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Plenty of time

John G. Quirk
San Jose State University

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PLENTY OF TIME

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John G. Quirk

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APPROVED FOR THE DEPARTMENT OF PHILOSOPHY

Joseph B. Waterhouse

Dr. Joseph B. Waterhouse

Richard L. Tieszen

Dr. Richard L. Tieszen

Tom Teddy

Dr. Thomas Leddy

APPROVED FOR THE UNIVERSITY

Joseph J. Pesek

ABSTRACT

PLENTY OF TIME

By John G. Quirk

J.M.E. McTaggart claims to have shown that time is unreal by means of two arguments. Both arguments are premised on the idea that time necessarily involves change. His first argument is that the events of past, present, and future, never change among themselves, and so the changing nature of time must involve change in relation to something outside of time, which is impossible. His second argument is that the idea of changing time involves a contradiction, since all events have the inconsistent terms past, present, and future applicable to them at once.

McTaggart's first argument assumes a future that does not come into existence, an assumption which can be disputed. His second argument does not consider the transitive relations between past, present, and future. Inconsistent terms can be applied to things that are in a transitive relation to each other without contradiction.

INTRODUCTION

Foundational for contemporary philosophical debates about time are the arguments of J.M.E. McTaggart for the unreality of time. Notably, one of his arguments has been adopted, and recast, by D.H. Mellor. The difference between the views of these two philosophers is that McTaggart believes that he demonstrates the unreality of time entirely, whereas Mellor holds that McTaggart has only shown the unreality of a changing, dynamic time, leaving an unchanging, static view of time intact.[1] The purpose of this paper is to try to show that McTaggart has shown neither.

It should be emphasized at the onset that there will be no attempt here to demonstrate the reality of time entirely, or dynamic time particularly, in any conclusive way. In order to do so, every serious argument that has been made in this area, and every conceivable argument, would have to be addressed. Instead, the more modest task of refuting McTaggart's arguments for the unreality of time (or, at least, dynamic time) will be attempted. Hopefully, this limited enquiry will prove fruitful enough for the purposes at hand.

I: McTAGGART'S TWO ARGUMENTS FOR THE UNREALITY OF TIME

(A): The "A" Time Series and "B" Time Series

For McTaggart, there are two different ways of thinking about time. The first way is to think of time in terms of past, present, and future. Every event moves through each of these designations. For example, the assassination of John Kennedy is past. But on November 22, 1963 it was present, and prior to that date it was future. McTaggart calls the time series that consists of past, present, and future, the A series.

The second way to think of time is in terms of earlier and later. The assassination of John Kennedy was earlier than Operation Desert Storm, but later than the Allied invasion of Normandy. McTaggart calls the time series that consists of earlier and later the B series.

An important distinction that McTaggart makes between the A series and the B series is the changing nature of the A series, and the unchanging nature of the B series. An event that is future becomes present and then past. In 1962 the assassination of John Kennedy was future, became present on November 22, 1963, and is now past. But an event X is always earlier (or later) than event Y. The assassination of John Kennedy is always earlier than Opera-

tion Desert Storm, and later than the Allied invasion of Normandy.[2]

(B): The "A" Series and the Reality of Time

It is McTaggart's view that the A series is essential to the reality of time. So, according to McTaggart, if the A series can be shown to be unreal, time itself will be shown to be unreal.

McTaggart's line of reasoning begins with the premise that time involves change. But, he argues, change is not possible without the A series. Change cannot happen with the B series alone because of the unchanging relations between events in the B series. The Kennedy Assassination is earlier than Operation Desert Storm, always will be so, and, on McTaggart's view, always has been so.

Moreover, events themselves cannot change. They permanently remain where they are on the B timeline. And an event cannot change into another event, since the distinction between any two events shows that they remain distinct. Events that can be referred to are separate from other events that can be referred to, and there is no transition point that is not itself an event where one event changes into another.

Now, since an event can neither cease to be an event,

nor change into another event, it appears that the only way an event can change is in terms of its being past, present, or future, that is, in terms of the A series. The Kennedy Assassination maintains a fixed relation to all other events; it always takes place in Dallas, it is always effected by sniper fire, it precedes the inauguration of Lyndon Johnson, and so on. But in one respect the event does undergo change. Once the event was in the future, then became present, and now recedes further and further into the past.[3]

McTaggart thus makes his demonstration that time depends on the A series. If his reasoning is sound, it follows that if there is no A series, there is no time. And so, McTaggart attempts to show that there is no A series.

