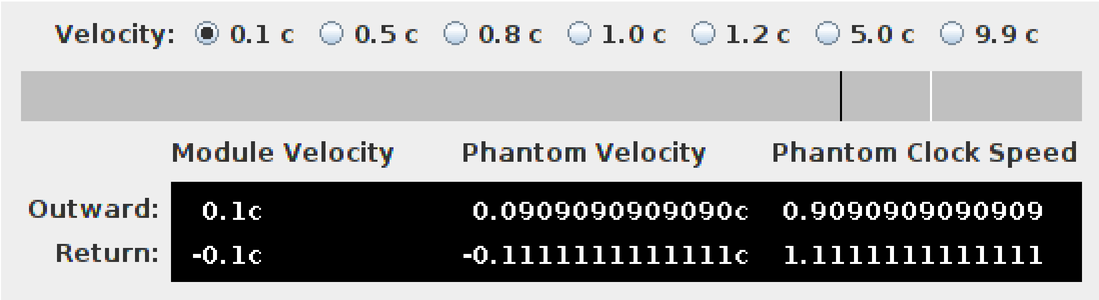
Time Dilation & Length Contraction



I believe that it is conceptually flawed to try to represent something by another thing that is less fundamental. For centuries, scientists have represented *time* as a line on a graph. This is representing *time* as a distance, that is, *space*. *Time*, I believe, is more fundamental than *space* and that consequently, *time* cannot be conceptually represented by *space*. *Time*, I believe, can only be truly represented by itself. Therefore, in the following thought experiments, this is what I have done. And the way I have done it is by using animation.

Suppose our "travelling" module makes a round trip to the vicinity of a distant star many light-years away. As soon as it arrives back at the "stationary" module, it immediately springs off on another round trip, and so on. It keeps going *to and fro* between the "stationary" module (the observer) and the vicinity of the distant star. In the above applet, the black line represents the *reality* of the "travelling" module and the white line represents its phantom - what is seen by the observer on-board the "stationary" module. The observer is on the left. The vicinity of the distant star is on the right.

According to the above speculative reasoning, the "travelling" module will appear to an observer as follows. The phantom travels more slowly and lags behind the "travelling" module on the outbound voyage. It also lags behind on the return voyage, but travels *faster* than the module, catching it up as it arrives home. This is well illustrated by the default setting of the above applet where the "travelling" module is moving at one tenth the speed of light.

Notice the phantom's clock speeds. To the observer on the "stationary" module, the clock on-board the "moving" module *appears* to be running slow. This means that each of its *seconds* is longer. On the return journey, however, the clock on-board the "moving" module *appears* to be running fast. By the time the "moving" module and its phantom reach home (the observer) again, its clock has caught up with the observer's clock. Both the observer's and the "moving" module's clocks once again show the same time. In fact, the clock on-board the real "moving" module represented by the black line, agreed with the observer's clock throughout the journey. Information from it, however, was inaccessible to the observer during the journey. The observer could only receive information via its phantom.

Now select *0.5c* on the Module Velocity Selector. The module now moves much faster than its phantom on the outbound journey. By the time the outbound phantom reaches the distant star, the module itself is already half way back on its return journey. The phantom, however, then travels so fast on its return journey that it catches up with the real module just as it reaches home. Notice that on the return trip, the phantom is travelling at the speed of light. On the outward journey, the phantom's clock runs even slower than it did when the module travelled only at 0.1c. On the return journey, however, the phantom's clock is running at double speed to catch up with the observer's clock by the time it reaches home.

Now select *0.8c* on the Module Velocity Selector. On the outbound journey, the module now pulls rapidly away, leaving its phantom way behind. The clock on-board the phantom now travels at only half speed. On the return journey, however, the phantom now has to travel at 4 times the speed of light in order to catch up with the module as it arrives home. This makes its return journey time very short. Its on-board clock therefore has to run at 5 times the speed of the observer's clock in order to catch up by the time it reaches home.

Now select *1.0c* on the Module Velocity Selector. I will not discuss here whether or not the module could travel at or above the speed of light relative to the observer. I have heard reputable scientists say that there is nothing in relativity theory that says that no *entity* can travel at or above the speed of light. It merely says that the speed of light *in vacuo* is the maximum speed at which information about an entity at one location can be intimated to an observer at another location.

The module is now travelling at the speed of light. On the outbound journey, its phantom travels at half the speed of light. Thus the module makes the complete round trip in the time it takes its phantom to finish only the outbound leg of the journey. This leaves zero time for the phantom to travel back to the observer. Nevertheless, the module is emitting information (light, gravitational influence etc.) all the time (at every instant) during its return journey.

