

## **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 validities of Lorentz invariants are fully confirmed empirically for the last one hundred years and therefore its status are canonical underlying all physical principles. However, spacetime metric is a geometric approach on nature when we interpret the natural phenomenon. A geometric flaw on this will be exhibited and the alternative is suggested. The reasonable geometric model of space and time is a three dimensional space which is translating along the time direction. This model legitimately represents the true characteristic 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-Riemannian geometry[2]. This is a geometric interpretation on nature using metric tensor and other basic geometric characteristics. Extensive results were deduced from spacetime without any empirical confirmation[3-7]. These axiomatic approaches are the mainstays of modern physics on this part. However, it will be questioned on the integrity of this and a few contradictions will be suggested. To achieve this, the languages related to time should be defined more rigorously from physical state not from geometry. Conventional uses of language are incomplete and therefore they mislead us to the paradoxical thinking. The geometric character of time should be expressed correctly after sufficient considerations on the difference and similarity of space and time. The contradictions on special relativity using newly established geometric structure are introduced. 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 abstract concept to the geometry which is believed to represent the concept legitimately. With this in mind, two different geometries are suggested in Figure 1. The first one is a two dimensional space which is translating along the direction out of surface. The second one is a three dimensional(3-d) space. The two geometric structures have distinctive features with regard to the existence of geometric object. We need a Figure 1b to express the translation of surface in Figure1a.

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Now the translation means the variation of surface location.

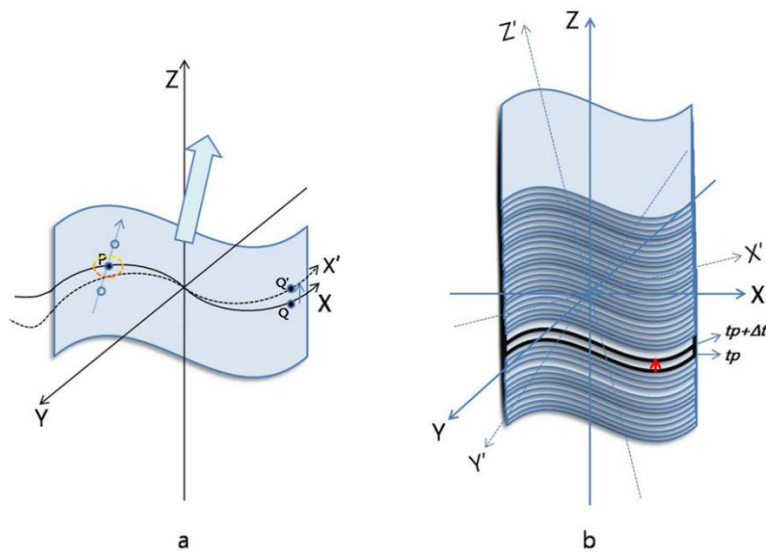


Figure 1. Two different geometries on existence are represented. a) It is a 2-d complete space which is translating along the direction out of surface. b) It is a 3-d complete space. Each picture has different degrees of freedom on the rotation and translation of coordinate systems.

## Time

### The nature with space and time

Time is an important concept when we infer about nature. We use this concept to construct a physical theory and to express human activities as well. Some people might think that there are no problems with this concept and therefore they use it without hesitation. It has been used from primitive period and been used by everyone throughout the world with the language of geometry. However, time is a very elusive one which we still don't acknowledge completely. Therefore, this needs to be investigated in depth in order to understand nature correctly. We need to understand the true characteristic of nature and then the human reasoning process on this entity.

### The true characteristic of nature

First, it is important to understand how nature is constructed. We are living in a 3 dimensional space. This is all what exist. We can never escape from this space, which is analogous to the fish in a fish bowl. However, the physical state of this space is continually changing. This is the way nature is constructed.

