International Journal of Mathematics and Statistics Studies

Vol.8, No.2, pp.38-95, July 2020

Published by ***ECRTD-UK***

Print ISSN: 2053-2229 (Print)

Online ISSN: 2053-2210 (Online)

The Elements of Time Theorem

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ABSTRACT: Time travel may be accomplished by creating a time loop.

KEY WORDS: elements of time, Lorentz transformation, Pythagorean Theorem, and time loop.

INTRODUCTION

A Cartesian coordinate system in three dimensions, which is commonly used to describe space, and may be called a spatial coordinate system, can be extended to include another dimension that is linear like the other three dimensions of space, but possesses the attributes of time.

The attributes of time differ from those for space, mass, and energy. Time appears like a window by which we observe the motion of stars, planets, and other bodies, and the many interactions involving energy and matter. Countless graphs and equations use time as a variable. Nearly every computer has a clock.

One attribute of time, which appears similar to the attributes of space, is how its flow or passage is consistent or uniform. A clock in one location on Earth will register the same interval of time as a clock in another location on Earth, and its length of measurement stays the same, regardless of the day or year.

In other words, the flow or passage of time appears to be linear since it occurs at a steady rate, making it similar to the dimensions of space that are considered to be flat and linear. While space may curve, this requires a large concentration of mass such as a black hole, whose high gravity affects the properties of space nearby.

Another attribute of time is how it flows in a line in a single direction. Time seems to come from the future before it enters the present, and moves into the past where it is lost or gone, unable to be retrieved. Time flows like a river, which may flow steadily for thousands of miles before it empties into a sea.

Since time flows in a single direction, it is unlike the dimensions of space where an observer may move freely in every direction. An observer seems trapped within its flow, existing only in the present, unable to enter the past or the future so that its flow appears like a powerful current.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

Another attribute of time is how its flow or passage is smooth and very fine. Its subdivision into tiny intervals smaller than a second still results in its apparent movement, suggesting that it flows at a high rate of speed.

To help visualize the flow or passage of time, an analogy may be used of where an observer inhabits a straight line in a two dimensional Cartesian coordinate system, which lies in one of its dimensions.

To an observer on the line, the flow of time may be represented by the steady movement of the line past another line that is perpendicular to it, which represents the dimension of time. A clock at any location on the line registers the same interval of time as a clock at another location, and its interval or length of measurement stays the same since the line moves at a steady rate past the line perpendicular to it.

Since a clock at any location on the line measures a steady flow of time, or uses a consistent interval or length of measurement, the flow of time appears to be consistent across the boundaries of space, as defined by the moving line.

From another perspective, the line may exist in a two dimensional Cartesian coordinate system where one dimension expresses time as a rate of flow that passes through the line at a uniform rate, letting an observer on the line view a steady flow of time from any location or direction on the line.

Cartesian coordinate system

A Cartesian coordinate system is usually defined for a flat plane or some other two dimensional setting by using a pair of axis lines to count or measure distance over a fixed or uniform interval that intersect at a right angle, or are perpendicular, making them geometrically independent of each other.

Two lines that are geometrically independent may be viewed in terms of their projection upon each other as a point or edge, where an edge represents a line segment of minimum length, analogous to a point, a condition satisfied by their being perpendicular to each other, or their intersection at a right angle.

In a sense, the geometrical independence of two lines may be defined in terms of their projection upon each other with a minimum set of intersection, which consists of a single point. Such a minimum set of intersection enables them to represent separate but related dimensions, such as a pair of axis lines that measure distance within a plane, while retaining a common point of origin.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
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Cartesian coordinate systems are often used to graph a function in a plane. A function may be defined as the application of a formula to a numeric variable, often called x, that gives a numeric result, often called y, where f(x) = y, and f stands for the function or formula applied to the variable x.

Functions are typically graphed by applying the function to an ordered set of values of x, which results in an accumulation of points. A point is usually denoted as (x, y), where x represents a value of x, and y represents the value of the function applied to x, so that a point represents the application of the function to a specific value of x.

To graph a point, the value of x is plotted along the x axis, which is usually placed in a horizontal position, and the value of y is plotted along the y axis, which is usually placed in a vertical position.

Distance along a line of axis is counted from a common point of origin denoted as (0, 0). The distance of the point (x, y) from the point of origin (0, 0) is measured along each line of axis as x – 0, and y – 0, respectively.

The point of origin, which represents the intersection of the x axis with the y axis, is used as a point of reference for ordering the coordinate system, or determining the coordinates of another point.

To count or measure distance, equal spacing or intervals on a number line are used. The spacing or intervals are chosen to be easily visible, and suited in scale to solve a specific problem or class of problems. However, graphs may sometimes use logarithmic and exponential scales.

A Cartesian coordinate system is analogous to a polar coordinate system, since both systems use two elements to describe the location of a point in a plane with respect to a point of origin.

A polar coordinate system denotes a point as (Ɵ, r), where the first element Ɵ or theta, represents the angle of the right triangle formed by using the x axis as a baseline, or side adjacent in a counterclockwise rotation, going up the y axis. The second element r represents the length of the hypotenuse.

In other words, a polar coordinate system represents a point as the endpoint of the hypotenuse of a right triangle. The length r of the hypotenuse is counted in a straight line from the point of origin, while the angle Ɵ is determined with respect to the point of origin and the x axis for the side adjacent.

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Since the hypotenuse of the right triangle intersects a circle of radius r from the point of origin, (ϴ, r) appears as a point on a circle with radius r. ϴ may be expressed in terms of degrees or radians, where a circle has 2π radians or 360 degrees.

To convert a point in Cartesian coordinates into polar coordinates, the point (x, y) may be viewed as the endpoint of the hypotenuse of a right triangle, where x represents the length of side adjacent, and y represents the length of the side opposite, as measured from the point of origin.

Since the x axis and y axis intersect at a ninety degree angle, the Pythagorean Theorem may be applied to calculate the length of the hypotenuse as the positive square root of the sum of x squared and y squared. In other words, $r = \sqrt{(x^2 + y^2)}$.

ϴ, or the angle of the right triangle, may be determined from its sine, or the ratio of y/r, or from its cosine, or the ratio of x/r, since x, y, and r have all been determined.

Where polar coordinates are often used to express geometric figures that involve circles, cylinders, or spheres, Cartesian coordinates are used to graph functions that involve linear or quadratic equations, as well as other formulas.

Mathematical Mirror

Since the lines of axis in a Cartesian coordinate system are often used to count or measure distance, they may be viewed as the reflection or image of a number line that has been geometrically arranged to count or measure distance on a straight line, and includes a point of origin.

In other words, a line of axis in a Cartesian coordinate system may be viewed as the reflection of a mirror that replicates a number line and establishes a point of origin in the two dimensions of a plane, or three dimensions of space where the lines of axis are perpendicular to each other.

For example, the x axis and y axis may be viewed as separate reflections or images of a number line that has been geometrically arranged to count or measure distance in a plane. The x axis is placed in a horizontal position, and the y axis is placed in a vertical position, making them perpendicular to each other, where the only point they share in common is their point of intersection or origin.

Alternatively, the y axis may be viewed as a reflection of the x axis that is rotated at a ninety degree angle within a plane from a common point of origin, making the two lines perpendicular to each other, or geometrically independent.

In other words, a mathematical mirror replicates a number line in another dimension, similar to how the y axis may be viewed as a reflection or image of the x axis at a ninety degree angle within a plane.

The common mirror with its flat surface and high reflectivity may be viewed as a type of mathematical mirror that can replicate the image of an object, set, or number line, which is able to turn the x axis into the y axis by rotating its image around a common point of intersection in a plane.

A mathematical mirror replicates a set or number line in another set or dimension, changing one of its traits or characteristics in a manner that is often geometrical, while allowing for a point of intersection.

While a mathematical mirror is similar to a multiplier since it takes the image of a set or number line and changes a trait or characteristic in a uniform manner, such as multiplying each element by a constant, it may change the geometry of its image, or the identity of the set, instead of staying within the boundaries of the set or dimension.

To help clarify the distinction between a mathematical mirror and multiplier, an example may be used of a reflecting telescope, which returns an image or a reflection of an object that is upside down and greatly magnified.

Where the typical multiplier registers the magnification of a reflecting telescope by using a constant, the upside down image is typically unaccounted for. While a negative number or some other type of multiplier may be able to represent the change in geometry, some explanation is usually required, or given in context.

In other words, a mathematical mirror may change or alter the geometry of its image or reflection to where some explanation is needed beyond the use of a negative number to represent a change in direction or a reverse element.

While most mirrors are designed to return an accurate image or reflection of an object, or to magnify it, other mirrors may be designed at a quantum level to interact with a wave of light, such as converting it into electricity using a photovoltaic cell, or scattering it with an invisibility cloak.

In other words, a quantum mirror may involve the design of materials that are shaped or interact with individual rays of light, to either absorb or scatter a ray, so that the mirror no longer returns an accurate image or reflection, but instead converts the wave into a different form of energy or scatters it.

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Military aircraft are often shaped to scatter radar, which is another type of electromagnetic wave but longer in wavelength. A stealth aircraft usually has its wings, fuselage, and engines shaped to minimize its reflection seen by radar, especially from its front or side, and may minimize or scatter the emission of heat from its jet engines, and may be shaped to its visibility in daylight.

The idea of a mathematical mirror is also employed in cryptography or codes, which are used to disguise sensitive communications. Several images or reflections of a document may be involved in its coding and decoding.

Going back to a Cartesian coordinate system, two lines in a plane may be viewed as geometrically independent if they intersect at a ninety degree angle, or project upon each other as a point or edge, where an edge represents a line segment of minimum length, analogous to a point.

Where a line is edge on if there is no shadow from the projection of one line upon the other, a shadow represents a linear projection of one line upon the other, which produces a line or a line segment rather than a point or edge.

With this in mind, the condition of two lines that are geometrically independent may be seen as the opposite condition of two lines that are geometrically dependent, or parallel to each other, so that the shadow of one line upon the other preserves the length of a linear projection from one line to the other.

From another perspective, parallel lines reflect each other at an equal distance in a plane, or have a full shadow. If they intersect, then they are superimposed upon each other, as a condition of maintaining an equal distance between them, where the distance between them has a value of zero.

While mathematics seems to imply that multipliers and functions have the ability to compress information from one line onto a shorter line with no loss of data, as a practical matter, information may become lost if the projection employs a steep angle or uses a high rate of data compression.

On the other hand, interpolations and extrapolations using standard functions, such as a linear or quadratic equation, or difference equations are often highly successful in filling in missing or incomplete data, and interpreting results.

From another perspective, a projection may involve a rate of flow that is superimposed upon another dimension, like a wave passing through a medium or a body at a steady rate of flow like an ocean current such as the Gulf Stream, or a jet stream that moves through the atmosphere.

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With this in mind, if the flow or passage of time is viewed as a rate of flow from another dimension, which is apparently non-spatial, its flow or passage through space at a steady rate and consistent manner would explain why an observer seems trapped in its flow, unable to enter the past or future.

In other words, if time is viewed as a rate of flow that passes through space, its point of intersection in space occurs in the present, or at a point that represents the present, rather than the past or future.

Linear Geometry

Where time is sometimes thought of as another dimension that is added to a spatial coordinate system, physics has worked out a relationship between space and time called the Lorentz transformation that determines the passage of time for a moving observer compared to a stationary observer.

In other words, while the flow or passage of time may be viewed as a universal constant, since it displays traits or characteristics that are consistent or are uniform across space, its value at a particular location depends upon the motion of its location, or the motion of a moving observer compared to a stationary observer.

Unlike the dimensions of space, the observation of time is dependent upon the motion of its location, or the speed or rate of motion of a moving observer compared to a stationary observer, who is at rest compared to the moving observer.

In other words, a moving observer experiences a difference in the flow or passage of time compared to a stationary observer, who lies outside the moving observer's local condition of motion, or his frame of reference, which may be computed by using the Lorentz transformation.

The Lorentz transformation determines the local time that is experienced by a moving observer compared to a stationary observer by multiplying the local time of a stationary observer by two factors.

The first factor, called the Lorentz factor, is the reciprocal of the square root of one less the ratio of the velocity of the moving observer squared to the speed of light squared. It is generally small or negligible unless the moving observer is moving at a speed that is relativistic, or an appreciable fraction of the speed of light, much faster than by using automobiles or jet aircraft.

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The second factor, which is multiplied by the Lorentz factor, is the time of the stationary observer from which is subtracted the ratio of the moving observer's velocity multiplied by the distance traveled to the speed of light squared.

