Universal Specificity Investigation 2: Implications of a Universally Stationary Frame

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The prior investigation into the theory of universal specificity (or specificity for short) found that time properly conceptualized is the interval over which change occurs, and is not a property of the universe apart from physical changes to things in the Universe. Additionally, it was revealed that changes to this interval over which identical changes occur implies a change in conditions. For example, when an hourglass or grandfather clock relocates to a different altitude, the interval over which the sands drops or the pendulum swings changes because of the difference in gravitational force at the two altitudes. This proper conception of time missed in common practice led to the certainty in the existence of a universally stationary frame (USF), and now we investigate the implications for such a frame existing.

1. Implications of a USF

Recall that specificity agrees with most (if not all) observations, and predicted observation by relativity. However, it rejects many of the conclusions made in relativity, which are drawn from observations. For example, specificity makes use of the law of identity, and asserts that events occur at specific instances in time and space. Specificity holds that events only appear relative because of a model error in relativity involving an undetected change in units being measured by our instruments. This implies that events at distance have certain sequence in which they occur and their simultaneity is not relative, but only appear relative. The one frame that predicts the true sequence, given current models, is the USF we seek.

All of this implies the following:

- The speed of light is constant only in the USF, while light's relative speeds is less than that in all other frame [1].
- The speed of light appears to remain constant in any other frame due to the miscalibration of measuring instruments.

In order to see these implications consider any object traveling any speed less than c with respect to the USF, in any arbitrary direction. The x-axis could easily be rotated such that the velocity of the object aligns with an arbitrary x-axis in the USF, as shown in Figure (1) for two dimensions.

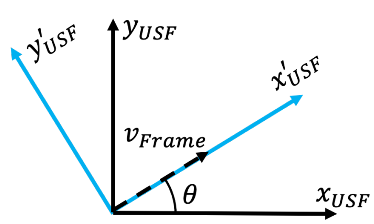

Figure 1. Velocity aligns with any arbitrary USF x-axis.

The equation for this rotation is the traditional rotation of axis, and its formulation is presented in matrix form in Equation (1).

$$\begin{bmatrix} x'_{USF} \\ y'_{USF} \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x_{USF} \\ y_{USF} \end{bmatrix} \tag{1}$$

Now consider the Michelson–Morley experiment [2] illustrated in Figure (2). In this experiment light would arrive from a direction, and split in two orthogonal directions relative to the apparatus's reference frame (ARF), reflect off mirrors and return to be combined again such that any interference in the combined rays (caused by differing arrival times) can be detected. The length of both paths is made to be identical (measured in the ARF).

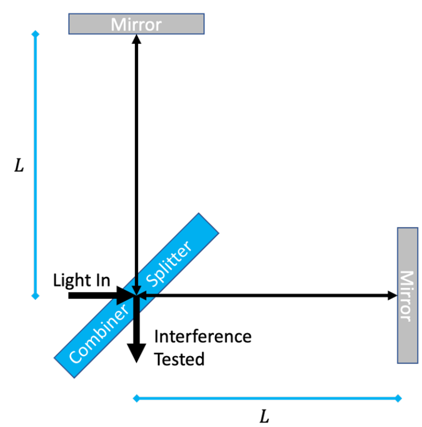

Figure 2. Michelson–Morley experiment schematic.

From this experiment if light traveled at a constant c only for the USF, it was hypothesized that this instrument would detect interference patterns if the apparatus were traveling some positive velocity in the USF. It failed to detect interference patters regardless of which part of earth's orbit this test was conducted, and regardless of the direction measurements were taken. Many consider this proof that the speed of light, c, is constant as Maxwell's equations seemed to suggest, to the point where the notion that the speed of light is the same in all frames has become orthodox. The existence of a USF implies the speed of light can only be constant in the USF, so many take this to mean a USF does not exist.

If a USF exists we have to make sense of this experiment, and the first thing to realize is that interference detected by this experiment would only mean the duration it took light to travel both paths were not identical. With this understanding, the negative results only suggest that the light took the the same amount of time to travel both paths, not that its speed remained c relative the apparatus. Because the light travels a path to and from a mirror in the apparatus, then the average speed of light (for both directions) relative to the moving frame could easily be less than c. Therefore, a negative result could still be due to the average speed for both paths being identical.

