Contradictions inherent in Special relativity: Space varies.

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Special relativity has changed the fundamental view on space and time since Einstein introduced it in 1905. It substitutes four dimensional spacetime for the absolute space and time of Newtonian mechanics. It is believed that the validity of this theory has been fully confirmed empirically for the last one hundred years, and therefore, its status is considered canonical, underpinning all physical principles. However, the spacetime metric is a geometric approach to nature when interpreting natural phenomena. A geometric flaw will be exhibited on this, and an alternative is suggested. The reasonable geometric model of space and time is a three-dimensional space that translates along the time direction. This model accurately represents the true characteristics of nature.

Keywords: space and time, object and property, the present, recording, EPR paradox, relativity of simultaneity, ordering on existence, rule of inference, objectification of property.

Introduction

Since the introduction of special relativity[1], most works on this theory have been based on spacetime metric: a four-dimensional vector space with pseudo-Riemanian geometry [2]. This is a geometric interpretation of nature using the metric tensor and other basic geometric characteristics. An extensive amount of results were deduced from spacetime without any empirical confirmation [3-7]. These axiomatic approaches are the mainstream in modern physics on this topic. However, there will be questions raised regarding the integrity of this, and several contradictions will be suggested. To achieve this, the languages related to time should be defined more rigorously based on physical states rather than geometry. Conventional uses of language are incomplete; therefore, they have misled us into paradoxical thinking. The geometric nature of time should be accurately expressed after thorough consideration of the differences and similarities between space and time. The contradictions in special relativity are introduced using a newly established geometric structure. Throughout this paper, physical and mathematical terminologies will be used together to bridge the ideas between them.

Geometry

Geometry is widely used in diverse fields as this approach is intuitive and concise. This is a matching process of an abstract concept to the properties of geometry, which is believed to represent the concept legitimately. A main feature of this approach is that we represent the abstract concept as a

matter of location. Therefore, it is important to acknowledge the true characteristics of geometry. When we consider a space, we implicitly assume its existence. However, we need to have a more rigorous understanding of what geometry is. A space is considered complete when it satisfies the condition of having a continuous co-existing neighborhood at any arbitrary point within the space. In this regard, we assume that point is a basic element of the space. However, a point is a geometric object without magnitude. Instead, infinitesimally small segment of line, surface, and volume actually constitute a space.

For example, a straight line is a element of space that satisfies the above requirement, and the neighborhood constitutes a one-dimensional environment. In order to construct an N-dimensional vector space, it is essential that it has N-dimensional neighborhoods at arbitrary points inside with the property of continuous co-existence. After this requirement is satisfied, it is possible to construct a coordinate system in the space for mathematical working. A coordinate system consists of virtual lines that assume continuous co-existence, straightness, and orthogonality in the Cartesian coordinate system.

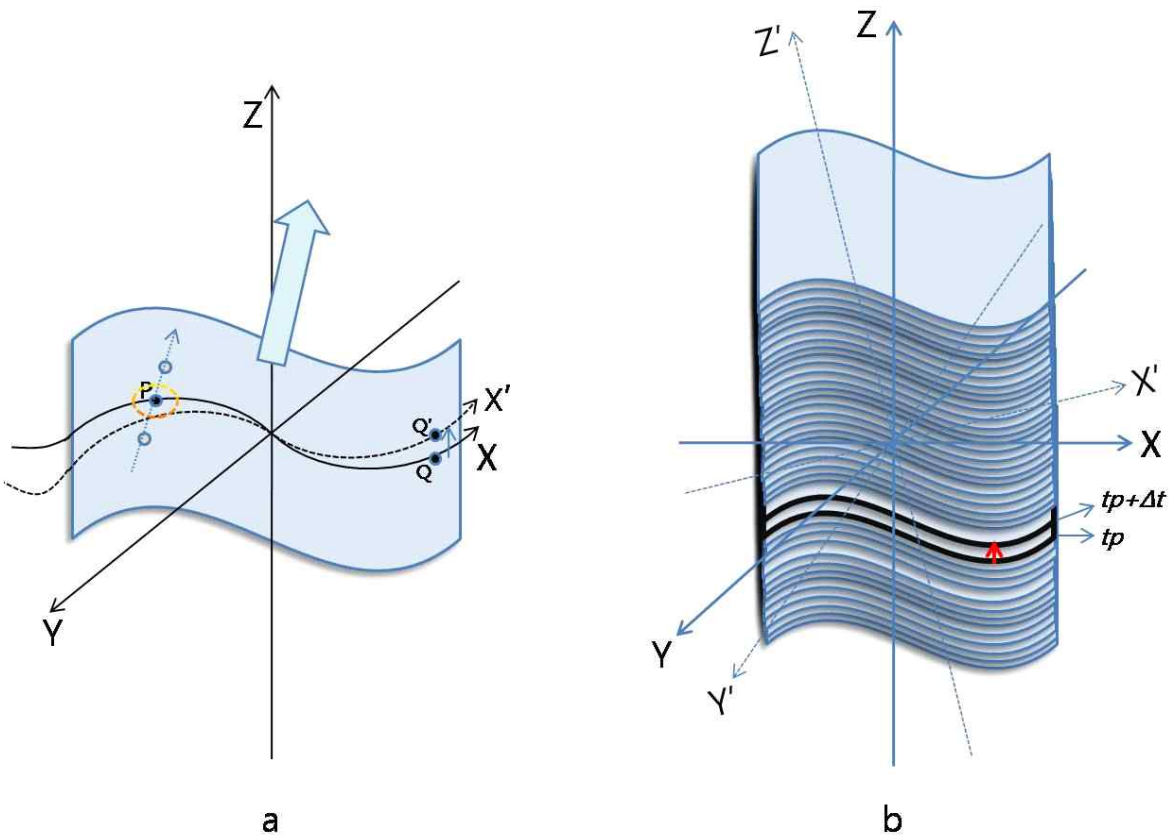

Figure 1. Two different geometries are represented on the matter of existence. a) It is a 2-d complete space which is translating to the direction out of surface. b) It is a 3-d complete space. Each picture has different degrees of freedom in the rotation and translation of coordinate systems.

