

## Re: An interesting SR puzzle

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Eli Botkin wrote:

> *"Ben Rudiak-Gould"* <[br276deleteme@cam.ac.uk](mailto:br276deleteme@cam.ac.uk)> wrote in message

> [news:cu0rp6\\$7a\\$1@gemini.csx.cam.ac.uk...](mailto:news:cu0rp6$7a$1@gemini.csx.cam.ac.uk...)

>

>> *Here's a two-part SR puzzle:*

>>

>> *1. I'm standing still (i.e. moving inertially) while whirling a  
>> clock around my head at a constant speed. (If you're worried  
>> about conservation of momentum, imagine that I'm whirling two  
>> clocks: it doesn't make any difference). I'm wearing a  
>> wristwatch. Which of these--the clock or the wristwatch--will  
>> appear to me to tick faster, and by how much?*

>>

>> *2. Now I'm a different person, sitting on the clock as it whirls  
>> around, looking at the clock and at the wristwatch of the  
>> person doing the whirling. Which (if either) will appear to  
>> me to tick faster, and by how much?*

>>

>> *I already know what the answer to this puzzle is, and why. But I find it  
>> very interesting from a pedagogical perspective. Despite doing well in my  
>> undergrad SR course, and despite the puzzle's simplicity (no calculation  
>> required), I doubt I could have solved part 2 had it been on an exam. I  
>> would have become hopelessly mired in trying to figure out the reference  
>> frame of the person sitting on the clock, because SR, as it was taught to  
>> me, was about relating the reference frames of different observers. I  
>> didn't understand at the time that the coordinate system you choose to  
>> solve a problem needn't be the rest frame of the measurement device, and  
>> that there isn't even a well-defined notion of /the/ rest frame of an  
>> object in general. I conjecture that this kind of confusion is quite  
>> common.*

>>

>> *This puzzle seems to highlight this point more clearly than any I've seen  
>> before. More generally, it's interesting as an example of a problem  
>> involving relative motion for which the Lorentz transformation is really  
>> no help at all. And its solution might help to dispel the common  
>> misconception that SR can't deal with acceleration.*

>>

>> *One can also add parts 1b and 2b which ask whether the clock and*

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>>wristwatch are redshifted or blueshifted, and by what factor. Not until  
>>years later did I understand the relationship between Doppler shift and  
>>the apparent rate of clocks.

>>

>>In short, I like this puzzle a lot, and I wish it were taught alongside  
>>the twin paradox (or instead of it!) in undergraduate courses and  
>>textbooks. I'm curious to know if anyone here has taught it, or thought  
>>about doing so, or decided against it, or whatever.

>>

>>

>>-- Ben

>

>

> Hi Ben:

> I haven't heard this one before. My response is:

> Each person will claim that the other clock is running slower than his own.

> Also, if they are viewing each others clocks, the images will appear to

> advance in synchrony with their personal clocks (or wristwatches).

> If you don't agree, I would very much like your take on the correct

> solution.

> Eli

The "whirling clock" is accelerated.

That makes all the difference.

The correct answer is they will both agree  
that the wrist watch runs faster.

Paul