Algebraically, the Lorentz transformation is $1/\sqrt{(1- v^2/c^2)}$ multiplied by $(t - vx/c^2)$, where v is the velocity of the traveler, c is the speed of light, t is the time of the stationary observer, and x is the distance traveled by the moving observer.

When v is small compared to the speed of light or c, the Lorentz transformation gives only a small adjustment. But as v approaches the speed of light, the transformation starts to show the effect of time dilation, where the local time of the moving observer appears to slow down with respect to the stationary observer.

For example, consider a moving observer traveling at a velocity of 0.9 c in a straight line for a year, who travels a distance of 0.9 light years during the course of the year.

Plugging in values, the local time of the moving observer is:

$1/\sqrt{(1 - (0.9\ c)^2/c^2)}$ x (1 year – 0.9 c x 0.9 light years $/c^2$) =

$1/\sqrt{(1 - (0.9)^2\ c^2/c^2)}$ x (1 year – 0.9 c x 0.9 light years /c x c) =

$1/\sqrt{(1 - (0.81))}$ x (1 year – 0.9 x 0.9 light years /c (1 light year per year)) =

$1/\sqrt{0.19}$ x (1 year – 0.81 light years/ 1 light year / 1 year) =

1/ 0.44 x (1 year – 0.81 years) =

2.29 x (0.19 years) =

0.44 years

In other words, for a moving observer who approaches the speed of light, the effect of time dilation is noticeable, and when he reaches the speed of light, time appears to come to a standstill, or reaches a point of equilibrium since it is no longer running forward.

When the moving observer moves faster than the speed of light, time appears to run backwards. In other words, a moving observer traveling faster than the speed of light outruns the flow of time experienced by a stationary observer.

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Mathematically, time that moves into the past takes the form of an imaginary number. An imaginary number is a real number multiplied by the square root of negative one, and is commonly denoted as i.

For example, consider a moving observer traveling at 10 c for a year, who travels in a straight line. Plugging in values, the local time of the moving observer becomes:

$1/ \sqrt{} (1 – (10\ c)^2/c^2)$ x (1 year – 10 c x 10 light years $/c^2$) =

$1/ \sqrt{} (1 – (100\ c^2/c^2)$ x (1 year – 10 c x 10 light years /c x c) =

$1/ \sqrt{} (1 – 100)$ x (1 year – 100 light years /c (1 light year per year)) =

$1/ (\sqrt{-1} \times \sqrt{99})$ x (1 year – 100 years) =

$(1/i \times 1/\sqrt{99})$ x (-99 years) =

-i x 1/ 9.95 x (-99 years) =

i x 1/ 9.95 x (99 years) =

i 9.95 years

So, while a fast moving observer travels back in time, there is a limit on the length of time he travels back, since he does not observe his point of departure. He never runs fast enough to observe his point of departure, at least by using light, which propagates at the speed of light.

In other words, a fast moving observer who travels faster than the speed of light travels back in time, but no further than the time of his departure, while reaching a point in space that is far from his point of departure.

As a result, for this linear geometry of a fast moving observer, the popular notion of time travel is not accomplished. Since the fast moving observer does not travel back in time at the same location, but trades distance for time, the popular idea of time travel requires a different geometry.

For this case of a moving observer who travels in a straight line, the algebra of the Lorentz transformation simplifies to $t \times \sqrt{} (1 – v^2/c^2)$, where v is the velocity or speed of the moving observer, c is the speed of light, and t is the time of the stationary observer. In other words, a linear geometry of speed gives a simpler expression for a moving observer's local time.

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The Elements of One

Since, for a moving observer travels faster than the speed of light the Lorentz transformation for time results in a number multiplied by the square root of negative one, or an imaginary number, it may be helpful to recall how i is a derivative of negative one that, along with one and negative i, forms a group of four elements that is closed under multiplication.

A derivative of an element uses an operation of arithmetic to alter its sense or location on a number line while retaining its absolute value or magnitude just as negative one has the same absolute value of one but lies on the opposite side of a number line with zero as a point of origin.

A group is a set of mathematical elements that uses an operation such as addition or multiplication to compute or specify another element of the set. A group is considered to be closed under an operation when the result of the operation always returns or computes an element that is a member of the set.

The proposition that the set consisting of 1, -1, i, and -i forms a group under multiplication is supported by the following table, which shows the multiplication of each element of the set by the elements of the set.

Multiplication Table

1	-1	i	-i
1 x 1 = 1	-1 x 1 = -1	i x 1 = i	-i x 1 = -i
1 x -1 = -1	-1 x -1 = 1	i x -1 = -i	-i x -1 = i
1 x i = i	-1 x i = -i	i x i = -1	-i x i = 1
1 x -i = -i	-1 x -i = i	i x -i = 1	-i x -i = -1

Since the operation of multiplication may be applied to all the elements of the set, and its product is another element of the set, which does not default to a single element, as in the case of multiplication by zero, the set forms a group that is closed under the operation of multiplication.

The proposition that the set consisting of 1, -1, i, and -i forms a group under multiplication extends to the operation of division, which is the reverse of multiplication. The proposition is supported by the following table, which shows the division of each element of the set by all the elements of the set.

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Division Table

1	-1	i	-i
1 / 1= 1	-1/ 1 = -1	i/ 1 = i	-i/ 1 = -i
1/ -1 = -1	-1/ -1= 1	i/ -1 = -i	-i/ -1 = i
1/ i = -i	-1/ i = i	i/ i = 1	-i/ i = -1
1/ -i = i	-1/ -i = -i	i / -i = -1	-i/ -i = 1

In summary, the tables show that the set consisting of one and its three derivatives is closed under both operations of multiplication and division, and that one is the identity element, just as one is the identity element for the set of real numbers under the operations of multiplication and division.

While i is defined as the square root of negative one, i may also be viewed as that element when multiplied by itself or squared results in the product of negative one, when no element from the set of real numbers multiplied by itself or squared results in the product of a negative number.

With this in mind, i may be viewed as the key multiplier or mirror element, which generates the set of imaginary numbers as a reflection or a mirror image of the set of real numbers by multiplying a real number with itself. The linear combination of a real and imaginary number is called a complex number. A Cartesian coordinate system represents a complex number by using one line of axis to represent the set of real numbers and the other line of axis to represent the set of imaginary numbers.

Imaginary numbers are encountered in solving problems that involve the square root of a negative number, which effectively reduces to taking the square root of negative one as a multiplier of a real number.

In contrast to square roots, which are often encountered in solving quadratic equations and inverse square relationships, cube roots occur less frequently, and do not require i since the cube root of a negative number is a negative number just as the cube root of negative one is negative one.

In other words, $(-1)^{1/3} = -1$ since $(-1)^3 = -1 \text{ x } -1 \text{ x } -1 = (-1 \text{ x } -1) \text{ x } -1 = 1 \text{ x } -1 = -1$.

From another point of view, where a magnetic compass uses North, South, East, and West to describe directions on a globe or map, a mathematical compass uses1, -1, i, and -i to describe the sets of real and imaginary numbers, where the negative sign indicates a reverse direction within a set or number line.

From another perspective, a physicist would see i as the elementary particle that results from splitting apart negative one into two equal parts or components in taking its square root, the reverse process of multiplying a number by itself or squaring it, or a process similar to splitting an atomic nucleus.

From another point of view, where negative one represents the opposite of one as an element that is equal in value but opposite in sense or direction, lying on the opposite side of a number line, i represents an element that is the opposite of itself, which is not found on a number line based on the set of integers or real numbers.

In a sense, i comes from a number line that generates a negative number using multiplication, or splits a negative number into two equal parts under division like a dark mirror, whose reflection subdivides an element into two equal parts.

In contrast, the square root of one is one. The square root does not split it apart. The difference in square roots between one and negative one is due to how the negative sign changes the sense or direction of a number on a number line, rather than changing its absolute value or magnitude.

This may suggest that i could be viewed as the square root of the negative sign. In other words, i subdivides the negative sign into an intermediate value that enables it to change the sense or direction of a number halfway, instead of moving it all the way to the other side of a number line with zero as a point of origin.

To generate one using the imaginary numbers and multiplication, i and -i may be multiplied together from a number line consisting of positive and negative multiples of i. One may also be obtained by multiplying i by itself two times to obtain -1 and -1, and multiplying -1 by -1 in a double reverse of a dark mirror.

To recount, where multiplying a number by negative one gives a number that is the opposite of it, like a reflection on the opposite side of a number line, multiplication by i subdivides a number into the opposite of itself.

The idea that i is obtained by splitting apart negative one into two equal parts, which are the opposite of themselves, makes it a key element of mathematics like the first counting or natural number of one. This is supported by the following table.

Powers of i

$i^1 = i$
$i^2 = i \times i = -1$
$i^3 = i \times i \times i = (i \times i) \times i = -1 \times i = -i$

$i^4 = i \times i \times i \times i = (i \times i) \times (i \times i) = -1 \times -1 = 1$

When these four elements are added together, their sum is a sum of two zeroes, or zero, so that zero represents the center of the four points of a mathematical compass of sets that consists of the real and imaginary numbers. In other words, i can generate the set of i, -1, -i, and 1 using the operation of multiplication, and it can generate zero by adding the elements of the set.

Regarding the splitting apart of negative one under multiplication, it may be observed that $i^{-1} = -i$, and $-1/i = -1 \times i^{-1} = i$, while $-1^{-1} = -1$ and $-1/-1 = 1$, making i appears as an intermediate value, lying between one and negative one, under both the operations of multiplication and division.

The Flow of Time

Where the coordinates of space are viewed as being fixed with respect to a point of origin that is found in space, the coordinates of time appear to flow in a single direction and at a uniform rate through the boundaries of space.

In other words, where a spatial coordinate system measures distance with respect to a point of origin that is fixed in space, the coordinates of time flow past a point in space in a single direction and at a uniform rate. This flow of time represents a consistent trait or characteristic from another dimension, which apparently lies outside the boundaries of a spatial coordinate system.

In other words, since the coordinates of time flow in a single direction and at a uniform rate, a stationary observer perceives a steady flow of time, like a flowing river, which is consistent across space.

The idea that the coordinates of time flow in a single direction and at a uniform rate is commonplace. For example, the calendar organizes the flow of time in a single direction and at a uniform rate as it counts the months and days to match how the Earth orbits the Sun on a consistent basis, defined by the laws of gravity.

While the calendar has been revised in history to use more accurate methods of astronomical time keeping, it has been used for thousands of years to count or measure the flow of time in a single direction and at a uniform rate.

As an aside, a calendar month is based on the lunar month, which is the time it takes the Moon to orbit the Earth in twenty-eight days. But since the calendar year, which is based on the Earth's orbit around the Sun, does not divide evenly into lunar months that consist

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of twenty-eight days, the calendar month usually includes additional days, making it longer on average than the lunar month.

Like the calendar year, the lunar month illustrates how the flow of time is measured indirectly by using the consistent motion of an object like the Moon, whose orbit around the Earth is repeated on a consistent basis.

Another example of the flow of time in a single direction and at a uniform rate is given by the hands on the face of a clock, which organize the flow of time in a single direction and at a uniform rate as they count the hours in the day, to match how the Earth rotates about its axis in a twenty-four hour day on a consistent basis.

As illustrated by the clock, lunar month, and calendar year, time flows in a single direction and at a uniform rate, measured in terms of distance by the motion of an object, which is repeated on a consistent basis.

In other words, time may be viewed as flowing through space in a linear manner, as represented by its flow in a single direction and at a uniform rate. While the flow of time is often measured by using a circular motion which is repeated on a consistent basis such as the orbit of a planet, a circular motion may be viewed as essentially linear in nature since it flows in a single direction and at a uniform rate.

This similarity between a linear and circular motion, in flowing in a single direction and at a uniform rate, is similar to how a polar coordinate system may be used to describe the location of a point like a Cartesian coordinate system.

Moreover, time flows in a single direction like a one way street rather than a two way highway. Time flows past a point in space similar to how a pencil and straightedge are used to draw a line between two points, where the pencil moves in a single direction along the straightedge.

In other words, time flows through space with geometric efficiency along a line rather than meandering, or twisting and turning, or doubling back upon itself like the Colorado River flowing through the Grand Canyon.

Since time flows through space in a linear manner, it may be viewed as representing the projection of a four dimensional coordinate system into the three dimensions of space. In other words, the flow of time may be depicted as a line moving past a point in space, just as how a line in two dimensions may project past a point along a line, or in one dimension, from any direction.

