Critique of "Experiment 3" in Ufuk Denizyar's paper

=== START QUOTATION FROM http://sites.google.com/site/udenizyar/pdf/lt4.pdf

3.3.1 Experiment 3

Let there are two observers A and B standing on two platforms P_A and P_B respectively. Initially the relative speed of them is zero. Also there are light sources and clocks on the two far side of the platform P_B. There is a detector at the middle. The distance between the detector and each light sources are equal. All of these equipment are placed in such a way that the light beams are emitted in the x direction. When a clock ticks a predefined value, the tied light source emits a light beam. The detector detects whether the two light beams hit at the same time or not.

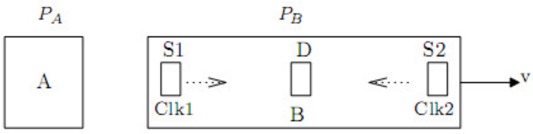

Figure 3:

In the first part of the experiment, the clocks are synchronized and set up such that after n ticks the light sources are excited. The light beams are emitted and then hit the detector at the same time. In the second part, again synchronize the clocks and set up such that their predefined values are the same. However, before the emitting time, let one of the platform accelerates in the x direction and has a constant speed after a while. Then wait for the result of the experiment. There are two possibilities: either the light beams hit the detector at the same time or not and both observers agree on this. Now we will show that the relativity interpretation of the Lorentz transforms gives different results for each observer.

If relativity principle is correct, the observer B on the platform P_B will get the same result. I.e. (s)he will see that the light beams are emitted and hit the detector at the same time. On the other hand, according to the observer A on the other platform, the clocks are still synchronized because they share the same movement and thus get the same affects. Therefore, the lights are emitted at the same time also wrt A.

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My comments:
The important flaw is found in the last statement above. *"On the other hand, according to the observer A on the other platform, the clocks are still synchronized because they share the same movement and thus get the same affects."* This is simply wrong.

Let us analyse what happens when we change the speed of platform P_B. How the platform is accelerated is not very well defined: *"let one of the platform accelerates in the x direction and has a constant speed after a while."* I will assume that what is meant is that both clocks and the detector are accelerated equally and simultaneously in the original inertial frame. There is a problem with this though. If the acceleration is done this way, the proper distance between S1, D and S2 will change; the platform will be physically stretched. (Bell's paradox). Nevertheless, let us assume that the acceleration is done simultaneously in the original frame. Let us further assume that that the acceleration is very high for a short time, so that we can consider the speed of the platform to change abruptly.

The question is: How will the clocks be synchronized, and what will the distance between S1, D and S2 be after the acceleration?

Let there be a clock at the detector at D, and let this clock as well as clock S_1 and S_2 be synchronized in an inertial frame K. Let the distances S_1-D and S_2-D both be equal to d.
Let an inertial frame K' be moving with the speed v relative to K. Let the origins of K and K' be aligned when t = t' = 0.

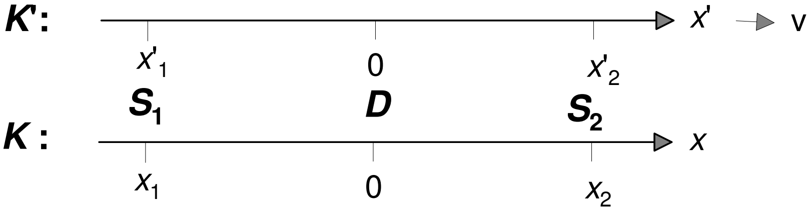

Fig. 1

At the time t = 0, let S_1 , S_2 and D be instantly set in motion to the speed v, so that they after that time will be stationary in the frame K'.

The coordinates of S_1 , S_2 and D in K' at the time t' = 0+ will then be:

D: x' = 0, t' = 0

S_1: $x_1^{'} = \dfrac{x_1 - x_1 \cdot t_1}{\sqrt{1-\dfrac{v^2}{c^2}}} = \dfrac{-d}{\sqrt{1-\dfrac{v^2}{c^2}}}$, $t_1^{'} = \dfrac{t_1 - \dfrac{x_1 \cdot v}{c^2}}{\sqrt{1-\dfrac{v^2}{c^2}}} = \dfrac{dv}{c^2\sqrt{1-\dfrac{v^2}{c^2}}}$

S_2: $x_2^{'} = \dfrac{x_2 - x_2 \cdot t_2}{\sqrt{1-\dfrac{v^2}{c^2}}} = \dfrac{d}{\sqrt{1-\dfrac{v^2}{c^2}}}$, $t_2^{'} = \dfrac{t_2 - \dfrac{x_2 \cdot v}{c^2}}{\sqrt{1-\dfrac{v^2}{c^2}}} = \dfrac{-dv}{c^2\sqrt{1-\dfrac{v^2}{c^2}}}$

The implication of this is that when S_1 , S_2 and D are instantly set in motion, the distances S_1-D and S_2-D will be increased as measured in K'. That means that the platform is physically stretched. (See Bell's 'paradox'). The clocks S_1 and S_2 will still show 0 immediately after they are set in motion. But this is different from the coordinate time in K', so they are no more synchronous to each other and to the clock at D.
S_1 will show less than it should to be synchronous, while S_2 will show more.

