Time travel has seen some discussion within analytic philosophy; this chapter surveys some of that debate. The first section discusses whether or not time travel is logically possible; the second section discusses further issues arising from considerations of time travel.

**Physics, Philosophy, and Logical Impossibility**

It is important to distinguish two types of possibility: logical possibility and physical possibility. Physically possible situations are those permitted by the laws of nature: it is physically possible for me to walk up the stairs, but not walk to the moon; it is physically possible to travel faster than the speed of sound, but not faster than the speed of light; it is physically possible (though unlikely) for a planet made of gold to exist, but not a planet made of uranium (as it’d explode). Logical possibility outstrips this, comprising all situations that are consistent with the laws of logic: it is logically possible that I walk to the moon, travel faster than 300,000 km s\(^{-1}\), or have a planet made of uranium. None of those things is inconsistent – they don’t engender a contradiction. Only contradictory things, like there being round squares or the square root of 4 being 6, are logically impossible. This distinction is important for whilst both philosophers and physicists are interested in the possibility of time travel, philosophers tend to focus on the logical possibility of time travel leaving its physical possibility to the physicists.

You might wonder whether philosophers have a legitimate role to play: why should we care about the logical possibility of things, rather than just focus on what is physically possible? One reason is that if it’s logically impossible – that travelling in time is on a par with making the square root of 4 equal 6 – then it won’t be physically possible either. So, just as no scientist need conduct an experiment to see if there are round squares, the scientific community wouldn’t have to entertain physical theories that permit time travel if time travel were logically impossible.

**The Grandfather Paradox**

One reason, much discussed in the philosophical literature, for why time travel is logically impossible is the *Grandfather Paradox* (with examples and variations of it replete in film and literature). The argument proceeds:

1. If time travel was possible I could go back in time and kill my own grandfather before my father was conceived.
2. If I killed my own grandfather (before my father is conceived), a contradiction would result.
3. If a contradiction could come about given the possibility of time travel, time travel is impossible.
(1), (2) and (3) entail that time travel is impossible, so those philosophers who believe time travel is possible must deny one of them. Before examining the details of such denials, first examine the *prima facie* case for each one.

(1) seems straightforward enough to motivate. In 1930, before the conception of my father, my paternal grandfather – call him ‘Pappy’ – was alive. If time travel was possible and we could travel back to a million BC, or a thousand BC, or 1500 AD etc., what’s to stop me travelling to 1929? And once there, what’s to stop me using my hi-powered sniper rifle from the 21st century to shoot Pappy dead? (Who knows why I would do such a thing, of course!) 1 It seems that I can kill Pappy in 1929, which would mean he won’t be alive in 1930. So (1) seems defensible.

The defence of (2) is also straightforward. In the thought experiment, Pappy is alive in 1930, i.e. the following proposition is true:

In 1930, Pappy is alive.

If I go back in time and shoot Pappy dead in 1929, the following proposition must then be true:

It’s not the case that in 1930, Pappy is alive.

Often expositions of the Grandfather Paradox argue that if my grandfather were dead I would no longer be born in order to go back in time and kill him, therefore I couldn’t be there to shoot him so he should be alive, but if he lives then I would be born and go back in time and shoot him (and so on *ad infinitum*). But the crux of the paradox is far simpler than this convoluted regress: if both of the above propositions were true, we’d have a contradiction. Just as it cannot be the case that, at any given time, an object is both a square and not a square, or 2+2 both equals 4 and does not equal 4, it is a contradiction – a *logical* impossibility – that it’s the case and it’s not the case that in 1930 Pappy is dead. Thus (2) seems defensible as well.

Finally, consider (3). Little defence of this premise is needed. An assumption leading to contradiction is almost universally taken to be a reason to think the assumption is false. For instance, in mathematics we might assume the truth of some principle (e.g. $0 \times 0 = 1$), demonstrate some contradiction results (e.g. that $2 = 1$) and use this to conclude that the assumed principle is false. (This line of reasoning is called ‘*reductio ad absurdum*’.) Or imagine a murder case wherein the accused argues that his line of defence – e.g. that he was at home when the murder happened – isn’t false even though it has been proven that some contradictory fact is the case – e.g. that he was definitely present at the scene of the crime. Only a deranged juror would think this was a sensible line of argument!

So that is the *prima facie* motivation of the Grandfather Paradox. Obviously, more can be said against the above premises (otherwise this would be a very short chapter!), to which we turn to in the following sub-sections.

The Ludovician Response to the Grandfather Paradox

Name a famous philosopher and I’m sure you’ll find Nietzsche, Aristotle, or Plato bandied about. In current professional philosophical circles you’ll hear an extra name: David Lewis. Working on just about every area (from philosophy of religion to philosophy of language, from metaphysics to logic) his influence on contemporary analytic philosophy has been undeniably

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1 For discussion of why one might want to do such a thing see Smith (2005).