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Moreover, the flow of time may appear from any direction since it flows through space from outside its boundaries. In other words, the flow of time is essentially non-spatial as its flow is not apparent from within a spatial coordinate system, which views only a single point in time across its boundaries.

From another point of view, time is like a clothes closet, with a pole going across at the top from which clothes are hung in order. But instead of clothes, boxes of space are hung in chronological order, which display the activity in a region or volume of space for a given moment or interval of time.

Instead of picking out a dress or shirt, an observer picks out the hanger for a box of space to observe the activity within it for a given moment, using its chronological order to view past events, although space and time curve around large concentrations of mass such as stars and black holes.

The flow of time through space provides a means by which mass and energy are able to change their composition and move through space. Moreover, the flow of time through space may viewed as being consistent across its expanse, flowing in a single direction from the future, and at a uniform rate, just as the laws of physics are viewed as being consistent across space.

While the flow of time is consistent across space, variations in its flow may occur due to local conditions such as the presence of a black hole, or an object moving faster than the speed of light, or other conditions that lie outside the general parameters of space, as defined by the speed of light and gravity.

Moreover, time always flows from the future. In order to occupy the present, time flows from the future as it flows past a point in space, and enters the past. In other words, time flows in an opposite direction compared to a timeline, which gives a chronological ordering of past events.

Rate of Flow – Quantum Argument

Since the flow of time may be viewed as a linear projection of another dimension into space, where both time and space measure distance in terms of displacement along a line, the flow of time may be measured in terms of its displacement along a line, or a linear rate of motion where distance is divided by time.

In other words, the flow of time in a single direction and at a uniform rate may be measured like any other motion where distance is divided by time. However, its units of distance, while consistent with a spatial coordinate system, represent a displacement in the dimension of time.

With this in mind, velocity, speed, or rate of motion, as described in a spatial coordinate system, may be defined by using two equations.

First, velocity, speed, or rate of motion as observed in a spatial coordinate system equals distance divided by time. This calculation may include an indication of direction, using a positive or negative sign.

Second, time equals distance or displacement in the dimension of time, divided by time. In other words, time may be defined in terms of a distance or displacement along a line that measures time in terms of distance.

Combining these two equations, velocity, speed, or rate of motion equals distance in space divided by distance in the dimension of time, where the units of time cancel each other out.

However, the units of distance found in the numerator of the equation represent a distance or displacement in space, while the units of distance found in the denominator represent a distance or displacement in the dimension of time.

Moreover, the units of distance in denominator, which represent the dimension of time, flow through space at a rate that is invisible with respect to a stationary observer since time flows from outside the boundaries of space.

In other words, a spatial coordinate system views the passage of time at a single point across its expanse. As a result, a spatial coordinate system observes the flow of time by quantizing it into an element of time, which represents a linear rate of motion in the dimension of time.

In other words, the flow of time through space represents a unit of distance in the dimension of time, which is quantized into time instead of being expressed as a distance since the flow of time through space is invisible, appearing only as a point, and its flow may appear from any direction.

While a second or any other unit of time may be replaced with a unit of distance in the dimension of time to determine the rate of motion, speed, or velocity of a moving object in space, the flow of time is observed only at a point, rather than a distance or displacement in the dimension of time.

In other words, since the flow of time through space is invisible, as it comes from outside the boundaries of space, and its flow may appear from any direction, its quantization into an element of time is a practical necessity.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

Moreover, a displacement in the dimension of time may translate from any type of motion in space, whether linear, circular, or elliptical. For example, the orbit of the Earth around the Sun, which is repeated on a consistent basis and is commonly used to measure time, translates into a linear displacement in the dimension of time.

A clue to the rate of flow of time is suggested by how time is commonly measured by using the Earth's orbit around the Sun, and the Earth's rotation about its axis, or motions that are repeated on a consistent basis, and astronomical in scale.

In other words, since time is commonly observed by using the Earth's orbit and rotation about its axis, which involve long distances, it may be suggested that time flows at a high rate of speed, so that it quickly travels over long distances. This makes it practical to quantize its rate of flow into units of time rather than a distance.

In other words, the flow of time is quantized into units of time as a matter of practical convenience, instead of requiring the observation of the distance that a moving object travels in the dimension of time.

For example, consider a car traveling down a street at a speed of 60 miles per hour or "a mile a minute," which is considered a high rate of speed in everyday life, and equivalent to a speed of about 88 feet per second.

If time flows at a high rate of speed like the speed of light, the speed of the moving car at 88 feet per second compared to the rate of flow of time at 186,000 miles per second in the dimension of time, further divided by 5,280 feet per mile, makes the car's relative displacement in time difficult to observe.

In other words, the quantization of a distance or displacement in the dimension of time into time is a practical necessity in determining the motion of a moving object in space since it is difficult to directly observe the distance or displacement in the dimension of time of a moving object in space.

The difficulty of directly observing the flow of time in space is due to how time flows through space to where it is observed at a single point, rather than a span of time, the flow of time may appear from any direction with respect to a point in space, and the flow of time at a high rate of speed.

The idea that time flows at a high rate of speed, which is the speed of light, is confirmed by the Lorentz transformation.

For example, as a moving object approaches the speed of light, the Lorentz transformation shows that time seems to slow down, or dilate, so that the flow of time through space appears to reach a limit at the speed of light.

As a moving object reaches the speed of light, the flow of time appears to become frozen, where its rate of flow reaches a point of equilibrium compared to the speed of the moving object. This point of equilibrium strongly suggests how time flows at a rate equal to the speed of light.

Finally, as the speed of the moving object exceeds the speed of light, time appears to run backwards, a condition indicated by the presence of imaginary numbers used to describe its flow. A moving object that travels faster than the speed of light appears to outrun the flow of time through space. (Hughes, “The Accelerated Wave”).

From another point of view, since a moving object in space seems to approach the rate of flow of time through space as its speed approaches the speed of light, it may be deduced that time flows at the speed of light.

The flow of time at the speed of light would explain how time is commonly measured indirectly, by using motions, such as the Earth’s orbit around the Sun or its rotation about its axis that are repeated on a consistent basis, instead of direct observation within the dimension of time.

Rate of Flow – Indirect Observation

Since time flows from outside the boundaries of a spatial coordinate system, and may appear from any direction, its rate of flow is measured indirectly by observing the motion of an object, which is repeated on a consistent basis.

In other words, the consistent or repetitive motion of an object, which is commonly used to measure time, resembles the flow of time since its motion occurs in a single direction and at a uniform rate. Moreover, its rate of motion may provide a way to evaluate an estimate of the rate of flow of time.

With this in mind, the Earth’s orbit around the Sun, which defines the calendar year, and the Earth’s rotation about its axis, which defines the twenty-four day, give two examples of a moving object whose motion may be used to evaluate an estimate of the rate of flow of time through space.

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Published by ECRTD-UK
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In other words, since the Earth's orbit around the Sun and the Earth's rotation about its axis are commonly used to measure time, they provide a natural baseline for evaluating an estimate of its rate of flow.

This evaluation may be performed by using a ratio, which compares the motion of the Earth's orbit or rotation about its axis to the estimated rate of flow of time, by placing the rate of motion of the Earth's orbit or rotation in the numerator, and the estimated rate of flow of time in the denominator.

This ratio places the rate of motion of the Earth's orbit or rotation in the numerator, and the estimated rate of flow of time in the denominator since the flow of time may be seen as a benchmark or point of reference, while the motion of the Earth is local.

In other words, in using a ratio to compare two quantities, a local or specific value is generally placed in the numerator, while a benchmark or point of reference is generally placed in the denominator.

Analytically speaking, it may be expected that rate of flow of time should be faster than the motion of an object, which is commonly used to measure time, since the flow of time may be viewed as a benchmark or point of reference.

In other words, for the flow of time to be stable compared to the Earth's orbit or rotation, time must flow at a high rate of speed. Otherwise, the ratio will show the measurement of time changes markedly for small differences in the motion of an object, which is commonly used to measure it.

In other words, using a low estimate for the rate of flow of time is appropriate for when its flow is viewed as a component of the motion of an object rather than a benchmark or reference point.

From a geometrical point of view, if the flow of time is like a smooth plane moving through space, a high rate of flow will make its flow appear to be stable compared to the motion of objects, which are commonly used to measure it. But a low rate of flow will make the motion of objects, which are commonly used to measure time, appear as tall mountains, making its flow appear inconsistent.

From another point of view, the ratio that compares the motion of an object, which is commonly used to measure time, to its estimated rate of flow has an interpretation that is similar to a coefficient of correlation, which is used in statistics to identify a cause and effect relationship.

Viewing this ratio like a coefficient of correlation, a ratio of one implies a cause and effect relationship, where the flow of time depends directly upon the moving object that is chosen for its measurement, making the flow of time dependent upon local circumstances.

On the other hand, a ratio that is a tiny fraction implies that the flow of time is largely independent of the moving object that is chosen for its measurement, making the flow of time appear to be stable or consistent across space, or as a common benchmark or point of reference.

From another point of view, since the Earth's orbit and rotation about its axis provide an adequate baseline of motion or distance to measure the flow of time, it may be expected that time flows faster than either motion. In other words, since the measurement of time using the distance that the Earth travels as it orbits the Sun or rotates about its axis are viewed as stable measurements of time, it may be expected that time flows faster than either motion.

While a comparison of the Earth's orbit around the Sun and its rotation to the flow of time involve rates of motion, the comparison may also use distance since the flow of time may be measured in terms of the distance that time travels during the same period or cycle of motion.

Evaluating the rate of flow of time may help identify the type of energy that drives its flow through space. In other words, the flow of time through space implies the existence a type of energy that drives its flow through space instead of a moving object or electromagnetic wave.

Using the Earth's orbit around the Sun, a ratio of comparison based on distance would compare the distance that the Earth travels as it orbits the Sun in a year to an estimate of the distance that time travels in the same period of a year.

Since the Earth orbits the Sun at a distance from about 147 to 152 million kilometers, or about 93 million miles, and its orbit is nearly circular, the distance that the Earth travels during its orbit is roughly equal to the circumference of a circle, calculated by multiplying the radius of its orbit by 2π.

Using a midpoint value for the radius of the Earth's orbit of 149.5 million kilometers, or about 93 million miles, and multiplying this value by 2π, or 6.28, results in a distance that the Earth travels in its orbit of about 939 million kilometers, or 584 million miles. The ratio would compare this distance to the estimated distance that time travels in the same period of a year.

Likewise, using the Earth's rotation about its axis, a ratio based on distance would compare the distance that the Earth rotates during a day to an estimate of the distance that time travels in the same period of a day.

Since the Earth has a diameter of about 12,756 kilometers, or 7,918 miles, the distance it rotates over during a day is its circumference, calculated by multiplying its diameter by π, or 3.14. This gives a distance traveled of about 40,054 kilometers, or 24,863 miles. The ratio of comparison would then compare this distance to the estimated distance that time travels in the same period.

To compare the two ratios for the same period of a year, the distance that the Earth rotates in a day may be multiplied by 365 days in a year. Multiplying 40,054 kilometers, or 24,863 miles per day by 365 days per year gives a distance traveled of about 14.62 million kilometers, or 9.07 million miles per year.

The ratio may be completed by making an assumption about the rate of flow of time. Two assumptions will be evaluated. One assumption will use a low rate of flow. The other assumption will use a high rate of flow.

To calculate the ratio when time is assumed to flow at a low rate of speed, its flow may be estimated to be one kilometer per year, a value chosen for convenience of calculation. Using this estimate of 1 kilometer per year for the flow of time, the ratio using the Earth's orbit around the Sun in the numerator is 939 million kilometers per year divided by 1 kilometer per year, or a value of 939 million.

Likewise, using an estimate of 1 kilometer per year for the flow of time, the ratio of comparison using the Earth's rotation about its axis in the numerator is 14.62 million kilometers per year divided by 1 kilometer per year, or a value of 14.62 million.

While these two ratios of 939 million and 14.62 million are somewhat similar in terms of their order of magnitude, their wide arithmetic difference of about 924 million shows that the measurement of time is greatly affected, many times over, by the moving object that is chosen for its measurement.

In other words, when 939 million and 14.62 million are compared to the flow of time at a rate of one kilometer per year, these ratios appear as very tall mountains, making the flow of time highly dependent upon the moving object chosen for its measurement.

On the other hand, time may be assumed to flow at a high rate of speed. To emphasize the contrast between using a low and high rate of flow, the estimate of a high rate of flow may use the highest rate of speed observed in nature, which is the speed of light, so the ratio is constructed at its limit.