This means that S_2 will emit the light pulse before S_1 will, and since the speed of light in K' is isotropic and the distances are equal, we can conclude:

The detector will receive the pulse from S_2 before it will receive the pulse from S_1, and the time difference is: $\Delta t' = \dfrac{2dv}{c^2\sqrt{1-\dfrac{v^2}{c^2}}}$

Note that this is a proper time interval; it is measured by a clock at the detector.

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Then wait for the result of the experiment. There are two possibilities: either the light beams hit the detector at the same time or not and both observers agree on this. Now we will show that the relativity interpretation of the Lorentz transforms gives different results for each observer.

If relativity principle is correct, the observer B on the platform P_B will get the same result. I.e. (s)he will see that the light beams are emitted and hit the detector at the same time. On the other hand, according to the observer A on the other platform, the clocks are still synchronized because they share the same movement and thus get the same affects. Therefore, the lights are emitted at the same time also wrt A. Let w is the speed of light in the medium which fills the platform P_B according to B. Then, from the point of view of A, the speed of light from S_1 would be

$$w_1 = \frac{v+w}{1+v.w/c^2} = \frac{(v+w)c^2}{c^2+v.w}$$

and the speed of light from S_2 would be

$$w_2 = \frac{v-w}{1-v.w/c^2} = \frac{(v-w)c^2}{c^2-v.w}$$

Also it is known that distance between each source and the detector had been equal when the relative speed of platform were zero. Therefore, the distance between the light sources and detector is shorter than original but still the same. Let this distance be d. Therefore, the period between the emitting time and arrival time of the light beam emitted from S_1 is

$$\begin{aligned} t_1 &= \frac{d+t_1.v}{w_1} \\ \Rightarrow t_1 &= \frac{d}{w_1-v} = \frac{d}{\frac{(v+w)c^2}{c^2+v.w}-v} \\ &= \frac{(c^2+v.w)d}{w(c^2-v^2)} \end{aligned}$$

The period between the emitting time and arrival time of the light beam emitted from S_2 is

$$\begin{aligned} t_2 &= \frac{d-t_2.v}{-w_2} \\ \Rightarrow t_2 &= \frac{d}{-w_2+v} = \frac{d}{\frac{(w-v)c^2}{c^2-v.w}+v} \\ &= \frac{(c^2-v.w)d}{w(c^2-v^2)} \end{aligned}$$

These two times are different even for $w = c$. So, according to A, the light beams hit the detector at different times.

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My comments:
This is correct.
But let's calculate the time difference:

$$\Delta t = t_1 - t_2 = \frac{\left(c^2 - v\cdot w\right)d}{w\left(c^2-v^2\right)} - \frac{\left(c^2 + v\cdot w\right)d}{w\left(c^2-v^2\right)} = \frac{2dv}{\left(c^2-v^2\right)}$$

Note the possibly surprising phenomenon that the speed of light in the medium cancels in the time difference. This is because although the light is slowed down in both directions, the light going with the medium is slowed down less than the light going in the other direction, so the time difference remains the same.

This is the same phenomenon as why the index of refraction in the fibre of a fibre optic gyro doesn't affect the phase difference, see:
https://paulba.no/pdf/fiber_optic_gyro.pdf

So we have:

Measured in K': $\Delta t' = \dfrac{2dv}{c^2\sqrt{1-\dfrac{v^2}{c^2}}}$

Measured in K: $\Delta t = \dfrac{2dv}{c^2\left(1-\dfrac{v^2}{c^2}\right)}$

These time intervals seem to be different. But $\Delta t'$ is a proper time, measured by one clock at D, while Δt is measured by two different coordinate clocks in K. So to find the time measured by the clock at D, which is moving in K, we have to transform Δt to K'.

$$\Delta t' = \Delta t \cdot \sqrt{1-\frac{v^2}{c^2}} = \frac{2dv}{c^2\left(1-\frac{v^2}{c^2}\right)} \cdot \sqrt{1-\frac{v^2}{c^2}} = \frac{2dv}{c^2\sqrt{1-\frac{v^2}{c^2}}}$$

Conclusion.
There is no contradiction.

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