The Philosophy of Time and Time Travel

Introduction to Philosophy – Professor Wilson

Is Time Travel Possible? *Yes and No*. The answer depends on at least two things:

(1) ***What Is Meant by "Time Travel"***:

We've all seen movies like "Back to the Future" and "Terminator", and so we all have some sense of what time travel *is*. However, there are different senses in which one might "travel through time"; so it's critical to give "time travel" a precise definition. Also, even given such a definition, there are different ways one might travel through time; and so different kinds of kinds of time travel must be distinguished. The type commonly shown in popular films might be impossible; but other kinds might be possible.

Whether time travel is possible depends also very heavily upon *the nature of time* itself. That is, it depends on:

(2) ***The Metaphysics of Time***:

"Metaphysics" is the philosophical study of the fundamental nature of reality, or of *what there is*. By the "metaphysics of time" we mean questions about the fundamental nature of time, and whether or what sense *time is real*. Some philosophers have argued that time is not real. Other philosophers have argued that reality itself is dependent on time (i.e., that nothing can be real without being temporal). Still other philosophers have argued that *only the present moment is real* or exists. Before we look specifically at time travel, we should focus on (2): *the Metaphysics of Time*.

Section 1: The Metaphysics of Time

What is time? "Time" is a notoriously difficult concept to define. The Philosopher-theologian Saint Augustine is famous for saying: *"What then is time? If no one asks me, I know: if I wish to explain it to one that asketh, I know not"*. The science fiction author Ray Cummings once jokingly defined time as "what keeps everything from happening at once". This might be true, but it is also unhelpful.

First, let us consider the common idea that time is something that *flows* or *moves*.

This seems true. But in exactly what sense does time flow or move? It cannot move in the same sense that we or other material objects move. In order for an object to move, it has to move *with respect to something else*. As Newton showed, all motion is relative. In order for you to be moving, you have to be moving with respect to, say, another person (as you walk by a person), a building (as you pass the building), or the Earth (you move from one point on the Earth to a

different point on the Earth). But with respect to what could *time* itself possibly be moving? It could be moving with respect to some other dimension of reality; but we have no idea what that could be.

One might say that time is moving only in the sense that the *present moment* is, at each moment, a *different* moment. What we call the *present* moment, or "now", always seems different from one to the next. But how, or in what sense, do moments change? It could just be that *we are changing*, going from one moment to the next, rather than that moments themselves are changing.

But even this account of how time flows or changes has problems. That we are moving from one moment to the next presumes that *something is moving us*. But what is that? What exactly is pushing us from one moment to the next? Whatever that is, it seems impossible to avoid it. Further, that we are constantly moving from one moment to the next assumes that *each moment*, like each section of a road we might drive on, *exists*, and we are simply moving from one to other.

But is this right? Does every moment of time exist? Since we distinguish between the *past*, *present*, and *future*, the answer might seem to be: *no*. Past moments don't seem to exist (any longer) and future moments don't seem to exist (yet). Others, however, might contend that past and future moments *do exist*, in a tenseless sense. There are three views on the existence or non-existence of the past and the future. First, Presentism is the view that only the present moment exists; and past and future moments *do not exist*. But a paradox arises with this view: if only the present moment exists, then how can the present moment ever change, or how can we go from one moment to the next? It seems it or we would have to change into *a different moment*; but, according to Presentism, there are no other moments.

Alternatively, Possibilism is the view that the past and the present exist, but the future does not exist. Possibilism corresponds to our sense that past events really happened, and that in order for them to have really happened, they have to be real. Possibilism also corresponds to our sense that the future *is not fixed*, and depends on the choices we make in the past and the present. Finally, Eternalism is the view that past, present, and future all exist.

A potential problem for both possibilism and eternalism is that, if we say that the past *exists*, and if "the past" just refers to *past events*, then that means *past events exist*, along with the things that comprise them. The birth of Julius Caesar is a past event, and if that exists, then Julius Caesar exists too! Further, if we say that the future exists (as eternalism says) and the "the future" refers to future events, then people who haven't even been born yet (your great-great-grandchildren, for instance) *exist*. But this is paradoxical. Our great-great-grandchildren don't exist!

