Special Relativity – Alternative Lorentz transformations

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Abstract
Einstein's theory of special relativity, SR, is a generally accepted theory that analyses, for instance, relationships between two inertial reference systems moving at a constant speed against each other. This relationship between the coordinates of an event in the two inertial reference systems is made using so-called Lorentz Transformations, LT. These transformations constitute the most central concept within SR.

We will build an alternative theory to SR. We will derive **new transformations** between the two reference systems. It will be easy to compare these two theories. We will show that if all the steps taken during the derivation apply the existing mathematics, logic and physics, our transformations will be flawless, contradiction free! We follow the same steps, the same way of thinking as one do in [B1].

Keywords
Special Relativity, Reference System, Event, Light Signal, Lorentz Transformations, Mathematical model, Alternative theory

1 Our thought experiments
Imagine a highway, perfectly straight and perfectly horizontal. On this highway, we mark a point where an observer S is located. An additional observer, S', is at the same point at the beginning of each thought experiment (in our case we can do these experiments for real). The observer S' moves at constant speed $v > 0$ to the right in our model. We decide that $v = 2\ m/s$.

The two observers exchange information using a Tesla car that moves during our experiments at a constant speed $w = 20\ m/s$.

An event that occurs in our reality will be considered as a point in the two 2-dimensional reference systems:

(x, t) for S
(x', t') for S'

where x, x' is the coordinate of space and t, t' is the coordinate of time.

We will try to determine **two linear transformations** (equations) between (x, t) and (x', t') and vice versa.

We denote them by LEx' and LEt':

LEx': $x' = Ax + Bt$
LEt': $t' = Cx + Dt$

With a little simple mathematics, we get the corresponding **inverse transformation**
LEx: $x = (D/K)x' - (B/K)t'$
LEt: $t = -(C/K)x' + (A/K)t'$
where $K = AD - BC$. These two systems of equations are equivalent.

To determine the constants A, B, C and D, we perform two thought experiments and name them special cases, SC.
We consider two inertial reference systems, S and S', two 2-dimensional coordinate systems. Their x-axis and x'-axis coincide on the same line.

2. SC1

At the beginning of this experiment, S and S' are at the same point. The car is moving at a constant speed, $w > 0$, **from the right** towards these two observers.

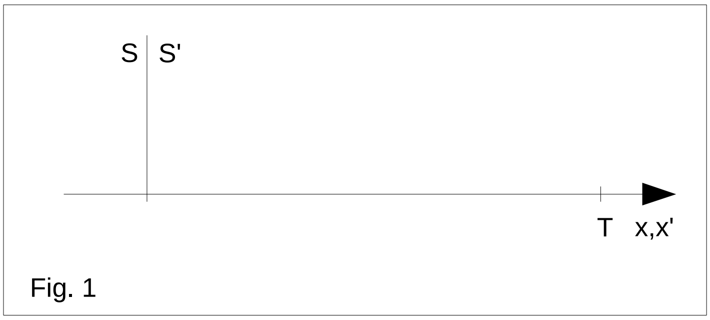

Fig. 1

After a time, $t' > 0$, Tesla passes S' on its way to S.

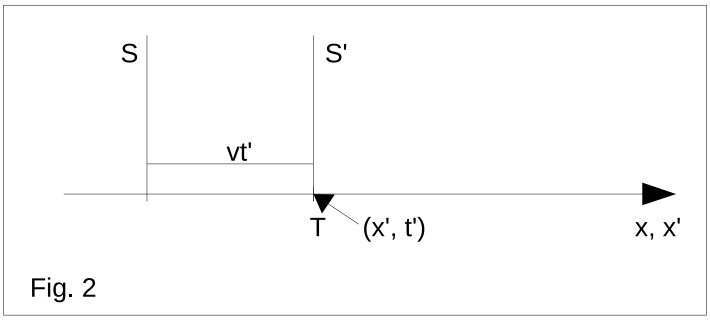

Fig. 2

At this moment S' reads time t' and considers that the event has occurred in its origin, $x' = 0$.

$(x', t') = (0, t')$.

It is obvious that the distance between S and S', at this moment, is vt'!
After this, the car continues on to S and when it reaches this observer, S reads the time t. What value does t have?

t is t' plus the time the car needs to drive the distance vt'.

$$t = t' + vt'/w \rightarrow t = t'(1 + v/w) \rightarrow$$

$$\boldsymbol{t = t'(w + v)/w}$$

Then S can calculate the time when the event occurred in S'-origo.

$$\boldsymbol{t' = tw/(w + v)}$$

and can then also calculate the distance to the point where the event occurred.

$$x = vt' \rightarrow x = twv/(w + v)$$

Now we have the coordinates of the event for both S' and S

$$(x', t') = (0, t')$$

$$(x, t) = (twv/(w + v), tw/(w + v))$$

We replace these coordinates in LEx' and LEt' to determine A, B, C and D.