With this in mind, two different geometries are suggested in Figure 1. The first one is a two-dimensional space that is translating along the direction out of the surface. The second one is a three-dimensional(3-d) space which satisfy the above requirement: continuous co-existence for the 3-d neighbourhood at an arbitrary point. Figure 1b is labelled as complete 3-d space. This space also contains countless one-dimensional and two-dimensional complete spaces within it. It is possible to construct a coordinate system inside. The rotation and translation of the coordinate system are free in this space, as it is complete. The coordinate axis of this complete space (V^3) can be mapped to the real number space (R^3) for mathematical operations. However, the line of reasoning is different in Figure 1a. In this geometry, actual objects are only defined in 2-d complete space. To express the translation of 2-d complete space, we need a 3-d coordinate system. We can rotate and translate the coordinate axis within 2-d space since it is complete. However, this operation is limited in 3-d coordinate system as this means the actual rotation of complete 2-d space. Otherwise, the coordinate axis deviates from 2-d complete space as shown in Figure 1a. The coordinate axis in 2-d complete space is also translating due to the actual translation of the space.

Figure 1a depicts a 3-d coordinate system. However, this is not a 3-d complete space. It is a 2-d complete space. The third axis does not represent actual objects but is related to the history of translation. If we choose an arbitrary point inside the 2-d complete space, it has 3-d neighbourhoods with a 2-d continuous coexistence as shown in Figure 1a. However, the reasoning on the third axis is idiosyncratic. The third axis can be separated into two directions, forward and backward. To the backward, a point once existed but no longer does. To the forward, a point will not exist until the 2-d complete space arrives there. The point P refers to this event as shown in Figure 1a. In this geometry, the 2-d complete surface is named the present surface, and all points inside are referred to the present point. When expressing the history of translation, it is necessary to document every infinitesimal movement in a 3-d space, such as shown in Figure 1b. This process is named recording. The recording is a order-preserving mapping between events and documents. After this, it is possible to conduct mathematical work using recorded properties, such as mapping V^3 onto R^3. In this process, any mathematical object represented as a function of the third axis is a recorded value, except at the present point. The geometry of Figure 1a is a 3-d neighbourhood with a 2-d complete space, while Figure 1b is a 3-d complete space. These are preliminary works to understand the true character of time.

Time

The nature of space and time

Time is an important concept when inferring about nature. We use this concept to construct a physical theory and to express human activities. Someone might think that there are no problems with this concept and therefore use it without hesitation. It has been used since primitive times and has been used by people all over the world in the language of geometry. However, time is a very elusive concept that we still don't fully acknowledge. Therefore, this needs to be investigated in depth in order to understand nature correctly. We need to understand the true characteristics of nature and then the human reasoning process regarding this entity.

The true characteristics of nature

First, it is important to understand how nature is constructed. We are living in a three-dimensional space. This is all what exist. We can never escape from this space, which is analogous to a fish in a fish bowl. However, the physical state of this space is continually changing. This is the way nature is constructed.

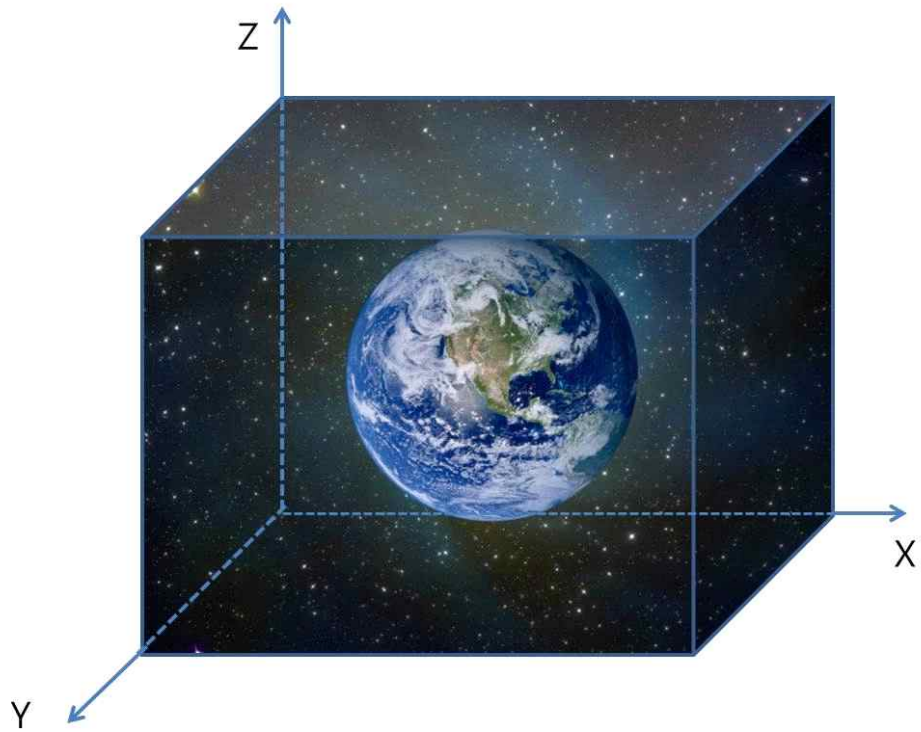

Figure 2. There is a three dimensional space in which the quantity remain constant. However, the physical state of this space changes constantly. The concept of time is introduced to express this circumstance and is represented geometrically by incorporating a time coordinate into that of space.

