THE CONVENIENT NUMERICAL BASE FOR LENGTH AND TIME

BRIEF INTRODUCTION

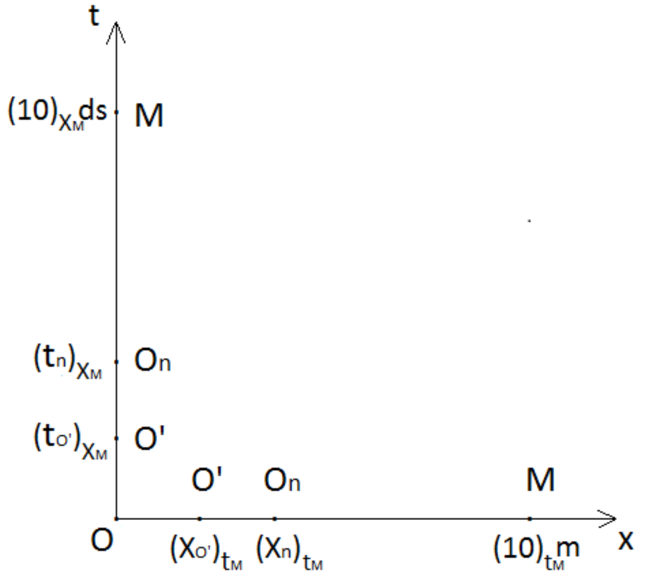
If A and B are two points in the space, the following two statements
i) the points A, B are distinct in the space
ii) the points A, B are coincident in the space
can not be simultaneously true.
a) Let's assume to istante t_o, the points A and B distinct in the space.
Then, the time necessary to make A and B overlap must be $\Delta t \neq 0$.
In fact if the time necessary to make A and B overlap was $\Delta t = 0$,
we can also assert that at time t_o, the points A and B are coincident, since it is not necessary time to make A and B overlap and i), ii) are simultaneously true in spite of the initial assumption a).

BEGINNING

Let's the points O, O', M coincident with the origin $x_o = 0$ of IRS(O xyt) at time $t_o = 0$ (according to the clock of O and O') and let O', M, in motion in the IRS(O xyt) along the axis $x > 0$ at constant speed, such that $| v_{o'} | < | v_M |$.
According to the clock of O, we assume that the coordinate t_x in the t-axis, is the time needed for M to cover any distance $x-x_o$ along the x-axis;
let's call it, time interval t_x.
1) Let $x_{o'}$ be the coordinate of M to time $t_{o'}$, according to the clock of O;
2) Let x_M be the coordinate of point M to time t_M, according to the clock of O, when the coordinate of O' is $x_{o'}$.

Whether, to a generic point $x > 0$ of the x-axis, we assign from the origin O a spatial distance of 10m, If I comunicate by phone that distance to my friend, for my friend 10m may represent any distance, because it is not defined the numerical base; for example: $(10)_{123}$ m = 123m, $(10)_{12}$ m = 12m.
This distance becomes quantifiable if my friend know its numerical base b (b > 1 and integer).
Then, if at time t_M according to the clock of O, we assign to the point M a spatial distance of 10m from the origin O, we define $x_M = (10)_{t_M}$m and let's assume the time interval t_M, as the numerical base of the spatial distance from the origin O, of any point of x-axis.
Likewise, in the t-axis we define $t_M = (10)_{x_M}$ m. See picture 1.

*We choose the unit of measurement in such a way that t_M and x_M are integer and positive numbers: $t_M > 1$, $x_M > 1$.



picture 1

t-axis

If x_M is the coordinate of M at time t_M according to the clock of O, let M(On) be the value of the time interval $\Delta t_n = t_M - t_n$, from the point M to point On, then we have the two equalities:
m) $M(O)_{\text{asse t}} = (10)_{x_M}ds = (t_M)_{\text{asse t}}$
n) $M(O')_{\text{asse t}} = (10 - t_{o'})_{x_M}ds = (t'_M)_{\text{asse t}}$
conversely, if let's assume the time interval $t_M - t_n$ as the base of the spatial distance of the point M from the origin O, we have:
m') $M(O)_{\text{asse t}} = (10)_{t_M}m = (x_M)_{\text{asse t}}$
n') $M(O')_{\text{asse t}} = (10 + x_{o'})_{t_M} - t_{o'}m = (x'_M)_{\text{asse t}}$ see point 1)
with $(x_M)_{\text{asse t}} = (x'_M)_{\text{asse t}}$.

x-axis

p) $M(O)_{\text{asse x}} = (10)_{t_M}m = (x_M)_{\text{asse x}}$
q) $M(O')_{\text{asse x}} = (10 - x_{o'})_{t_M}m = (x'_M)_{\text{asse x}}$,
and conversely
p') $M(O)_{\text{asse x}} = (10)_{x_M}ds = (t_M)_{\text{asse x}}$
q') $M(O')_{\text{asse x}} = (10 + t_{o'})_{x_M} - x_{o'}ds = (t'_M)_{\text{asse x}}$
with $(t_M)_{\text{asse x}} = (t'_M)_{\text{asse x}}$