We cannot define the magnitude of whole universe. However, it is possible to define a space of which we are mainly concerned as in Figure 2. There are seasonal changes. Thermodynamic and biological evolutions also happen. We get older in this space. Certain elementary objects transform into an apple macroscopically and return to the earth again after eaten and digested by someone. We endow identities when the objects have a unique character macroscopically, like apple, car,

bridge, book, computer, etc.

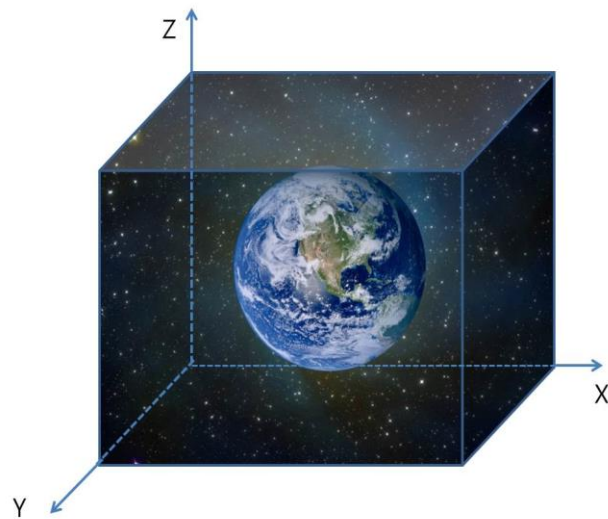


Figure 2. There exists a three dimensional space and it maintains the quantity constant. However, the physical state of this space changes continually. The concept of time is introduced to express this circumstance and represented geometrically by incorporating time coordinate to that of space.

To understand nature, we need to clarify important facts regarding this entity. First of all, a matter of existence needs to be defined. Many kinds of materials exist and occupy the space. From the point of elementary particles, material is in a sense a space with dense and strong interaction of particles or part of it. Natural phenomenon such as cosmic background radiation also happens in the empty space without any materials. Thus, it is possible to identify a specific existence even with empty space. The relationship between space and existence is defined in this way. A transition of space needs to be understood definitely. The transition means the process of variation in the materials or space.

There is an apple on the table in front of you. The apple is a unique existence in the whole universe, i.e. the uniqueness of existence is guaranteed. However, the physical state of the apple has changed continually 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 makes a new green apple. It just has changed its state. There is only one apple on the table. Rigorously speaking, an apple with infinitesimal state exists on the table.

The other example is the variable position of 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 ball is unique during the rolling by observation. When the ball is located at the centre, it does not exist anymore to the backward direction. It will exist somewhere to the forward but not until it actually moved to that position. The existence of ball is unique only at the present position. The ball does not clone itself during rolling. Rigorously speaking, a ball exists at the present point with infinitesimal period.

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

### **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 at all in nature. In other words, this concept is useless, when everything is standstill and maintains the initial state forever.

Natural phenomena such as the location of the sun or its shadow were used from primitive period. These have been replaced by a mechanical or digital clock as the 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 geometric method.

### **The related language**

The language related to space and time should be defined rigorously at this point. From primitive time to modern age and regardless of ethnic background, we use space when we recognize, understand, and express time. We mention time flow without enough consideration about how this expression is invented by ourselves. Again, it is necessary to consider the motivation of this concept. This is introduced to represent the process of variation. We endow direction which is a geometric concept to this process and represent onto space. This direction is named time and we interpret this geometrically.

Once the motivation and measuring method of time is introduced, it is important to acknowledge how this conventional method was used without any recognition on fallacy. We need to clarify languages related to time for this work. First of all, a matter of existence needs to be arranged definitely. Proper noun and abstract noun represent the real objects in nature and the abstract entities in our head. The former is to identify actual objects and the latter is to clarify concepts when we infer about nature. Examples of proper noun include car, furniture, sun, moon, etc. These can be perceived through human senses or detected through mechanical tools when this is out of our ability. Examples of abstract noun include time, the past, the future, etc. These can be recognized after thinking or be measured by certain methods if we make a rule for these in advance. The word existence will be limited to proper noun throughout this paper as we mainly interested what are actually exist in nature and how these are understood by ourselves.