International Journal of Mathematics and Statistics Studies
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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In other words, in assuming that time flows at a high rate of speed, it is reasonable to assume that it flows at the highest speed observed in nature, which is the speed of light, or 299,792 kilometers per second, or 186,000 miles per second so that the ratio of comparison is constructed at a natural limit.

While time could be assumed to flow faster than the speed of light, the assumption that time flows at the speed of light marks a high end estimate, consistent with the highest speed that is observed in nature.

In other words, if time flows faster than the speed of light, some explanation would needed for why it flows faster than the speed of light since light is assumed to propagate freely through space.

In other words, since space is considered to be a void or vacuum, which does not resist the propagation of light and other electromagnetic waves, time may be viewed as flowing through space at the same rate of speed as light and other electromagnetic waves, which propagate freely through space.

Assuming that time flows at the speed of light results in a distance traveled by the flow of time in a year of one light year, which is a distance of 9.46 trillion kilometers, or nearly 6 trillion miles.

Using this estimate of the distance traveled by the flow of time in a year, the ratio that is calculated using the Earth's orbit around the Sun in the numerator is equal to 939 million kilometers divided by one light year or about 9.46 trillion kilometers, or 900 million divided by 9 trillion, or about 1×10^{-4} or 0.0001.

Likewise, using this estimate for the distanced traveled by the flow of time in a year, the ratio that is calculated using the Earth's rotation about its axis in the numerator is equal to 14.62 million kilometers divided by one light year or about 9.46 trillion kilometers, or 14.62 million divided by 9.46 trillion, or about 2×10^{-6} or 0.000002.

While these values of 1×10^{-4} and 2×10^{-6} are also somewhat similar in terms of their order of magnitude, both are tiny fractions, showing that the flow of time through space is like a smooth plain instead of a tall mountain range.

In other words, under the assumption that time flows at a high rate of speed, these ratios of comparison show the measurement of time through space is largely independent of the moving object chosen for its measurement.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by **ECRTD-UK**
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In other words, when time is assumed to flow at the speed of light, the measurement of time appears as a point of stability compared to the motion of objects that are commonly used to measure it.

In conclusion, the observation of the rate of flow of time by indirect motion strongly suggests that time flows through space at the speed of light, as the highest rate of speed that is observed in nature.

Moreover, it may be argued that it is the flow of time at the speed of light that allows light to propagate through space at the speed of light. Time must flow through space at a rate that is no less than the speed of light since it is the flow of time that makes room within space for light to propagate.

From another point of view, the propagation of light at the speed of light requires time to flow at a rate that is no less than its speed of propagation since time is used as a basis for measuring the speed of light. Time must flow at a rate that is no less than its basis of measurement.

The rate of flow of time that is used to determine the speed of light must capture enough distance to let light propagate at the speed of light. With this in mind, the propagation of light at the speed of light may be viewed as a mirror image, or a reflection of how time flows through space since it is the flow of time through space that allows speed to be determined.

Since the flow of time at the speed of light is difficult to observe directly, it is measured indirectly by using the motion of an object, such as the Earth's orbit around the Sun or its rotation about its axis, which is repeated on a consistent basis.

Since time flows through space at the speed of light, its flow appears to be consistent, at least as measured by the motion of stars and planets, which move much more slowly than the speed of light.

In other words, where a spatial coordinate system establishes its sense of stability by using a point of origin that is fixed in space, the flow of time through space establishes its sense of stability by flowing at the highest rate of speed that is observed in nature, or the speed of light.

As a result, since the Earth moves so slowly compared to the speed of light, the flow of time appears to be stable and is easily measured by the consistent motion of the Earth's orbit, which defines the calendar year, and the Earth's rotation about its axis, which defines the twenty-four day.

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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
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This is one of reasons why before the early 20^{th} century, with its advances such as the theory of relativity, scientists were able to think of time as being static in its rate of flow, a universal constant, instead of dependent upon its frame of reference.

From another point of view, since time is measured indirectly by using the motion of an object, which is observed by using light or some other type of electromagnetic wave that travels at the speed of light, its rate of flow is measured by the speed of light.

Since time flows at the speed of light, the time dilation effect for most moving objects will appear to be negligible for a stationary observer, letting its flow appear to be stable or invariant, except under conditions of special relativity.

For example, the time dilation of a chemical rocket compared to the flow of time at the speed of light may be determined by using the Lorentz transformation, which applies to two moving frames of reference.

A rocket launched into space will generally have a velocity of about 40,000 kilometers per hour, or 25,000 miles per hour, the Earth's escape velocity. To compare the rocket's velocity to the speed of light, which is usually given as 300,000 kilometers per second or 186,000 miles per second, the rocket's velocity needs to be converted into kilometers or miles per second instead of kilometers or miles per hour.

When the rocket's speed of 40,000 kilometers or 25,000 miles per hour is divided by 60 minutes per hour and 60 seconds per minute, its speed becomes 11 kilometers per second, or about 7 miles per second.

Comparing the speed of the rocket, which is 11 kilometers per second or 7 miles per second, to the speed of light, which is 300,000 kilometers per second or 186,000 miles per second, results in a ratio of v/c that is less than 0.004 percent.

Putting this small ratio of v/c into the equation of $1/\sqrt{(1- v^2/c^2)}$ multiplied by $(t – vx /c^2)$ gives a result that is negligible. In other words, for these two moving frames of reference, the time dilation determined by the Lorentz transformation is negligible.

Furthermore, the flow of time at the speed of light is suggested by the Lorentz Transformation itself, which adjusts the local time of an observer in relationship to the velocity of a traveler with respect to the speed of light.

The Elements of Time

As time flows through space, it creates a frame of reference that may be used to determine the speed or rate of motion of a moving observer in space and his displacement in time with respect to a stationary observer. This frame of reference consists of the flow of time through space, the moving observer, and a stationary observer, who is at rest compared to the moving observer.

Since the stationary observer is at rest compared to the moving observer, he views his motion against the background of viewing the flow of time through space at the speed of light. In other words, the stationary observer views the moving observer in comparison to his view of the flow of time at the speed of light.

Since the stationary observer views both the motion of the moving observer and the flow of time through space at the speed of light, he can determine his relative displacement in time by comparing his speed or rate of motion to his view of the flow of time through space by dividing his speed or rate of motion by the flow of time at the speed of light, which results in the familiar ratio of v/c.

The ratio of v/c has a physical interpretation. Since the stationary observer is at rest, the ratio allows him to view the moving observer catch up to the flow of time through space as he views both his motion with its resulting displacement in time, and the flow of time through space at the speed of light.

In effect, the stationary observer is able to view the moving observer catch up to the flow of time since he possesses two lines of sight that view his relative displacement in time as described by the ratio of v/c. These two lines of sight are based on their common view of the flow of time through space, and the stationary observer's state of rest as compared to the moving observer.

Since these lines of sight allow the stationary observer to view the moving observer's relative displacement in time, it may be inferred that they intersect it at its endpoints or its top and bottom if the displacement is viewed as a vertical line.

Geometrically speaking, an observer requires two lines of sight to view the length of a line, which intersect it at its endpoints. Preferably, one of the lines of sight intersects the line at a right angle to simplify the calculation of its length by using the Pythagorean Theorem.

This geometric interpretation of the moving observer's relative displacement in time as a straight line instead of a curve is consistent with the construction of v and c as linear rates of motion in a spatial coordinate system that is flat, rather than curved, like a Cartesian coordinate system in three dimensions.

Since the stationary and moving observer share an identical view of the flow of time, which flows through space in a consistent or uniform manner, regardless of the distance or motion

International Journal of Mathematics and Statistics Studies
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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

between them, their identical view of its flow gives the stationary observer a line of sight to the moving observer that intersects the tip of his displacement.

In other words, since the stationary and moving observer share an identical view of the flow of time, a line connects them in the dimension of time, with each observer located at its endpoints, where the length of the line represents their identical view of the flow of time through space at the speed of light.

In other words, since time flows through space in a consistent or uniform manner, a stationary and a moving observer have an identical view of its flow through space. Their identical view of its flow through space may be represented by a line that connects them in the dimension of time, where the length of the line represents the rate of flow of time through space at the speed of light.

More generally, since any two observers share an identical view of the flow of time through space, their identical view of its flow lets them be connected by a line of sight in the dimension of time, which represents its rate of flow at the speed of light.

Since this line of sight represents the flow of time through space, the line may be defined to have a length of one by dividing how each observer views its rate of flow at the speed of light, by the flow of time through space at the speed of light.

With this in mind, this line of sight between two observers that represents the flow of time through space is fixed or invariant in length, since time flows through space in a consistent or uniform manner.

Using this line of sight, the stationary observer is able to view the moving observer catch up to the flow of time through space, since he views the moving observer at the tip or end point of his displacement in time as described by the ratio of v/c, while he maintains his view of the flow of time through space at the speed of light.

In other words, this line of sight connects the stationary observer directly with the moving observer and his relative displacement in time, while he views the flow of time through space independently of the moving observer.

Unlike a spatial coordinate system, where a line of sight represents a distance in space, a line of sight in the dimension of time represents a common observation of its rate of flow by two observers, making the dimension of time relative in terms of how two observers view its flow.

This line of sight intersects the tip of the moving observer's displacement in time since it represents his speed or rate of motion. If the displacement is viewed as a vertical line that

International Journal of Mathematics and Statistics Studies
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Published by *ECRTD-UK*
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

lies parallel to a vertical line of axis that converts the moving observer's speed or rate of motion into a displacement in time by using the ratio of v/c, then the line of sight intersects it at its top endpoint.

From the perspective of the stationary observer, since this line of sight intersects the tip of the moving observer's displacement in time, it intersects it an angle, compared to his other line of sight, which is based on his state of rest. These two lines of sight form a plane in the dimension of time that measures their relative views of the flow of time through space.

Since this first line of sight is fixed in length, the angle it forms with respect to the stationary observer shifts or changes in value, depending on the degree or magnitude of the moving observer's displacement in time.

In other words, for a slow moving observer with a small value of v/c, who has a small displacement in time, a stationary observer views his displacement at a small angle with respect to his state of rest compared to the moving observer.

In contrast, for a fast moving observer with a large value of v/c, who has a large displacement in time, a stationary observer views his displacement at a large angle with respect to his state of rest compared to the moving observer.

In other words, the size or magnitude of the moving observer's displacement in time affects the stationary observer's view of the angle of this line of sight to his displacement in time, since he views the angle with respect to his state or condition of rest compared to the moving observer.

The stationary observer's state of rest compared to the moving observer defines his second line of sight to the moving observer's displacement in time, and the baseline by which he measures the angle of the first line of sight.

Moreover, this second line of sight, which measures the state of rest between the two observers, is relative since it measures the degree of stability between them, as a measure of their state of rest, and is independent of the first line of sight, which represents the flow of time through space at the speed of light.

While this second line of sight does not directly connect the stationary observer to the moving observer in the dimension of time, it connects him to a measurement of the state of rest between them, which varies in an opposite sense or direction, compared to their relative motion.

With this in mind, this second line of sight, which measures the state of rest between the two observers, enables the stationary observer to view the start, or beginning point of the moving observer's displacement in time, since his motion and relative displacement in time start from a condition of rest.

In other words, where the first line of sight intersects the tip or top of the moving observer's displacement in time, this second line of sight intersects the start or beginning of the displacement at its opposite end, or its bottom if it is viewed as a vertical line.

These two lines of sight enable the stationary observer to view the full length of the moving observer's displacement in time, from top to bottom, from its tip to its start or beginning point.

Since this second line of sight is based on the degree of rest between the stationary and moving observer, which represents the opposite condition of their relative motion and the moving observer's displacement in time, it intersects it at a right angle.

If the displacement is viewed as a vertical line, parallel to a vertical line of axis like the y axis in a Cartesian coordinate system, the first line of sight intersects it at its top, and the second line of sight intersects it at its bottom, along a horizontal line of axis like the x axis in a Cartesian coordinate system.

The intersection between the second line of sight and the displacement in time forms a right angle, where the point of intersection measures the degree of rest between the two observers along the horizontal x axis.

Using this second line of sight, the stationary observer is able to view the start or beginning of the moving observer's displacement in time, while he maintains his view of the flow of time through space, which remains connected to the tip or top of the moving observer's displacement in time.

Since this second line of sight, which connects the stationary observer to the start or beginning point of the moving observer's displacement in time, rather than his location in the dimension of time like the first line of sight, measures the state of rest between them, may be called a line of stability, which measures the degree of spatial stability between them as an equivalent statement of their state of rest.