From LEx', (x', t') and (x, t) we get

LEx': $x' = Ax + Bt$

$$0 = Atwv/(w + v) + Btw/(w + v) \rightarrow$$

$$0 = Av + B \rightarrow$$

$$\boldsymbol{B = -Av}$$

From LEt', (x', t') and (x, t) we get

LEt': $t' = Cx + Dt$

$$tw/(w + v) = Ctwv/(w + v) + Dtw/(w + v) \rightarrow$$

$$1 = Cv + D \rightarrow$$

$$\boldsymbol{C = (1 - D)/v}$$

We get the same value for B and C if we use

$$(x', t') = (0, t')$$

$$(x, t) = (vt', t').$$

3. SC2

At the beginning of this experiment, S and S' are at the same point. The car is moving at a constant speed, $w > 0$, **from the left** towards these two observers.

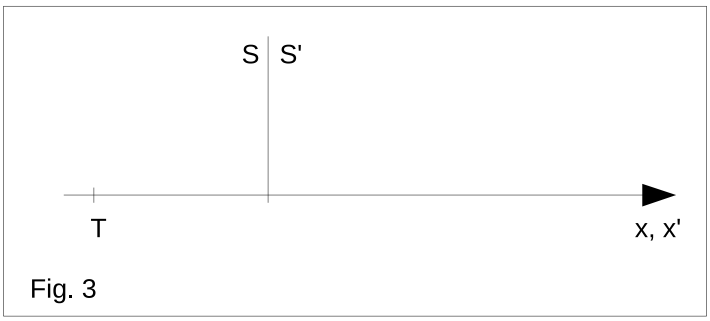

Fig. 3

After a time, $t > 0$, Tesla passes S on its way to S'.
This event is shown in the Fig. 4.

When the car passes S, the observer in S reads the time t. It is considered that the event occurred in S-origo.

$$(x, t) = (0, t).$$

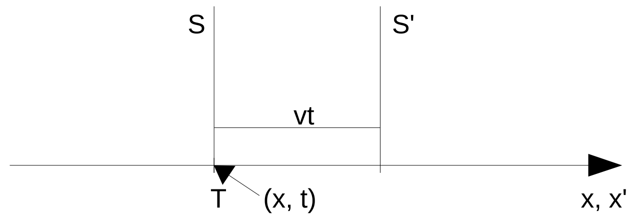

Fig. 4

It is obvious that the distance between S and S', at this moment, is *vt*!

After this, the car continues on to S'. But as the car approaches S', this reference system manages to go a small chunk.

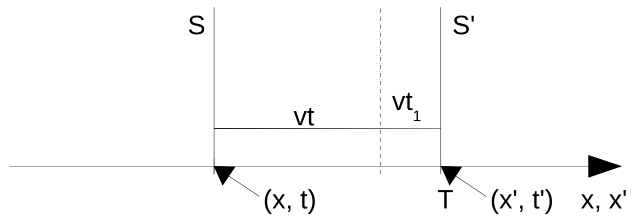

Fig. 5

The observer in S' reads the time t'.
The distance between S and S' at this moment is x'. We see that

$$x' = vt' \rightarrow$$
$$x' = vt + vt_1 \rightarrow$$
$$t' = t + t_1$$

but we also see that

$$x' = wt_1$$

It is the distance that the car moves between S and S'. From here we get

$$vt + vt_1 = wt_1 \rightarrow$$
$$vt = t_1(w - v) \rightarrow$$
$$t_1 = tv / (w - v) \rightarrow$$

From

$$t' = t + t_1 \text{ and}$$
$$t_1 = tv / (w - v) \rightarrow$$
$$t' = t + tv / (w - v) \rightarrow$$
$$\boldsymbol{t' = tw/(w - v)}$$

Now we have the coordinates of the event for both S' and S

$(x, t) = (0, t)$

$(x', t') = (-vt', t')$ *or*

$(x', t') = (-twv/(w-v), tw/(w-v))$

We have the minus sign because x' is measured to the left, towards the negative part of the x-axis, x'-axis.
We replace these coordinates in LEx' and LEt' to determine *A, B, C* and *D*.

From LEx', (x', t') and (x, t) we get

LEx': $x' = Ax + Bt$

$-twv/(w-v) = A*0 + Bt \rightarrow$

$\mathbf{B = -wv/(w-v)}$

From LEt', (x', t') and (x, t) we get

LEt': $t' = Cx + Dt$

$tw/(w-v) = C*0 + Dt \rightarrow$

$tw/(w-v) = Dt \rightarrow$

$\mathbf{D = w/(w-v)}$

4. Merger of results

From these two thought experiments we obtained the following relations for the constants A, B, C and D.