2 If $2 \times 0 = 1 \times 0$, then $2 \times (0 + 0) = 1 \times (0 + 0)$. Given $0 + 0 = 1$, $2 \times 1 = 1 \times 1$, which it to say $2 = 1$. 
extensive. When it comes to time travel it is his ‘Ludovician’ response to the grandfather paradox that is often brought to bear (the same line of response was also developed by Paul Horwich, although it is usually Lewis’s exposition that is focussed on).³

The Ludovician response comes in two parts. The first part is to deny that (1) is true. Imagine a blacksmith. The blacksmith can take a block of iron and smelt it into a certain shape. The blacksmith can make the iron into a cube – that’s possible. The blacksmith can make the iron into a sphere – that’s possible. But the blacksmith cannot make it into a spherical cube – that’s (obviously!) impossible. Lewis thinks time travel is a bit like this. I can shoot a man dead with a hi-powered sniper rifle – that’s possible. I can go back in time and meet Pappy – that’s possible. But that doesn’t mean I can go back in time, meet Pappy, and shoot him dead with a hi-powered sniper rifle – that’s impossible! Lewis thinks we are confused when we believe (1) is true, just as someone would be confused if they thought blacksmiths could shape impossible objects like those from the works of Escher.

But what, then, would happen if I went back in time to shoot my grandfather? What would explain my failure to be able to shoot him with a hi-powered sniper rifle? Why can I have a cup of tea with him, but not murder him? The Ludovician says something would stop me. The possibilities are endless: in a case of mistaken identity I shoot someone who looks like Pappy instead; my gun jams; I meet the girl of my dreams seconds before the attempted assassination and give up on killing poor Pappy; I die of a heart attack just before firing; I, whilst aiming, slip on a banana peel that causes me to miss etc. The options for what event might intercede in my assassination attempt are endless. In the literature, they are called ‘banana peels’ (as a nod to the last example) even if they involve strokes, mistaken identity, or the girl of my dreams rather than the skin of a piece of fruit. (The idea that we can’t change the past, and always end up with logically consistent situations, has been explored in many media representations, e.g. Bradbury’s ‘A Sound of Thunder’ [1952], Moorcocks’ Behold the Man [1969], various episodes of Quantum Leap [1989-93] and Star Trek [1966-] – at least when the plot finds it convenient! – and Terry Gilliam’s 12 Monkeys [1995].)

You might think it’s strange that banana peels always get in the way. Isn’t it weird, you might think, that such things always crop up? Is there some force of nature – or some collection of individuals, like a cosmic protection agency – that act to prevent paradoxes coming about and keeping time travellers in line? Is it not simply true that I can shoot dead Pappy with my hi-powered rifle? It certainly seems it!

The second part of the Ludovician theory, then, is to explain away this problem – and explain the apparent correctness of saying that you can shoot Pappy – by paying careful attention to our ‘modal language’ (i.e. to sentences concerning what is, or is not, possible). Lewis points out that modal sentences are context-dependent, and whether they are true or false doesn’t depend just on what words make up the sentence, but also the context they are to be evaluated in. That the evaluation of sentences is context dependent is clear enough. For instance, in one context it might be true to say ‘Jim is tall’ if, say, Jim is 5’10” and trying to get on a roller coaster ride with a minimum height of 5’7” (for he is, after all, tall enough), but that same sentence – that same concatenation of words – is false if we’re picking tall people to play in a basketball team and Jim

is surrounded by men 6'2” and taller. The sentence ‘Jim is tall’ means different things, and varies over whether it is true or false, in different contexts. Lewis thinks the same thinking applies to modal sentences. For instance, the sentence ‘I couldn’t communicate with Spaniards in their native tongue’ will be true or false in different contexts. In one context it’s true for I can’t speak Spanish and, if I was in Spain right now, I would be unable to communicate in their native tongue. But in another context, it’s false. If we’re looking for someone to undergo intensive training and learn Spanish, and the candidates are me and an ape, then it’s true to say I could communicate in Spanish – the ape, on the other hand, clearly could not. Clearly different contexts lead to us evaluating the truth of modal sentences differently. Lewis cashes this out thus: to say X is possible (or impossible) is to say X is consistent (or inconsistent) with certain facts, where the facts in question are determined by context. So to determine whether ‘I couldn’t communicate with Spaniards in their native tongue’ is true or not, we try and figure out whether the proposition:

I am talking Spanish with native Spaniards

is consistent with certain other facts. In the first context, those facts are, e.g., ‘I lack the ability to speak Spanish right now’ and ‘I am talking to the Spaniards right now’. Clearly those two things are incompatible with the above proposition. In the second context, we are to instead ask whether the proposition is consistent with facts like, e.g., ‘I have a year to learn Spanish’, ‘I will receive intensive training in Spanish during that year’, ‘The point at which I am talking Spanish with native Spaniards is a year from now’ etc. And those things are consistent.