One way to resolve this problem is to identify time, not as just a chain of events, but as a sort of "container" in which events unfold. If a moment of time is not identical to the events that take place at the moment, then a past or future moment can exist without the past or future events existing too! This brings us to the debate between Substantivalism and Relationism. This metaphysical debate can be understood as follows. *Suppose every physical process and motion in the universe suddenly ceased*: you and everyone else suddenly froze, along with the wind, the earth, and even all the atoms in your body cease to move. The question is: *would the present moment continue to change? Or would the present moment stop changing?*

If the present moment stops changing, then that means *time is nothing but change in the sequence of events*. This is Relationism. Relationism denies that time exists independently of change, motion, or the sequence of physical events. In contrast, if the present moment would continue to change—if time would continue to pass—even if all physical changes ceased, then that means time exists independently of physical change. Substantivalism (aka Absolutism) affirms that time exists independently of change, motion, or the sequence of physical events. In support of Relationism, if all motion in the universe suddenly ceased, then there would be no way of measuring any passage of time. In support of Substantivalism, however, it seems you can still conceive of time passing by though all motion has ceased. However, the relationist replies that when you imagine this, you are actually imagining yourself still moving, or at least you're imagining your thoughts still moving. So to imagine all motion ceasing, you would have to imagine your thoughts and perceptions ceasing to move too, in which case you would *not* notice any passage of time.

Which theory is correct? Modern physics (namely, Einstein's general theory of relativity) suggests that time is dependent on physical processes; so modern physics seems to side with *Relationism*. It is also thought to side with *Eternalism*. In fact, a popular view of time that has emerged in the 20th century is Space-Time Theory. This view holds that the past, present, and future all exist, but are nothing but sequences of events; but that what *is* the past, the present, and the future is entirely *relative* to where something is in time. Just as "here" is relative to where you are in space, "now" is relative to where you are in time. There is no past, present, or future that is the same for all observers: in other words, there is no *absolute* past, present, or future. According to Space-Time Theory, we should regard time as being very similar to space, in that:

(a) Just as objects have spatial parts (ex: your left hand is in one point in space, while your right hand is at a different point in space), so objects have *temporal parts* (ex: there is you *right now*, you *five minutes ago*, you *five minutes from now*, etc.).

(b) Just as an object's location in space does not affect its existence or reality, so an object's location in time does not affect its existence or real (i.e., an object that exists in 2044 is just as real as an object that exists now.

(c) Just as there is no absolute "here" that's the same for everyone, so there is no absolute "now" that is the same for everyone. There is no absolute past, present, or future: it is entirely relative to when an observer is in time.

Of course, Space-Time Theory acknowledges that time is unlike space in a few respects. There are three major differences between time and space:

1. Relations between different points in space are symmetrical. Any two objects in space can be said to be "before" or "after" the other. Does Mexico come before the United States, or after it? It entirely depends whether you are heading north or south! But relations between different points in time are asymmetrical: regardless of where you are in time, *1955 is always before 2015, and never after it*.
2. Relatedly, while an object at any point in space can affect another object at any other point in space, an object at any point in time cannot affect another object at any other point in time: for instance, we cannot affect people who lived in Ancient Rome. There is no "backwards causation".
3. This is clearly because one cannot move back and forth in time, though one can move back and forth in space.

The asymmetry of time is perhaps its most puzzling feature. From a human standpoint, it's also its most frustrating. As much as we want to, we cannot change the past; we can only effect things in the future. How do we account for this asymmetry, given the tenets of space-time theory?

Some maintain that the asymmetry of time, or time as we usually conceive it, is an *illusion*. Events occur; but there is no objective, asymmetrical ordering of events. This was famously argued by the philosopher John McTaggart (1866–1925). In "The Unreality of Time" (1908), McTaggart argues that time is unreal, first by observing that there are two ways of expressing relations in time: A-series – in which events are ordered according to *past*, *present*, and *future*; and B-series – in which events are ordered according to *earlier than* and *later than* relations (1955 is *earlier than* 2015, 2055 is *later than* 2015, etc.).