We understand time with a language of geometry. This means that time is expressed as a matter of location. It is important to acknowledge what this implicitly means, including paradoxical aspect. We mention time flow very commonly. Flow is a geometric concept representing the change of position. The same is applied to time travel. We state the following in ordinary life: i) Time flows

very fast. ii) Time flows from the past to the future. iii) Does time travel possible? However they are metaphorical expressions, which can mislead us to the wrong conclusions. Time never flows in nature. Instead, a physical state has just been changed.

Once we recognize the fact that time represent the process of variation, we can rephrase the expressions with correct ones: i) A physical state has changed rapidly. ii) An old state has disappeared completely in the whole universe and replaced by new one. iii) This statement belongs to Russell paradox, which mainly originate from wrong or ambiguous definition. Therefore, it is meaningless from the point of logic. If this means the reappearing of old state, it is impossible in nature.

The present should be defined first. The present represents what actually exist in nature. After this, we need to define the past and the future, not from geometry but from physical state. There is an apple on the table and I eat this. Therefore, it does not exist anymore. This is a drastic change of physical state which loses the macroscopic identity. Rigorously, it was existed on the table but not anymore as I have eaten it. Tomorrow in the morning, you plan to bake a bread but this does not exist until you press the button of oven. Specifically, it does not exist until it becomes the present time and you do actually take an action. Without this, it is just in your imagination.

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

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

Periodic motions of device are conventionally used as a tool to measure time. This method is convenient to coordinate times with an identical interval. However, the true characteristic of time is the continual evolution of a physical state. As time evolves, it substitutes a new state for the old one and repeating this endlessly. During the evolution of physical state, each infinitesimal state is mapped into the location of the needle of clock. This in turn is mapped into real number system for the quantitative analysis of the geometry of space and time. The coordinate of space and time is completed after this process.

Figure 3 provides a valuable insight into apprehending time and its geometric character. This is a Reel clock. It is devised to represent the evolving property of time in addition to the periodic motion of conventional clock and to get an idea on the geometric characteristic 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 identify time from the length of released thread if it is exhibited on the reel or from the present location of arrow. The present location of arrow identifies the present time. During the translation of arrow, we can also identify backward direction if the arrow left footprints along the path. To the forward, it is possible to infer the location of footprints when we assume the homogeneity of space and time, thus the translation of arrow is predictable. This process is named recording, identifying backward and predicting forward through

footprints. With these, it is possible to construct the geometry of space and time. Only the present time indicates a real arrow. From this location, an arrow was existed but not any more to the backward. It will exist but not until it becomes the present time to the forward. We just infer the foregone and forthcoming existences through footprint.