Lewis then turns his attention to sentences like ‘I could kill Pappy with my hi-powered sniper rifle.’ That sentence is true or false depending upon what context we are in. If I didn’t travel in time, it’d be true – there’s no (non-moral) problem with me killing my grandfather in that situation. If I travel in time, it becomes trickier. In one context it’s true – my shooting the man I aim the gun at (who happens to be Pappy) is consistent with the wind conditions, consistent with my aim, consistent with the aerodynamics of bullets and the facts about what fast moving lead does to soft tissue and vital organs. In that context – considering those facts – I could kill Pappy and the sentence is true. However, in another context I can’t, for in another context – a context where we recognise that the man before me is my grandfather before my father’s conception – my shooting of Pappy isn’t consistent with that fact. These facts about context dependence explain why we so readily believe we could, even in time travel scenarios, shoot Pappy (you can! in a certain context!), even though you can’t shoot Pappy (you can’t! in a certain other context!).

Or here’s another way of thinking about it: something will stop the blacksmith making the spherical cube – no matter how hard he tries to shape it, it just won’t work! But is there anything mysterious or weird about his inability to do this? Should we posit a mysterious force of nature that affects blocks of iron and blacksmiths? Or posit some mysterious agency of people who intervene to stop all blacksmiths from making round cubes? Certainly not! Rather, the sentence ‘The blacksmith could make the iron into a cube’ is true in some contexts – say the context we’re in before the blacksmith has shaped the metal into a sphere. But when the blacksmith has shaped it into a sphere we are now in a different context, and when we ask whether it could be shaped into a cube the context we are in means we have to assume one of the facts the iron being a cube is to be consistent with is that it is, in fact, a sphere – and it clearly isn’t consistent with that! So, in that second context, it’s false to say it could be a cube. That is, the context you are in makes it
that the sentence expresses something closer to ‘The blacksmith can make the iron into a cube given be shaped it into the shape of a sphere’. And that’s clearly contradictory! Similarly, then, that I can kill Pappy is true, but that I can kill Pappy given he is my grandfather and we are at a point in time before my father’s conception is false. (And there’s nothing special about me, either – during 1930 it was true of anyone that they could kill Pappy, but false of everyone that they could kill Pappy given that Nikk Effingham would be born in 1979, Pappy was my paternal grandfather, and my father had not yet been conceived. We don’t need time travellers for the latter sentence to be false!) So it is true and it is false that I can kill Pappy; but this isn’t a contradiction once we see that those statements are uttered in different contexts. Compare: it’s not a contradiction to say ‘All the beer is in the fridge’ having come home from the supermarket and put the beer in the fridge, even though I recognise that not all the beer – not every can and bottle from anywhere in the world – is now inside my fridge. There’s no contradiction as the true sentences ‘All the beer is in the fridge’ and ‘All the beer isn’t in the fridge’ are from different contexts.

**Ludovicians and changing the past**

So Lewis thinks that time travel is possible, although he also thinks there are limits on what can be done: if X is the case in the past, then you can never bring it about that X isn’t the case. Does that mean the Ludovician says that we can’t change the past? It depends what you mean by ‘change’. If X was the case in the past, you can’t change it so that X is no longer the case; but that, says Lewis, is different from banning a time traveller from causally affecting the past. I can, for instance, go back in time and shoot some random person in 10,000 BC with no fear of paradox – it’s just that such a person won’t be an ancestor of mine or, indeed, anyone else for it was always the case that I went back and shot them. This isn’t a case of changing the past – it is not that, at one point, the man was alive in 10,000 BC and lived a full and happy life, never once laying eyes on a rabid rifle wielding time traveller, but that, after I use my time machine, it is now the case that he dies instead at my hands, with no full and happy life. No: if Lewis is right, it was always the case that, in 10,000 BC, I turned up and shot him. I causally interact in the past, and in one sense change it (for I changed a live man to being a dead man), but in another sense of changing the past (of making what once was no longer ever having been) I cannot.