We cannot define the magnitude of the whole universe. However, it is possible to define the space with which we are mainly concerned. Consider the three-dimensional spaces shown in Figure 2. We assume all natural phenomena happen inside this, and there are no physical interactions with the outside. The magnitude of space remains constant, but there are constant transitions of physical states within this space. First of all, there are seasonal changes. Thermodynamic and biological evolutions also occur. We get older in this space. Certain elementary objects transform into an apple macroscopically, and return to the earth again after being eaten and digested by someone. We assign identities to objects with unique macroscopic characteristics such as apples,cars,bridges,books,computers, etc.

In Figure 2, a three-dimensional space exists and maintains a constant magnitude, while the physical state constantly changes. Thus, we need to introduce a concept to express this. We can observe these phenomena easily if we are located outside of the space. However, we cannot be sure of this if we are inside. We might lose some important facts in that situation. To understand nature, we need to clarify important facts regarding this entity. First of all, the matter of existence needs to be rigorously defined. Many kinds of materials exist and occupy the space. From the perspective of elementary particles, material can be seen as a space with dense and strong interactions between particles, or as a part of it. Natural phenomena, such as cosmic background radiation, also occur in empty space without any materials. Thus, it is possible to identify a specific existence even within empty space. The relationship between space and existence is defined in this way. A transition of space also needs to be understood definitively. The transition refers to the process of variation in materials or spaces.

There is an apple on the table in front of you. The apple is a unique existence in the entire universe; i.e. the uniqueness of its existence is guaranteed. However, the physical state of the apple has constantly changed from blue to green, and then to red. We need to specify this process. During the process of variation, the apple does not clone itself. It does not leave a blue apple behind and creates a new green apple. It has just changed its state. There is only one apple on the table. Strictly speaking, an apple with an infinitesimal moment of stillness exists on the table.

The other example is the variable position of the particle. There is a glass ball on the table in front of you. The ball is unique in the whole universe. It starts to roll across the table. We observe the process of rolling. The location of a ball is unique during its rolling, as observed. When the ball is located at the

center, it no longer exists in the backward direction. It will exist somewhere forward, but not until it actually moves to that position. The existence of a ball is unique only in its current position. The ball does not clone itself while rolling. Strictly speaking, a ball exists at the current point with an infinitesimal period.

The variations in state and position are interrelated with each other. The change of state corresponds to the movement of elementary particles that constitute the object at the microscopic level. The change in location can be expressed as a variation of state when we consider the particle and its surroundings together. It is just a matter of the subject. The term "physical state" will be used throughout this paper to represent them collectively.

The motivation and measuring method of time

We need to express the above circumstance. Therefore, the concept of time is introduced. We don't need this concept if there are no variations in nature. In other words, this concept is useless when everything is at a standstill and remains in the initial state forever. There are various events in the universe. Certain objects change more rapidly than others. Physical and chemical interactions also happen regardless of space and time. Even identical objects change differently depending on their location. There is no unique pattern with the variation. Because of this, we need to establish a rule for how to measure it reliably. It should be steady and reproducible for us to use as a reference. Natural phenomena such as the position of the sun or its shadow were utilized since ancient times. These have been replaced by mechanical or digital clocks as technology advances. The traditional methods are closely related to geometry. We should be extremely careful about what the measuring of time means when we use a geometric method.

The related language

The language related to space and time should be defined rigorously at this point. From ancient times to the modern age, and regardless of ethnic background, we use space to recognize, understand, and express time. We often refer to the passage of time without fully recognizing that we are the ones who define this concept. It is necessary to consider the motivation of this concept again. This is introduced to represent the process of variation. We provide direction, a geometric concept, to this process and represent it in space. This concept is called time, and we interpret it geometrically.

Once the motivation and methodology of time measurement are introduced, it is important to

acknowledge how this conventional method was used without recognizing any fallacies. We need to clarify languages related to time in order to do this. First and foremost, the issue of existence needs to be definitively addressed. Proper nouns and abstract nouns represent real objects in nature and abstract entities in our minds, respectively. The former is used to identify actual objects, while the latter is used to clarify concepts when inferring about nature. Examples of proper nouns include Car, Furniture, Sun, Moon, etc. These can be perceived through human senses or detected through mechanical tools when it is beyond our ability. Examples of abstract nouns include time, the past, the future, etc. These can be recognized through thought or measured using specific methods if a rule is established in advance. The word "existence" will be limited to a proper noun throughout this paper, as we are mainly interested in what actually exists in nature and how these things are understood by ourselves.

We understand time through the language of geometry. This means that time is expressed as a matter of location. It is important to acknowledge the implicit meaning of this, including its paradoxical aspect. We mention time flow very commonly. Flow is a geometric concept that represents a change in position. The same principle applies to time travel. In ordinary life, we state the following: i)Time flow very fast. ii)Time flows from the past to the future. iii) Is time travel possible? However, they are metaphorical expressions that can lead us to wrong conclusions. Time never flows in nature if this pertains to a proper noun. Instead, a physical state has just been changed.

Once we recognize the fact that time represents the process of variation, we can rephrase the expressions with the correct ones as follows: i)A physical state has changed rapidly. ii) An old state has completely disappeared from the entire universe and has been replaced by a new one. iii) This statement pertains to the Russell paradox, which mainly originates from a wrong or ambiguous definition. Therefore, it is illogical. If this means the reappearance of the old state, it is impossible in nature.