To see how specificity quantifies the average speed of light, consider two cases. The first case the apparatus is not moving relative to the USF, as shown in Figure (3a), and the second case it is moving, as shown in Figure (3b). Consider the path the light takes in the USF in both cases.

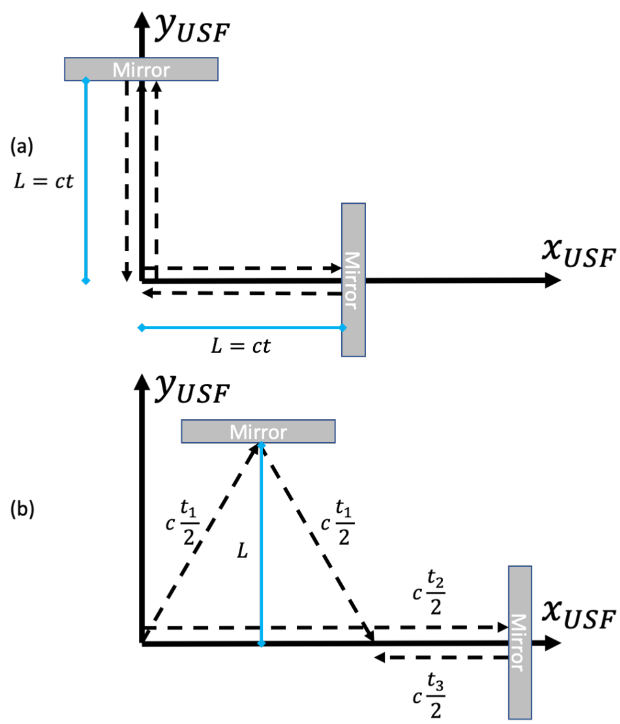

Figure 3. (a) Stationary apparatus. (b) Moving apparatus.

In the first case it is easy to see the average speed of light relative to the apparatus, since it is by definition c in all directions; therefore, the light returns to the combiner at the same time.

In the second case, the average speed of light is more complicated to derive. The average relative speed of light in the y-axis of the moving frame is $c_\perp = \sqrt{c^2 - v^2}$ based on trigonometric laws illustrated in Figure (4).

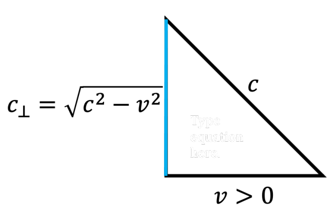

Figure 4. Trigonometric derivation of $c_\perp$.

The average relative speed of light in the x-axis is even more complicated to derive, as shown in Equation (2).

$$\text{Length There}: \; ct_2 = L + vt_2 \tag{2a}$$
$$t_2 = \frac{L}{c-v} \tag{2b}$$
$$\text{Length Back}: \; ct_3 = L - vt_3 \tag{2c}$$
$$t_3 = \frac{L}{c+v} \tag{2d}$$
$$\overline{v} = c_{||} = \frac{(c-v)t_2 + (c+v)t_3}{t_2 + t_3} \tag{2e}$$
$$c_{||} = \frac{(c-v)\frac{L}{c-v} + (c+v)\frac{L}{c+v}}{\frac{L}{c-v} + \frac{L}{c+v}} \tag{2f}$$
$$c_{||} = \frac{1+1}{\frac{1}{c-v} + \frac{1}{c+v}} \tag{2g}$$
$$c_{||} = \frac{2(c+v)(c-v)}{(c+v)+(c-v)} \tag{2h}$$
$$c_{||} = \frac{2(c^2 - v^2)}{2c} = c - \frac{v^2}{c} \tag{2i}$$
$$c_{||} = c\left(1 - \frac{v^2}{c^2}\right) \tag{2j}$$
$$\text{Let}: \; \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2k}$$
$$\therefore c_{||} = \gamma^{-2} c \; \blacksquare \tag{2l}$$

Comparing $c_{||}$ to $c_\perp$ gives us Equation (3).

