A TREATISE ON THE NATURE OF INERTIAL MOTION

(Learning from New Information Found Only Outside the Box of Inertial Reference Frames)

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Observers in different inertial reference frames each will observe the same celestial bodies, but will see them as moving in different directions at different velocities. According to the special theory of relativity, this will cause the celestial bodies to have different physical dimensions[i] and different amounts of mass[ii] in different inertial reference frames. Also, the greater the difference in relative velocity between inertial reference frames, the slower an observer in one reference frame will observed time to pass in the other reference frame.[iii] According to the special theory's premise of equal merit, what is observed in each inertial reference frame is an equally valid description of reality as what is observed in any of the others.[iv] Thus, the observed celestial bodies behave differently and have different physical characteristics in each inertial reference frame. This is what gives rise to the concepts of multiple universes and multiple coexisting dimensions of space.

An observer in an inertial reference frame has no means by which he can determine which of the innumerable inertial reference frames he happens to occupy.[v] He can know only that he is traveling at a constant (but unknown) speed in a constant (but unknown) direction. Because inertial reference frames do not change their states of motion, different inertial reference frames are perpetually quarantined from each other. Their constant motion relative to each other precludes them from being brought together to share and compare results. Thus, all an observer can know about the motion of another inertial reference frame is the motion he observes relative to him.[vi] As a result, the difference in velocity v_d between the two reference frames has the same effect in both directions. [vii]

The thought experiment presented in this paper takes a different approach to explaining the difference between the motions of different inertial reference frames. It is based on the fact that the only way an observer can get from one inertial reference frame to another is by *changing* his inertial velocity. By definition, the value of the *change* in his velocity Δv must be identical to the *difference* in velocity v_d between the same two reference frames. However, although the values of Δv and v_d are the same, their effects are not the same. The causal source of v_d is undefined and the *difference* in velocity works the same way in both directions. In contrast, both the immediate causal source of Δv and the directionality of that source are known unambiguously. The immediate causal source of Δv is the acceleration which is experienced uniquely by the observer and by any other objects he takes along with him.[viii] They are the only objects whose motion is changed by that acceleration. Clearly, the motions of celestial bodies will not be materially affected by the amount of energy used to change an observer's spaceship from one inertial state of motion to another.

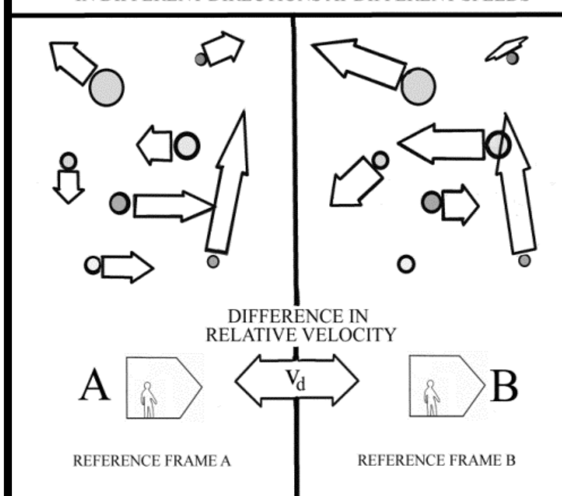
1. What an Observation "Means" is Determined Entirely by How it is Interpreted.

The special theory of relativity is founded exclusively on observations made by observers in inertial reference frames. Experiments used to evaluate the special theory also accept the limitation of that same mental box. Einstein deferred addressing the effects of non-inertial motion to the general theory.[ix]

Figure 1 shows two spaceships which are stationary in two different inertial reference frames named A and B. They are in inertial motion relative to each other at a constant velocity v_d. Neither observer can know his own state of motion beyond the fact that is inertial.[x] Neither observer can determine whether he is stationary and the other is in motion, or whether it is the reverse.[xi]All either observer can know about the

FIGURE 1

OBSERVERS IN DIFFERENT INERTIAL REFERENCE FRAMES WILL SEE THE SAME CELESTIAL BODIES MOVING IN DIFFERENT DIRECTIONS AT DIFFERENT SPEEDS



motion of the other reference frame is his observation of its motion relative to him, which is the same in both directions.[xii] As a result, the difference in velocity v_d between the two reference frames has the same effect in both directions (i.e., each observer will conclude from his observations that objects are smaller, their mass is greater and time moves more slowly in the other reference frame than it does in his own).[xiii]