The present should be defined first. Think of where you currently are. You and your surroundings have changed into their current state and they will continue to vary. The present represents what actually exists in nature. After this, we need to define the past and the future not through geometry, but through physical states. There is an apple on the table, and I eat it. Therefore, it does not exist any more. This is a drastic change of physical state that results in the loss of macroscopic identity. Strictly speaking,

it was on the table, but it is no longer there as I have eaten it. Tomorrow morning, you plan to bake bread, but it will not exist until you press the button of oven. Specifically, it does not exist until it becomes the present time and you actually take action. Without this, it is just in your imagination. The expression that the apple still exists on the table, referred to as the past, is incorrect. Just planning for tomorrow does not guarantee the existence of real objects in the future. The vanished state of an apple and the backward position of a rolling ball, where a ball once existed, belong to the past. The opposite state and position of the past are called the future. The present represents the infinitesimal moment of the physical state during the variation. We can define the past and the future as the foregone and forthcoming physical states, respectively. The present is defined as a state that actually exists in nature during an infinitesimal period. Space is a subject that exists in a specific physical state and undergoes variation. This can be identified with existence.

The mapping process: infinitesimal state to the location of real objects.

We have defined the true characteristics of nature and the related languages that are indispensable for the correct understanding of it. It is necessary to understand how they are interrelated and expressed, especially with a geometric tool.

Periodic motions of a device are conventionally used as a tool for measuring time. This method is convenient for coordinating times with an identical interval. However, the true property of time is the constant evolution of a physical state. As time evolves, a new state is substituted for the old state, repeating endlessly. During the evolution of the physical state, each infinitesimal state is mapped to the location of the clock's needle. This, in turn, is mapped onto the real number system for the quantitative analysis of the geometry of space and time. The coordination of space and time is completed after this process. First, we need to observe nature and then record the process of variation in space. We need to keep in mind that there is only one apple on the table, and it does not clone itself during the evolution. An apple with an infinitesimal transition state actually exists on the table. What is happening inside the apple is the old state disappearing and the new state emerging. Variation refers to the recurring process of this event. We need to compare the actual phenomenon of the apple to the geometry of space and time.

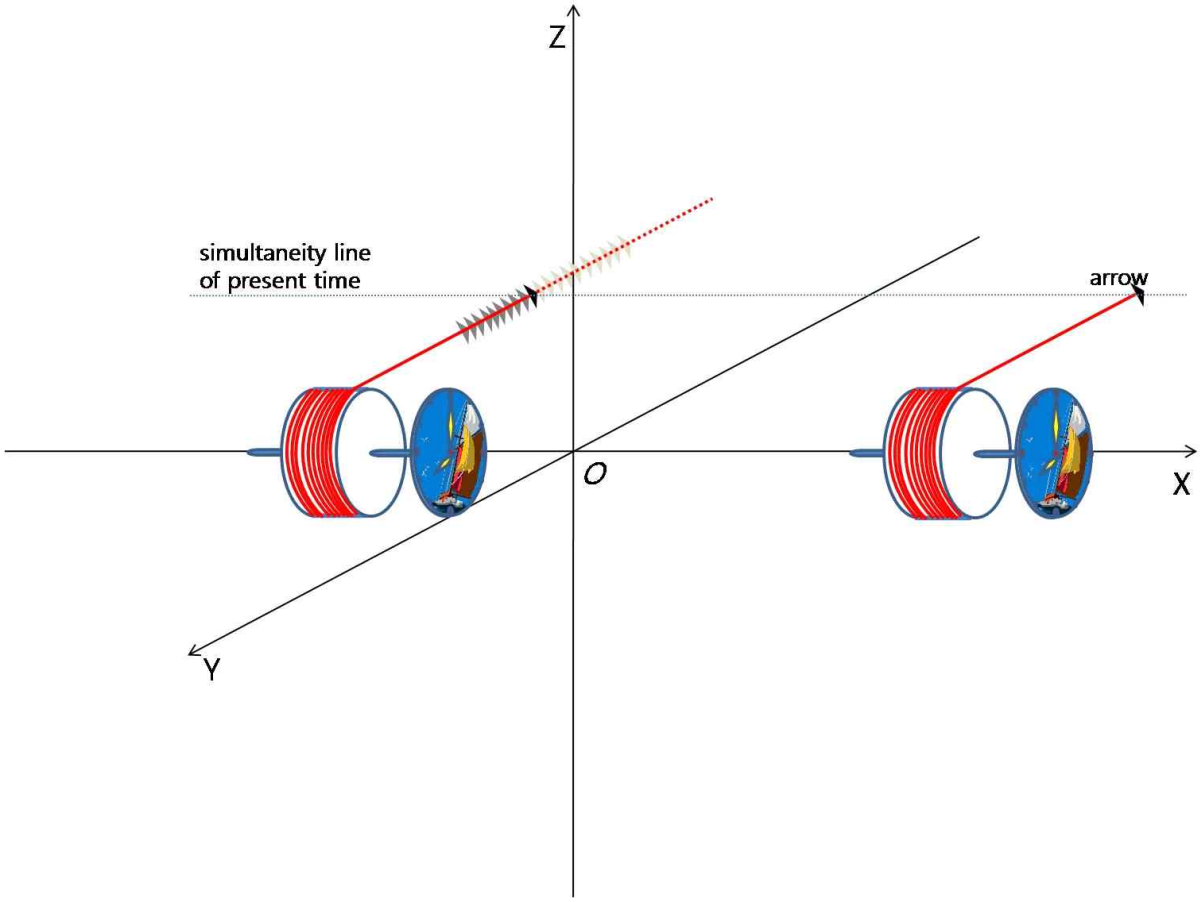

Figure 3. The geometric nature of time is represented by an arrow at the end of a thread. Footprints indicate the foregone and forthcoming present.