$$c_{||} = \gamma^{-2} c \tag{3a}$$
$$c_\perp = \sqrt{c^2 - v^2} = c\sqrt{1 - \frac{v^2}{c^2}} = \gamma^{-1} c \tag{3b}$$
$$\therefore c_{||} = \gamma^{-1} c_\perp \; \blacksquare \tag{3c}$$

The average relative speed of light in the moving frame is not equal for both the x-axis and the y-axis. Light travels slower in the x-axis by a factor of γ^{-1}. This is because the mirror (or the combiner) travels away from the UIF, thus, artificially creating more distance for the light to travel. The only way for the light to travel both paths over the same duration, therefore, is for the distance along the x-axis to contract by a factor of γ^{-1} to compensate for the slower average speed of light, as shown in Equation (4).

$$
\begin{aligned}
t_1 &= t_2 + t_3 && \text{(4a)}\\
\frac{2L}{c_\perp} &= \frac{L_x}{c-v} + \frac{L_x}{c+v} && \text{(4b)}\\
\frac{2L}{\gamma^{-1}c} &= \frac{L_x(c+v)+L_x(c-v)}{c^2-v^2} && \text{(4c)}\\
\frac{\gamma 2L}{c} &= \frac{2L_x c}{c^2-v^2} && \text{(4d)}\\
\frac{\gamma L}{c} &= \frac{L_x}{c}\frac{1}{1-\frac{v^2}{c^2}} = \frac{\gamma^2 L_x}{c} && \text{(4e)}\\
L_x &= \gamma^{-1} L \blacksquare && \text{(4f)}
\end{aligned}
$$

Indeed, this is the exact value given to length contraction commonly mentioned in relativity [3]. This length contraction makes the average *effective* speed of light, c_0, in any moving frame the same in all directions, quantified in Equation (5).

$$c_0 = \gamma^{-1} c \tag{5}$$

The only remaining question to be answered in order to make sense of the negative results of this experiment is why would a relatively slower traveling light not be detected? Could not a modified experiment to measure the duration it took for light to show up at the combiner measure the longer time it took for light to arrive for higher velocities?

Current orthodoxy in relativity says duration of travel would be the same in any inertial frame because of something called time dilation, which is caused by a rotation in spacetime governed by the Lorentz Transformation [4]. Specificity agrees with relativity in what would be observed, as in the observed results from identical clocks report the same duration in any inertial frame; and specificity agrees that a phenomenon called time dilation caused this observation. Specificity, however, disagrees with relativity in what time dilation is really doing, and what causes time dilation, which is the focus of the next investigation in this series.

2. Conclusion

In conclusion, an existing USF has many implications, among which are: the average speed of light relative to any moving frame is not constant; the average speed of light is different in both the x-axis and y-axis (axes parallel and perpendicular to velocity respectively) in a moving frame; and length contraction allows the light to travel less distance in the x-axis to make up for the slower speed in the x-axis. This causes the round trip times of light to be identical in the Michelson–Morley experiment regardless of velocity of the experiment; therefore, the average effective speed of light is identical in any direction for any inertial reference frame. Lastly, the slower traveling light, in moving reference frames (relative to USF), means travel times take longer; and the reason the longer travel times go undetected is because of a phenomenon known as time dilation.

That brings us to the following questions: What is kinetic time dilation if not a rotation in spacetime? What then causes kinetic time dilation? Answering these questions is the focus of the next investigation in this series.

References

[1] K. Szostek and R. Szostek, *Kinematics in the special theory of ether*, Moscow University Physics Bulletin, vol. 73, no. 4, pp. 413–421, 2018.

[2] A. Michelson & E. Morley, *On the relative motion of the Earth and the luminiferous ether*,American Journal of Science, vol. s3-34, no. 203, pp. 333–345, 1887.

[3] *Length Contraction*, Wikipedia, 12-Jan-2023. [Online]. Available: https://en.wikipedia.org/wiki/Length_contraction. [Accessed: 10-Feb-2023].

[4] *Lorentz Transformation*, Wikipedia, 12-Jan-2023. [Online]. Available: https://en.wikipedia.org/wiki/Lorentz_transformation. [Accessed: 10-Feb-2023].