(C): McTaggart's First Argument for the Unreality of Time

McTaggart begins his first argument for the unreality of time by pointing out that the terms past, present, and future are relational terms. Anything that is past, present, or future, he points out, must be such in relation to something else. But, he says, this something else must be something outside of the A series. This is because, on the one hand, the relations of the A series are constantly changing as events change from being future to present to

past, and, on the other hand, the relations between past, present, and future themselves never change.

An event in the A series, say, the Kennedy assassination, was future before November 22, 1963, became present on that date, and is now past. And so, the event changed from being future, to being present, and, finally, to being past. But the relation of the Kennedy assassination to Operation Desert Storm is permanent. Operation Desert Storm is always in the future of the Kennedy assassination, and ever shall be. But if an event does not change its status as past, present, and future in relation to other events, in relation to what does it change its status? It must be in relation to something outside of the time series. But there is nothing outside of the time series.[4]

The existence of some sort of reference point outside of the time series seems, to McTaggart, to be an incoherent proposition. But if this is so, then the notion of an A series becomes equally incoherent, since there can be no changing relation to make the A series applicable to anything in reality.

(D): McTaggart's Second Argument for the Unreality of Time

Every event must be either past, present, or future. These terms are exclusive. If an event is past, then it

cannot be either present or future. And this exclusivity is necessary in order for there to be change, because, as has been explained, in McTaggart's system, the only way there can be change is by an event moving from future to past.

But McTaggart sees a problem in this incompatibility between past, present, and future. This is because although the terms past, present, and future are incompatible, every event has each of the terms applicable to it at once. If an event is present, for example, it was future, and will be past. Similarly, if an event is future, it will be present and past. And if an event is past, it was future and present.[5]

What McTaggart sees in this is a contradiction. On the one hand, an event can only be designated past, present, or future, to the exclusion of the other designations. On the other hand, all three designations are applicable to every event.

Initially, it might be difficult to see a contradiction here. Where is the contradiction in an event that is present, was future, and will be past? An event that we consider present is not future and past at the same time. Do not the verb forms is, was, and will be belie the notion

of a contradiction?

McTaggart's response is that one can see the contradiction only by looking closely at what we mean when we say that an event is, for example, past, was present, and was future. The Kennedy assassination is past, and was present and future. By this we mean that that the event is past at a moment of present time, is present at a moment of past time, and is future at a moment of still further past time. And thus the event has all three incompatible designations at once. The verb forms that indicate tense (i.e. <u>is</u>, <u>was</u>, and <u>will be</u>) actually do nothing to remove the contradiction.[6]

McTaggart's argument is not easy to grasp. But the temptation to be dismissive should be avoided. Mellor restates the argument utilizing a kind of subject-predicate symbol structure that shows that, whatever we might otherwise think of McTaggart's argument, it cannot be simply dismissed as sophomoric sophistry.

Let us designate a given event by 'e'. To this symbol we add the predicates P, N, and F to designate past, present, and future respectively. So

(1) Pe $\models$ ~Ne & ~Fe, Ne $\models$ ~Pe & ~Fe, and Fe $\models$ ~Pe & ~Ne.

But, McTaggart argues, every event has the designa-

tions of past, present, and future at once, hence:

(2) Pe & Ne & Fe.

Now (1) and (2) are clearly contradictory. But, it will be argued, there is no real contradiction, since no event is properly assigned P, N, and F (or any two of them) at once. If e is present than it was future and will be past, that is,

(3) FPe & Ne & PFe.

and there is no contradiction between (1) and (3).

But McTaggart's response is, in essence, that by simply adding another predicate term all that is accomplished is raising the contradictions to a new level. Whatever has any simple (one predicate) tense, also has it now, so Pe $\models$ NPe, Ne $\models$ NNe, and Fe $\models$ NFe. Also, whatever is past <u>was</u> present and <u>was</u> future, and whatever is future <u>will be</u> present and <u>will be</u> past, hence: Pe $\models$ PNe & PFe, and Fe $\models$ FNe & FPe. Moreover, an event that is sufficiently past was past, and an event that is sufficiently future will be future, hence: PPe and FFe.