Figure 3 provides valuable insight into understanding time and its geometric characteristics. This is a Reel clock. It is devised to represent the evolving nature of time, as well as the periodic motion of a conventional clock, and to provide insight into the geometric characteristics of time in real 3-d space. It releases an identical length of thread every turn, and an arrow is attached at the end to indicate the direction and location. With this clock, we can determine the time by observing the length of the released thread on the reel or by noting the current position of the arrow. The current location of the arrow indicates the present time. During the translation of an arrow, we can also identify the backward direction if the arrow leaves footprints along the path. To the forward, it is possible to infer the location of footprints when assuming the homogeneity of space and time; thus, the trajectory of the arrow is predictable. This process is named recording, identifying backwards, and predicting forwards through

footprints. With these, it is possible to construct the geometry of space and time. The simultaneity line of the present time corresponds to a complete 2-dimensional space, which translates into the third direction as demonstrated in the previous geometry section. Only the present time indicates a real arrow. We infer both past and future existences through footprints.

Imagine that there is an apple beside the Reel clock. We can compare the variable properties of an apple with those of a clock. It is possible to map each infinitesimal state to the location of the arrow. We can infer the location of the arrow without considering the speed of light if the length of the released thread is displayed on the shaft of the reel. The occurrence of events and observations is simultaneous, leading to precise mapping with exact values. A disappeared state can be identified by a footprint. The forthcoming states can be inferred if we have a well-established physical theory that predicts the evolution of an apple correctly. It is possible to record the history of an apple by mapping its physical state to the location of an arrow, assuming homogeneity of space and time. The two are analogous to each other, and it is the geometric nature of time.

Construction of space and time with pure geometric languages

We have acquired the geometry of space and time. This can be represented by another method using purely geometric language. It should be expressed using the correct language of geometry. The essence of geometry is closely related to existence and location. A geometric approach means that we deal with specific abstract concepts by location. It is absolutely important to define what actually exists in nature. We need to distinguish what exists in nature from what is in our mind. In nature, there exists a 3-dimensional space with an infinitesimal moment of physical state. The variation is expressed as the translation of this space into the time direction. With this method, time is represented as a matter of location. The geometry of Figure 1a is consistent with this circumstance. In this model, the present surface translates to the forward direction. Nothing exists outside of this. We observe the translation and record it. Figure 1b refers to this. The geometry obtained through this method is called the recorded one. The rotation and translation of coordinate systems are limited in Figure 1a. To sum up, Figure 1a expresses nature through geometry. With this methodology, matters of existence and location are solved. Figure 1b is obtained through human efforts, including observation and recording.

The metaphorical expression in a previous section can be rephrased more reasonably as follows: i)The present surface translates quickly. ii) The present surface translates to the forward direction. iii) The

question itself is paradoxical one. If that means rotating the line of simultaneity or translating backwards artificially, we consider this impossible within this model.

Interpretation of recorded geometry

Once the geometry is completed, it is necessary for us to interpret it correctly. Suppose the specific time "t_p" represents the present in Figure 1b. The backward and forward zones belong to the past and the future, respectively. Upon reflecting on the current situation in nature, the object has transitioned to this state and the corresponding timeline of events represents what truly exists throughout the entire universe. The others represent the entities that we remember from observation or expect from our imagination. At this point, an interval Δt has passed, and now the present is $t_p+\Delta t$. The simultaneity line has been translated to this position, representing real objects throughout the entire universe. The other zones represent forgone and forthcoming existence.

Recording represents this circumstance within one geometric frame and thus makes it possible for us to observe them all at once. The relationships between the recorded footprints in Figure 3 are completely different from the points in the complete space where the footprints are marked. The former are characterized by being ordered by existence, while the latter are characterized by continuous co-existence. The footprints should be seen as markings on the corresponding space, and should not be mistaken for being identical to their background. In other words, we borrow complete hyperspace to record the translation of subspace, completing the geometric model of time. Modelling is the process of constructing another entity that is analogous to the original one for cognitive convenience. However, the two are not identical. Recording is a human activity used to illustrate the ongoing recurrence of the present. We can never escape from the present. Think of where you currently are. That is the present. A second has passed, but you are still in the present. The same thing happens even after one more second. You continue to stay in the present even though this process repeats countless times.

This can be understood otherwise. You can replay a particular motion picture and imagine that the screen represents the entire universe. What you observe on the screen always represents the present, and this is what actually exists. You can compare this with the translation of the present line in the recorded geometry. This is a useful method when we retrospect a specific natural phenomenon, and compare it with its geometric model. The recursions of the present are also applied here. The recorded

geometry expresses the ordering of existence. Each infinitesimal moment of state corresponds to the individual existence which is concerned. The interval is expressed geometrically. It can be predetermined depending on how we measure it with a specific tool. In other words, it depends on how we formulate a rule regarding the measuring method. The overall structure of this geometry represents the sequence of existence with a simultaneous line, allowing us to observe them all at once. The geometry itself is constructed by humans.

In depth analysis of time with its geometric model

The fact that we can never escape from the present seems strange at first sight. However, this does not originate from the bizarre character of nature, but from the defective language related to time. If we define the related language after recognizing the true characteristics of nature, we can then correctly infer about nature. We are currently here and experiencing variations in our surroundings. The infinitesimal moment of a physical state at the present is what actually exists in nature. This fact never surprises us. The variations happen even when you don't move and stop breathing temporarily. The stationary object in front of you also undergoes microscopic changes. Therefore, it is not the same object as the one a second before. Sometimes, we fail to realize this fact because of our lack of intuitive sense.