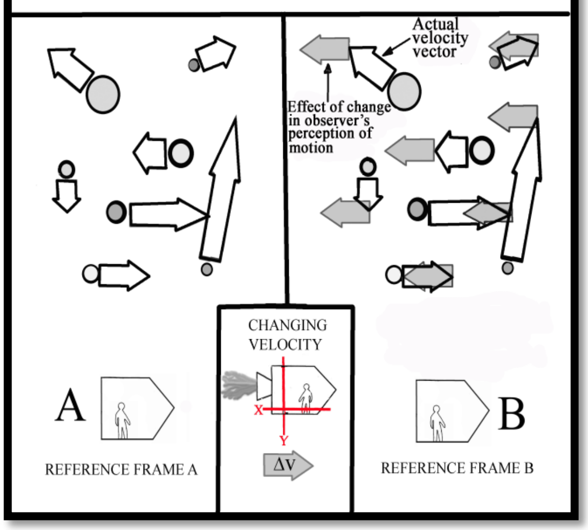
According to the special theory's premise of equal merit, what each observer observes is what actually happens in his reference frame.[xiv] The actual dimensions, mass and motions of celestial bodies are different in every different inertial reference frame.

2. An Alternative Explanation for the Difference in the Inertial Velocities of Reference Frames A and B.

Figure 2 takes a different approach to describing how reference frames A and B relate to each other. A single observer makes observations in reference frame A and then uses his spaceship to change his own velocity to that of reference frame B. Note that the *change* in his velocity Δv has identically the same value as the *difference* in velocity v_d between the two reference frames. Otherwise, the observer wouldn't end up in reference frame B. However, the two are not the same.

Unlike v_d, Δv is the *change* in velocity which is required to *move the observer* from reference frame A to reference frame B. That change takes place in a non-inertial reference frame. As noted above, empirical data from non-inertial reference frames is missing both from the foundation on which the special theory is based and from the experiments used to evaluate it. However, *changing* his velocity by Δv is the only means by which an observer in reference frame A can get to reference frame B. It not only explains what *causes* the *observed difference* v_d between the two reference frames but also provides new information regarding the locus and directionality of its effect. For example, it is known that conditions in reference frame A are "before" the change in velocity Δv and conditions in reference frame B are "after" Δv is in effect. Thus, the effect of Δv on what happens to physical entities and its effect on the manner in which observers and scientific instruments define motion is limited to those entities in reference frame B which experienced the acceleration which caused Δv. Note that none of the celestial bodies and no observers or apparatus not in the spaceship will be affected by the change in the spaceship's velocity.

FIGURE 2
CHANGE IN OBSERVER'S VELOCITY ALTERS OBSERVED TRAJECTORIES OF OBSERVED OBJECTS WHOSE MOTION HAS NOT CHANGED



As shown in the box at the bottom of Figure 2, when the spaceship observer *changes* the spaceship's inertial velocity, he takes his coordinate system and his human senses along with him. As shown in Figure 3, this *alters his perception* of the motion of objects whose motion hasn't changed. By changing how his coordinate system identifies locations, it even will change his *definition* of what constitutes motion. These changes are totally subjective and are unique to him. He is the only observer in the universe who experiences the acceleration which causes the change in his inertial velocity. This circularity between his own state of motion and his definition of motion also will affect video cameras, radar detectors and other experimental apparatus he might use to detect and record the motions of observed experimental objects.

As shown in Figures 2 and 3, the change in the observer's *perception* of motion alters what he *observes* when he arrives in reference frame B. His observation of the motions of celestial bodies in reference frame B will be the vector sum of:

1. What he observed when he was in reference frame A (the white vectors in Figure 2) and
2. The effect of the change in his own, subjective definition and perception of motion caused by the change in his inertial velocity (the gray vectors shown in Figure 2).

The net effect of these vector summations is shown in Figure 4. Not surprisingly, the result is identical to what is shown for reference frame B in Figure 1. It cannot be otherwise since the value of Δv is identical to that of v_d.

The difference between how one interprets the observations in Figure 1 versus how one interprets the same observations in Figure 4 lies in what one believes *caused* the *difference* in velocity v_d between the two reference frames. In Figure 1, the special theory treats the *difference* in velocity v_d as a partially definable and immutable fact of nature.