At every point along the return journey, the module emits information. From the observer's point of view, that information traverses the space between that point and him at the speed of light. Since the module is travelling at the speed of light, the light (information) it emitted at every point along its journey arrives at the observer at the same instant. This is also the instant the module itself arrives back at the observer. The observer therefore sees the module at all points of the return journey at the instant the module arrives home. This is manifested by the above applet as a flash across the full distance at the instant the module (and all the light it emitted en route) arrives at the observer.

The phantom's clock appears to run at half speed during the outward leg of the journey. This means that when it reaches the distant star, it registers only half the elapsed time of the observer's clock. However, during the phantom's instantaneous transit back home, its clock runs at infinite speed, after which it registers the same time as the observer's clock. This sounds incredible explained this way. But there is a way of looking at this situation that is much easier to digest.

What is manifested mathematically as the phantom's clock running infinitely fast is really an image of the phantom's clock at every point on the return trip showing the time the module was actually *at* that point. So nothing here is really infinite. The apparent infinite speed of the clock is simply an anomaly of how the human mind perceives velocity. The zero transit time of the phantom does not signify an infinite velocity: it simply signifies the co-incident (or parallel) arrival of information from the whole continuum of separate "points" in space along the return path.

Now select *1.2c* on the Module Velocity Selector. The outbound module pulls away from its phantom so rapidly that it reaches the distant star before the phantom is even half way there. The module actually arrives home again on the return trip *before* its outbound phantom has reached the distant star. At the instant the module reaches home again, its "inbound" phantom starts to travel very rapidly from the *end* of its journey (the observer) back to the *beginning* of its journey (the distant star). This fast "inbound" phantom reaches the distant star at the same time the slow outbound phantom finally arrives there. In other words, the "inbound" phantom - the phantom image of the module on its return trip - travels backwards. Furthermore, this "inbound" phantom's on-board clock appears (to the observer) to be running at 5 times normal speed - *backwards.*

At each point along the return route, the module emits light. From the observer's point of view, the light emitted at each point takes an amount of time to reach him that is proportional to the distance the point is from him. The constant of this proportionality is 'c' - what we call the "velocity" of light.

Because the module is travelling faster than light, light emitted further away will arrive later than light emitted closer to the observer. Light emitted by the module when it was further away will arrive later than the light emitted by the module when it is closer. So the observer will see the module when it was further away *after* he has seen it when it was closer to home. He will therefore observe the module to be moving backwards.

The same is true of the module's on-board clock. Information about the clock when the module is at a greater distance will arrive *after* information about the clock when the module is at a lesser distance. Therefore the observer will receive information about the clock when it is showing a later time *before* he receives the information about it when it was showing an earlier time. To the observer, therefore, the clock appears to be running backwards. From the point of view of the observer, therefore, time on the "inbound" phantom (which is a "real" object within his universe) *is* running backwards!

These strange effects are, however, only appearances. From the point of view of the crew of the module, its on-board clock moves forwards in time at normal speed - just as the observer's own clock does for him. Time hasn't dilated. Space hasn't contracted. All these effects are due solely to the way in which information from a phenomenon in one frame of reference is transmitted to an observer in another frame of reference.

There is an interesting point to note when the module travels at just beyond the speed of light. Just after it actually arrives back at the observer, it becomes manifest to the observer as two separate and distinct phantoms that exist at the same time. The outbound and the backward moving "inbound" phantoms both exist at once. And they are not simply illusionary images: they are, from the observer's point of view, completely real. They emit not only light, but also gravitational and all other real physical effects. By travelling back and forth beyond the speed of light, the module has created for the observer multiple manifestations of itself.

Now select *5.0c* on the Module Velocity Selector. We now see the same effect as before but with many more phantoms present at the same time. Now select 9.9c on the Module Velocity Selector. The result is even more phantoms "in flight" at the same time. To the observer, it is as if a whole fleet of space modules is travelling towards the distant star. He is oblivious to the fact that the module is actually going to and fro. The backward-running "inbound" phantoms are travelling faster than the outbound phantoms. Each "inbound" phantom appears to leave the company of one outbound phantom, catching up with the previous one as it reaches its destination. It is a bit like a group and phase velocity effect. And remember that, from the observer's point of view, each phantom is a complete physical manifestation of the single module.

We do not, at present, have spaceships that can travel at relativistically significant speeds. But suppose our module were a subatomic entity moving in some kind of cyclical manner. It could be a point particle, a string or a closed surface of equilibrium between two types of opposing force fields. Suppose further that the phantoms it manifests are the plethora of microscopic phenomena we currently perceive indirectly through our experiments.

So I conclude that **if** the velocity of light be the same from the point of view of all observers travelling at different constant velocities in free space, **then** the *apparent* time dilation and space contraction must be simply a result of how space-time transmits (or distributes) information from one place to another. Time and space themselves cannot really be dilated and contracted. Unfortunately, when we apply the ideas of this article to the "now-classical" thought experiment involving the *light clock*, we encounter a paradox.

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