Why have the paradoxical aspects of time distressed us for so long? Above all, we have understood time with a geometric language. Therefore, we unwittingly identify them together, and this has been ingrained in our reasoning process. Our lack of perceptive ability has also contributed to the misunderstanding, especially due to the presence of stationary objects around us and within ourselves. This can be understood with the figurative comparison of fish in Figure 2. The outside observer can easily recognize everything with regard to the space. He can also grasp a very important fact about the relationship between space and inside fish, an object, and the observer. He knows how the fish inside objectifies its surroundings. The fish inside cannot easily perceive these. It is difficult to survive when one tries to be an outside observer for true understanding. Furthermore, it fails to recognize the fact that it is also amidst variations. It is also located on the current line of recorded geometry when this is translated forward. We are observers of nature and also part of it.

We have used imprecise language concerning time, therefore it is necessary to use precise alternatives

in order to understand it correctly. Once we identify an object, we must acknowledge its properties. In nature, they correspond to space and time, respectively. Space has a variable property. Finally, we obtain a statement that a space always varies. The space and time correspond to a subject and predicate, respectively. Time is not an object but a property of it. Therefore, we should not use it like a proper noun. A statement that time always varies is illogical. Space is perceived or detected, and then measured for quantitative analysis. However, time is simply measured, not detected. Nature is a space subject to variation. This is the objectification of nature.

It is possible to identify the past from observations but the future is subtly different. The future events can be categorized into four different types: predictable from physical theory, plannable with human activity, contingent but still predictable and plannable, and completely chaotic, thus not contingent. None of these candidates can be considered real objects in nature until they are located in the present and their existence is identified. We can only record a few of them in the future zone. We do not live in a predetermined world; not everything already exists in what is referred to as the future. There are always some uncertainties in the future.

Time is a useful concept when comparing the ordering and intervals of existence. Different times at the same location indicate how the physical states are ordered. The same time in different locations implies that the objects exist simultaneously. The real number represents this when time is mapped onto it. Physically, this ordering is related to the causal relationship. We can determine the duration of existence through recording. If this were yesterday, it would be a one-day interval of existence. It is important to recognize the fact that existence itself has disappeared in the entire universe, not just to me.

This concept can be used when we compare the ordering of events which happen in two isolated places. When two observers have identical clocks synchronized and are located at different places, they record what they observe in each place at the same time interval. They don't communicate with each other until they are joined together after finishing the recording. They compare the recordings, and this is the mapping of two well-ordered events. The synchronization of clocks is crucial to this matter.
The present moment in nature is the one that is being experienced right now. It is a unique time in the whole universe. When we retrospect a series of past events with a recorded history, we should remember that they have disappeared from the world.

Fallacy

The true characteristics of nature are understood, and a geometric model is established to represent it. Therefore, it is possible to investigate the validity of this theory with the revised interpretation of the present.

A physical theory loses validity when the result predicted by it contradicts the postulates on which it is based. Metrics are not a necessary and sufficient condition for the integrity of physical theory. Any type of metric is viable if we do not consider its empirical validity in nature. There are fundamental assumptions about nature that we make when interpreting it: the homogeneity of space and time[8], the isotropy of space[8], the principle of locality[2], causality invariance[2], conserved quantities as in Noether's theorem[9], irreversible entropy increase[10], etc. These assumptions have been empirically verified over a long period of time, with careful consideration given to nature. Therefore, its generalization is not doubted. However, this theory predicts many non-physical phenomena when we speculate about nature using the revised concept of the present. Even more, it is contradictory to the above assumptions and is not consistent within itself.

This theory is paradoxical [4,11,12-14] on many aspects, most of which are resolved with spacetime metric, especially when using the concept of the relativity of simultaneity. This is the final option that deductively backs up this theory. However, this inevitably leads to conclusions about bizarre natural phenomena that appear without any empirical confirmation. The simultaneity line is related to the existence of real objects in the present. This becomes definite in Figure 1a. The rotation of this line during acceleration predicts non-physical phenomena such as action at a distance, whitening out, self-cloning, etc. This also violates the fundamental assumptions of nature such as thermal diffusion.

This theory predicts non-physical phenomena. Upon recognizing the meaning of the present time and recording, we can certainly grasp the problems induced by the relativity of simultaneity. It is only hypothetically possible when we assume each inertial frame has an unknown origin and maintain its state consistently. In other words, it never experiences any kind of acceleration.

However, the philosophy of Einstein-Podolsky-Rosen(EPR) paradox [15] provokes controversy regarding this issue. Suppose there are many observers at the origin in Figure 3, and they suddenly scatter in both directions of the X-axis. They will have different lines of simultaneity in the present time, and we can determine these from the location of an arrow. However, this is not a simple matter. The different lines of simultaneity in the present will be indicated by footprints, not by actual arrows. There should be

action at a distance by a hidden variable, indicated by a real arrow. Even more, this can be satisfied only when one observer is infinitesimally accelerated. If there are many, it becomes a completely non-physical state. Of course, we do not observe these empirically. It is a spooky action at a distance, as indicated by Einstein[15], which is represented as point Q in Figure 1a. This problem might be resolved if we consider each inertial frame from negative infinite times without any acceleration, taking into account that the arrow can evolve at any arbitrary time. However, this also sparks another controversy regarding the age of the universe [16].

If we observe a rolling ball on the table, it becomes apparent what time travel means, if it is indeed possible. Imagine if we were to replay the motion pictures of this event, or retrospect on the series of events that took place. The location of a ball is unique in the present, enabling comparison to the world line of Minkowski space. The ball should clone itself during the translation. It leaves a ball behind and then moves to another place. This process should be repeated continually to satisfy the world line. The world might implode if this actually happens. Time travel itself is neither a logical concept nor a physical phenomenon.