We can sharpen the difference by introducing some (very basic) symbols. Use letters (‘A’, ‘B’, ‘C’ etc.) to represent arbitrary propositions (e.g. using ‘A’ to stand for ‘Pappy is alive’). To say a proposition is true at a given time t, use the prefix ‘At t:’ (so to say Pappy was alive in 1930 we’d write ‘At 1930: A’, which is itself a – larger, more complex – proposition). To say some proposition is not the case stick a ‘~’ before it. So, to say that a proposition is true at a time we say:

\[ \text{At } t: \ A \]

At a later time, \( t^* \), A is false (e.g. in 2014 when Pappy has died):

\[ \text{At } t^*: \sim A \]

When Lewis says that we can change the past he means it in the innocuous sense that we can make it the case that:

\[ \left[ \text{At } t: \ A \right] \text{ and } \left[ \text{At } t^*: \sim A \right] \]

We can do things like that quite regardless of time travel! But no-one – not even God – can, if at some time (4) is true, do the impossible and make it the case that:
(7) \( \sim \text{At} \in A \)

That is to say that no-one can bring it about that:

(8) \( [\text{At} \in A] \) and \( [\sim \text{At} \in A] \)

Notice the difference between (6) and (8) – the latter, but not the former, is contradictory.

The Multiverse Theory

Whatever the merits of this Ludovician approach, not everyone is convinced. Some people think that time travel can, and should, permit us to, e.g., go back in time and kill Pappy. (Certainly lots of time travel stories involve such events!) So, as an alternative to the Ludovician view, we may deny a different premise of the Paradox, e.g.:

(2) If I killed my own grandfather (before my father is conceived), a contradiction would result.

Such philosophers deny that a logical contradiction arises from killing Pappy. One example of a theory denying (2) is the ‘multiverse theory’ according to which time travel takes me to another universe. That universe has exactly the same past as the one I left, up until the point that I arrive at (at which point I kill Pappy, and history diverges from how it originally was). In the initial universe, Pappy remains alive and well: he never gets visited by a murderer in 1929, he conceives my father (who conceives me etc.) and in 2014 I step into a time machine, intent on murdering Pappy, and… vanish. It is in the other universe where the macabre grand patricide takes place. In that universe, Pappy is shot by me back in 1929, my father does not exist and I am never born (although I don’t vanish from existence – whilst, as I’ll never be born, my younger self never exists in that universe, my time travelling self from the other universe still ‘hangs around’ after Pappy’s death presumably trying to avoid the police of the early 20th century). Now there is no contradiction (and (2) is false) for in the same way that a proposition can be true in one place and not another (for instance ‘It is raining’ can be true in one place and not another) ‘Pappy is alive in 1930’ is now true in one universe (the one I left) and not in the other (the one I arrive at). Contradiction averted! (Stephen Baxter’s The Time Ships [1995] utilises just such a theory, as does David Gerrold’s The Man Who Folded Himself [1973]; and films explicitly buying into this understanding include Richard Kelly’s Donnie Darko [2001] and Shane Carruth’s Primer [2004] – it also features in Back to the Future II [1989] and the Star Trek series [1966-], although sometimes this theory is conveniently ignored as the plot demands.)

This theory gets a lot of backing from philosophy’s equivalent of scripture: contemporary science. David Deutsch [1991] has argued that quantum mechanics demands that exactly this story should be told about time travel, and that a Ludovician style tale is in conflict with various scientific principles [Deutsch and Lockwood 1994; although see Sider 1997]. As a discussion of this errs more on the territory of science than that of vanilla philosophy, I’ll set aside the details (although it bears noting that Deutsch’s interpretation of the laws of physics are readily contestable).

Qua philosophy, the multiverse theory is not without problems. It has been argued, for instance, that the upshot of this theory is that were any extended object to try and travel through time, it’d

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be ‘chopped up’ into an infinite number of slices.\footnote{See Effingham 2012.} The details of that argument are lengthy, so I neglect them in favour of a more popularised problem: the doppelgänger objection.\footnote{See Hewett 1994 and Richmond 2003: 303-4.} The fear is that I do not genuinely go back in time, and instead only get the chance to kill Pappy’s doppelgänger. If correct, the ‘past’ I arrive at is more like a brilliantly staged mock-up of the past – exactly the same in every way, such that I’d never notice the difference. Nevertheless it is \textit{not} the past, and it not really being the past makes a difference! If I was hellbent on seeking revenge on my grandfather, I won’t be sated if I, say, killed his identical twin. Killing someone \textit{a lot like} Pappy just doesn’t cut it – I want Pappy himself! So the objection does, this is the situation time travellers end up in.