Since this line of stability measures the degree of stability between the two observers, it decreases in value or length with the degree or magnitude of their relative motion, which represents the opposite condition of their stability.

In other words, a slow moving observer with a small value of v/c, who has a small displacement in time, has a high degree of stability with respect to a stationary observer in space, and so the line of stability between them is close to its ideal value or length.

International Journal of Mathematics and Statistics Studies
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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In contrast, a fast moving observer with a large value of v/c, who has a large displacement in time, has a low degree of stability with respect to the stationary observer in space, and so the line of stability between them is noticeably shorter than its ideal value or length.

The ideal value or length for the line of stability between two observers may be defined by a system of two stationary observers. Since they are completely stable with respect to each other in space and have no motion between them, they represent a state of complete rest between themselves, or spatial equilibrium.

For a system of two stationary observers, their line of stability attains its ideal value or length. This ideal value may be defined as one, by using a process similar to defining the length of the line of sight between a stationary and moving observer, whose length represents the flow of time at the speed of light.

In other words, since a system of two stationary observers represents an ideal system of stability between two observers, the value or measurement of its stability may be defined as one, to represent how the two observers are completely stable in space with respect to each other.

The use of one, as the identity element of multiplication and first natural or counting number, may be used to represent a state of fullness or completeness, such as the spatial equilibrium between two stationary observers.

In other words, as a counting number, one may be viewed as representing a value of wholeness or completeness, as in counting an object or element. In contrast, the absence of stability between two observers may be represented mathematically by zero, which represents the absence of a value or element.

From another perspective, since a system of two stationary observers represents a system of ideal stability, with its two observers in state of spatial equilibrium, they view the flow of time for each other in the same way that they view the flow of time through space at the speed of light.

In other words, a system of two stationary observers represents an ideal system of spatial stability, which gives a perfect reflection, or has a mirror element of one, to describe how its two observers view the flow of time for each other, or internally, as compared to its rate of flow through space at the speed of light.

With this in mind, a stationary observer views the start or beginning of the moving observer’s displacement in time as a change in the degree of spatial equilibrium within an ideal system of two stationary observers.

Since this line of stability is independent of the flow of time through space, as the relative motion or stability between two observers is independent of its flow through space, how a stationary and moving observer view the flow of time for each other is conserved with a value equal to its rate of flow at the speed of light, or their identical view of its flow through space at the speed of light.

In other words, how two observers view the flow of time for each other is relative, since it is dependent on the degree of their relative motion, which affects their line of stability, and its total value is conserved with respect to the spatial equilibrium that is found between two stationary observers.

In other words, how two observers view the flow of time for each other is related to the degree of spatial stability between them, which represents the opposite condition of their relative motion, and the moving observer's displacement in time.

In other words, as a moving observer creates a displacement in time, which is viewed by a stationary observer, his speed or rate of motion reduces or shortens the line of stability between them, and this reduction is conserved with respect to a system of two stationary observers who view the flow of time for each other at the same rate as its rate of flow through space at the speed of light.

In other words, as a moving observer creates a displacement in time with respect to the stationary observer, it shortens or reduces the line of stability between them that measures the stability between them, since the moving observer converts some of the stability between them into relative motion.

Since this reduction in the line of stability, which measures the degree of stability between the observers, is proportional to the displacement in time of the moving observer, it occurs at a right angle to the displacement since motion and stability represent opposite conditions. As a result, the Pythagorean Theorem may be applied to calculate the length of the line of stability.

From another perspective, the stationary observer serves as a point of origin for viewing the moving observer's displacement in time by using two lines of sight that intersect it at its top and bottom, where the displacement is viewed lying parallel to a vertical line of axis, like the side opposite of a right triangle.

The first line of sight, which represents the identical view that the two observers share of the flow of time through space, intersects the displacement at its top, as the hypotenuse of a right triangle, while the second line of sight, or line of stability, intersects it at its bottom at a right angle, as the side adjacent of a right triangle.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by **ECRTD-UK**
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

The line of stability, which lies on a horizontal line of axis at a ninety degree angle to the moving observer's displacement in time, intersects the displacement at a right angle since the stability between the two observers represents the opposite condition of the moving observer's motion and displacement in time.

To apply the Pythagorean Theorem, the stationary observer may take the moving observer's displacement in time as represented by the ratio of v/c, square it, and add it to the square of the line of stability, which equals the square of the hypotenuse or first line of sight, which has a length of one to represent the flow of time through space at the speed of light.

In other words, $(v/c)^2$ + (line of stability)$^2 = 1^2$

Rearranging terms, and since $1^2 = 1$, (line of stability)$^2 = 1 - (v/c)^2$

Taking the square root of both sides, line of stability = $\sqrt{((1 - (v/c)^2)}$

Applying the square of $(v/c)^2$ inside the parentheses results in

Line of stability = $\sqrt{(1 - v^2/c^2)}$, or the Lorentz transformation.

In other words, the line of stability gives the time dilation effect between a stationary and moving observer.

The line of stability gives the time dilation effect since its point of intersection with the moving observer's displacement in time forms a bridge between how the stationary and moving observer view the flow of time for each other, compared to its rate of flow through space at the speed of light.

As a bridge, the point of intersection between the line of stability and moving observer's displacement in time lets the stationary observer view the moving observer's state of rest compared to his view of the flow of time through space, and it lets the moving observer view the stationary observer's state of rest compared to his view of the flow of time through space.

In other words, the line of stability lets the stationary observer and moving observer see how they each view the flow of time for the other in terms of their respective view of the flow of time through space, as an equivalent statement of the degree of rest or spatial stability between themselves.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
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In other words, the line of stability lets the moving observer see how the stationary observer views the flow of time, and it lets the moving observer see how the stationary observer views the flow of time.

From another perspective, as a moving observer creates a displacement in time, the line of stability lets the stationary observer see how the moving observer experiences a slower flow of time in comparison to how he views the flow of time.

And the line of stability lets the moving observer look back to his state of rest in comparison to the stationary observer, to see how he has left the stationary observer so far behind that time moves at a slower pace for him.

Since the line of stability is shorter than the hypotenuse, the flow of time that is viewed by its endpoints, or by the two observers viewing their relative state of rest, is slower than the flow of time at the speed of light.

In other words, as the moving observer catches up to the flow of time through space, the line of stability lets him see how his relative speed or rate of motion is letting him leave the stationary observer so far behind that he sees the flow of time for the stationary observer slow down in comparison to his own view of the flow of time.

Likewise, the line of stability lets the stationary observer see how much slower the flow of time is the moving observer in comparison to his own state of rest, while he continues to view the flow of time through space at the speed of light.

In other words, the stationary observer continues to view both the same flow of time that the moving observer continues to observe as time flows through space, even as he views the slower flow of time that is described by the line of stability, which compares their relative states of rest.

With this in mind, a stationary observer only needs to multiply his view of the flow of time by the length of the line of stability, or $\sqrt{(1 - v^2/c^2)}$, to see how the moving observer views his state of rest, or is able to look back and see his relative state of rest in comparison to himself.

Second Perspective

To use a Cartesian coordinate system to describe how a stationary and moving observer view the flow of time through space and the moving observer's displacement in time, the x axis may be used to depict the degree of stability between the two observers, while the y axis is used to depict the moving observer's displacement in time.

Since the stationary observer serves as a point of reference for determining the moving observer's displacement in time, he may be placed at the point of origin for the Cartesian coordinate system. As a result, the stationary observer views the moving observer's displacement in time as starting from a point on the x axis, where the displacement appears as a vertical line that is parallel to the y axis.

The y axis may be used to depict the moving observer's displacement in time since his motion and its resulting displacement represents the opposite condition of his state of rest or stability in comparison to the stationary observer. A Cartesian coordinate system is often used to represent opposite conditions.

With this in mind, the moving observer's displacement in time may be measured at a right angle from the x axis, which measures the degree of rest or spatial stability between the two observers, or how they view the flow of time for each other compared to its rate of flow through space at the speed of light.

How two observers view the flow of time for each other depends upon their degree of spatial stability since the flow of time through space, which flows at the speed of light, is itself a rate of motion.

The stationary observer views the moving observer's displacement in time like the side opposite of a right triangle, using two lines of sight that intersect its top and bottom just as how the hypotenuse and side adjacent intersect the side opposite.

The first line of sight, which represents the hypotenuse of the triangle, represents the identical view that the two observers share of the flow of time through space at the speed of light. This line of sight, which is fixed in length, connects the stationary observer with the top of the side opposite and it is from this position he views the moving observer catch up to the flow of time at the speed of light.

The second line of sight, which represents the side adjacent of the right triangle and lies on the x axis, represents the degree of stability between the two observers, as the opposite condition of their relative motion. Its length varies in an opposite sense compared to the moving observer's displacement in time.

This second line of sight connects the stationary observer to the bottom of the side opposite since it is from this position he views the moving observer's state of rest or the degree of rest between them.

Since this second line of sight represents the degree of stability between the two observers as the opposite condition of their relative motion, it represents how they view the flow of time for each other in comparison to its rate of flow through space at the speed of light.

International Journal of Mathematics and Statistics Studies
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Published by **ECRTD-UK**
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In other words, this second line of sight represents how the stationary observer views the flow of time in comparison to the moving observer's state of rest, while he is catching up to the flow of time. As a result, this line of sight is shorter or represents a slower flow of time than its rate of flow through space at the speed of light.

Likewise, this second line of sight represents how the moving observer views the stationary observer from his state of rest, being left behind, since he sees that time seems to slow down for the stationary observer while he still views the flow of time through space at the speed of light, using the hypotenuse.

Since these two lines of sight are independent of each other, as the flow of time through space is independent of the relative motion and stability between the two observers, when both observers are stationary, their relative stability has value of one to represent a state of complete rest or spatial equilibrium between them.

In other words, when both observers are stationary, the side adjacent has a length of one, while the side opposite, which represents the relative displacement in time of the moving observer, has a length of zero since he is actually stationary.

In other words, when both observers are stationary, a one sided right triangle appears where these two lines of sight are superimposed upon each other with the same length. In other words, two stationary observers view the flow of time for each other at the same rate as its rate of flow through space at the speed of light.

But when motion appears, the stationary observer notices a change in how he views the flow of time for the moving observer, compared to the background of space, where time flows through space at the speed of light.

In other words, time is conserved between how the stationary and moving observer view the flow of time for each other, compared to when they were both stationary or at a state of rest or spatial equilibrium.

The motion of the moving observer changes how the stationary observer views the flow of time for him, just as it changes how the moving observer views the flow of time for the stationary observer.

Third Perspective

From another perspective, a stationary observer views the moving observer against the background of space as an independent point reference or origin. This lets him view his

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Published by ***ECRTD-UK***
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relative displacement in time by comparing it to the flow of time through space at the speed of light.

Since a stationary and moving observer view the flow of time at the speed of light at the same point of its flow through space, their view of its flow identical. More generally, any two observers share an identical view of the flow of time at the speed of light since time flows through space in a uniform or consistent manner.

With this in mind, a diagram of a stationary and moving observer as two points in space may be used to illustrate their identical view of the flow of time through space by using a line to connect them, whose length represents their identical view of the rate of flow of time at the speed of light, rather than a timeline or chronology of past events, or a distance in space.

In other words, a line may be used to represent the rate of flow that is viewed by its endpoints since the meaning of a line depends on the trait or characteristic that is depicted by its coordinate system. Since time may be quantized into a rate of flow rather than a timeline or a chronology of past events, how two observers in space view the flow of time through space may be depicted by a line or line segment.

Since a stationary and moving observer share an identical view of the flow of time through space, their view of its flow has a smooth gradient, which replicates or gives an exact image of its rate of flow through space at the speed of light.

This smooth gradient means that dividing the length of the line between a stationary and moving observer, which represents their identical view of the flow of time through space by the speed of light, gives it a value of one, for representing their identical view of the flow of time at the speed of light.

In other words, dividing the length of the line that describes how two observers view the flow of time through space at the speed of light by the speed of light gives it a unit value of one, so that the dimension of time may be described in terms of how two observers in space views its rate of flow.

Moreover, a line in a plane or two dimensional Cartesian coordinate system may be described by using the linear equation of $y = mx + b$, where y is a variable that represents the value of a point (x, y) on the y axis, as determined by the value of x drawn from the x axis, m represents the slope of the line, and b is a constant that represents the point of intercept with the y axis.

With this in mind, the line that connects a stationary observer with a moving observer in dimension of time, which represents their identical view the flow of time through space at

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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
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the speed of light, has a slope of one as its multiplier or mirror element, which replicates the flow of time through space at the speed of light exactly.

