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Original Article

Time Travel – Paradoxes & Solutions (A Never-Ending Debate)

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Abstract - *Science is a highly complex thing; it doesn't have any boundaries or limits. Every time a question was answered, another new question arose from that solution. It is a never-ending process, an answer to a question will be a question to many upcoming answers, and that is how science develops. According to the general English definition, science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. So, it is not defined or limited and is ever-growing and ever-expanding. There may be many questions that science cannot answer, but they will definitely be answered someday. Some of such questions can even turn down entire human life. One of such great question is, "Can we travel through time?". For thousands of years, one of the greatest dreams of humankind has been "to know their future" or "to change their past". For both of these things to happen, there is only one way, and that is TIME TRAVEL, which is being considered a myth or an impossible event by many scientists. But some of the great scientists believed in time travel. They even proposed some theories and possibilities to travel through time. One such great scientist is Stephen Hawkins; he bought a new life to this topic by bringing some interesting phenomena like "Time Dilation" and "Time Bending" into the light. But these phenomena alone may not help us to achieve complete-time travel. But practically, there are some ways to achieve time travel. Some of these practical ways were clearly mentioned in my previous paper titled "Creating a Scientifical Way to Travel through Time", in which a highly successful way to achieve Time Travel is mentioned. But as mentioned initially, one answer is responsible for many questions. Similarly, many questions related to uncertainties, such as paradoxes, were raised after my solution got published. In this paper, I'll try to explain and answer some questions and propose exciting theories that may solve many questions.*

Keywords *– Time travel, Paradox, Uncertainty, Science, Bootstrap, Universal limit, Hypothesis*.

1. Introduction

TIME TRAVEL is an incredible thing which makes everything possible in this world. The human race can be saved from many disasters. Humans can easily achieve any impossible thing. But all these things happen only if TIME TRAVEL is possible. Before all these things, what is TIME. According to physical laws, time is a scalar quantity with an only magnitude but no direction. But time is not limited to this definition; it is mysterious. While most people think of time as a constant, physicist Albert Einstein showed that time is an illusion which can be relative, it can vary for different observers depending on your speed and position. According to Albert Einstein, time is a fourth-dimensional quantity which can control all the other three dimensions of space (length, width and height). Although conventionally, time moves forward, it definitely had a direction. This direction can be altered under specific conditions like gravity and density. This phenomenon is known as time Bending which can be clearly observed around black holes or such heavy-density things. The laws of relativity also proved it. According to this, time bends or slows down near heavy-density objects such as black holes. The minimum bending can also be observed near pyramids and mountains. But going near a black hole to achieve time travel is definitely not an easy task.

Similarly, time can be slowed down when something travels at high speed. This phenomenon is known as Time Dilation. According to this, when an object is nearing the speed of light, its relative time will be slowed down compared to a still observer. According to this phenomenon, the relative time becomes zero, or the aging will be stopped if something achieves the speed of light. But this phenomenon is limited by the "Universal Limit", which objects to the thought of travelling at light speed.

So, these two phenomena individually can-not can achieve Time Travel. But according to my previous paper, time travel can be achieved by mixing these two phenomena. In order to achieve the speed for TIME DILATION, the slingshot technique or any other improved techniques can be used. In order to achieve TIME BENDING, the object can be made to move near a heavy-density object, either a black hole or a neutron star. If the object is made to revolve around a neutron star at high speed, then it may get worked out. But this is not an easy

way, many obstacles may be arised in this way, but if all those are cleared and solved, the final destination, TIME TRAVEL, can be experienced.

But what if Time Travel is achieved? There may be many consequences. Our anxiety may bring many problems to us. It may lead to the destruction of the entire universe. In some cases, it may even lead to the creation of Paradoxes.

In this paper, we are going to see some interesting information about paradoxes and some of my theories which may stand out as an answer to many questions raised in this process.

2. Paradox

According to the definition, a Paradox is a seemingly absurd or contradictory statement or proposition that, when investigated, may prove to be well-founded or accurate. In simple language, it is a true statement which confirms itself as false.

In our context, it can be defined as a result of a change which doesn't allow that change to happen. There are many ways these paradoxes can be created. Some of them are listed below:

2.1. Grand-Father Paradox

This is a special kind of time paradox which gives rise to a 'self-inconsistent solution'. According to this Paradox, if a person somehow created a way to travel through time, travelled to his past, and killed his own grandfather, he is never born and would not have been able to travel through time.