Homogeneity of space and time, as well as isotropy of time, are also violated when a new inertial frame is created. Creation of a new inertial frame from the same origin necessarily results in a non-homogeneous spacetime due to the relativity of simultaneity when it is accelerated by a homogeneous force or by pulling. The Bell spaceship paradox[11] predicts a contradiction during acceleration. When the two spaceships, separated apart, are both accelerated by an identical force, the string connecting them must and must not break depending on the observers. According to the principle of this theory, the two observers moving in opposite directions, as well as another in a spaceship, will experience different results regarding a natural phenomenon.

In ordinary life, we observe many collisions and, in certain aspects, an inertial frame is an idealized state that does not exist in the real world as it is always subject to internal or external interactions. The rotation of the simultaneity line actually signifies violations of fundamental assumptions, such as the principle of locality and causality invariance.

It is necessary to revise the above arguments in the context of the present moment, rather than the present as recorded in geometry. If the simultaneity line of the present time rotates as in special relativity, you need to place back on the table the apple you have just eaten. This is a violation of causality invariance. In some situations, you need to jump into tomorrow in the morning, press the

button to make the bread an actual existing object, and then come back to where you are today. The bread cannot exist forever if you suddenly change your mind right before the deadline. Just memories and imagination do not guarantee the existence of real objects. If you accelerate while driving on the street, the surroundings can blur into a whiteout, or the perspective of the street trees may appear different due to the rotation of the line of simultaneity. These become apparent when we refer to Figure 1a. Empirically, these events do not occur, limiting the degree of freedom in the rotation and translation of inertial coordinate systems.

Scientists believe that Lorentz invariants are on a solid empirical foundation, confirmed with high precision using modern state-of-the-art technology [17-19]. Time dilation [20-24], length contraction, and relativity of simultaneity are indispensable for completing the spacetime metric. Without any one of these, the spacetime metric loses validity. However, the empirical foundations for length contraction are neither solid nor abundant [25-28]. These conclusions need to be revised as long as they are not from immediate reasoning. They are inferred from the analysis of the interference pattern or the frequency shift of light [25, 28, 29]. We need to refrain from taking any kind of axiomatic approach to spacetime. This axiom is not as integral as it is often thought when we contemplate nature. On this occasion, we should adhere to what is clearly true. This should be the rule of inference when we establish a physical theory.

A fallacy regarding special relativity originates from a retrospective reasoning method that fails to acknowledge the significance of the present moment or the act of recording. We record all events in a complete space and observe them simultaneously. This is the Minkowski space [2]. Instead, we need to acknowledge the fact that the line of simultaneity translated in this space represents the present. Only the present can translate in this geometry. We can reflect on an actual situation in nature and compare it with the translation of the present line in Minkowski space. It is recommended to set a specific time as the present to avoid unnecessary confusion. This is a useful method to indicate a current state in the world line.

It is possible to construct a more specific structure than Figure 1a using the fundamental assumptions. In this construction, the present surface in Figure 1a becomes flat and translates uniformly when we assume the homogeneity of space and time. The time coordinate is orthogonal to that of space, assuming isotropy of space as shown in Figure 4. The absolute space and time of Newtonian mechanics

originate from these concepts, rather than from infinite speed as indicated by special relativity [2]. If we do not accept these assumptions, time becomes a relative property, and the present surface is curved. The relativity of time is dependent on location, not on different inertial frames. However, the present still represents actual existence. It needs to be determined empirically whether the validity of the above assumptions is universal or local.

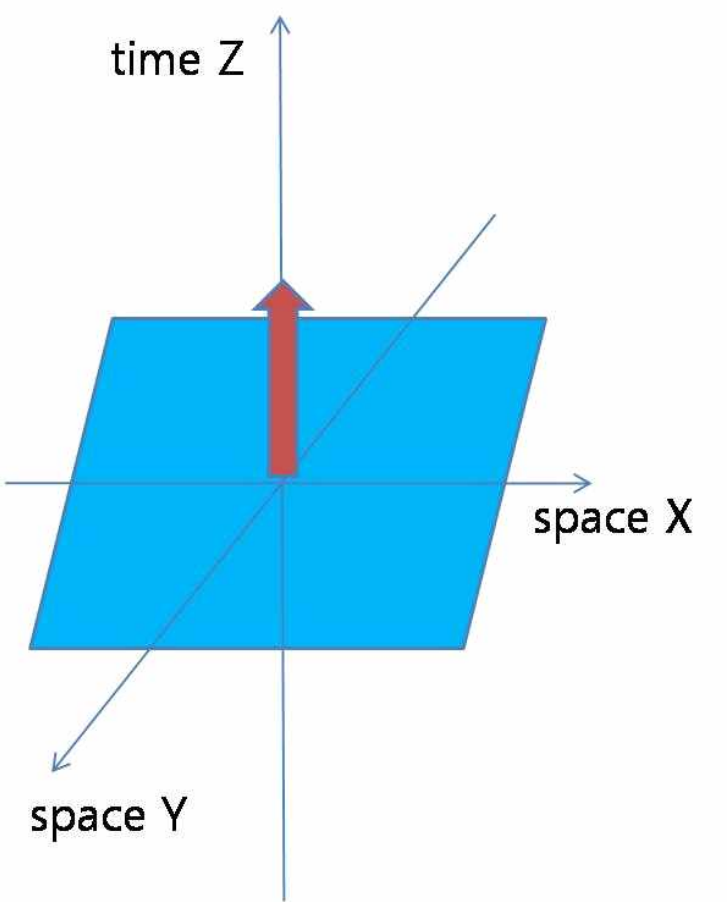

Figure 4. The homogeneity of space and time, as well as the isotropy of space, determine the geometric structure of the present surface more precisely. It is a plane which is moving along the time direction, orthogonal to the spatial direction.