$B = -Av$

$C = (1-D)/v$

$B = -wv/(w-v)$

$D = w/(w-v)$

$\rightarrow$

$A = -B/v \rightarrow$

$\mathbf{A = w/(w-v)}$

$C = (1-D)/v \rightarrow$

$\mathbf{C = -1/(w-v)}$

We have seen in section 1 that the inverse transformation has the form

LEx: $x = (D/K)x' - (B/K)t'$

LEt: $t = -(C/K)x' + (A/K)t'$

where $K = AD - BC$.

When we calculate the value of the expression $AD - BC$ we get

$K = w/(w-v)*w/(w-v) - (-wv/(w-v))*(-1/(w-v)) \rightarrow$

$K = w^2/(w-v)^2 - wv/((w-v)^2 \rightarrow$

$K = (w^2 - wv)/(w-v)^2 \rightarrow$

$K = w(w-v)/(w-v)^2 \rightarrow$

$\boldsymbol{K = w/(w - v)}$

We see that $K = A = D$.

Now we can write the two new transformations between coordinate systems for S and S'.

NTx': $x' = (w/(w - v))x - (wv/(w - v))t$

NTt': $t' = -(1/(w - v))\, x + (w/w - v))t$

If we denote $w/(w - v) = K$ we get

NTx': $x' = (x - vt)K$

NTt': $t' = (t - x/w)K$

We replace A, B, C, D and K in LTx and LTt.

NTx: $x = (D/K)x' - (B/K)t'$

NTt: $t = -(C/K)x' + (A/K)t'$

→

NTx: $x = x' + vt'$

NTt: $t = t' + x'/w$

It feels strange that NTx' and NTt' contain K-factor but NTx and NTt do not.

We have obtained two pairs of new transformations between the coordinates of the two inertial reference systems:

NTx': $x' = (x - vt)K$

NTt': $t' = (t - x/w)K$

NTx: $x = x' + vt'$

NTt: $t = t' + x'/w$

Our two events from our two special cases are:

SC1 $(x', t') = (0, t')$

$(x, t) = (twv/(\boldsymbol{w + v}), tw/(\boldsymbol{w + v}))$

SC2 $(x, t) = (0, t)$

$(x', t') = (-twv/(\boldsymbol{w - v}), tw/(\boldsymbol{w - v}))$

But we also have the relationship between t and t' in each experiment:

SC1 $t = t'(w + v)/w$

$t' = tw/(w + v)$

SC2 $t' = tw/(w - v)$

$t = t'(w - v)/w$

In [B1] the value of A is determined by assuming that Lorentz transformations are symmetric and by replacing

x' with x,
t' with t,
x with x',
t with t'
v with $-v$

in the LTx' and LTt'

NTx': $x' = (x - vt)K$
NTt': $t' = (t - x/w)K$
$\rightarrow$
NTx: $x = (x' + vt')K$
NTt: $t = (t' + x'/w)K$

But before we got the following

NTx: $x = x' + vt'$
NTt: $t = t' + x'/w$
$\rightarrow$
$K = 1 \rightarrow$
$v = 0$

Again we get the result that LT only applies to $v = 0$.
Why do we always get this result?
The reason is that we are trying to build linear transformations between S and S'.
Such transformations **do not exist** between S and S' if we use as the carrier of the message between these two reference systems light signals (or a Tesla car).

The transition from one reference system to another depends on how these two inertial reference systems move relative to each other and especially from which direction the light signal moves towards the reference system in motion [B3].

5. Verification of calculations

We verify our calculations by replacing these coordinates in our equations.
We should get equality as a result!

First, we look at all four transformations, NTx', NTt', NTx, NTt and conditions in SC1.

NTx', SC1:

NTx': $x' = (x - vt)K$
$(x', t') = (0, t')$
$(x, t) = (twv/(w + v), tw/(w + v))$
$t = t'(w + v)/w$

$t' = tw/(w + v)$

$\rightarrow$

$0 = (twv/(w + v) - vtw/(w + v))K \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTt', SC1:

NTt': $t' = (t - x/w)K$

$(x', t') = (0, t')$

$(x, t) = (twv/(w + v), tw/(w + v))$

$t = t'(w + v)/w$

$t' = tw/(w + v)$

$\rightarrow$

$tw/(w + v) = ((-1/v)twv/(w + v) + tw/(w + v))K \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTx, SC1:

NTx: $x = x' + vt'$

$(x', t') = (0, t')$

$(x, t) = (twv/(w + v), tw/(w + v))$

$t = t'(w + v)/w$

$t' = tw/(w + v)$

$\rightarrow$

$twv/(w + v) = 0 + vtw/(w + v)$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTt, SC1:

NTt: $t = t' + x'/w$

$(x', t') = (0, t')$

$(x, t) = (twv/(w + v), tw/(w + v))$

$t = t'(w + v)/w$

$t' = tw/(w + v)$

$\rightarrow$

$tw/(w + v) = 0 + tw/(w + v)$

$\boldsymbol{0 = 0 \rightarrow ok}$

Now, we look at all four transformations, NTx', NTt', NTx, NTt and conditions in SC2.