As a result we now have nine compound tenses instead of the original three simple ones: PP, PN, PF, NP, NN, NF, FP, FN, and FF. And because tense is constantly changing, any event that has any of these compound tenses must have

them all.

But some of these compound tenses are incompatible. Take FF and PP, for example. These are incompatible, since what will be future cannot also have been past. NP, NN, and NF are obviously incompatible, since what is past cannot also be present or future. Moreover, this last example is actually the equivalent of the one predicate P, N, and F. The same result will follow if we add a third predicate (e.g., "is now past" or NNP). And this process continues, ad infinitum.[7]

Thus, for McTaggart, the A series necessarily involves a contradiction. Belief in the A series commits one to the position that an event has only one of the designations of past, present, or future, and yet has them all. In this way, McTaggart purports to have shown that the A series cannot exist and that, therefore, time does not exist.

II. RESPONSES TO McTAGGART'S TWO ARGUMENTS

(A): McTaggart's First Argument

McTaggart's position that change, if there is any, must be with reference to something outside of the time series is based on the premise that the relations between members of the time-series cannot change. For McTaggart, the relations of past, present, and future themselves are

fixed.

But this assertion assumes something about the nature of time itself. If the relations of the A series are fixed, then there can be no change of any kind between the past, the present, and the future. It follows from this that past, present, and future maintain a permanent ontological status. For if past, present, or future were to come into existence, or go out of existence, then the relations of the A series would not be fixed, because such would constitute a change in the relations between the members of the time series.

But let us assume the truth of the common perception that the future comes into existence. Now we have a change that occurs within the time series itself, and there is no need to posit something outside of the time series as a reference point. In this scenario, change occurs constantly within the time series as more and more future is added to it. So it appears that in order to accept McTaggart's first argument one must also accept his assumption about the ontological status of the future. But that assumption is disputable.

(B): McTaggart's Second Argument

One might be strong in relation to an infant, but weak

in relation to the heavyweight boxing champion of the world. Similarly, one might be short in relation to a center in the National Basketball Association, and tall in relation to a child. There is no contradiction here, because weak and strong, tall and short are transitive terms.

Now McTaggart takes the position that the terms past, present, and future, designate relations.[8] It follows that an event Y can be future in relation to event X, past in relation to event Z, and present in relation to, say, Y^2. There is no contradiction because the terms involved are transitive.

Notice that it is not necessary to add predicates indefinitely in order to accomplish this. McTaggart's point is that we will accomplish nothing if we say that an event is, for example, past at a moment of present time, present at a moment of past time, and future at a moment of past time. This is because, he says, we cannot rid ourselves of the contradiction by increasing the predicates.

But if we recognize temporal predicates as transitive terms, the contradiction disappears. The future is such in relation to a moment referred to as the present. The same is to be said for the past. There is no more contradiction in referring to the future or the past than there is in re-

ferring to one's son or father. One can be a son in relation to his father, and a father in relation to his son. The different predicates are applicable to him without contradiction because of the relationships he has with the individuals involved. Similarly there is no contradiction in referring to the Kennedy assassination as past simply because that event is future in relation to the Civil War. Thus, there is no contradiction inherent in ascribing the terms past, present, and future to events.

III. DEFENSES OF McTAGGART

(A): Michael Dummett's Defense of McTaggart

Michael Dummett insists that what has just been said about past, present, and future being transitive terms ignores something essential about McTaggart's argument. Specifically, Dummett says, McTaggart impliedly assumes that there must be an observer-independent description of everything in reality. Since there is no way to talk about time except within it, there is no way to discuss it from the outside, as it were, and, hence, no way to give it an observer-independent description. For this reason, time is unreal according to Dummett's rendition of McTaggart's argument. Thus, Dummett says, anyone who wishes to refute McTaggart must first dispense with the notion that anything

that is real must be susceptible of an observer-independent description.[9]

McTaggart's two arguments are (1) any change that exists, which is necessary for time to be real, can only be with reference to something that is outside of time, which is impossible, and (2) the assertion of the reality of time leads to a contradiction. One can assert these arguments, and also assert that it is not the case that anything that is real must be susceptible of an observer-independent description, without contradiction. So one cannot be confident that McTaggart makes the assumption that Dummett assigns to him, since nothing he says necessitates such an assumption.

