On the Logical Inconsistency of Einstein's Time Dilation

Stephen J. Crothers

Tasmania, Australia
thenarmis@yahoo.com

9 March, 2017

ABSTRACT

Time dilation is a principal feature of the Special Theory of Relativity. It is purported to be independent of position, being a function only of uniform relative velocity, via the Lorentz Transformation. However, it is not possible for a 'clock-synchronised stationary system' of observers K to assign a definite time to any 'event' relative to a 'moving system' k using the Lorentz Transformation. Consequently, the Theory of Relativity is false due to an insurmountable intrinsic logical contradiction.

1 Introduction

In a previous paper [1] I proved that a system of clock-synchronised stationary observers is inconsistent with the Lorentz Transformation. Assuming both leads to a contradiction. Herein I synchronise clocks in Einstein's 'stationary system' K by mathematical construction and prove that his 'stationary system' K cannot then assign any definite time τ anywhere in his 'moving system' k for any given position x and time t in his 'stationary system' K. From this it follows immediately that Einstein's 'time dilation' is false because there is no common determinable time dilation for all observers in Einstein's 'stationary system' K.

2 Stationary and moving clocks

In §4 of his 1905 paper, Einstein [2] compared one clock 'at rest' relative to the 'moving system' k, with all the synchronised identical clocks 'at rest' relative to his 'stationary system' K:

> "... *we imagine one of the clocks which are qualified to mark the time t when at rest relatively to the stationary system, and the time* τ *when at rest relatively to the moving system, to be located at the origin of the co-ordinates of k, and so adjusted that it marks the time* τ. *What is the rate of this clock, when viewed from the stationary system?*
>
> "*Between the quantities x, t, and* τ, *which refer to the position of the clock, we have, evidently,* $x = vt$ *and*
>
> $$\tau = \frac{1}{\sqrt{1 - v^2/c^2}}\left(t - vx/c^2\right).$$
>
> "*Therefore,*
>
> $$\tau = t\sqrt{1 - v^2/c^2} = t - \left(1 - \sqrt{1 - v^2/c^2}\right)t$$
>
> "*whence it follows that the time marked by the clock (viewed in the stationary system) is slow by* $1 - \sqrt{1 - v^2/c^2}$ *seconds per second,* ..." [2, §4]

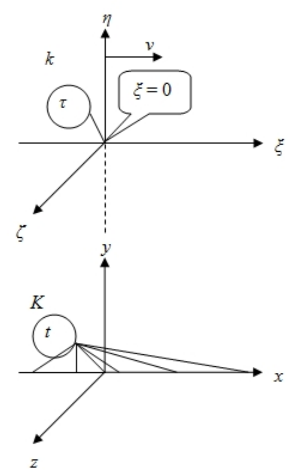

Fig. 1: All the synchronised clocks in Einstein's 'stationary system' K read the same time t at all positions x in the K system. The clock at the origin of the 'moving system' k, where $\xi = 0$, reads $\tau = 0$ when the y and η axes coincide, so $t = 0$ and $x = 0$ too.

In Einstein's notation the coordinates of his assumed system of clock-synchronised stationary observers K are x, y, z, t, those corresponding to the 'moving system' k are ξ, η, ζ, τ, illustrated in figure 1, for his initial conditions.

The Lorentz Transformation is,

$$\begin{aligned} &\tau = \beta\left(t - vx/c^2\right), \quad && \xi = \beta\left(x - vt\right), \\ &\eta = y, && \zeta = z, \\ &\beta = 1/\sqrt{1 - v^2/c^2}. && \end{aligned} \tag{1}$$

Note that according to the Lorentz Transformation the time τ depends upon both t and x. Einstein specifically set $x = 0 = \xi$ for $\tau = t = 0$, shown in figure 1.

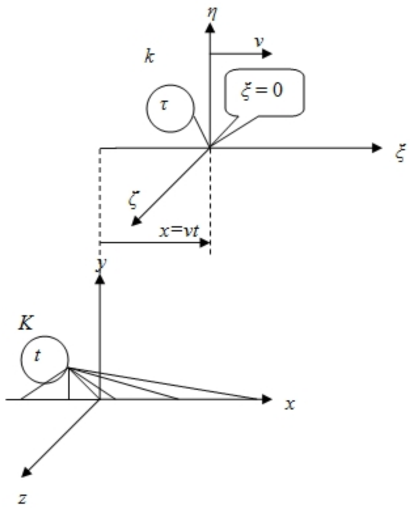

Fig. 2: After a time $t > 0$ all the synchronised clocks in Einstein's 'stationary system' K read the same time t at all positions x in the K system. The clock at the origin of the 'moving system' k, where $\xi = 0$, reads $\tau > 0$. The origin $\xi = 0$ has advanced a distance $x = vt$.