So the multiverse theorist needs some sort of response to this doppelgänger problem. One response is to think of time travel as being a lot like a ‘fission case’. A fission case is where an object ‘splits’ into two, for example when an amoeba divides. When this happens, which of the resulting cells is identical to the original amoeba? Both? Neither? One but not the other? We can also imagine a fission scenario involving people where a woman steps into a duplicate making machine and two versions of her step out, or where a man somehow divides – amoeba-like – into two. If the woman who stepped into the machine (or the pre-fissioning man) was the one you sought vengeance on, who should you kill on the way out? Whilst there’s a lot of room for saying otherwise, many philosophers think that it’s correct to say that they’re \textit{both} the person who stepped in (and both the person who existed pre-fissioning).\footnote{For an introduction to these issues, see Noonan 2005.} If that’s right, then killing either of them will suffice for vengeance! Similarly, we can say that universes fission at the point at which a time traveller arrives. When my time machine takes me to 1930, the entire universe – and all of its contents – fission into two, leaving me in one of those universes with a fissioned version of Pappy – a version who will satisfy my death lust just as much as the one I left behind…

\textbf{Variations on the multiverse theory}

An alternative solution is to drop multiverses in favour of ‘hypertimes’.\footnote{See van Inwagen 2010, with a similar theory from Goddu 2003 (see also Goff 2010, although he believes he doesn’t require hypertime to make his theory work). Responses, including variations on these scheme whereby hypertime works differently, include Forrest 2010 and Hudson & Wasserman 2010.} For instance, we might think that, just as there are three dimensions of space, there are two dimensions of time – our ordinary dimension of time and a ‘hypertemporal’ dimension. For every moment of time that elapses, a moment of hypertime elapses as well e.g. if 15 billion years of time have elapsed since the start of the universe, 15 billions years of hypertime have elapsed. Imagine that, in 2014, no-one has time travelled before and I return to 1930; time ‘rolls back’ to 1930 but hypertime keeps on going. Think of it in terms of clocks, where we have two clocks – one measuring what time it is and one measuring what hypertime it is. Imagine I travel at one minute past midnight on New Year’s Day 2014 to the early hours of a day in March 1930. The clocks would progress thus:

\begin{center}
\begin{tabular}{ccc}
\textit{Clock One (Measures time)} & \textit{Clock Two (Measures hypertime)} \\
2359, 31\textsuperscript{st} December 2013 & 2359, 31\textsuperscript{st} December 2013 \\
0000, 31\textsuperscript{st} December 2013 & 0000, 31\textsuperscript{st} December 2013 \\
0500, 8\textsuperscript{th} March 1930 & 0001, 1\textsuperscript{st} January 2014 \\
\end{tabular}
\end{center}
Similarly, if I waited from 1930 to 2014 all over again (and became a very old man!) I could go back in time to 1930 again. In that case the hypertemporal year would be 2098 but the year would be 1930 (for the third time).

You might prefer this theory because it better serves to solve the doppelgänger objection for, in the same way that Pappy at one time is the same person as Pappy at another time (and there’s no mystery about that, even if very different things are true of Pappy at those different times), Pappy at one hypertime will be the same person as Pappy at another hypertime (and there’s no mystery about that, even if very different things are true of them at those different hypertimes e.g. being alive at one and dead at another).

This theory is also like the multiverse theory in that (2) is false. Just as it is unproblematic having a proposition like ‘Bob is alive’ being true at one time and not another, you can have a proposition of the form ‘At some time & A’ be true at one hypertime but false at another hypertime. So I can go back in time and kill Pappy by making it the case that at one hypertime it’s true that in 1930 Pappy is alive, but at a later hypertime it’s true that in 1930 he’s dead. There are, though, some differences and this theory leaves open some frightening possibilities. Imagine a cosmic terrorist deploys a time travelling device that forever travels back in time one second with the instruction to send itself back in time again: now hypertime will keep on rolling, but every time the terrorist’s device goes back in time, time rolls back with it! We will, forever in hypertime, be caught in the same looping second, with the future never playing out in front of us. Scary stuff. But the resolution as to why (2) is false is substantially the same: they introduce some extra element – either a universe or a hypertime – and hold that the allegedly contradictory events play out according to different elements (either in different universes or at different hypertimes).

Once we note that similarity, we might imagine that different elements could play a similar role; that is, we could relativise temporal events to something other than hypertimes or universes. One suggestion has been to use time itself as such an element. This gets a little tricky (and the daunted may wish to skip this subsection) but if we go slowly it should make sense. The multiverse theorist says of Pappy’s being dead and alive that:

\[ (9) \text{ At universe } \alpha \text{ it’s the case that in 1930 Pappy is alive } \text{ and } \text{ At universe } \beta \text{ it’s not the case that in 1930 Pappy is alive } \]

The hypertemporal theorist says:

\[ (10) \text{ At the hypertemporal year 1930, it’s the case that in 1930 Pappy is alive } \text{ and } \text{ At the hypertemporal year 2014 it’s not the case that in 1930 Pappy is alive } \]

