Title: A Possible Proof That Negative Ageing Doesn't Occur In Special Relativity

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Abstract:

The CMIF (Co-Moving-Inertial-Frames) simultaneity method is the most commonly-used way in special relativity of determining the current age of a distant person, according to an accelerated observer. CMIF says that, when an observer accelerates in the direction AWAY from a distant person, the observer will conclude that the distant person gets YOUNGER. But the proof described herein shows that such negative aging, according to the observer, doesn't occur.

According to the CMIF (Co-Moving-Inertial Frames) simultaneity method, an observer (he) who accelerates in the direction away from a distant person (she) will conclude that she rapidly gets YOUNGER during his acceleration. But I think I may have found a counterexample that shows that such an accelerating observer does NOT conclude that.

It is well-known that two stationary clocks at different positions in a gravitational field will run at different rates. The clock that is closer to the source of the gravitational field will run slower than the clock that is farther from the source of the field.

Because of the equivalence principle, it is also true that if two clocks that are separated by a fixed distance "d" ly are both accelerated with a constant equal acceleration of "A" ly/y/y, the trailing clock runs slower than the leading clock, by the factor exp(Ad).

So consider the following scenario:

At some instant, the perpetually-inertial "home twin" (she) is 20 years old, and is holding a display that always shows her current age. Facing her is the "helper friend" (the "HF") of an observer (he) who is "d" ly away to her right. Both the HF and he are also 20 years old, and are stationary wrt her at that instant. Like her, he and the HF are each holding a display that always shows their current ages.

Now, suppose that he and his helper then both start accelerating at a constant "A" ly/y/y toward the right. He knows that his helper friend (the HF) is then ageing at a constant rate that is slower than his own rate of ageing, by the factor exp(Ad).

An instant later, his display shows the time 20 + epsilon_1, where epsilon_1 is a very small positive number. He knows that HF's display shows the time 20 + epsilon_2, where epsilon_2 = epsilon_1 / exp(Ad). Epsilon_2 is less than epsilon_1, but is also positive. She can still see HF's display (because HF has only moved an infinitesimal distance away from her, to her right). She will see that HF's display reads 20 + epsilon_1 / exp(Ad). And likewise, HF can still see her display. What does HF see on her display?

Does HF see that she is now slightly younger than 20? No! It would clearly be absurd for someone essentially co-located with her to see her get younger. What HF would see her display reporting is that she was now some very small amount epsilon_3 OLDER that she was at the instant before the acceleration. HF then sends a message to him, telling him that she was 20 + epsilon_3 right then. When he receives that message, he then knows that her current age, when he was 20 + epsilon_1, was 20 + epsilon_3, which is greater than 20. So he KNOWS that she didn't get younger when he accelerated away from her. That contradicts what CMIF simultaneity says.

In the above, I asked

"What does HF see on her display?".

And I answered

"HF would see her display reporting that she was some very small amount epsilon_3 OLDER that she was at the instant before the acceleration."

Since the above argument makes use of very small (unspecified) quantities, it could be argued that time delays due to the speed of light might also need to be taken into account when describing what the HF sees on her display.

But I think any such concerns can be alleviated by pointing out that the separation "d" between him and her can be made arbitrarily large, and CMIF simultaneity says that the amount of negative ageing that occurs is proportional to their separation. Since the errors involved due to the finite speed of light between her and the HF are independent of the distance "d", those errors become negligible compared to the change in her displayed age seen by the HF, for sufficiently large "d".

If the CMIF simultaneity method is incorrect, what is the alternative? I am aware of only a single alternative that (like the CMIF method) obeys the principle of causality. I describe that alternative in my monograph, entitled “A New Simultaneity Method for Accelerated Observers in Special Relativity”, which is available for $5.00 on Amazon.