However, the stationary and moving observer may lie in different time zones, as represented by the numerical constant b in the equation of $y = mx + b$, which adjusts the local time of a point in space for the local time of another point in space by adding or subtracting a constant.

Moreover, another line connects a stationary with a moving observer in the dimension of time, a line of sight for how they view the flow of time for each other. Two observers in space not only share an identical view of the flow of time through space, they may view the flow of time for each other in comparison to its rate of flow through space at the speed of light.

However, how two observers in space view the flow of time for each other will vary, according to their relative motion, since time is defined in terms of a rate of motion based on distance as it flows through space at the speed of light. With this in mind, the motion of a moving observer creates a displacement in time, which affects how two observers view the flow of time for each other.

In other words, the line of sight between two observers in the dimension varies in length with the degree of their relative motion, to reflect the displacement in time that is created by a moving observer.

This line of sight between two observers represents a different rate of flow for time than its rate of flow for two stationary observers, who may be in different time zones, to where the difference in how they view the flow of time for each other may be represented by a numerical constant.

Time Zones

The idea of time zones is illustrated by how the surface of the Earth is divided into twenty-four basic time zones, which allow clocks inside a zone to count the same hour or time of day based on the local noon of when the Sun is at its highest point of transit across the sky as viewed within the zone.

Time zones generally have equal shapes and areas, but are often adjusted for political or geographic boundaries. They recognize how, as the Earth rotates about its axis on a daily basis, an observer on its surface views the Sun reach its highest point at a different time or local noon, than an observer located further East or West.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by *ECRTD-UK*
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

Since time zones follow how the Sun transits across the sky, going from East to West, they follow the lines of longitude that identify a location on the Earth's surface in terms of degrees East or West, and which run from North to South on a globe or map.

The lines of longitude consist of two sets, East and West, each with one hundred and eighty degrees, which are divided by a line of zero degrees longitude that runs through Greenwich, England.

In contrast to the lines of longitude, the lines of latitude, which run from East to West on a globe or map, identify a location on the Earth's surface in terms of its degrees North or South with respect to the Sun's maximum position above the horizon, or the rotation of the stars at night.

In the northern hemisphere, the stars rotate around the North Star or Polaris in the constellation of the Little Dipper, or Ursa Minor, whose position above the horizon gives the latitude for a location on the Earth's surface.

Like the lines of longitude, the lines of latitude consist of two sets, North and South, each with one hundred and eighty degrees, which are divided by a line of zero degrees latitude, called the equator that lies midway between the North Pole and South Pole.

The advantage of having time zones is simple. They help people in cities and nearby areas to organize their activity by using clocks and watches that are set to the same hour of the day, or the same local time. And they help people in different time zones to coordinate their activity.

For example, if a person in New York City, which is located on the East Coast of the United States, a large country on the continent of North America, wants to know the time in the city of Los Angeles, which is located on the West Coast of the United States, he subtracts three hours from his local time.

This three hour difference in time zones reflects how New York City lies in the Eastern Time Zone of the United States, separated from the Pacific Time Zone, where the city of Los Angeles, is located by the Central and Mountain Time Zones, which are each one hour apart.

This three hour difference also means that a person in Los Angeles can view the time in New York City by adding three hours to his local time or view of the flow of time since he has the same view of the flow of time as the person in New York City, except for the difference in time zones.

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Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
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In other words, since time flows smoothly across space, two observers on the Earth's surface, who are stationary with respect to each other have the same view of its flow, and can view the time of the other on the same basis, adding or subtracting a constant to account for any difference in time zones.

In other words, since two observers on the Earth's surface are stationary with respect to each other, they view of the flow of time for each other at the same rate as its rate of flow through space at the speed of light, even as the Earth moves through space, orbiting the Sun and rotating about its axis.

Two Stationary Observers

Since two observers who are stationary in space view the flow of time for each other at its rate of flow through space of the speed of light, their line of sight in the dimension of time may be given a length of one by dividing how they view the flow of time for each other by its rate of flow through space at the speed of light.

In other words, since the line of sight between two observers in the dimension of time represents the rate of flow of time that they view for each other, it is like a mirror element whose length compares how they view of the flow of time for each other to its rate of flow through space at the speed of light.

Since two observers who are stationary view the flow of time for each other at its rate of flow through space, they are stationary in time as well as space, since time is measured in terms of distance as it flows through space at the speed of light. As a result, the line of sight between two observers in the dimension of time measures their relative stability compared to a system of two stationary observers.

In other words, since two stationary observers view the flow of time for each other at its rate of flow through space, the stability between them provides an equivalent measure of how they view the flow of time for each other, since their line of sight is adjusted for their relative motion.

In other words, the line of sight between two observers in the dimension of time has a length of one when they are stationary since it captures the flow of time through space in its entirety. When two observers are stationary, their line of sight has a length of one to reflect how they view the flow of time for each other at its rate of flow through space at the speed of light.

But, when one of the two stationary observers starts to move, their relative motion and displacement in time take on a positive value, which is greater than zero. Since relative motion reduces their relative stability, the length of their line of sight becomes less than

International Journal of Mathematics and Statistics Studies
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Published by **ECRTD-UK**
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

one, as they view the flow of time for each other at a slower rate than its rate of flow through space at the speed of light.

Since relative motion and relative stability represent opposite conditions, they may be described by a pair of axis lines in a Cartesian coordinate system that represents how two observers view the flow of time for each other and its flow through space, so that the line of sight between observers is measured along the line of axis that measures their relative stability.

Since each observer looks across the full length of their line of sight to view the rate of flow that it represents, they are located at its endpoints. In a Cartesian coordinate system, each of the endpoints of a line or curve views the full length of the line or curve from opposite directions.

For convenience, the stationary observer may be located at the point of origin for the line of axis that measures their relative stability, which may be placed in a horizontal position, like the x axis in a Cartesian coordinate system. The line of axis that measures their relative motion may be placed in a vertical position, like the y axis in a Cartesian coordinate system.

When both observers are stationary, their relative motion is zero, so their line of sight, which measures their relative stability, reaches its maximum value of one. Moreover, a second line connects the observers, which represents their identical view of the flow of time, and has a length of one to represent the flow of time at the speed of light.

Since the observers are located at the endpoints of their line of sight and the line that represents their identical view of the flow of time through space, when the two observers are both stationary, their line of sight is equal in length to the line that represents their identical view of the flow of time through space, since it captures the flow of time through space exactly.

Moreover, since there is no relative motion, both lines are superimposed upon the line of axis that measures their relative stability, and they are independent of each other since the line of sight between the two observers is defined by how they view of the flow of time for each other, while the line that represents their identical view of the flow of time through space represents a physical constant.

In summary, for two observers are stationary, two independent lines are superimposed on the line of axis that measures their relative stability in the dimension of time. Where one line represents their line of sight in the dimension of time, the other line represents their identical view of the flow of time through space.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by *ECRTD-UK*
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

A Stationary and Moving Observer

Since two stationary observers may be represented by two lines of equal length that are superimposed upon a line of axis that measures their relative stability in the dimension of time, this system gives one of the simplest representations of the three elements of time, which consist of the flow of time through space, a moving observer, and a stationary observer, who is at rest compared to the moving observer.

With this in mind, a moving observer's displacement in time may be analyzed by the appearance of motion in a system of two stationary observers, which alters their geometry as two lines superimposed upon each other along a line of axis that measures their relative stability.

In other words, as one of two stationary observers starts to move, he creates a displacement in time. This displacement appears parallel to the line of axis that measures his relative motion, while it shortens his line of sight to the remaining stationary observer since his motion decreases their relative stability.

Since the moving observer's displacement in time lies parallel to the line of axis that measures relative motion, it appears at a right angle to his line of sight to the remaining stationary observer, along the line of axis that measures their relative stability since he vacates his position on his line of sight to lead his motion or displacement in time, like the tip of an arrow or a vector that measures his displacement in time.

While the line that represents the identical view that the two observers share of the flow of time through space retains its length of one, the appearance of relative motion between them shifts its position off the line of axis that measures their relative stability so that it appears as a separate line, which is distinct from their line of sight and connects the stationary observer directly to the moving observer.

With this in mind, the moving observer's line of sight to the stationary observer becomes relative as he vacates his position at its endpoint, which becomes the point of intersection between his line of sight and displacement in time.

In other words, with the appearance of relative motion, the two observers no longer view each other directly along their line of sight. Instead, they view the flow of time for each other by using the point of intersection between the moving observer's displacement in time and their line of sight.

In summary, three distinct lines or measurement of the flow of time appear in analyzing how a stationary and moving observer view the flow of time for each other and the flow of time through space.

One line represents the identical view that the two observers share of the flow of time through space. This line connects them to each other independently of the degree of their relative motion or relative stability, and its length is invariant since it represents the flow of time through space at the speed of light.

A second line represents their line of sight, or their view of the flow of time for each other, or relative stability in the dimension of time. This line is measured along the line of axis that measures their relative stability, and its length contracts with the degree of their relative motion.

A third line measures the moving observer's relative motion or displacement in time. This line lies parallel to the line of axis that measures their relative motion, and its length is equal to the moving observer's speed or rate of motion divided by the flow of time through space at the speed of light, or the familiar ratio of v/c.

When both observers are stationary, their line of sight has a length of one since they view the flow of time for each other at its rate of flow through space. Since the observers have no relative motion, the line that measures a moving observer's relative motion or displacement in time has a length of zero.

In other words, when both observers are stationary, with no relative motion, the general case of a moving and stationary observer with its three lines that measure the flow of time simplifies to just two lines superimposed upon each other, along the line of axis that measures their relative stability.

In other words, when the line of sight between two observers equals the rate of flow of time through space, it displaces any relative motion. When two observers are stationary, the condition of being stationary displaces any motion between them.

But, when one observer starts to move, their line of sight starts to contract since it converts the flow of time they view between themselves into measuring the speed or rate of motion of the moving observer and his displacement in time.

Their line of sight contracts since the moving observer disturbs their state of rest or equilibrium measured by their line of sight, whose length of one represented a state of equilibrium in space, or how they viewed the flow of time for each other at its rate of flow through space.

Their line of sight contracts since its full length was used to represent the condition that the two observers were stationary, or viewed the flow of time for each other at the speed of light with no motion or displacement in time between them.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by **_ECRTD-UK_**
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

With this in mind, the stationary observer views the moving observer's motion and displacement in time by converting part of their line of sight into a displacement in time, since he views the moving observer move off of their line of sight at an angle to the line of axis that measures relative stability by using the line that represents their identical view of the flow of time through space.

In other words, the stationary observer views the moving observer's displacement in time through the contraction of their line of sight. The motion of the moving observer changes how they view the flow of time for each other since it decreases their relative stability while it does not create new time.

Since the moving observer's motion or displacement in time does not create time, or add or subtract from the flow of time through space, the flow of time that is measured by the line of sight between the two stationary observers is conserved. Its total value does not change when one of the observers starts to move. What changes is how the observers view its total value.

From another perspective, the line of sight between two stationary observers uses their identical view of the flow of time through space as a benchmark for measuring how they view the flow of time for each other. When both observers are stationary, the two lines are equal in length.

But, when one of the observers starts to move, their line of sight contracts since the moving observer's displacement in time cause him to change position with respect to the stationary observer. The moving observer's displacement in time affects how they view the flow of time for each other, rather than adding or subtracting from the flow of time through space.

In other words, the flow of time that was measured by the line of sight between two stationary observers is conserved when one of them becomes a moving observer since the remaining stationary observer uses a part of its flow to view the moving observer's displacement in time.

The stationary observer sees the moving observer create a displacement in time since he diverts or channels part of the flow of time that was measured by their line of sight when they were both stationary into a perpendicular displacement parallel to the line of axis that measures their relative motion.

Since the moving observer's displacement in time is conserved with respect to their identical view of the flow of time through space, and is measured along a line of axis that is perpendicular to their line of sight, the Pythagorean Theorem may be applied to determine the length of their line of sight.

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

In other words, since the line that represents the identical view that the two observers share of the flow of time through space is invariant in length, the Pythagorean Theorem may be applied to conserve the length of their line of sight when they were stationary compared to their current or shortened line of sight and the moving observer's displacement in time.

In other words, the Pythagorean Theorem may be applied to conserve a total value of one for the length of the line of sight between two stationary observers by adding together the square of the length of line of sight between a stationary and moving observer and the square of the moving observer's displacement in time.

The resulting sum equals the square of the length of the line of sight between two stationary observers, and it equals the square of identical view that any two observers share of the flow of time through space.