As a variation of the distance x_M of point M corresponds to a variation of time interval t_M, then for the representation $(10)_{t_M}m$ and $(10)_{x_M}ds$ of the points, the following proportion must be apply:

$$\frac{(X_M)_{asse\ x}}{(t_M)_{asse\ t}} : \frac{(t_M)_{asse\ x}}{(X_M)_{asse\ t}} = \frac{(X'_M)_{asse\ x}}{(t'_M)_{asse\ t}} : \frac{(t'_M)_{asse\ x}}{(X'_M)_{asse\ t}} \tag{1.1}$$

then,

$$(t'_M)_{asse\ x'}\,(t'_M)_{asse\ t'} = (t_M)_{asse\ x}\,(t_M)_{asse\ t}\,\frac{(X'_M)_{asse\ x}\,(X'_M)_{asse\ t}}{(X_M)_{asse\ x}\,(X_M)_{asse\ t}} \tag{1.2}$$

i.e being

$$\left|\begin{array}{l} (t'_M)_{asse\ x'} = (t'_M)_{asse\ t'} = t'_M \\ (t_M)_{asse\ x} = (t_M)_{asse\ t} = t_M \\ (X_M)_{asse\ x} = (X_M)_{asse\ t} = X_M \end{array}\right. \Rightarrow t'_M = t_M\sqrt{\frac{(X'_M)_{asse\ x}\,(X'_M)_{asse\ t}}{(X_M)_{asse\ x}\,(X_M)_{asse\ t}}} \tag{1.3}$$

Let's find the time of O' with respect to time of O.

If we replace the $(x'_M)_{asse\ x}$, $(x'_M)_{asse\ t}$ coordinates, with the $(x'_M)_{asse\ x} = (10 - x_{o'})_{t_M}m$, $(x'_M)_{asse\ t} = (10 + x_{o'})_{t_M - t_{o'}}m$ coordinates, we write the formula 1.3) as

$$t'_M = t_M\sqrt{\frac{((10 - X_{o'})_{t_M}\,m)((10 + X_{o'})_{t_M - t_{o'}}\,m)}{X_M^2}} \tag{1.4}$$

To perform mathematical operations in 1.4), we must assign for each number, the same numerical base, i.e. we must express $(x'_M)_{asse\ t}$ in the base t_M.

When we talked about spatial distance, we realized that a spatial distance of 10m becomes quantifiable when we know its numerical base; if we argue that the numerical base of space, is the time it takes the point M to move from one point to another, as we define $t_{o'} = (10)_{x_{o'}}ds$ (see point 1), then a variation of time implies a variation of the spatial distance.

Then, if let's x_M in the base $t_M - t_{o'}$, to obtain x_M in the base t_M, we must add up to $t_M - t_{o'}$ the time interval $t_{o'}$ and therefore, as $t_{o'} = (10)_{x_{o'}}ds$, we must add to the spatial distance x_M the spatial distance $x_{o'}$.

So $(x'_M)_{asse\ t} = (x_M)_{asse\ t}$ becomes $x_M + x_{O'}$ in the base t_M, i.e. $(10 + x_{O'})_{t_M}ds$.
Then the formula 1.4) becomes

$$t'_M = t_M \sqrt{\frac{(X_M - X_{O'})(X_M + X_{O'})}{X_M^2}} = t_M \sqrt{\frac{(X_M^2 - X_{O'}^2)}{X_M^2}}$$

$$t'_M = t_M \sqrt{1 - \frac{X_O^2}{X_M^2}} \qquad 1.5)$$

t'_M is the time marked by the clock of O', when the clock of O marks t_M.
Likewise from 1.1) we define:

$$X'_M = X_M \sqrt{1 - \frac{t_{O'}^2}{t_M^2}} \qquad 1.6)$$

i.e. in the reference frame of O', x'_M is the distance covered by M, from the origin O to point x_M.
Therefore for the point O', the distance covered in 2) don't is $x_{O'}$, but

$$X'_{O'} = X_{O'} \sqrt{1 - \frac{t_{O'}^2}{t_M^2}}$$

CONCLUSION

1) The formula 1.1),
which can also be written as $v_M : 1/ v_M = v'_M : 1/ v'_M$, imply $v_M = v'_M$.
Therefore, let's given a point M in motion along the x-axis in the IRS(O xyt), that cover a distance x_M in time t_M according to the clock of O, if t_M is the numerical base of space (in this case of points in x-axis), i.e. $x_M = (10)_{t_M}m$ or conversely $t_M = (10)_{x_M}ds$, <u>the speed of M is constant in all IRS</u>.
The same example should also apply to the y-axes.
The speed of M is constant because the point M, with respect to other points in motion, possesses the following property: the time t_M necessary to M for cover any distance x_M is the numerical base of x_M, such that $x_M = (10)_{t_M}m$.

2) According to the clock of O, at time t_M, the spatial distance covered by points O' and M in the IRS(O xyt), is respectively $x_{O'}$ and x_M.
Therefore, with $x_M/t_M = v_M = c$, the 1.5) represents Einstein's time dilation formula and we can assert that the speed of point M is the speed of light.
Likewise, substituting ds with m inside the square root, the 1.6) is Einstein's length contraction formula.

3) As $b > 1$, in agreement with the theory of relativity,the assumption $| v_{O'} | \geq | v_M |$is an absurd case.
In fact, for *n*'), $| v_{O'} | \geq | v_M | \Rightarrow b \leq 0$.

So, take the time as a numerical base of space, <u>the speed of light is an insuperable limit</u>.

** in the case of negative coordinates we write $(-1)x_M = (10)^{t_M}(-1)m$ instead of $x_M = (10)^{t_M}m$.*

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