so too different models may yet predict the same phenomenon. But as science is not mathematics we don't (rather we shouldn't) care about which model we use, only about what phenomena are predicted.

Relativity predicts phenomena which are seen over and over again. GPS wouldn't work as well if the engineers ignored phenomena predicted by SR and GR. Argue that they shouldn't listen to Einstein and they'll laugh in your face because they know the clocks in orbit do not listen to Newton. Show them a "proof on paper" that its wrong and they'll rightly tell you "I don't care if it's right, I care if it works!" Show them a theory that "works better" and they and I will happily chunk Einstein's theory out the window.

(Unless the math is nastier and the improvement doesn't make it worthwhile to change theories. Building houses doesn't require we account for Einstein's corrections to Newton. Building GPS systems does.)

Regards,
James Baugh
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