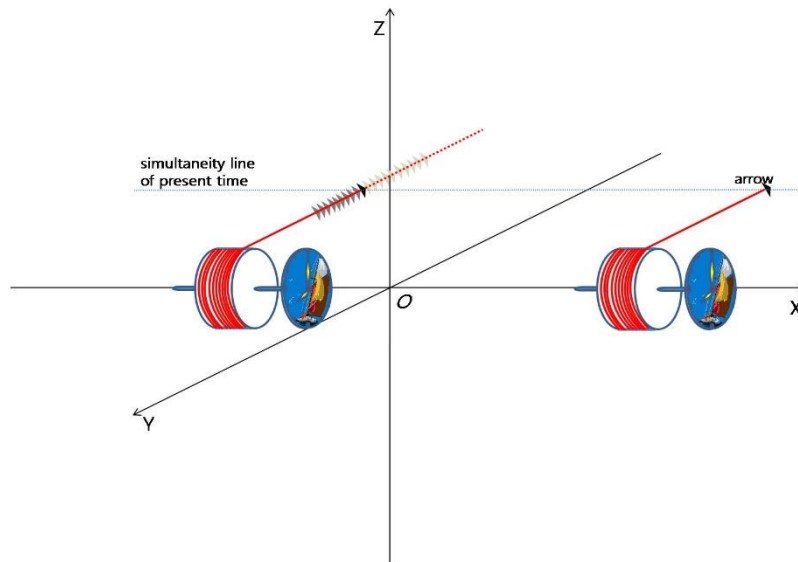


Figure 3. Geometric character of time is represented with an arrow at the end of thread. Footprints imply the foregone and forthcoming the present.

Suppose there is an apple beside the Reel clock. We can compare the variable property of an apple with the clock. It is possible to map each infinitesimal state to the location of arrow. We can infer the location of arrow without any consideration on the speed of light if the length of thread is exhibited on the shaft of the reel. The occurrence of event and observation are simultaneous and thus the mapping can have exact value. A disappeared state can be identified with a footprint. The forthcoming states can be inferred if we have a well-established physical theory that predicts the evolution of an apple correctly. After this, they can be mapped to the expected position of an arrow, when the translation of arrow is predictable with the homogeneity of space along the path.

### **Construction of space and time with pure geometric languages**

We have acquired the geometry of space and time. This can be represented by other method with purely geometry languages. It should be expressed with the correct language of geometry. The essence of geometry is closely related to an existence and location. Geometric approach means that we deal specific abstract concepts with a matter of location. It is absolutely important to define what actually exist in nature and to represent variation legitimately. We need to distinguish what exist in nature from what is in our head. In nature, the 3-d space with an infinitesimal physical state exists. The variation is expressed as the translation of this space to 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 corresponds to this. The rotation and translation of coordinate systems is limited in Figure 1a.

To sum up, Figure 1a expresses nature through geometry. With this structure, matters of existence and location are determined. Figure 1b is acquired by the works of man such as observation and recording. However, we need to keep in mind that this is just a model, not identical to original one. The metaphorical expression in previous section can be rephrased accordingly with more reasonable ones: i) The present surface translates rapidly. ii) The present surface translates to the forward direction. iii) The question itself is paradoxical one. If that means the rotation of simultaneity line or backward translation by artificially method, we suppose this is impossible in this model.

### **Interpretation of recorded geometry**

Once the geometry is completed, it is necessary for us to interpret this 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. If we retrospect the actual situation in nature, the object has changed to this state and the simultaneity line corresponding to this represents what actually exist in the whole universe. The others represent the entities what we remember from observation or what to expect from imagination. From this time, it has passed an interval  $\Delta t$  and then the present becomes  $t_p + \Delta t$ . The simultaneity line has translated to this position and this represents real objects in the whole universe. The other zones represent forgone and forthcoming existence.

Recording represents this circumstance within one geometric frame and thus make it possible for us to observe them all at once. Recording is a human activity to describe the fact that recursion of the present continues forever.

### **In depth analysis of time with its geometry**

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 characteristic of nature, it is possible to infer about nature correctly. We are here at the present and just experience variations with our surroundings. The infinitesimal 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 standstill object in front of you also experiences microscopic changes. Therefore, it is not the same object as the one a second before. Sometimes, we don't realize this fact due to the lack of intuition.

Why the paradoxical aspects of time have distressed us for so long? Above all, we have recognized time with a geometric language. Therefore, we unwittingly identify them together and this has been ingrained in our reasoning process. The lack of our perceptive ability has also contributed to the misunderstanding, especially because of standstill objects surrounding us.

We have used defective language related to time and therefore this demands rigorous alternative

to comprehend it correctly. We have an entity which we are interested in and suppose that it is nature. It is necessary to discover what object exists in this and we realize that this is space. This object is identified as a space, which belong to proper noun. Once we have found the object, it is required to acknowledge the property of this. It has a variable property. This is defined as time, which is abstract noun. Finally, we obtain a statement that a space always varies. The space and time in this correspond to a subject and predicate, respectively. Time is not an object but the property of it. Therefore, we should not use it like a proper noun.