In other words, adding the square of the line of sight between two observers to the square of the moving observer's displacement in time, gives a sum that equals the square of their identical view of the flow of time through space, which has a value or length of one, and is equal to one when squared.

Since the square of the identical view that two observers share of the flow of time has a value of one, by rearranging terms and taking a square root, the length of the line of sight between a stationary and moving observer is equal to the square root of one less the square of v/c, or $\sqrt{(1 - v^2/c^2)}$.

Since the line of sight between two observers describes how they view the flow of time for each other, for the stationary observer to see how the moving observer views the flow of time, he may multiply his view of the flow of time by $\sqrt{(1 - v^2/c^2)}$ to see the flow of time for the moving observer dilate or slow down as he approaches the flow of time through space at the speed of light.

Second Perspective

A stationary observer views a moving observer's displacement in time from outside the boundaries of space by using a line of sight that is based on the moving observer's speed or rate of motion compared to the flow of time through space at the speed of light, or the familiar ratio of v/c, since the flow of time through space is independent of his relative motion.

In other words, a stationary observer views a moving observer's displacement in time against the background of space of where time flows through it at the speed of light, so that

International Journal of Mathematics and Statistics Studies
Vol.8, No.2, pp.38-95, July 2020
Published by ***ECRTD-UK***
Print ISSN: 2053-2229 (Print)
Online ISSN: 2053-2210 (Online)

two observers view the rate of flow of time for each other compared to its rate of flow through space.

With this in mind, how two observers view the flow of time for each other is affected by their relative motion. Since relative motion represents the opposite condition of relative stability, these two conditions may be represented by a pair of axis lines in a Cartesian coordinate system.

In other words, as a moving observer creates a displacement in time with respect to a stationary observer, his motion changes how the two observers view the flow of time for each other, while the stationary observer views the displacement at a right angle to the line of axis that measures their relative stability.

With this in mind, the stationary observer is able to view the time dilation of the moving observer as he catches up to its flow through space at the speed of light since he remains connected to him by their identical view of the flow of time through space.

The effect of time dilation may become clearer by considering a foot race with a runner as a moving observer, and an observer stationed at the starting point. As the runner starts to run, he leaves the stationary observer behind, while the stationary observer sees the runner quickly moving away from him.

While for the usual foot race a stationary observer and runner will perceive the flow of time for each other to be the same, as the runner picks up more and more speed and starts to run at an appreciable fraction of the speed of light, the stationary observer sees that the runner is moving so fast that he is catching up to the flow of time through space at the speed of light.

In other words, the stationary observer starts to see the runner catch up to the flow of time through space at the speed of light by using the ratio of v/c, independently of their line of sight in the dimension of time.

As the stationary observer views the moving observer catch up to the flow of time through space, he sees the normal passage of time for the moving observer slow down as he catches up to the flow of time at the speed of light, and approach the point where time stands still. At the same time, the runner sees that he is leaving the stationary observer behind in the dust to the point of where he sees that time moves very slowly for the stationary observer.

In summary, a high rate of speed at an appreciable fraction of the speed of light will heighten the normal effects of motion to where they affect the perception of time between a stationary and moving observer.

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Geometrical Setting

The idea that a stationary observer views a moving observer's displacement in time as a vertical line that rises from their line of sight in the dimension of time, where their line of sight has an initial length of one for a system of two stationary observers, gives the stationary observer a clear view of his displacement in time.

An observer needs a line of sight that is of some practical length to view an object. A line of sight must be neither too long so an object appears practically invisible as a speck on the far horizon, nor too short so an observer sees only part of it from up close.

While a displacement in time involves relativistic time effects, which tend to occur under laboratory conditions or in astronomy, the principle remains of where an observer needs a line of sight to view an object, or moving observer's displacement in time.

To view a moving observer's displacement in time, a stationary observer needs a line of sight compares that how the two observers view the rate of flow of time for each other to its rate of flow of time through space at the speed of light. A non-spatial geometry may use lines that represent rates of flow rather than distances in space.

With this in mind, a stationary observer views a moving observer's displacement in time as rising vertically from their line of sight in the dimension of time, like the side opposite in a right triangle, even though this displacement is essentially invisible within a spatial coordinate system.

To view the displacement in time, the stationary observer uses the line that represents their identical view of the flow of time through space to connect with its top, and his line of sight in the dimension of time to connect with its bottom since the two observers still view the flow of time for each other, although indirectly.

From a different perspective, two observers possess a line of sight to each other in the dimension of time, where they view the flow of time for each other since they view the flow of time through space at the same point of its flow.

In other words, since the observers exist or share a common point or interval where they share the same view of the flow of time through space, they are not separated in time by being in the past or future.

In other words, when two observers share the same plane of existence, or exist at the same point of flow of time through space, they possess a line of sight to each other in the dimension of time, which lets them view each other in its flow with respect to their local condition of motion, or relative motion.

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In other words, how two observers view the flow of time for each other is based on their local condition of motion, since time is defined as a rate of motion flowing through space at the speed of light.

When two observers have the same local condition of motion, or the same motion in space, they are stationary with respect to each other. In other words, the condition of two stationary observers may be explained by their possessing the same local condition of motion, regardless of their location in space.

With this in mind, the relative stability of two observers may be defined in terms of their local condition of motion. When the local condition of motion of one observer is equal to the local condition of motion for another observer, the two observers are stationary with respect to each other.

As a result, when the local condition of motion for one observer is equal to the other, their relative stability may be defined to have a value of one, since their local condition of motion reflect each other exactly.

In other words, one serves as the measure of equality between the condition of local motion for two observers and how they view the flow of time for each other. With this in mind, the flow of time between two observers has a line of sight between them with a length of one when they have the same local condition of motion.

But when the local condition of motion varies between the two observers, they view the flow of time for each other with respect to the variation in their local condition of motion, compared to the flow of time through space at the speed of light.

In other words, two observers view the flow of time for each other by comparing their local condition of motion to the flow of time through space at the speed of light, and with respect to how two observers with the same local motion view the flow of time for each other at the same rate as its rate of flow through space.

Since two stationary observers in the dimension of time have a line of sight with a length of one, a change in their local condition of motion, or the appearance of relative motion is viewed by a stationary observer by diverting part of their line of sight into a displacement in time, which forces their line of sight to contract in length with the degree of change in their local condition of motion.

In other words, since a change in the local condition of motion for a moving observer appears on the line of axis for measuring his motion, which the stationary observer views, this motion reduces his stability with respect to the stationary observer since the flow of time is conserved.

In other words, as one observer starts to move with respect to an observer who remains stationary, the flow of time that is represented by their line of sight when they were both stationary, which had a length of one, is channeled from the line of axis for measuring their relative stability into measuring their relative motion along the line of axis that measures their relative motion.

In other words, two observers view the flow of time for each other by comparing the local motion of one observer to the other as compared to the flow of time through space, which is independent of their local condition of motion.

As a result, when there is no relative motion between two observers in space, their line of sight in the dimension of time possesses the full quality of being stationary, which means it has a length of one, so the observers view the flow of time for each other at the same rate as the flow of time through space at the speed of light.

Since there is no relative motion between the observers, the line that represents their identical view of the flow of time, which has a length of one as an invariant, folds onto their line of sight in the dimension of time, which represents their degree of being stationary with respect to each other.

Therefore, this line of sight in the dimension of time may be treated as a line of axis in the dimension of time, which measures the degree of the two observers being stationary with each other as compared to the condition of their relative motion, which creates a displacement in time.

In other words, since the dimension of time, as viewed by two observers in space, has a line of axis for representing their condition of being stationary, a second line of axis may be introduced, like the y axis in a Cartesian coordinate system, which represents their condition of relative motion.

In summary, how two observers view the flow of time for each other may be represented by a line of axis that measures their degree of being stationary, or relative stability, and a line of axis that measures their relative motion.

The One Sided Right Triangle

A right triangle consists of two sides, called the side opposite and the side adjacent, that intersect at a right angle, and a third side, called the hypotenuse, that intersects those two sides at their other endpoints.

A right triangle is usually viewed by placing the side adjacent in a horizontal position and the side opposite in a vertical position with their point of intersection at the right endpoint of the side adjacent, as the hypotenuse stretches in a diagonal from the left endpoint of the side adjacent to the top of the side opposite.

A one sided right triangle uses a single line to represent all three sides of a right triangle when they are superimposed on each other. This occurs when either the side opposite or the side adjacent has no length, and the hypotenuse is fixed in length. The Pythagorean Theorem requires the other side to have the same length as the hypotenuse, which is superimposed upon it.

A Cartesian coordinate system usually depicts a right triangle the same way by using its point of origin as the point of intersection between the side adjacent and hypotenuse. The side adjacent is placed on the x axis in a horizontal position. The side opposite is placed parallel to the y axis in a vertical position, and the hypotenuse stretches in a diagonal from the point of origin to the top of the side opposite.

A Cartesian coordinate system depicts a one sided right triangle as a horizontal line on the x axis when the side opposite has no length, and depicts a one sided right triangle as a vertical line on the y axis when the side adjacent has no length.

While in a one sided right triangle either the side opposite or the side adjacent has no length, the two sides still intersect at a right angle, since a side with no length retains its identity as a line by possessing two endpoints.

A line with no length connects its two endpoints, which define its boundary, and the directions to traverse its domain, even if the line has no length or interior line segment.

Since the superposition of one line upon another does not require their merger, each side in a one sided right triangle retains its identity. However, the retention of their identities means that a one sided right triangle has a more complex mathematical structure than its appearance suggests, as it consists of two superimposed lines, and a line with no length that intersects one of the lines at a right angle.

For example, when the side opposite has no length, its bottom endpoint serves as the point of intersection with the side adjacent, while its top endpoint is superimposed on the bottom endpoint.

However, this superposition of endpoints requires a sense of order, or point of information that lies outside the visual appearance of a single endpoint, or a mathematical structure

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more complex than a single endpoint since it superimposes a point from one dimension onto another dimension.

This point of information orders the superimposed endpoint as the top of the side opposite that lies on the bottom endpoint. Otherwise, the top endpoint lies just above the bottom endpoint, using a line with no length as a substitute for the order in the superposition of endpoints.

Where geometry describes visual relationships using lines and angles, a one sided right triangle describes a state of equilibrium or balance within a group three elements, where each element is represented by the side of a right triangle.

A group of three elements may be described by the sides of a right triangle when two elements represent opposite conditions, described by the length of the side opposite and the side adjacent that intersect at a right angle, and the third element represents a fixed value or constant, described by the length of the hypotenuse, which is conserved with respect to the length of the side opposite and the side adjacent using the Pythagorean Theorem.

In other words, when in a group of three elements, two elements represent opposite conditions that are conserved with respect to a third element that represents a fixed value, the Pythagorean Theorem may be applied to describe their relationship like the sides of a right triangle.

With this in mind, a one sided right triangle may represent a state of equilibrium or balance in a group of three elements described by the sides of a right triangle when either the side opposite or the side adjacent has no length and the hypotenuse is fixed in length, so that the other side has a length equal to the hypotenuse.

An example of such a group is found in the sine curve, which graphs the sine of a right triangle, or the length of the side opposite divided by the length of the hypotenuse, which is fixed in length since the length of the side opposite and the side adjacent represent opposite conditions that are conserved with respect to the length of the hypotenuse.

For a right triangle with an angle of zero degrees, the sine curve displays a one sided right triangle since the side opposite has no length, while the hypotenuse is superimposed upon the side adjacent on the x axis in a horizontal position.

For a right triangle with an angle of ninety degrees, the sine curve displays a one sided right triangle since the side adjacent has no length, while the hypotenuse is superimposed upon the side opposite on the y axis in a vertical position.

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The sine curve is based on the Pythagorean Theorem, which determines the length of the side opposite and side adjacent as a function of the angle of a right triangle and length of the hypotenuse.

Another example of a one sided right triangle is found in the geometry of two stationary observers in the flow of time through space, who may be represented by the endpoints of two lines that are superimposed on a line of axis that measures their relative stability or the degree of equality in their local condition of motion.

One line represents the identical view that the two observers share of the flow of time through space, a physical constant. The other line represents how the two observers view the flow of time for each other, a condition that is relative since its value depends on the degree of stability between the observers as the opposite condition of their relative motion.

The second line has a length equal to the first line only when the two observers are stationary with respect to each other, or have the same local condition of motion, with no relative motion between them.

In other words, when two observers are stationary with respect to each other, a one sided right triangle represents a state of balance in their local condition of motion compared to the flow of time through space, seen in the superposition of the hypotenuse on the side adjacent since the side opposite has no length.