More generically, saying something of the following form avoids a contradiction:

\[ (11) \text{ At element } X, \text{ it’s the case that in 1930 Pappy is alive } \text{ and } \text{ At element } Y \text{ it’s not the case that in 1930 Pappy is alive } \]

Jack Meiland (1974) proposes a theory in which the elements are simply ‘times’ (Goff (2010) argues likewise). So in 1930, and all of the years leading up to 2014 (at which point I hop into the time machine and go back and kill him), it’s the case that, in 1930, Pappy is alive. But when, in...
2014, I travel back, I make it the case that from 2014 onwards, Pappy is not alive back in 1930. So it follows that we get a proposition of a form like (11):

(12) [ In 1930 it’s the case that in 1930 Pappy is alive ] and [ In 2014 it’s not the case that in 1930 Pappy is alive ]

Such a theory seems attractive for two reasons: first, we can again get around the doppelgänger objection in exactly the same way as the hypertemporal theory; second, we can do so without postulating weird notions like hypertime (or, indeed, postulating lots and lots of universes!). But here’s a major problem for this theory: what is true of a time is no longer always true of it. Many will baulk at this – whilst facts about things might change over time (e.g. facts about me might change, such as my going from thin to fat, or short to tall) facts about what the past is like shouldn’t change like this! If Pappy was alive in 1930, the thinking is that this will be true even later on; the past is not like me – it never changes. Call this the Principle of Eternal Past Truth.

It’s not inconceivable to see how we might deny this Principle. Peter Geach, in a work disconnected from time travel and instead on the philosophy of religion, argued exactly that. Imagine I am in a car, careering towards the edge of a cliff. I bash the brakes and they don’t work, before I hit upon leaping out of the vehicle. Hurling myself out of the door, I save myself from death. As I brush myself off I say ‘I was going to die right up until the point that I realised I could dive out of the door.’ Geach says this is clearly a true statement, but taken literally it shows that what is true of a time changes. Take three moments in time: \( t_1 \) is when I am jabbing at the brakes; \( t_2 \) is when I realise I need to leap out of the vehicle instead; \( t_3 \) is the time at which I am brushing myself off, and is also a time I would be dead at had I still been in the vehicle when it went over the cliff. I seem to say that something is true at \( t_1 \) – me being dead at \( t_3 \) – that isn’t then true at \( t_2 \). That is, I assert:

(13) [ At \( t_1 \) it’s the case that at \( t_3 \) I am dead ] and [ At \( t_2 \) it’s not the case that at \( t_3 \) I am dead ]

I leave it to you to think whether or not this Geachian objection to the Principle of Eternal Past Truth is a good one or not – most philosophers, I dare say, will say ‘not’.

**Dialetheic Time Travel**

We have covered two broad families of theories concerning time travel: the Ludovician theories that deny (1), and the theories that deny (2) by ‘relativising’ truth to different ‘elements’ (either universes, hypertimes, or times). But we might think there is a way to deny the final premise of the Paradox:

(3) If a contradiction could come about given the possibility of time travel, time travel is impossible.

It has rarely been suggested in the philosophical literature on time travel that this could be false (although presumably every film that opts neither for a Ludovician explanation nor a multiverse explanation of time travel is depicting exactly that!). It is an interesting omission, for in other

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9 See Geach 1977 and Todd 2011, where they discuss the – fairly closely related – problem in philosophy of religion of divine foreknowledge (see Zagzebski 2011 for more on that). Nor is this the only crossover between the philosophy of religion and time travel. Explicit connection is made with the Trinity [Leftow 2004, Effingham MS].

10 Consider *Back to the Future* [1985] where Marty McFly starts to fade from existence (similar things happen in *Looper* [2012], Gregory Hoblit’s *Frequency* [2000] and *Austin Powers in Goldmember* [2002], amongst others), or
areas of philosophy it *is* the case that a premise like (3) is denied; in those cases the truth of a contradiction is not taken to necessarily indicate that something has gone wrong – it just turns out there are some true contradictions! Such philosophers are called dialetheists (as true contradictions are known as ‘dialetheia’).  

Dialetheism is meant to be attractive because it’s the upshot of various problematic, paradoxical situations, the most famous of which is the *Liar Paradox*. Consider:  

(14) This sentence is false.  