McTaggart then argues as follows. First, he argues that *Time is real only if real change occurs*. This expresses the idea that relations in time must be asymmetrical, since change is essentially an asymmetrical relation and is how we understand and measure time. However, McTaggart then notes that *Real change occurs only if the A-series (past, present, future) exists*. This is

because, one, the present is ever-changing, while, two, earlier-than and later-than relations (the B-series) are *static*; they don't change. 1955 is always earlier-than 2015, and so on. However, the A-series doesn't seem to be real. Instead, it seems entirely relative. As space-time theory points out, what is past, present, and future just depends on where you are in time. *All points in time are past, present, and future*, relative to some other point in time.

But, one might argue, the B-series is asymmetrical, since 1955 *is always* earlier than 2015, but 2015 *is never* earlier than 1955. However, this asymmetry might also be illusory. Objects have different properties at different times, and objects either exist or don't exist at different times. Also, there are laws that govern what objects there are at different times, and what properties objects have at different times. However, none of these differences need to amount to "change" as an asymmetrical relation. If we understand objects as "4-dimensional worms", as according to space-time theory, then "change" is just a worm having different properties at different time slices. In this way, we can completely understand time in spatial terms, without any asymmetry.

So, is time (or at least its asymmetry) actually an illusion?

Even if the asymmetry of time is merely something we experience, and is not a real or objective feature of time, that asymmetry has a profound effect on how feel and experience the world. *Existentialist* and *Phenomenological* viewpoints on time emphasize how our experience is essentially oriented towards the future. Our experience is not simply a series of discrete moments; rather, it is always *anticipatory*—we are constantly anticipating what will happen next. Our attention is always focused on the immediate or distant future. Even when we think about the past, we do so with an eye towards the future. We feel *helpless* with respect to the past; we are completely passive with respect to past events. However, with respect to the future, we feel like true *agents*, or like beings with *free will*.

The desire to exert of our free will over the past, just as we seem to exert our free will over the future, motivate our *desire for time travel*. To go back and correct a past mistake, to make it as if it never happened, is a common dream of all humanity. But notice that time travel is already ruled out by some of the views we mentioned. If presentism is right, then time travel is impossible because you cannot travel to a point which does not exist (the past or the future). Moreover, if relationism is correct, then time traveling into the past would be like reversing the series of events. This might not be impossible; but, as we'll discuss in the next section, *to preserve oneself during such reversal* might result in contradictions.

Section 2: Time Travel

What is time travel?

The philosopher David Lewis (1941–2001) defines time travel as follows (summarized):

> *An object time travels if and only if the time interval between departure and arrival ("travel time") as measured by the traveler's clock ("personal time") is different from the time interval between departure and arrival as measured by clocks in the external environment ("external time").*[1]

For instance, suppose one travel back to 1985 from 2015. Let's say the journey take 2 seconds. *Personal Time* is an interval of 2 seconds; but *External Time* is an interval of -30 years. There is a difference between the travel time as measured by the traveler's clock and the travel time as measured by the clocks in the external environment. Hence, this counts as time travel.

Further, according to Lewis (pg. 314-315), the time traveler must be the same at both the departure and the arrival. That is, the time travelling object at the point of departure *must be identical to the object at the point of arrival*—in order for there to be any "time traveler".

Based on Lewis's definition, we can exclude *cryogenic sleep* as a form of time travel. If someone goes to sleep in 2015 but does not wake up until 2055, that person has not time traveled, because while *subjectively* 40 years has passed instantly, there is no objective clock measuring a difference between personal time and external time. Even you were asleep, the watch on you would measure 40 years, just as the clocks in the external environment would.

The possible forms of time travel that are included under Lewis's definition are below. They are categorized according to whether or not they seem possible.

A. **Known Physically Possible Kinds of Time Travel**.

A.I. Time Dilation Travel Time. Time goes by slower than *External Time*, by way of accelerating close to the speed of light, which will produce a *time dilation* effect according to Special Relativity, where the traveler's clock moves slower than clocks that are not accelerating. Once the traveler slows down to the velocity of the other clock, much more time will have passed on that clock than passed on the traveler's clock.