Second Perspective

From another perspective, two observers in space possess two relationships in how they view the flow of time. One relationship is defined by their identical view of the flow of time through space. Since this relationship is based on their identical view of a constant, it may be described by a hypotenuse of fixed length in a right triangle, whose length represents the flow of time at the speed of light.

In this relationship, the observers are located at the endpoints of the hypotenuse since they each view its full length or the flow of time through space that its length represents. One observer is stationary while the other observer is moving.

The other relationship is defined by how two observers view the flow of time for each other. This relationship is relative since it depends on a moving observer's displacement in time or relative motion with respect to a stationary observer. It may be described by the side adjacent and the side opposite of a right triangle, whose intersection at a right angle connects the observers to each other indirectly, without the hypotenuse that describes a fixed relationship.

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In this relationship, the two observers do not view each other directly by being at the endpoints of a line. Instead, they view each other indirectly by using the vertex, or point of intersection between the side opposite and side adjacent that represent the opposite conditions of their relative motion and relative stability.

Since a stationary observer views a moving observer's displacement in time at a right angle to condition of their relative stability, or the line of axis that represents their relative stability as the opposite condition of their relative motion, his displacement in time may be described by the side opposite of a right triangle.

The side opposite of a right triangle is ideally suited to represent a moving observer's displacement in time compared to a stationary observer since it is joined to the flow of time through space represented by the hypotenuse, forming a baseline to compare his motion to the flow of time through space, while its point of intersection with the side adjacent lets the moving observer look back and view his displacement in time with respect to the stationary observer.

Likewise, the point of intersection between the side opposite and the side adjacent lets the stationary observer view the moving observer's displacement in time from its beginning point with respect to their state of rest, which is compared to the flow of time through space represented by the hypotenuse.

Third Perspective

For two stationary observers in the flow of time through space, the superimposed sides of a one sided right triangle represents their identical view of the flow of time through space, and their view of the flow of time for each other, or their line of sight in the flow of time. Both views are represented by lines of equal length whose value is equal to the flow of time through space at the speed of light.

In the one sided right triangle, the hypotenuse represents the identical view that two observers share of the flow of time through space. Since it represents a physical constant, its length is fixed and independent of whether the two observers are stationary or moving with respect to each other.

Moreover, the hypotenuse is superimposed upon the side adjacent that represents the view that the two observers have of the flow of time for each other since its length, which depends on their relative stability, has a value equal to the flow of time through space since both observers are stationary.

If the left endpoint of the side adjacent identifies the location of the stationary observer, the right endpoint identifies the start or beginning of a moving observer's displacement in time as the point of intersection with the side opposite that intersects the side adjacent at a right angle, even though the angle is nascent, or not yet visible since the side opposite has no length.

But as the second stationary observer starts to move, he disturbs their state of spatial equilibrium as he vacates his position on the right endpoint of the side adjacent since he is located at the top of the side opposite.

Since the motion of a moving observer does not add or subtract from the flow of time through space, a stationary observer views his displacement in time by subtracting it from their line of sight represented by the side adjacent, using the Pythagorean Theorem to conserve the flow of time represented by their line of sight when they were both stationary, which represented the flow of time through space.

In other words, when one of two stationary observers starts to move, his motion creates a displacement in time at a right angle to the line of sight between the observers in the flow of time that is represented by the side opposite, which starts at the right endpoint of their line of sight on the side adjacent.

As the moving observer approaches the speed of light, another one sided right triangle starts to appear. When the moving observer attains the speed of light, this one sided right triangle appears as a vertical line to represent how his speed or rate of motion is equal to the flow of time through space.

In this one sided right triangle, the side adjacent has no length since the two observers are in a state of total disequilibrium compared to the flow of time through space, with no stability between them.

With this in mind, a vertical one sided right triangle represents the opposite condition of two stationary observers. It represents the condition of no stability, or two observers who are poles apart in viewing the flow of time for each other, as one observer has a speed or rate of motion equal to the flow of time through space.

The Imaginary Right Triangle

As a moving observer exceeds the flow of time at the speed of light, a stationary observer may view his displacement in time by using an imaginary right triangle as an extension of the vertical one sided right triangle for when the length of the side opposite exceeds the hypotenuse.

In other words, when in a group of three elements, two elements represent opposite conditions that are conserved with respect to a third element that represents a fixed value,

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and one of the elements that represents the opposite conditions exceeds the fixed value, the Pythagorean Theorem may be applied to describe their relationship, using a right triangle with a side that is imaginary in length.

In other words, a right triangle may lie outside the normal bounds of plane geometry based on the set of real numbers, or a Cartesian coordinate system, when either the side opposite or the side adjacent exceeds the length of the hypotenuse, which the Pythagorean Theorem requires to be imaginary.

For example, when a moving observer exceeds the flow of time through space, the right triangle that describes how a stationary observer views his displacement in time and their line of sight has a side adjacent that is imaginary since the side opposite is longer than the hypotenuse. In other words, their line of sight lies outside the spatial coordinate system of the stationary observer as an indicator of time travel.

In other words, when the speed or rate of motion of a moving observer exceeds the flow of time through space, his relative stability with respect to a stationary observer becomes imaginary. The moving observer has crossed the threshold of being in the same flow of time as the stationary observer, and lies outside it.

As the speed or rate of motion of a moving observer exceeds the flow of time through space, a stationary observer is unable to see him. The moving observer has crossed into a different section of the flow of time, or traveled in time compared to the stationary observer.

Since the moving observer has caught up to and exceeds the flow of time through space, he is moving to where time was before, or back in time, or into the past compared to the stationary observer.

In other words, since time may be viewed as a rate of flow moving through space, when a moving observer exceeds its rate of flow, he moves ahead in its flow to a point before, or that lies ahead of its flow as viewed by the stationary observer, whom he views as lying in the future.

This condition of time travel between the two observers is represented by an imaginary number since it lies outside the boundaries of space and time as viewed by the stationary observer. A moving observer who moves outside the boundaries of space and time that are viewed by the stationary observer is represented by an imaginary number, since the motion is real, but outside his view of space and time.

The flow of time is not interrupted or destroyed, as would be implied by a negative value for the relative stability of a stationary and moving observer. Rather, the imaginary value

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for their relative stability shows how the moving observer has moved outside the boundaries of space and time that are viewed by the stationary observer.

Second Perspective

Where a spatial coordinate system counts or measures distance based on a fixed point of origin, which uses an identity element of zero since counting is like addition, an observer views the flow of time based on a comparison to its rate of flow through space, or using the operation of division that has an identity element of one.

In other words, since time flows through space in a uniform manner and steady rate, its stability resides in its consistent rate of flow at the speed of light rather than a fixed point in space. Comparisons of its flow between observers are made by using a ratio, or the operation of division, rather than addition or subtraction.

In other words, a stationary and moving observer may view the flow of time for each other by computing a ratio that divides their view of the flow of time for each other by its rate of flow through space at the speed of light, using the operation of division that has an identity element of one.

This use of division in describing the flow of time through space between different observers means that the representation of a point in the flow of time that lies outside a spatial coordinate system is mathematically represented by an imaginary number as a multiplier of its flow, rather than a negative number.

The use of negative imaginary numbers to describe the flow of time is relative, not absolute, since it is made with respect to a stationary observer to indicate the motion of a moving observer who is traveling into the future, in the flow of time, with respect to his view of the flow of time in the present.

Moreover, a moving observer's displacement in time translates into a linear displacement in the flow of time regardless of whether the motion in space is linear or circular since the flow of time through space is essentially non-spatial, or comes from outside a spatial coordinate system.

In other words, since a stationary observer views a moving observer's displacement in time by dividing his speed or rate of motion by the rate of flow of time through space, his displacement in time is independent of whether his motion is linear or circular.

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Third Perspective

When a moving observer exceeds the flow of time through space, his line of sight to a stationary observer in the flow of time becomes imaginary since it represents a condition that lies outside the flow of time through space viewed by the stationary observer, or a condition of time travel.

In other words, in a Cartesian coordinate system that measures how two observers view the flow of time for each other by using relative motion and relative stability as lines of axis, a speed or displacement in time that is greater than the flow of time through space lies outside its boundaries, or is imaginary, so that a moving observer lies outside the flow of time viewed by a stationary observer.

In other words, while the moving observer has moved outside the boundaries of space that are viewed by the stationary observer, he remains within those boundaries of space, but at a different point in the flow of time.

Returning to the example of an observer moving at a speed of 10c, or ten times the speed of light, applying the Pythagorean Theorem to the elements of time gives his local time as 9.95i compared to a stationary observer.

In other words, an observer moving at a speed of 10c has a local time with respect to a stationary observer of 9.95i. For every interval of time viewed by a stationary observer, the moving observer moves back in time by a factor of 9.95.

For example, as the stationary observer views the passage of an hour, the moving observer has moved back in time by 9.95 hours, assuming his speed or rate of motion of 10c remains constant.

In geometric terms, a right triangle that measures the moving observer's relative motion or displacement in time with respect to a stationary observer has a side opposite of 10c, a hypotenuse of one c, and a side adjacent of 9.95i.

The Pythagorean Theorem holds since the length of the side opposite squared added to the length of the side adjacent squared is equal to the length of the hypotenuse squared, or $(10)^2 + (9.95i)^2 = 1^2$ ($\sqrt{99}$ is rounded to 9.95).

While this imaginary right triangle has a side adjacent that is imaginary, the side opposite and hypotenuse are real. Only one side is imaginary, while the other two sides are real in a Cartesian coordinate system that measures the relative motion and relative stability of two observers.

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From another point of view, where distance in a spatial coordinate system is generally expressed in terms of a real number line, a flow of time that lies outside the local time of a stationary observer uses an imaginary number to indicate a point in the flow that lies in the past or future.

Since time flows from the future into the past, as a moving observer exceeds its rate of flow at the speed of light, he travels into the past so that an imaginary number represents travel into the past, while a negative imaginary number represents travel into the future.

A negative imaginary number may be regarded as a reverse direction in a moving observer's speed or rate of motion that reverses the direction of his displacement in time, since time is fundamentally measured in terms of distance with its rate of flow through space at the speed of light.

Since reversing the direction of a moving observer's motion or displacement of time reveres the direction of his movement in the flow of time, a moving observer may return to the present after traveling into the past. A moving observer may depart and return to the present after traveling back in time, crossing a bridge where he travels back into the future after traveling back in time.

Returning to the example of a moving observer traveling at a speed of 10c to a nearby star system, when the moving observer returns to Earth, he does not travel farther into the past during his return but restores himself to the present by traveling into the future. In other words, during his return, the moving observer travels into the future since he reverses his direction of travel compared to his departure.

In the linear geometry of a moving observer traveling from Earth to a nearby star system, the moving observer does not travel farther into the past on his return, but forms a bridge in time, which allows him to return to the present or to the current flow of time with respect to a stationary observer on Earth.

Time Loop

In the example of a moving observer traveling at a speed of 10c to a nearby star system, a linear geometry was used, which traded distance for time. The moving observer was able to travel back in time, compared to an observer on Earth, but had not traveled back in time from his point of departure.

However, a different geometry could let the moving observer achieve time travel if he traveled in a loop, or circle, so the distance he travels does not move him away from his initial point of departure. If this were done, he would travel back in time by 9.95 years compared to his point of departure.

To return to the future, or the present compared to an observer on Earth, the moving observer would only need to reverse the direction of his travel, or the direction of travel in the loop to cross the flow of time, or a bridge in the flow of time through space.

In other words, since time flows in a straight line, like a beam of light, it may be traversed by using a time loop, where a moving observer travels in a loop across the flow of time through space. Such travel requires a way to travel faster than the flow of time through space, or a way to fold space itself, as an alternate means of quickly traveling over long distances.

In a sense, a time loop enables you to meet a different part of the flow of time in the same location, or to travel in time. In a sense, it captures the flow of time and puts it into a bank account of time, which allows a person or observer to buy back the future, or return to the present.

Moreover, a time loop or circle may be repeated many times to increase the length of time travel over its circumference, similar to how many car races use a track instead of a long course.

From another perspective, if a moving observer is given the ability to run faster than the speed of light, as he runs faster and faster in a circle, before he reaches the speed of light, he will seem to disappear to a stationary observer, just as the whirling propellers of an airplane seem to disappear as they turn faster and faster.

This disappearance of a moving observer from a stationary observer gives another indication of how the moving observer has moved outside the coordinates of space that are viewed by the stationary observer, and traveled in time.

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