After a time $t > 0$ the origin of Einstein's 'moving system' k has advanced a distance $x = vt$, illustrated in figure 2. At this time t all the observers in Einstein's 'stationary system' K read the same time t on their clocks no matter where they are located, because their clocks are synchronised. The clock at Einstein's $\xi = 0$ of the 'moving system' k reads time $\tau > 0$. According to Einstein's time dilation, $\tau = t/\beta$.

All of Einstein's 'stationary observers' in K are entitled to look at the same moving clock. An observer located at any $x^* \neq x$ in Einstein's 'stationary system' K can observe the clock in the 'moving system' k at any synchronised time t of Einstein's 'stationary system' K, to see what the clock reads. Observer x^* does not find the same τ or the same ξ as observer x does. Solving the first of the Lorentz Transformation equations for t gives,

$$t = \frac{\tau}{\beta} + \frac{vx}{c^2}. \tag{2}$$

To synchronise clocks for all observers in the system K by mathematical construction, set

$$t = \frac{\tau}{\beta} + \frac{vx}{c^2} = \frac{\tau^*}{\beta} + \frac{vx^*}{c^2} = \frac{\kappa\tau}{\beta} + \frac{vx^*}{c^2},$$

$$\tau^* = \kappa\tau, \tag{3}$$

where $(1 - v/c) \leq \kappa$. Solving (3) for x^* gives,

$$x^* = \frac{(1-\kappa)\, c^2\tau}{v\beta} + x. \tag{4}$$

From this it follows that, from their vantage points, no two observers in the 'stationary system' K read either the same time or same time interval on the moving clock; examples tabulated:

κ	x^*	τ^*	τ
$1 - \frac{v}{c}$	$c\tau/\beta + x$	$\left(1 - \frac{v}{c}\right)\tau$	$\beta\left(t - vx/c^2\right)$
1	x	τ	$\beta\left(t - vx/c^2\right)$
2	$-c^2\tau/v\beta + x$	2τ	$\beta\left(t - vx/c^2\right)$
3	$-2c^2\tau/v\beta + x$	3τ	$\beta\left(t - vx/c^2\right)$
$1/\beta$	$c^2\,(\beta - 1)\,\tau/v\beta^2 + x$	τ/β	$\beta\left(t - vx/c^2\right)$

For any given time $t > 0$ and any given x of the system K, there are always places $x^* \neq x$ according to which the observed time $\tau^* \neq \tau$ and the time interval $\Delta\tau^* \neq \Delta\tau$. Thus, for any time $t > 0$ no two observers in the system K agree on the time τ on the same clock in the 'moving system' k, or on a time interval by it. Therefore the *system* K cannot assign a definite time τ to any place ξ in the 'moving system' k. Consequently, there is no common determinable time dilation for any two observers in the system K. Einstein's 'time dilation' equation applies at only one point in K, which is not the whole of the system K, clearly seen at $\kappa = 1$ in the table: Observed from x^*, $\Delta\tau^* = \kappa\Delta\tau = \kappa\beta\Delta t \neq \Delta\tau = \beta\Delta t$ unless $\kappa = 1$. The observer x^* for $\kappa = 1/\beta$ observes no time dilation: $\Delta\tau^* = \Delta\tau/\beta = \beta\Delta t/\beta = \Delta t$. Although the system K is clock-synchronised, only one observer is 'stationary', as the locations of all other observers other than $x^* = x$ are functions of t. Thus, using the Lorentz Transformation to synchronise time t for all observers in K does not permit all observers to be 'stationary'. Conversely, assuring all observers to be stationary in the system K by means of the Lorentz Transformation, does not permit them to be clock synchronised [1].

3 Conclusions

For $t > 0$ Einstein's 'clock-synchronised stationary system' K cannot assign any definite time τ at any place ξ in the 'moving system' k. Consequently there is no common determinable time dilation for the 'stationary system' K. A system of clock-synchronised stationary observers is not consistent with the Lorentz Transformation. Einstein's time dilation is inconsistent with the Lorentz Transformation. It is therefore false. Hence, the Theory of Relativity is false.

References

[1] Crothers, S.J., On the Logical Inconsistency of the Special Theory of Relativity, 6th March 2017, http://vixra.org/abs/1703.0047

[2] Einstein, A., On the electrodynamics of moving bodies, *Annalen der Physik*, 17, 1905