Moreover, there is no reason to take it for granted that anything that is real must be susceptible of an observer-independent description. Dummett does not, in his defense of McTaggart, explain why we should. He only says that he personally feels strongly that such a description is necessary, and that the belief that such a description is necessary is a prejudice that lies deep in many people.[10] But for those who experience no such prejudice, it is difficult indeed to connect the dots between "something is real" and "that thing must be susceptible of an observer-

independent description." If there is a hidden enthymeme involved here, Dummett should make it explicit.

(B): D.H. Mellor's Restatement Of McTaggart's Second Argument

Mellor believes that he has found a way to recast McTaggart's second argument so as to make it unassailable. What he says is, essentially, this. Tokens of a proposition about the pastness, presentness, or futurity of an event will have different truth values at different times. For example, the statement "e is past" will be true after the event, and false before it. Given this obvious fact, the truth value of the token at any time is not necessarily the truth value of the proposition at that time. Otherwise one's death tomorrow will verify an announcement of it yesterday.

Here, Mellor says, we uncover a formulation of McTaggart's contradiction that allows no riposte. Since the truth value of a token of "e is past" is not necessarily the truth value of the proposition at that time, it follows, he says, that the proposition cannot be describing anything real. This is because the tokens appearing earlier than e would have to be both true and false.[11]

But why is it necessary that the tokens of the proposition "e is past" share their truth value at all times in

order for the proposition to be describing something real at any time? Mellor accepts as a true statement that the truth value of a token of any proposition is the truth value the proposition has for whoever produces the token at the place and time they do so.[12] If we apply this statement to the proposition "e is past," we arrive at the unsurprising result that a token of the proposition will be false before the event, and another such token will be true after the event.

(C): Mellor: The "A" Series is Not Necessary

But, according to Mellor, the reason why "e is past" is false at time x and true at time y is because x is earlier than e and y is later than e. The terminology of the A series does not need to be used, and is, hence, irrelevant. Indeed, he says, the terminology of the A series is inadequate to make the proposition "e is past" either true or false. Since the terminology of the A series is designed to do just that, the terminology of the A series does not describe anything about reality.[13]

The response is this. First of all, it does not follow from the assertion that the terms of the A series are not necessary that they are irrelevant or do not describe anything about reality. Of course, they are not necessary

if they are irrelevant or do not describe anything about reality. But to recast the argument that way would be question begging.

Secondly, Mellor's argument does not take account of the fact that the terms of the A series are transitive terms. One can dispense with B series terms, and discover the truth of "e is past" perfectly well. A token of the proposition is false at x and true at y because x is more past than e and y is less past than e. If Mellor wants to insist that we use only B series terms in this connection, he will have to somehow dispense with the idea that past, present, and future are transitive terms.

(D): B Series in A Series' Clothing?

Let us consider an argument like the following. To insist that the A terms are transitive is to concede that one can only save the A series by subtly ascribing to it a B series nature. The A series terms thus become no more than alternative ways of describing the terms of the B series, and the A series has not been saved at all.

But the distinction between the A series and the B series is not that one has transitive terms and the other does not. The distinction is that the A series entails change, whereas the B series does not. There is nothing

about the A series that requires that its terms be something other than transitive.

The point that the aspect of change does not deprive the terms of the A series of their transitive nature can, perhaps, be best put by means of an illustration. One's great-grandfather was a son of his great-great-grandfather. But when his grandfather was born his great-grandfather became a father. Similarly, his grandfather was a son. But when his father was born, his grandfather became a father. Here is an example of a set that is both transitive and changing. In the same way the terms of the A series are both transitive and involve change, and there is nothing inconsistent about it.

(E): A Growing "B" World?

Of course, if the future comes into existence in terms of the A series, then McTaggart's conception of the B series is impacted. Essential to McTaggart's idea of the B series is that it is changeless. But it is apparent that if the future comes into existence, then this must be true in terms of both the A and the B series. And if this is so, then the B series must involve change as well, in exactly the same way as the A series does. But does that make sense? Mellor, who follows McTaggart in denying the

reality of the A series, but affirms the existence of the B series, rejects the possibility of a B series that develops into the future. His argument is as follows.