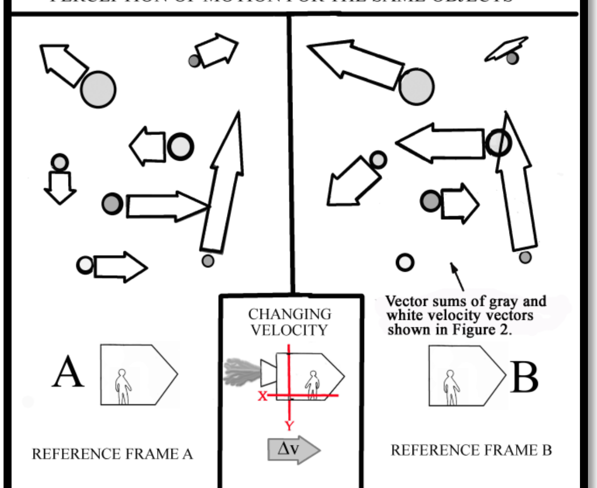


FIGURE 4
THE ONLY DIFFERENCE BETWEEN REFERENCE FRAME A AND REFERENCE FRAME B IS IN HOW THE CHANGE IN THE OBSERVER'S INERTIAL VELOCITY CHANGED HIS PERCEPTION OF MOTION FOR THE SAME OBJECTS

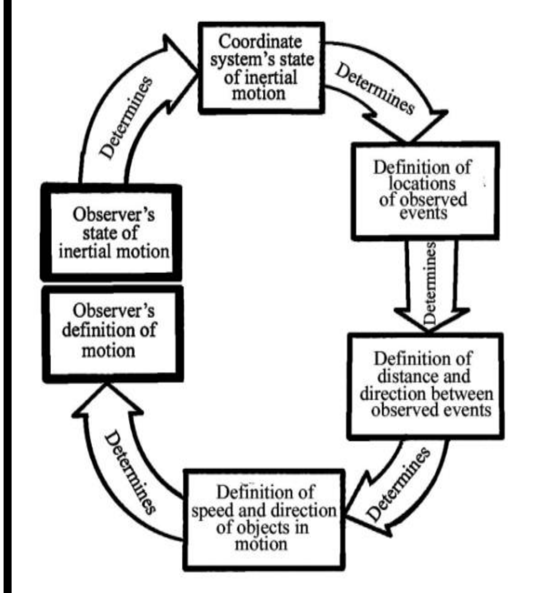


FIGURE 3
Uncorrected observations made from an inertial reference frame are meaningless.
The observer's perceptions of motion and even his very definition of motion are totally subjective and are determined by his own state of motion.

Having no means by which one observer's observation can be shown to be either better or worse than the other's, the special theory accepts both observations as having equal merit. According to that interpretation, the motions of the celestial bodies and their physical characteristics must be different in reference frame B than they are in reference frame A.

However, as shown in Figures 2 and 3, when the observer *changes his own state of motion* from reference frame A to reference frame B, the actual motions of the celestial bodies do not change. The spaceship observer, his spaceship and the spaceship's contents are the only objects which experience the acceleration that changes their inertial velocity. The celestial bodies do not experience acceleration and their inertial velocities do not change..

Given the above, Occam's razor would suggest that the difference between the motions of the celestial bodies as observed from reference frame A versus those observed from reference frame B is caused by simple observation error. An observer in reference frame B and his motion sensing apparatus simply perceive and define the motions of the same physical objects differently from how they are perceived and defined by observers and apparatus in reference frame A.

If the observations made in reference frame A are correct, the observations made in reference frame B must be incorrect. Accordingly, the premise of equal merit is invalid. To conclude otherwise not only flies in the face of Occam's razor but requires a strong dose of magical thinking. For example, how many gremlins with large rocket engines and enormous fuel supplies would it take to change the motion of every celestial body in the universe during the time it takes the observer's spaceship to move from Reference frame A to Reference frame B?

It is inarguable that an observer in reference frame A can move to reference frame B simply by changing his own inertial velocity by $\Delta v = v_d$.

It is inarguable that when an observer changes his own inertial velocity, he will observe a change in the motion of objects whose motion has not changed (i.e., which have not experienced acceleration).

It is inarguable that the actual motion of celestial bodies cannot be materially affected by the amount of energy used to change a spaceship's inertial velocity from one reference frame to another.

Accordingly, it is inarguable that if the observer's observations made from reference frame A are correct, his observations made from reference frame B must be incorrect, and vice versa. Either way, the principle of equal merit is invalid, which invalidates the first postulate of relativity.

