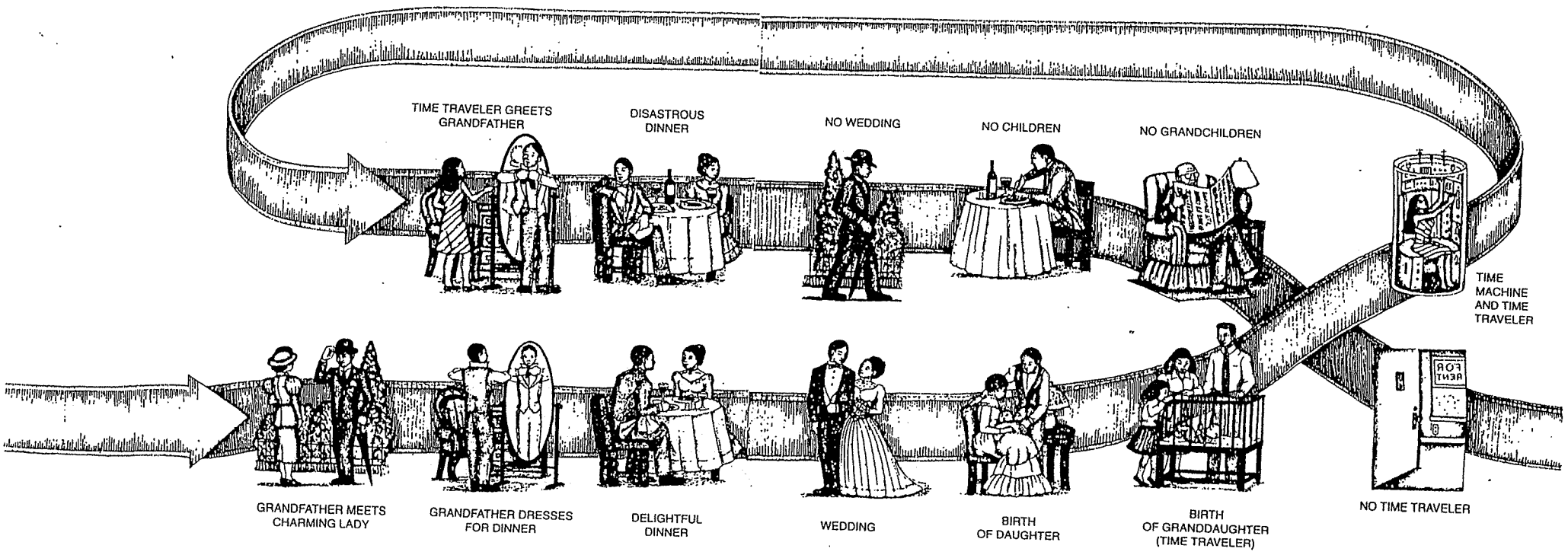
# Year 11 Philosophy - Time & Time Travel

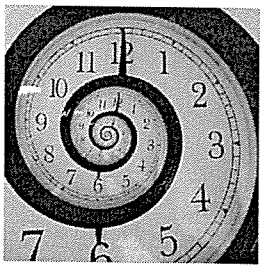
## Readings and Coursework Entries
**Due:** Friday, March 13th

Read and annotate (highlight and make notes on) the following.
The set readings can be found at the back of this booklet.
The coursework entries appear in italics throughout and should be completed in full, detailed sentences in your workbook. Where possible, incorporate quotations from the readings in your responses.




SCIENTIFIC AMERICAN *March 1994*

## Introduction



What is the nature of time? Does time exist, or is it simply a human construct that exists only in our minds? When the Big Bang occurred, were time and space brought into existence, or can time be said to have existed before the universe? Does time only flow in one direction, like a river? Is only the present real? Or, do events that occurred in the past still exist? Do events that will occur in the future exist?

If the past is still real, it may be possible for us to travel back and revisit the past. Equally, if the future is real, it may be possible for us to travel forward into the future.

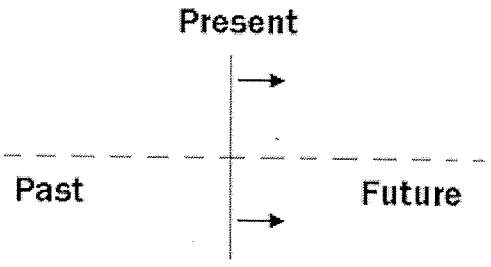
Many scientists and mathematicians have concluded that time travel is consistent with the laws of nature. Some theories, most notably special and general relativity, suggest that suitable geometries of space-time, or specific types of motion in space, might allow time travel into the past and future if these geometries or motions are possible.