To say that events exist at some B times and not at others cannot, Mellor says, mean simply that they are located at certain B times. If so, this would mean that events only exist when they are present. But the argument that Mellor wants to refute must affirm events that exist later than the point on which they are plotted on the B timeline. Now if the B location of an event has nothing to do with its existence, it is nonsense to say that an event exists at one B location and not at another.[14]

One obvious response is to assert that events only do exist at the points they are plotted on the B timeline, and this will topple the argument at its foundation. But to do so might not be entirely fair, since Mellor is not really trying to address such a position.

But let us propose in reply that an event does not exist at earlier B locations and does exist at its own and later B locations. Mellor's riposte is that we are confusing the proposition of an event's existence with its tokens, since the token a of the proposition 'e exists' cannot be false at a B location earlier than e, yet become

true after the event e. One's death does not make true all premature announcements of it.[15]

The response to this riposte is that Mellor is, in fact, guilty of confusing the proposition with its tokens. Mellor accepts as a true statement that the truth value of a token of any proposition is the truth value the proposition has for whoever produces the token at the place and time they do so.[16] Applying this to the present discussion we can arrive at the (again) unsurprising conclusion that a token affirming an event's existence is false at B locations earlier than the event, and that other tokens of the same proposition are true at the B location of the event and at B locations later than the event.

IV. SPECIAL RELATIVITY AND A FUTURE THAT COMES INTO EXISTENCE

Mellor also claims that the idea of a growing B world is inconsistent with Special Relativity because he believes that a growing B world links the present, and, therefore, simultaneity, to existence.[17] But simultaneity is relative in Special Relativity, which it cannot be if it is to be linked to existence. Thus, Mellor says, a growing B world requires an absolute simultaneity, which is contrary to Special Relativity. In saying this Mellor joins with a number of philosophers who hold that special relativity

conclusively refutes any idea involving a past, present, and future that do not have the same ontological status.[18]

It will be shown in what follows that the idea of a future that comes into existence is quite consistent with Special Relativity. Specifically, it will be shown that the idea of a future that comes into existence is not at all rendered impossible by the relativity of simultaneity.

(A): The Geometry of Spacetime

Special relativity is most famous for its idea that temporal measurement is relative to the state of motion of the observer. So, too, is spatial measurement. But special relativity also involves an absolute measurement that is the same for all observers. That measurement is the spacetime interval.[19]

Temporal measurements are made between such things as seconds or minutes. Spatial measurements are made between two points in space, such as a surveyor's measurement between two stakes. But measurements of a spacetime interval are between events, such as particles colliding, or a lightning strike.[20]

The process of determining the interval begins with converting temporal units to spatial units, from seconds to meters. This is accomplished by multiplying the speed of

light by the square of the temporal separation between the events. The product is the temporal separation measured in spatial units.

After this, the spatial separation is squared and subtracted from the product of the speed of light and the square of the temporal separation. The difference is the square of the interval. All of this is expressed algebraically as

$$i^2 = ct^2 - s^2$$

where "i" is the spacetime interval, "c" is the speed of light, "t" is the temporal separation, and "s" is the spatial separation.[21]

Now i^2 cannot be a negative number. So what happens if ct^2 is less than s^2? The terms on the right side of the equation are reversed this way: $i^2 = s^2 - ct^2$. Wherever ct^2 is greater than s^2, the interval is called a timelike interval. Where s^2 is greater than ct^2, the interval is called a spacelike interval. And where the two terms are equal, the interval is called a lightlike interval.[22] It should be emphasized that regardless of whether an interval between two events is timelike, spacelike, or lightlike, the interval between those two events is the same throughout the universe, from the standpoint of every reference frame. Space

and time measurements are relative, but the interval is not.