Is (14) true or false? If it’s true, then – as it says it’s false – it must be false. So it is both true and false – a dialetheia! If it’s false, then the sentence – which says that it is false – must be true. So it is both true and false – a dialetheia! Thus, says the dialetheist, we can see that there are at least some true contradictions. Before returning to time travel, note two things. First, the dialetheist doesn’t think just any old sentences can be contradictory (for instance, returning to the defense of (3) given all the way back at the start, they don’t think mathematics is now bust, and dialetheists can serve on a jury just like anyone else). They have developed complex theories to deal with the presence of contradictions – theories that are meant to avoid the madness of thinking any old sentence might be contradictory. Secondly, there are alternative responses to the Liar Paradox – dialetheism is one option amongst many (for instance, we might say (14) is meaningless, or (14) is neither true nor false, or that (14) is a contradiction and so, like all contradictions, is false – indeed, more options besides these exist). I do not mean to suggest that dialetheism is uncontroversial – the truth is that it is far from being popular, even amongst philosophers. But it might be that it turns out to be true, so it’s worth considering.

If dialetheism were true, then we might think that Pappy being both dead and alive is just one example of a dialetheia. It’s not clear to me what would be wrong with such a claim if we were to buy into there being dialetheia elsewhere. You might care little for this theory – perhaps you find it too bizarre or, perhaps, too uninteresting (after all, if it were true, there’d be little of interest to be said about the Grandfather Paradox). But there is one thing to be said in defence of considering it seriously: we said at the top that the philosophy of time travel was important even if it only considered the logical possibility of time travel rather than its physical possibility. But now we see that this might not be true, for if we thought this dialetheic version of time travel was plausible and coherent – a ‘live option’ as it were – then even if the scientist was convinced that the Ludovicians and the multiverse theorists (etc.) were wrong, it would still be worth pursuing theories that permitted time travel. After all, if it turned out to be possible, we’d have an empirical proof of dialetheism.

**Beyond Possibility**

A lot of ink has been spilt concerning whether time travel is logically possible, but there are more interesting issues besides. This last section briefly looks at some.

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Christopher Smith’s *Triangle* [2009]. In these films, time definitely changes (so Ludovicianism is false) but the changes do not seem to merely take place in some alternate universe where the time traveller can continue on unabashed concerning the changes they’ve made to the timeline. All seem to involve internal, inconsistent, narratives. Anecdotally it’s worth mentioning that many analytic philosophers find this inconsistency to be an aesthetic flaw (I, however, am not one of them!).

11 For an introduction to dialetheism see Priest and Berto 2013.
Probability

Even if time travel is possible that still leaves awkward questions concerning how probable it is? Imagine two situations. In one I don’t have a time machine and am trying to complete a particularly difficult crossword puzzle, such that I have only a 20% chance of success. In the second, the situation is the same except I do have a time machine and so, every now and again, my time travelling future self turns up to help me out with the crossword. Presumably this means my chance of completing the crossword in the second situation increases above 20% - but by how much? Or imagine that someone goes back in time to kill their grandfather: how likely is it that they’ll slip on a banana peel versus having a stroke? Does it end up becoming likely that we just don’t discover time travel in the first place (as in Paul Levinson’s short story ‘The Chronology Protection Case’ [1995])? And, if it does, is the best explanation for why we don’t discover time travel in the first place – the biggest and best banana peel of all – that the entire human race is wiped out before such a discovery is made? These questions still need a prolonged treatment and, as the last one indicates, even if time machines haven’t been invented yet, the answers to these questions might be of vital and immediate interest to us.

Time Machines

Just because time travel is possible doesn’t mean that every mode of time travel is also possible. We might imagine a time machine to be a lot like a TARDIS, where we turn it on and it magically teleports to another point in time and space. But what if a time machine was more like the vehicle from HG Wells’s famous story [1895]? When it travels in time, it doesn’t travel in space but stays exactly where it is – were you to witness it then you’d see in front of you a time machine piloted by a man acting in reverse as he travelled into the past (as in Watson’s ‘The Very Slow Time Machine’ [1978]). But, the philosophical worry is, if this is true, then as soon as it started time travelling wouldn’t it collide with its past self? (Or consider Silverberg’s The Masks of Time [1968] where matter travelling back in time acts like anti-matter – a scientifically plausible view – so strikes itself and immediately annihilates.) So even if the possibility of time travel is settled, the exact methods of time travel that are logically possible remain open for debate.

Conceptual Revision

A lot of philosophy is about analysing concepts. No doubt you will think that questions like ‘What is truth?’ or ‘What is justice?’ are stereotypical philosophical questions. When we introduce time travel into the mix, it seems that a lot of sensible answers to such questions don’t sound so sensible anymore.