NTx', SC2:

NTx': $x' = (x - vt)K$

$(x, t) = (0, t)$

$(x', t') = (-twv/(w - v), tw/(w - v))$

$t' = tw/(w - v)$

$t = t'(w - v)/w$

$\rightarrow$

$-twv/(w-v) = (0-vt)K \rightarrow$

$-twv/(w-v) = -vtw/(w-v) \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTt', SC2:

NTt': $t' = (t - x/w)K$

$(x, t) = (0, t)$

$(x', t') = (-twv/(w-v), tw/(w-v))$

$t' = tw/(w-v)$

$t = t'(w-v)/w$

$\rightarrow$

$tw/(w-v) = (0+t)K \rightarrow$

$tw/(w-v) = tw/(w-v) \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTx, SC2:

NTx: $x = x' + vt'$

$(x, t) = (0, t)$

$(x', t') = (-twv/(w-v), tw/(w-v))$

$t' = tw/(w-v)$

$t = t'(w-v)/w$

$\rightarrow$

$0 = -twv/(w-v) + vtw/(w-v) \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

NTt, SC2:

NTt: $t = t' + x'/w$

$(x, t) = (0, t)$

$(x', t') = (-twv/(w-v), tw/(w-v))$

$t' = tw/(w-v)$

$t = t'(w-v)/w$

$\rightarrow$

$t = (1/w)(-twv/(w-v) + tw/(w-v) \rightarrow$

$t = t(-v/(w-v) + w/(w-v))$

$t = t(w-v)/(w-v) \rightarrow$

$\boldsymbol{0 = 0 \rightarrow ok}$

6. Conclusions

We have derived four transformations, equations, using two thought experiments. In each experiment, we calculated the value of the event coordinates for the two inertial reference systems.

We have verified the four equations using the value of the event coordinates from the

two experiments.
Each verification has given us the result 0 = 0, an equality!

Remember that this does not happen when we verify Lorentz tarnsformations from SR. There we only get **one equality** of six verifications! See [A2], pages 53-54:

LTx', SC1 → 0 = 0 OK
LTt', SC1 → t' = t/γ
LTx', SC2 → t' = tγ
LTt', SC2 → t' = tγ
LTx', SC3 → t' = tγ(c – v)/c
LTt', SC3 → t' = tγ(c – v)/c

Why? How is that possible?
My only answer is that you have made a mistake somewhere!

All my verifications of Lorentz tarnsformations in SR give the conclusion that Lorentz tarnsformations only applies to $v = 0$!
Therefore, my conclusion in all my research ends with the sentence that
Special Relativity is nonsense!

7. Comparisons between the derivation of Lorentz transformations within SR and this work

In this work I use only **two** thought experiments while in SR **three** are used!
How is it possible that I managed to derive the constants A, B, C and D only with **two** thought experiments and I get all verification as **equalities** while within SR **three** thought experiments are used and you do not get all verifications as **equalities**?
Think about this!

Here we show once again two pairs of transformations we got in this work:

NTx': $x' = (x - vt)w/(w - v)$
NTt': $t' = (t - x/w)w/(w - v)$

NTx: $x = x' + vt'$
NTt: $t = t' + x'/w$

If we replace x' from NTx' and t' from NTt' in NTx and NTt we get **equalities**!
This is another verification that shows that our calculations are correct!

In the two thought experiments we have obtained relations between the value of the t- and t'-coordinates.

SC1 $t = t'(w + v)/w$
$t' = tw/(w + v)$

SC2 $t' = tw/(w-v)$

$t = t'(w-v)/w$

When the carrier of the information between the two observers comes from the right (as it approaches S' from the front), the conversion factor is $(w+v)/w$.
When the carrier of the information between the two observers comes from the left (as it approaches S' from behind), the conversion factor is $(w-v)/w$.

This does not mean that we have some time dilation! This means that the value for time coordinate in one reference system can be calculated using the value for time coordinate in the other reference system!

The time in the two reference systems runs at the same rate!
Think about how we did our two thought experiments!
Both distance and the time we use are **mathematical quantities**.
We used the math to calculate them!

We have used current mathematics, simple ones, current logic, and current classical physics!

Note that there are so many Lorentz transformations between S and S' how many definitions of (x, t) and (x', t') there are!

References

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