In order to understand the problem, one must step outside the mental box of restricting empirical data to observations made in inertial reference frames. The significance of Δv to defining the difference in motion v_d between the two reference frames cannot even be addressed without using empirical data available only in a non-inertial reference frame. That non-inertial reference frame is the one shown at the bottom of Figures 2 and 4, but is missing in Figure 1.

Ironically, one can understand the nature of observations made in and from inertial reference frames only by recognizing what happens in the non-inertial reference frames which bridge them together. Except for observers who have lived their entire lives in a single state of inertial motion, every other observer has arrived in whatever inertial state he is in by using non-inertial states of motion to get there. As shown in Figure 3, the effects on his observations of motion which result from his own changes in motion are entirely subjective and are unique to whatever reference frame he happens to be in. Thus, one must take care when determining the relative merit of observations made in different inertial reference frames.

3. Conclusions

Different inertial reference frames do not exist in isolation from each other. Observers routinely move from one to another simply by changing their own states of motion. However, because the *changes* in motion which bridge different inertial reference frames take place in non-inertial reference frames, this relationship between inertial reference frames has not been recognized.

Recognizing this dynamic relationship between inertial reference frames provides new information which fundamentally changes the interpretation of the observations used to develop and validate the special theory. The premise of equal merit is shown to be invalid which also shows the first postulate to be invalid. Accordingly, the special theory and its predictions are invalid. Since the general theory of relativity is founded on and depends on the validity of the special theory, the general theory also is invalid.

Finally, since the *change* in velocity Δv to move from one inertial reference frame to another is absolute, motion is definable in both relative and absolute terms. As shown in Maxwell's equations, there exists an absolute state of rest which is identified by the innate characteristics of the propagation of light.[xv] The method for identifying Maxwell's unique, at-rest reference frame is beyond the scope of this paper, but can be found in *The Problem With Relativity.*[xvi]

Endnotes

[i] Goldsmith, Dr. Donald, and Robert Libbon, *Einstein: A Relative History* (New York: Simon & Schuster, Inc., 2005), 73. Gribbin, John and Mary Gribben, *Annus Mirabilis: 1905, Albert Einstein, and the Theory of Relativity* (New York: Chamberlain Bros., Penguin Group, Inc., 2005), 100-101.

[ii] Goldsmith, *Einstein: A Relative History*, 73. Douglas G. Giancoli, *Physics*, 4th edition (Englewood Cliffs, New Jersey: Prentice Hall, 1995), 762.

[iii] Goldsmith, *Einstein: A Relative History*, 73. Giancoli, *Physics,755.* Gribbin, *Annus Mirabilus: 1905,* 101. Cutnell, John D. and Kenneth W. Johnson, *Physics,* 5th edition (New York: John Wiley & Sons, Inc., 2001), 867-871.

[iv] Giancoli, *Physics*, 745. Goldsmith, *Einstein: A Relative History*, 48, 745. Gribbin, *Annus Mirabilus: 1905,* 96-97.

[v] Gribbin, *Annus Mirabilus: 1905,* 95-99. Goldsmith, *Einstein: A Relative History*, 67-70. Hey, Tony and Patrick Walters, *Einstein's Mirror,* (New York: Cambridge Press, 1997), 45.

[vi] Goldsmith, *Einstein: A Relative History*, 67.

[vii] Gribbin, *Annus Mirabilus: 1905,* 100-101.

[viii] The term "immediate" is used because the acceleration, in turn, is caused by an external force whose direction is the same as the direction in which the acceleration occurs. What matters here is simply the fact that the acceleration changes the inertial velocity of only the physical entities which experience it. That includes only the spaceship, the observer in the spaceship and whatever objects are in the spaceship. It clearly does not include the celestial bodies he observes throughout the visible universe.

[ix] Giancoli, *Physics*, 743.

[x] See endnote v.

[xi] Gribbin, *Annus Mirabilus: 1905*, 99-101. Giancoli, *Physics*, 745. Hey, *Einstein's Mirror,* 45.

[xii] Gribbin, *Annus Mirabilus: 1905,* 100-101.

[xiii] Ibid.

[xiv] see endnote iv.

[xv] Giancoli, *Physics*, 745-746.

[xvi] Richard O. Calkins, *The Problem With Relativity: Maxwell Was Right, Einstein Was Wrong and the Human Condition Prevailed,* (Sammamish, Washington, Calkins Publishing Company, LLC, 2015).