For instance, take adultery. Presumably, one can only commit adultery if one is married, and one is married if and only if they have undergone a marriage ceremony with someone at some prior time, and since then their partner hasn’t died, divorced them, had the marriage annulled etc. This sounds sensible enough until we consider situations like that from time travel comedy Goodnight Sweetheart [1993-99] where the (morally repugnant!) protagonist, Gary, is – in the 1990s – married to Yvonne and travels back to the 1940s where he begins an affair with a woman named Phoebe. In the 1940s it’s not true that he ever had a marriage ceremony in the past (for he presumably got married to Yvonne at some point in the 1980s) so, given the above definition of

12 See Le Poidevin 2005 for more on this problem.
being married, Gary isn’t married – and if he isn’t married, he’s not committing adultery! Clearly, though, he is. So we might want to revise what we thought it took to be married.

Such revisions might be of little interest to you, but some revisions can be more pressing. Take the following principle:

(15) Every object either has no parts or two or more parts.

That seems true enough: maybe some objects have no parts at all (some sort of tiny sub-atomic atom or some such) but if they have any parts, they don’t have just one part. It is impossible, for instance, to have an object that only had an electron (or a wheel, or a heart etc.) as a part – what you would have is not a distinct object with the electron/wheel/heart as a part, but simply the electron/wheel/heart and nothing else. Nothing, it seems, has but one part. But now imagine that we take a brick back in time to January 1st 2014, time and time again; at the end of the day, we just pick it up and stick it back in the time machine. If we did this ninety nine times we would have one hundred bricks piled in the corner – well, one hundred ‘copies’ of the same brick. Now imagine we make a wall out of that brick. What we’ve done is create a composite object – a wall – out of a single object – the brick. Clearly it has the brick as a part, but it doesn’t seem to have any other parts at all. It’s wholly composed of the same, time travelling brick! So our understanding of the very structure of objects must be revised. Some philosophers – myself included – think you can draw fairly radical lessons from this, showing how the world includes not just objects like walls and bricks (and people and mountains and goats etc.) but strange objects called ‘temporal parts’ that exist for but an instant and exist exactly where every other object exists (so where you are sat now, there is an object that exists for but an instant that is exactly the same shape and size as you – and when it ceases to be, another takes its place!). The explanation for that is long and involved, but hopefully this is enough to give you a taste for how the possibility of time travel might revise our understanding of the world in an interesting way.13

As a final example of how time travel might fruitfully help with such revisions, consider euthanasia. Take the position according to which, when you are mentally incapacitated in the future, it is permissible (perhaps even obligatory) for someone to end your life if your current (non-mentally incapacitated) self says this should be done – that is, decisions made by you now bind what can be done to your future, incapacitated self. But once we take into account the possibility of time travel, this principle starts to look suspect; the decisions you make right now don’t bind your future self. Imagine that, as a 40 year old, you stumble across your future, time travelling self. Imagine that you are full of murderous, self-hating intent but your future self is a far more stable person who has nipped out for a quick, relaxing holiday in the past – notably, they definitely want to stay alive! (Another example would be that depicted in Rian Johnson’s Looper [2012].) Would it be moral or immoral for your younger self to kill your future self? Certainly it’d be wrong to kill anyone similar to your future self – and it seems just as immoral to kill your future self! If you disagree, picture the scene as your past self advances, menacingly, on your future self begging for his or her life… So it seems false that you get to make binding decisions about your future self – and we can frame that quite lucidly using a time travel situation. (Nor is this the only way ethics and time travel may intersect: Nacho Vigalondo’s Timecrimes

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13 See Effingham & Robson (2007). Other papers on similar topics include Gilmore 2007 and Kleinschmidt 2011.
[2007] raises many interesting questions about ethical situations that can only arise given the existence of a time machine.)

Note that these revisions apply whether or not we invent a time machine. Indeed, they probably apply whether or not time travel is physically possible – just as long as it’s logically possible, they have bite (and, some might suggest, even if they’re logically impossible). The reason is obvious enough: it’d be wrong to think that, say, marriage was defined one way, or certain things – like specific forms of euthanasia – were morally acceptable, only if time machines didn’t exist and/or the laws of physics were such and such a way, but that if time machines did exist or the laws of physics were different then marriage was to be defined differently or a particular form of euthanasia was immoral. It seems outright bizarre to think that the definition of marriage or the morality of euthanasia might depend on how the laws of physics turn out! Just because the curvature of spacetime might make a difference to whether we can travel in time (as the physicist Gödel [1949] thought) doesn’t mean it makes a difference to what is right and wrong! So how the world could be given time travel tells us how, e.g., the definition of marriage and laws of morality actually are.

Conclusion

Films, TV, comics etc. which feature time travel have general focussed on the possibility of time travel (and weird scenarios involving causal loops etc.). Correspondingly, as we’ve seen, contemporary analytic philosophy has been dominated by discussion of those issues (is time travel possible? how do we resolve the Grandfather paradox? etc.). Time travel’s possibility (or impossibility) is of interest to more than a niche of philosophers, and the ramifications if it were possible are noteworthy.

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