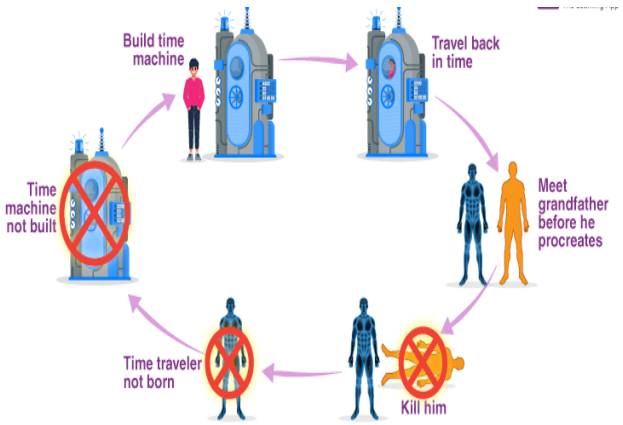

Fig. 1 Representation of Grand-Father Paradox

If no one travelled to the past, then who killed his Grand-Father?

What happened to that person after killing his Grand Father?

This paradox creates many confusing questions like the above.

2.2. Kill Yourself Paradox

This paradox is the most interesting one among all the others. A person somehow managed to travel back through time by carrying a gun. He finds himself as a kid coming out of school. Then he takes the gun and shoots the kid. BOOM. Now, what will happen? The person was killed in the past with a bullet designed for the future before he invented the way to travel through time.

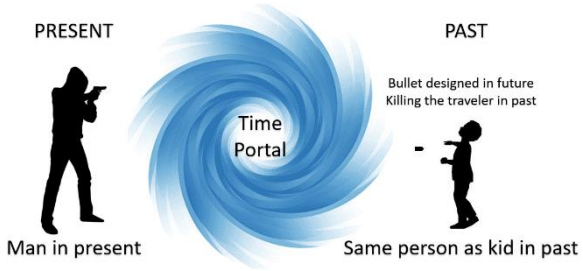

Fig. 2 Representation of the Kill yourself paradox

Then who travelled through time?

How did the bullet designed in future kill a person in the past?

What happened to the person after killing the kid? He should not have existed right. Then what'll happen to him?

2.3. Bootstrap Paradox

A Bootstrap Paradox is a type of paradox in which an object, person, or piece of information is sent back in time, resulting in an infinite loop where the object has no correct origin and exists without any creation. It is also called an Ontological Paradox, as ontology is a branch of philosophy concerned with the nature of being or existence.

For example, you took all the Harry Potter novels and went back in time when JK Rowling didn't even start thinking about Harry Potter. You gave your novels to her and asked her to re-write them so she'll be very famous someday. She did the same and got worldwide fame.

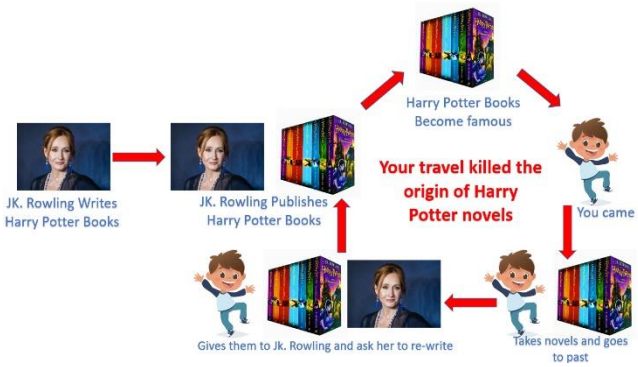

Fig. 3 Representation of Bootstrap paradox

But here arises another question, what is the origin of Harry Potter novels?

Similarly, a young 20-year-old male time traveler who goes back 21 years meets a woman, has an affair, and returns home after three months without knowing that the woman is pregnant. The child born grows up to be the 20-year-old time traveler, who travels back 21 years through time, meets a woman, and this cycle continues. Here rises another infinite loop.

2.4. Pre-Destination Paradox

A Pre-destination Paradox occurs when the actions of a traveler who is traveling back in time become a part of past events, which ultimately causes the event he is trying to prevent. The result of this is a typical 'temporal causality loop' in which Event 1 in the past influences Event 2 in the future (event 2 represents the time to travel to the past), which is responsible for Event 1 occurring.

This circular loop of events ensures that the time traveller does not affect history and that any attempts to stop something from happening in the past will lead to the cause itself instead of stopping it. Pre-destination paradoxes suggest that nothing can be changed in time; things are always destined to turn out in the same way, such that whatever has happened in the past must happen.