B. **Metaphysically Possible** (**and Possibly Physically Possible) Kinds of Time Travel**

[1] "The Paradoxes of Time Travel." Re-published in *Science Fiction and Philosophy* 2nd ed.; Susan Schneider (ed.), p.357-369.

B.I. Backward Causal Loop Time Travel: The arrival time is earlier than the departure time, as measured by an external clock (the arrival time is later than the departure time according to a time traveler's clock). The traveler can interact with the external environment, however (a) all of the travelers interactions with the environment are all parts of the causal chain of events leading up to the traveler's departure, and (b) any attempt to change that causal chain will necessarily fail (one way or another).

B.II. Non-Interaction Time Travel: The traveler cannot affect the external environment, but the external environment can affect the traveler by the fact that the traveler can observe some of the events in the past or in the future (in relation to the traveler's own clock), but that travel cannot affect the sequence of events, either in the future or in the past.

C. **Seemingly Metaphysically Impossible Kinds of Time Travel**

C.I. Timeline Altering Time Travel: The arrival time is earlier than the departure time, as measured by an external clock (the arrival time is later than the departure time according to a time traveler's clock). The traveler can interact with the environment in a way which can alter the causal chain leading up to the traveler's departure, in such a way that traveler never departed. The consequence is that the traveler both departed and did not depart: the "grandfather paradox"

Notice that one form of time travel is indeed real, and has been proven so! —*Time Dilation*. In class, we'll watch a video explaining this phenomenon. Unfortunately, time dilation time travel is only time travel into the future. It does not allow us to return to the past. Also, unfortunately, it requires massive amounts of energy in order to be at all worthwhile. We need to accelerate to 90% of the speed of light (300,000 km/s) in order travel 2 1/2 years (external time) in just 1 year (personal time). At 99% the speed of light, we can travel 7 years in just 1 year. But nothing man-made has even reached speeds close to 90% of light speed.

The metaphysically possible forms of time travel are purely hypothetical. There is no proof that they are *physically* possible. But they are still possible in the sense that no *logical contradictions* result from them. A logical contradiction is where *something both is and is not*, at the same time and in the same sense. *Aristotle is real and Aristotle is not real*. This is a contradiction. It makes no sense: how can Aristotle be real and not real, in the same exact sense of "real"? Contradictions are incoherent and, so far as humans are concerned, impossible.

In Causal Loop time travel, one travels back to the past, but *one cannot change the past*. In fact, one's traveling back to the past was already part of the chain of events leading up to the

departure. The arrival is just a completion of a closed, circular chain of events. What prevents one from changing the events? Who knows? It could be some natural mechanism, or it could be the traveler herself, fearing that changing events could destroy the space-time continuum.

Although Causal Loop time travel does not result in any logical contradictions, it can still result in paradoxes that involve *contradictions with our common sense*. For instance, suppose you built a time machine according to the instructions in a mysterious book handed to you by a much older "stranger" who you met briefly in a coffee shop 10 years ago. Let's say you go back 30 years, and you bring that book with you. Something malfunctions and you are unable to return. You are stuck in the past. 20 years goes by, and you go to a coffee shop. And who do you meet there but your younger self! You're now the older stranger. You hand yourself the book, and you disappear. It turns out that you received the book from yourself, but 30 years older.

The question is: where did the book come from? Who wrote it? The answer is: no one. The books exists entirely within a closed causal loop. It was never created. The knowledge in that book just exists. This is called the **Knowledge Paradox:** knowledge that would seem to have to come from somewhere actually comes from nowhere, and exists entirely within a causal loop. This is mindboggling, but it is not logically contradictory.