### Fallacy

The true characteristic of nature is understood and the geometric model for this is established. Therefore, it is possible to investigate the validity of this theory with the revised meaning of the present.

This theory is paradoxical[4, 8, 9-11] on many aspects and most of which are resolved with spacetime metric, especially with the relative of simultaneity. This is the last resort that supports this theory deductively. However, this necessarily accompanies inevitable conclusions on some bizarre natural phenomena as apparent without any empirical confirmation. This proposition also causes another paradoxical aspect if we investigate this during unsteady state with diffusion. A new paradox is introduced to justify the old one. This theory predicts non-physical phenomena. Upon recognizing the meaning of the present time and recording, we can understand definitely what the relativity of simultaneity means. Time travel itself is neither logical concept nor physical phenomenon.

It is possible to construct a more specific structure than Figure 1a with the fundamental assumptions. In this construction, the present surface in Figure 1a becomes plane and translates uniformly when we assume homogeneity of space and time. The time coordinate is orthogonal to that of space upon assuming isotropy of space as in Figure 4. An absolute space and time of Newtonian mechanics is originated from these, not from infinite speed as indicated by special relativity[2].

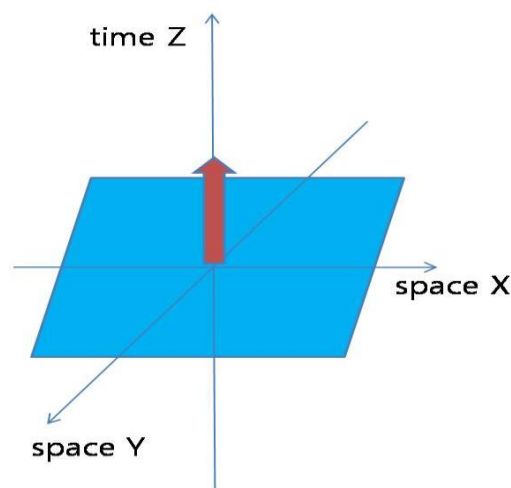


Figure 4. Homogeneity of space and time, isotropy of space determine the geometric structure of present surface more specifically. It is a plane which is translating along the time direction and this is orthogonal to space direction.



From the perspective of formal logic, the structure of this theory is valid but not sound one. The logical consequence of this theory is valid from premise to conclusion. In this theory, conclusion is confirmed empirically but not the premise. This can be understood with Michelson-Morley experiment. In this, the isotropy of interference pattern is proved by experiment. We interpret the conclusion under the assumption that the speed of light is invariant. However, this does not guarantee that the premise itself is proved and thus it is sound one. We cannot ascertain that the spacetime metric is a unique premise for the interpretation of the conclusion. Elliptical polarization of light which is reflected from thin layer can also be used for the interpretation of isotropic pattern and this is more reasonable one. This theory even loses the validity and consistency when we interpret it with the present. It is only valid when it is interpreted with strictly limited propositions.

### **Conclusion**

Space varies. Once we understand this sentence, it is apparent to us what the present means. The essences of space and time are an existence and the variations, respectively. Space and time are a subject and a verb, respectively, in this expression.

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

A fallacy related to the theory of relativity is apparent when we interpret this theory with revised languages. When we establish a physical theory, the fundamental assumptions should be verified fully from empirical foundation and thus its generalization is not doubted. A physical theory should be constructed by this way. We need to answer definitely to ourselves for the two questions: What is proved by experiment? What is inferred from this? If a conclusion is proved and the premise is inferred, this is not legitimate reasoning for the construction of physical theory. It should not be included in formal logic and it can result in a faulty physical theory.

Nature can be expressed with two important factors, space and time. Space always varies. This is the nature.

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