The invariance of the spacetime interval shows that time cannot be separated from space. Space and time are both part of a single entity called "spacetime."[23] When space and time are combined into spacetime, a fourth dimension is added: the dimension of time. The equation for the interval utilizes all four dimensions, "s" representing the three spatial dimensions, and "t" representing the temporal dimension. For this reason, the geometry of spacetime is said to be four-dimensional.[24]

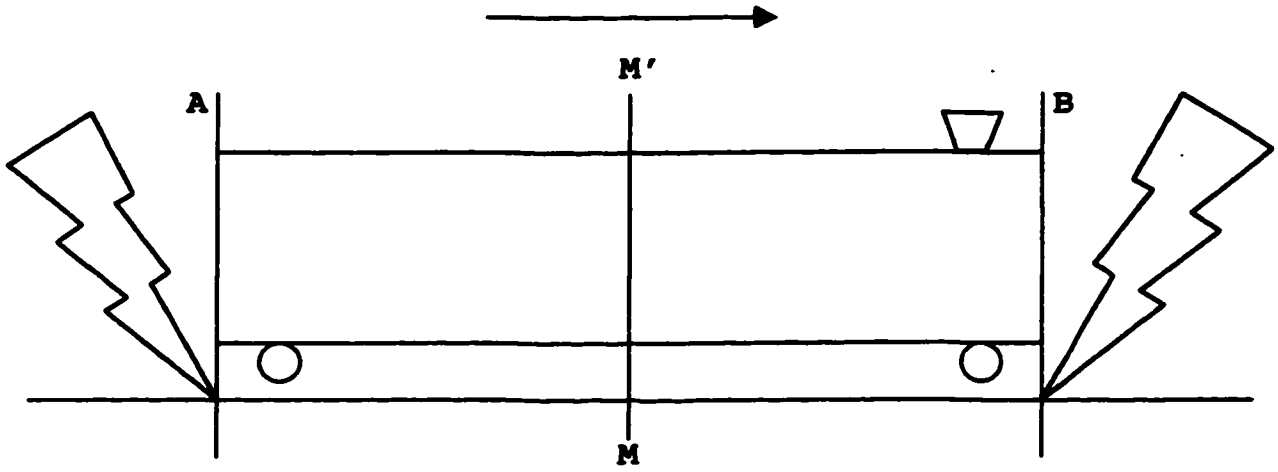
But it is important to point out that special relativity does not spatialize time. Time is not treated as if it was a fourth spatial dimension. This lack of identity between space and time is clearly seen in the formula for calculating the spacetime interval. The time and space terms of the equation are not interchangeable; they must always be separate.[25] Spacetime does not spatialize time any more than it temporalizes space.

(B): <u>The Relativity of Simultaneity</u>

The classic explanation of the relativity of simultaneity is Einstein's. His illustration is as follows.

Imagine a very long train traveling along the tracks

with a constant velocity and in the direction indicated in this figure:



People in this train regard all events in reference to the train. People standing on the embankment will, of course, regard all events in reference to the embankment. Regarding this situation, Einstein considers whether two strokes of lightning at A and B which are simultaneous relative to the embankment are also simultaneous relative to the train.[26] Einstein says "no." By "simultaneous" Einstein means that the rays of light emitted from the lightning strikes will meet at the midpoint, M, on the embankment.[27]

Now notice that there are corresponding points of A and B on the train, as well as a midpoint, M'. We will consider a person standing on the embankment at M, and a

person sitting on the train at M'. If the train remains stationary, then the light from the lightning strikes at A and B will reach M and M' in such a way that the people stationed at each will agree that the lightning strikes occurred simultaneously.

But now let us put the train in motion in the indicated direction. In this situation the person on the ground will still experience the lightning strikes as simultaneous. The person on the train, on the other hand, will be moving in the direction of the lightning strike at B, and the light from B will reach this person before the light from the lightning strike at A does. The person on the train, then, will conclude that the lightning strike at B occurred before the lightning strike at A.[28] Einstein concludes that since the lightning strikes are simultaneous relative to the embankment, and not so relative to the train, every reference frame has its own particular time, and any statement about the time of an event is meaningless unless we know the reference frame to which the statement refers.[29]

At first blush this may seem to be a rather odd conclusion to derive from such a commonplace observation. What makes Einstein's conclusion make sense is the invari-

ance of the speed of light.

Special relativity was developed in order to deal with a problem that was presented by the speed of light. The problem was this: the speed of light in a vacuum is the same (about 300,000 kilometers per second) regardless of the reference frame of the observer.