The form of time travel that results in logical contradictions is the *Timeline Altering Time Travel*. This is the type of time travel where you can go back and change the past. However, changing the past means altering the chain of events leading up to your departure, which would likely change the departure itself, such that you wouldn't change the past. But then you depart as you originally did, which means that you do change the past. Effectively, *you both change the past and you do not change the past*. To put it more concretely, let's say you go back and kill your grandfather before he has your mother. Doing so means that your mother never exists, and that means you never exist. But if you never exist, then you never go back in time to shoot your grandfather. This means that you do exist, and you do go back and shoot your grandfather, which means you don't exist, and you don't shoot your grandfather, *ad infinitum*. It turns out, you both shoot your grandfather and you do not shoot your grandfather—a logical contradiction. This is famously called **the Grandfather Paradox**.

Formally, the paradox is this: *Suppose that Timeline (A) is the timeline leading up to S's departure for the past. S departs at time T2 and arrives at an earlier time, T1. At some point in time between T1 and T2, S's actions change the timeline from A to timeline B, where in timeline B, S never departs. If S never departs, then S never changes the timeline from A to B, so it remains in timeline A, which leads up to S's departing and changing the timeline from A to B, where in timeline B, S never departs, ad infinitum.*

Perhaps upon arrival in the past, you somehow disconnect yourself from the chain of events. However, that would mean that you are not the same object or person that departed for the past. If you can alter the timeline such that your departing-self never exists, if your arrival-self continues to exist, then *arrival-you* cannot be the same person as *departing-you*. But recall that time travel requires sameness of the time traveler at both departure and arrival points.

Thus, as it results in a logical contradiction or violates time travel constraints, changing the past seems impossible. At least, however, we can change the future. …Or can we?

ASSIGNMENT (7 Points): Answer the following fill-in-the-blank questions on the above reading. **Some terms may be used twice, but no more than twice**. (0.3 points each)

1. Whether or not time travel is possible depends on what precisely is meant by "time travel" and also on _____.
2. "What then is time? If no one asks me, I know: if I wish to explain it to one that asketh, I know not" was famously said by _____.
3. That the *present moment* is, at each distinct moment, a different moment, is the only sense in which time can be said to be _____.
4. The view that only the present moment exists is called _____.
5. The view that the past, present, and future all exist is called _____.
6. If _____ is true, then Abraham Lincoln, Genghis Kahn, and Socrates all, in some sense, exist; but if _____ is true, not only do these people exist, our great grandchildren likely exist too. (the two blanks have different answers)
7. According to _____, if all motion or change in the universe suddenly ceased, time would continue to pass by.
8. According to _____, if all motion or change in the universe suddenly ceased, time would NOT continue to pass by.
9. _____ agrees with eternalism in holding that objects at different points in time are real.
10. For Space-Time Theory, the past, the present, and the future are all _____ .

11. While the relation between any two points in space is symmetrical, the relation between any two points in time is _____.

12. According to Space-Time Theory, just as objects have spatial parts, or parts of itself in different parts of space, so objects have _____.

13. The _____ is an ordering of events according to past, present, and future.

14. The _____ is an order of events according to *earlier than* and *later than relations*.

15. According to McTaggart, time is an _____ because the A-series is not real, and because the B-series fails to capture the asymmetry of temporal change.

16. & 17. According to David Lewis, time travel requires difference in travel time as shown between clocks on the traveler, known as _____, and clocks in the external environment, known as _____.

18. Though possible, causal loop time travel results in the _____ _____, where it seems something, like information for how to build a time machine, can exist entirely within a closed causal loop and have no creation point.

19. A possible but completely hypothetical form of time travel involves _____, where the traveler's arrival in the past was already part of the chain of events leading up to the traveler's departure, and the traveler is unable to change the past.

20. *Sleep* does not count as time travel, because while _____ you appear to have skipped over hours, or in the case of cryogenic sleep, years, there is no difference between the clock on you and clocks in the external environment.

21. A form of time travel is metaphysically possible so long as it does not result in _____ (two words), where something both is and is not, at the same time and in the same sense.

22. Timeline Altering time travel results the _____ _____, in which case it is true both that the traveler changes the past and does not change the past.

23. A proven form of time travel involves a phenomenon known as _____; however, it only allows time travel into the future, and it requires speeds close to the speed of light.