We also need to distinguish the underlying philosophies of physics and mathematics. Physical objects exist only at the present. In mathematics, we initiate deductive reasoning under the assumption that mathematical objects such as numbers exist. Even in set-theoretic operations, the existence of a mathematical object is so trivial that it is not even mentioned as an axiom [30]. Mathematics is a discipline that investigates the properties of numbers. A physical property called time is mapped into this mathematical object.

However, the existence of physical objects is only located in the present. We need a preliminary recording for mathematical calculations when time is involved. What we deduce mathematically from time are recorded values, except at the present. When we express complete space with mathematical variables, it can be mapped onto a real number immediately as both objects satisfy continuous coexistence. However, time needs to be mapped onto a real number after recording, as this concept represents the ordering of existence itself.

From the perspective of formal logic, the structure of this theory is a valid argument but not a sound one. The logical consequence of this theory is valid from premise to conclusion. In the sentence "if p, then q," p is the premise, and q is the conclusion.

There are premises in this theory such as time dilation, length contraction, and relativity of simultaneity. These are also based on the assumption of the invariant speed of light. In this theory, the conclusion is confirmed empirically, but not the premise. It is crucial to make a distinction between proven natural facts and human inferences.

This can be understood through the Michelson-Morley experiment. In this experiment, the isotropy of the interference pattern is proven. We interpret the conclusion under the assumption that the speed of light is invariant. Therefore it is a valid argument. However, this does not guarantee that the premise itself is proven, making the argument sound. We cannot ascertain that the spacetime metric is a unique premise for the interpretation of the conclusion. Elliptically polarized light reflected from a thin layer can also be used to interpret isotropic patterns, making it the more reasonable choice. This theory loses validity and consistency when interpreted with the present. It is only valid when interpreted with strictly limited propositions. According to this theory, a casual relationship is determined deductively; however, this does not guarantee that the relationship is empirically true. Invariant speed, time dilation, and length contraction are always considered as hypotheses, despite the existence of many Lorentz invariants. This fact will never change. They are only premises for valid interpretations of other experimental results and cannot be a conclusion in themselves; these must also be verified through experimentation.

Once the necessity and measuring method of time are established, we can obtain an interesting result. If we use a reel clock, it is possible to represent the velocity of a certain object differently. It is simply the ratio of variation relative to the criterion. A speed can be a dimensionless value. With this, we can define time more rigorously. Time is a variable property that is measured by a specific criterion. If the

tool is geometry or the mass of sandglass, time is no longer considered an independent fundamental unit. The dimension of time(t) includes criteria such as length (l^c), mass (m^c), etc. Time is simply a representation of these. It is just a matter of choice. Of course, the criterion should be a reliable one with certain properties such as reproducibility and steadiness. It is much more important to acknowledge the fact that time represents the variable property of a particular criterion than to choose between them. The role of time in many physical equations is that they are expressed using a specific criterion. These criteria are standardized, such as second, minute, and hour, which are commonly used today. A geometric method is composed of two components: background and indicator. Both factors should be in a steady state. The indicator's relative position to the background represents time. Therefore, the relative velocity and location of the background and indicator with respect to different inertial frames do not determine time. If we use tools other than geometry, the paradox related to time might take on different shapes. Time is also related to entropy. Nature is a space subject to an irreversible increase in entropy. This is a more in-depth expression about nature.

Conclusion

Space varies. Once we understand this sentence, it becomes apparent to us what the present means. The essences of space and time are an existence and its variations, respectively. This, in turn, means that the true characteristic of nature is that an object constantly varies. Space and time are a subject and a verb, respectively, in this expression.

The past and the future are said to be the present's predecessors and successors, respectively. An object with an infinitesimal physical state actually exists in nature. This is the present. The geometric model of space and time is a combination of the characteristics of nature and the works of man. Therefore, it should be interpreted correctly. Only the present translates in this geometry. This is the manifestation of the fact that we can never escape from the present. It is evident when we consider the unique present moment in which we currently find ourselves.

Time is a variable property in nature. This becomes a geometric object after we establish a rule for measurement using space. This is a human intervention. Both space and time are mapped into a real number, a mathematical object. However, we need to distinguish the various routes they have from the intrinsic nature to the same mathematical object. The former is from a natural object to a mathematical object, and the latter is from its property to the same object.

A fallacy related to the theory of relativity becomes apparent when we interpret this theory using revised language. The rotation of the simultaneity line is closely related to spooky action, white-out, and

self-cloning. Therefore, the translation and rotation of this line in different inertial frames are limited.

The paradoxical aspects of time originate from the imperfect languages we use in everyday life. They do not represent the actual nature of time, but rather the properties of the tools we use to measure it. They are mixed in our usage, and therefore should be sorted to clarify the circumstance. When we consider a subject of interest, it is important to define both the object and its properties. After this, it is possible to characterize the entity. The word "existence" should also be classified accordingly.

When establishing a physical theory, the fundamental assumptions should be fully verified by an empirical foundation, thereby eliminating any doubts about its generalization. Only after this, is it possible to derive and conclude another result that should also be proved by experiment. A physical theory should be constructed in this way. We need to definitively answer to ourselves the two questions: What is proven by experimentation? What is inferred from this?

The geometric model of space and time is obtained from the characteristics of nature and human labor. Only after substantial consideration of these rationales is it possible to construct a physical theory, including the construction of coordinate systems to express it with mathematics. Nature can be expressed with two important factors: space and time. Space always varies. This is the nature of things.

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