Let us envision an automobile traveling at 30 miles per hour on a road that is parallel to a railroad track. A train is traveling along the track at 60 miles per hour, in the same direction as the automobile. From the standpoint of a person standing on the ground, the speeds of the automobile and train are as described. From the standpoint of a person in the car, the train is traveling at 30 miles per hour, and the person on the ground is traveling at 30 miles per hour in the opposite direction. From the standpoint of a person on the train, the automobile is traveling in the opposite direction at 30 miles per hour, and the person on the ground is traveling in the opposite direction at 60 miles per hour.

Now let us imagine a beam of light that is sent along a path parallel to the road and track. For our purposes we will imagine that all of the air has been removed so that the beam of light can travel in a vacuum. Suddenly, the

neat symmetry of relative speeds that has been described disappears. The person on the ground, and those in the automobile and train will all observe the light beam traveling at the same speed.[30]

This seemingly odd circumstance is what Einstein sought to explain in developing his theory of special relativity. His conclusion was that since the speed of light is not relative to one's point of reference, the passage of time must be. Why this must be so can be seen by considering the laws of motion that were discovered by Galileo.

Galileo's laws tell us that the distance an object travels is equal to its average velocity during the journey multiplied by the time that the journey takes. Algebraically this is expressed as $d=vt$. It follows from this that the average velocity is equal to the distance traveled divided by the time ($v=d/t$), and that the time equals the distance divided by the velocity ($t=d/v$).

Now if these relationships hold, our person on the ground, and those in the automobile and train will all agree on the amount of time that passes, but disagree as to the relative velocities and distances. But the invariance of the speed of light enters the picture, and suddenly it becomes apparent that it is the velocity that must become

the fixed number. As a result, the time that passes for each observer, depending on the motion for each, must be variable.[31]

With this in mind, the concept of the relativity of simultaneity becomes clear. A person on the railway embankment and a person on the train will both measure the same speed of light. As a result, the only available explanation for the fact that only one of them will observe the lightning flashes as simultaneous is that the measurement of time for each is different.

Now there are some who, along with Mellor, maintain that the relativity of simultaneity entails a future that has a determinate existence, i.e., a future that does not come into existence. The argument runs, in various forms, this way:

To utilize the train example, consider a person standing on the embankment who observes the lightning flashes as simultaneous. From this person's standpoint, as he observes the person on the train, he will observe that the light from the flash at A has not yet reached the person sitting at M' on the train. Thus, for the person on the train, the flash from A lies in his future. But it is present for the person on the embankment. How, then, the ar-

gument goes, can the future be said to lack a determinate existence when the future of M′ is being experienced as present at M?[32]

But this argument only considers the scenario from a particular perspective. Certainly, the future of M′ is being experienced at M, and so to that extent the future of M′ is determinate and has a real existence no less than the present. What this means is that there are coordinates in spacetime at which the event of the lightning strike may be plotted, based on the perception of some theoretical observer, in this case the observer at M, although it lies in the future of another observer, in this case the observer at M′.

But let us consider the perspective of someone standing at A. (We will, of course, have to imagine this person as being impervious to lightning.) When the lightning strikes at A, the flash of lightning is in the present of A. But this time there are no coordinates of spacetime, other than those of A, where the lightning flash can be plotted based on the perception of a theoretical observer. The lightning flash, then, has an origin at the spatiotemporal coordinates of A, and comes into existence at those spacetime coordinates. It follows that the lightning flash

has no determinate existence in any reference frame other than A at the point that the lightning strike occurs at A. Moreover, moments before the flash occurs in A's reference frame (moments before, that is, according to A's reference frame) there are no coordinates at which the flash can be plotted; no interval can be calculated pertaining to the lightning flash.

Thus, special relativity does not necessitate a determinate future. The future becomes to some extent determined once an event comes into existence at a point of spatiotemporal coordinates. But if an event cannot be plotted at any spacetime coordinates it is difficult to see how it can be confidently said to have a determinate existence. And it has just been demonstrated that an event can occur in a reference frame which prior to the moment of its occurrence (that is, "prior to" in relation to the reference frame) cannot be plotted at any spacetime coordinates.

Now simultaneity continues to be relative to reference frames notwithstanding what has been shown. Returning to our train example, the lightning flash is present at A, yet is future at M and M'. The flash from A is simultaneous with the flash from B at M, but not at M'. The relativity of simultaneity remains intact notwithstanding the fact

that the lightning flash comes into existence, in the manner previously described, at A.