For example, your partner died in an accident. You somehow managed to travel to the past and tried to save her by racing to the spot. Eventually, you'll be ended up with the crash killing your partner.

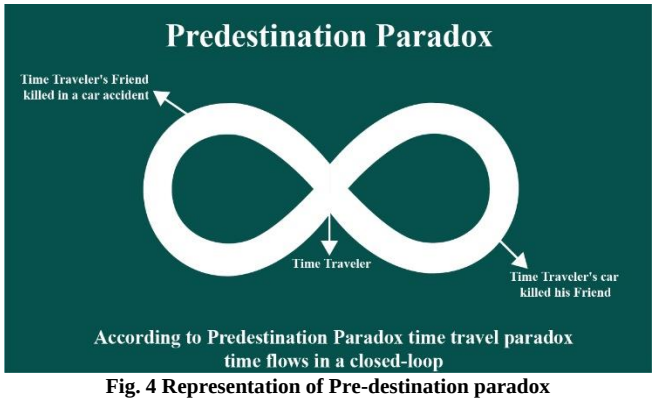

Fig. 4 Representation of Pre-destination paradox

This is a special type of paradox when compared to other paradoxes. While other contradictions raise multiple questions, this paradox stands as a solution for most of them.

3. Related Work (Survey)

Here are some interesting theories and possibilities which may stand out as the solution for some paradoxes.

3.1. Impossibility

Many scientists have declared this Time Travel impossible because of the unsolvable paradoxes it creates. Most of them consider this impossibility as the solution to many questions about this topic.

Of course, this solves many doubts about time travel because it is a big full stop to the topic itself. But according to me, time travel is possible. So, let's discuss about some more theories.

3.2. Self-healing Hypothesis

This is an interesting theory that states that time heals everything. According to this theory, if a person travels back in time and changes something, time will set off another set of events which will cause the present to remain the same.

For example, if someone travels back in time and saves one of his inventions from a fire accident, time will create some other events to destroy the invention. This is how the present will be similar even after his change.

Though this theory successfully answers some of the paradoxes, some major paradoxes, like the "Kill yourself Paradox", cannot be answered exactly by this.

3.3. Multiple World Hypothesis

According to this hypothesis, there will be an infinite number of worlds or timelines. If an event is altered in past by a time traveler, a new timeline is created, resulting from that change.

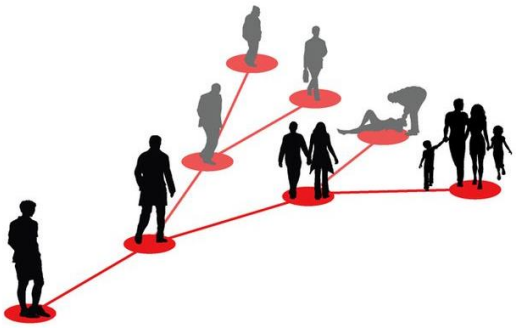

Fig. 5 Picture Representing Multiple World Hypothesis

Though this theory answers some questions, some new ones will be raised. What about the traveler's timeline? What happens to the traveler in his own timeline?

3.4. Travel to the Past is Impossible

This is a widely accepted thing in the case of time travel. Many physicists strongly believe that time travel to the past is impossible because it creates many unsolvable paradoxes. But according to this hypothesis, time travel to the future is possible. Again, it creates some more doubts, can we meet our future selves?

4. Proposed Theories

To answer most of the questions related to time travel and also to find the solution to the paradoxes, a new hypothesis is proposed, which covers all the missing points in the previous solutions (theories).

4.1. Destruction of Multiple Parallel Universes Hypothesis

This hypothesis talks more about destruction. According to this, a timeline is surrounded by 8 parallel universes, each running at different times. A thin barrier separates all these universes. If a person travels through time, he breaks the barrier and enters another universe with a different time (past/future). In order to break that barrier, a lot of energy is needed, which can be achieved by speed.

If a person travels back through time and changes an event, the timeline (universe) he came from gets destroyed and replaced by another new cosmos resulting from that change.

A small change in the past is responsible for the destruction of the entire universe in the present. Suppose a person went back in time and saved his invention from a fire accident. The universe he came from gets destroyed and replaced by another galaxy resulting from that change he created. The newly created universe may be more advanced than his present one, or maybe worse. If the invention he saved helped humankind grow further, the newly replaced universe would be highly advanced. But if that invention is meant for destruction, the newly replaced universe may be a barren land.

Similarly, suppose the traveler harms himself or his grandfather (Grand Father Paradox/Kill yourself paradox). In that case, their universe will be destroyed, and a new universe will be replaced in which no traces of him or his grandfather is present.