Of course, there is a relationship between events that is absolute, and that is the spacetime interval. As previously explained, the relationship between any two events is timelike, lightlike, or spacelike. At the moment of the lightning strike at A, there is a spacelike separation between the lightning flash and M. When the flash reaches an observer at M there is a lightlike separation. After the flash has been observed at M there is a timelike separation. All of these separations can be calculated as an interval. But before the lightning strike is experienced at A there is no interval at all between the lightning strike at A and its observation at M or M'.

Thus we see that the coming into existence of an event does not affect the relativity of simultaneity in the slightest. Any event will have a spacelike, lightlike, or timelike separation from another event that has come into existence at the coordinates of origin. There will be a spacetime interval that can be calculated between the two events. But no event can have any kind of separation from an event that has not come into existence at the point of origin, and there can be no interval between them.

II. Region III consists of events that cannot affect or be affected by O. Every event that can be plotted in Region I or Region II is at a timelike separation from O. Every event that can be plotted in Region III is at a spacelike separation from O. Every event that can be plotted on line A, B, C, or D is at a lightlike separation from O.[33]

Now let us return to the lightning strike at A along the railway. On the Minkowski diagram the lightning strike occurs at O. Both the observer on the train and the observer on the embankment are in the absolute future of the lightning flash. Simultaneity is, of course, relative, since the flash at A is simultaneous with the flash at B relative to the observer at M on the embankment, but is not so relative to the observer at M' on the train. But a ray of light emanating from the lightning flash at A (O on the Minkowski diagram) has a point of origin at A. Once the lightning strike occurs at A the ray will begin to outline a border between Regions I and III. But prior (relative to A) to the lightning strike at A, O cannot be plotted regarding the event on the Minkowski diagram, except hypothetically. Using the terms of the proverbial expression, there is no "there" there.

Now each event occurs at certain spatiotemporal coor-

dinates. And as we have seen, every event has a spatiotemporal point of origin. One of those coordinates is the temporal coordinate. It thus appears that there is a good basis for claiming that the future comes into existence at the temporal coordinate of an event's point of origin. One may want to insist that the temporal coordinate has a kind of existence although no hypothetical observer can witness an event there. But such a bald insistence hardly shows that the idea of a future that comes into existence is inconsistent with Special Relativity.

CONCLUSION

McTaggart claims to have shown that time is unreal by means of two arguments. His arguments, however, do not withstand scrutiny. His first argument assumes a future that does not come into existence, an assumption which can be disputed. His second argument does not consider the transitive relations between past, present, and future.

Dummett tries to defend McTaggart by saying that anyone who wishes to refute McTaggart must somehow dispense with the idea that anything that is real is capable of being described in an observer-independent manner. But there is nothing in McTaggart's reasoning that makes this idea of reality a necessary premise. Moreover, Dummett gives us no

reason to accept the idea.

Mellor tries to defend McTaggart by saying that the affirmation of the A series is to confuse propositions and tokens. But by Mellor's own definition of the truth of any token, there does not appear to be any reason why one token of a proposition cannot be false at one point on the time-line while another token of the same proposition is true at another point along the timeline.

Mellor also tries to make three other points that are relevant to his defense of McTaggart. The first is that the A series is not necessary for making temporal descriptions. But it has been shown that the terms of the B series can be dispensed with for this purpose as easily as the terms of the A series.

The second point is that the idea of a growing B world, which would have to be a reality if the future comes into existence, is incoherent. Here, again, Mellor utilizes his proposition-token argument, and the response to that argument is the same.

The third point is that the idea of a growing B world is inconsistent with Special Relativity, because the idea of a growing B world necessitates an absolute simultaneity. The response is that all the idea of a growing B world re-

quires, and any future that comes into existence requires, is an absolute spacetime interval. But an absolute spacetime interval happens to be a feature of Special Relativity.

This paper has also dealt with a possible objection that treating the terms of the A series as transitive is to ascribe a characteristic to those terms that are proper only to the terms of the B series. The response is that the distinction between the A series and the B series, as defined by McTaggart, is not that the terms of one are transitive and that the terms of the other are not, but that the A series involves change and the B series does not. Moreover, there is no inconsistency in viewing the terms of a changing time series as transitive as can be seen by considering developing generations and the transitive terms applied to the persons making them up.

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