Fig. 6 Destruction of Multiple Parallel Universes Hypothesis

But what happens to the traveler?

Here two things can happen. The traveler gets trapped forever in the small gap between time and space. He will be a left-out particle in the unimaginable flow of time.

The other possibility is disappearing. Ideally, he belongs to the universe, which is already destroyed. So, as soon as his universe is destroyed, even he will be disappeared along with that old universe.

I guess this theory solves many paradoxes and questions related to Time Travel. But there are many issues involved, which may turn out to be catastrophes. Destruction of the universe is the destruction of a dimension that may lead to unimaginable catastrophes. The traveler may destroy the layer between time and space.

5. Discussions and Results

The above hypothesis can stand out to be the solution to many questions related to Time Travel. But time travel is highly complex and cannot be achieved easily. With the present technology definitely, it is not possible, but it may be possible in the near future with technological advancements.

This Destruction of Multiple Parallel Universes Hypothesis answers another million-dollar question "If Time Travel is possible in future, why are there no visitors from the future?". There is a straightforward answer to this, even though there are many time travelers among us, they don't want to reveal their identity. If they do that, it leads to many unimaginable things. Their presence may get affected. So, even if there are some visitors from our future, they'll just be observing the events without touching the flow.

In my view, there are time travelers among us. They may be roaming on the roads or travelling by bus with you. But they'll never reveal their identity.

6. Some Interesting Things Related to Time

6.1. Time Bending

According to this concept, time bends or slows down around high-density objects. It means the observer near a heavy-density object can see his surroundings move a little bit faster. This can be merely experienced when we sit beside a pyramid or sit on a mountain. But its extent can be increased by increasing the extent of the high-density objects from mountains or pyramids to black holes or neutron stars.

6.2. Time Dilation

This technique explains how an object experiences abnormal behaviour of relative time when travelling at high speed. Time dilation can be expressed as a mathematical equation which is given below

$$t` = t\sqrt{1 - V^2/c^2}$$

where: t' = dilated time
t = stationary time
V = Velocity
c = Speed of light

Fig. 7 Time Dilation equation

According to this, the relative time of an object purely depends upon its speed. If the object's speed is much less than the speed of light, there won't be any difference in relative time. But when the object is approaching light speed, it starts to experience its relative time getting slowed down. The theory of relativity also accepts this.

But when it is taken to extreme conditions where the object reaches the speed of light (3*10^8 m/s), the relative time of the object stops. It stops aging until it travels at light speed. But what happens if the object reaches more than the speed of light? Then the relative time may get reversed. Here there is a great chance of the formation of "time loops", which may be utilized as "time portals" to travel through. But this is the most controversial assumption, as the whole world accepts a strong objection. That is "THE UNIVERSAL LIMIT". According to this, "traveling faster than the speed of light would violate the causality principle." It may lead to the disintegration of the travelling object into atoms and many unimaginable disasters.

6.3. No Present Hypothesis

It is a simple logical hypothesis. Although it doesn't solve any questions related to time travel, it makes us think about our present. There is nothing like PRESENT. The universe is just travelling from the past to the future.

If this hypothesis is explained mathematically, the past can be represented as integral (-∞ to 0) dx (let's assume the function more simply). -∞ is mentioned as the lower limit because time has no start.

$$\int_{-\infty}^{0} dx$$

Fig. 8 Mathematical representation of PAST

Similarly, the future can be represented as integral (0 to ∞) dx. ∞ It is mentioned as the upper limit because time has no end.

$$\int_{0}^{\infty} dx$$

Fig. 9 Mathematical representation of FUTURE

If these two equations are kept side by side, it can be clearly observed that the present is missing (integral 0 to 0 dx).

Then what is present? The present is a very minimal time between the past and the future. So, it is proved that there is no presence in time.

7. Conclusion

Time travel may be a dream as of now, but once technology improves, it is definitely possible. Many people objected to this time travel, but who thought 50 years that JUNO would achieve such high speed? Who thought that computers could be carried in pockets? So, this may not be possible now, but it is definitely possible in the future with improved technology.

But once time travel is achieved, it may lead to many types of problems. It may also lead to the destruction of humankind. But as history says, "Time heals everything" time is superior; it can heal any kind of destruction created by humanity.

The hypothesis proposed in this paper can solve many questions related to this topic. But as mentioned in the initial stages, science is very typical; many questions will be raised from each proposed solution. But according to an old English quotation, "Time answers everything"; time will answer all the questions.

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