Time travel is believed to be *theoretically possible* using the following methods; travelling faster than the speed of light, the use of cosmic strings and black holes and wormholes.

## Theories of Time

### *Presentism:*

Presentism is the view that only the present moment exists and the only things that exist are present things, and there are no non-present objects.




Presentists assert that the past and future are simply human constructs - they exist only in our minds.
Once a moment passes and slips into the past it ceases to exist. It would therefore absurd to propose travelling back into the past, say to visit Woodstock in 1969, as this event no longer exists.
We simply have present memories of these events that once existed.
Events that may occur in the future are not yet real either, according to the presentist view. The future is not set and has infinite possibilities, like a tree with an infinite number of branches. It would therefore be absurd to propose travelling into the future as these events do not yet exist. The future is still very much open.

### *Four Dimensionalism:*

Three-dimensional space is a model of the physical universe in which we live. The three dimensions are commonly called length, width, and height.
Four dimensionalism is the view that time is simply a fourth dimension in which we exist. The past, present and future all exist. Distant times in the past and future exist, just as distant places do, like New York or Tokyo.

Proponents of four-dimensionalism claim that both past and future objects lay equal claims to having the same level of reality as does the present moment. Physical objects like this piece of paper exist across time. This paper exists one hour ago, just a different version of it. A version of it also exists one hour from now.
The concept of four-dimensionalism is in direct contrast to presentism, which asserts that only the present moment exists.

This theory can also be referred to as **Eternalism**; the view that the past, present and future are all equally real.

**Personal Time:**

Say two identical twins were born in January 1990, named Tim and Jim. Yesterday, both of them were 21 years old.
Tim finished constructing his time machine yesterday and traveled back in time to 1788 to gain an insight into the British colonisation of Australia. Time spent fifteen years in Sydney Cove, from 1788 to 1803, before he decided to return in his time machine to the same day he left in 2011. This would mean that today Tim would now be fifteen years older than his twin brother, Jim:

Jim's personal time: 1990 - 2011 = 21 years
Tim's personal time: (1990 - 2011) + (1788 - 1803) = 36 years

Tim would therefore appear 15 years older than his identical twin brother.

*In your workbook:*

1. *Record your intuitions and own feelings on whether the past, present and future exist.*

2. *(a) Summarise the theory of presentism*
   *(b) Summarise the theory of four dimensionalism.*

## Four Arguments that attempt to prove the impossibility of time travel:

### 1. Identity Crisis

For time travel to be possible, it must be possible for a person to be present in more than one location at the same time. This is absurd. Just as a person cannot be in London and New York simultaneously, a person cannot be in 2011 and 1845 simultaneously.
(consider how a four dimensionalist may respond to this argument)

### 2. The Grandfather Paradox

For time travel to be possible, it must be possible for a time traveler to travel back in time before their birth and do something that would prevent their birth, like murder his grandfather before he met his grandmother. This is a paradox; the time traveler both exists and doesn't exist. He exists because he commits the murder of his grandfather, but he cannot exist because this murder will prevent his father's birth and therefore his own birth.

### 3. Foreknowledge

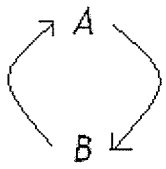
My mother was involved in a car accident on Christmas Day last year, 2010 (there were no serious injuries, but extensive damage to her car).
If time travel is possible, it would have been possible for me to travel into the future ten years ago (year 2001) and see that my mother would be in a terrible car accident on Christmas Day, 2010. I could then have traveled back to 2001 and warned her of this and tried to prevent her from driving on Christmas Day, 2010.
But, if I know that this car accident *will* occur in the future, then it *will* occur no matter what, despite my attempts to prevent it.

### 4. Causal loops

There is a typical pattern of cause an effect, a chain of causes and effects. I (*Z*) was caused by my parents (*Y*), who were caused by their parents (*X*), who were caused by their parents (*W*) and so on

$$W \rightarrow X \rightarrow Y \rightarrow Z$$

But, time travel seems to allow a causal loop where an event *A* will be the cause of a later event *B* which will in turn be the cause of a later event *A*. This is a paradox.




A typical example of a predestination paradox (used in *The Twilight Zone* episode "No Time Like the Past") is as follows:

*A man fascinated with disasters throughout history travels back in time to try and discover the cause of a famous fire in a government building in 1865. He travels back in time and goes to the building where the fire will start. As he enters, he accidentally knocks over a kerosene lantern and causes a fire, the same fire that would inspire him, years later, to travel back in time.*

*In your workbook:*

3. *Summarise each of these four arguments that attempt to disprove the possibility of time travel.*
4. *Formulate a possible counter-argument or response to any two of these four arguments (in order to defend the possibility of time travel).*
5. *Think of **your own example** of a causal loop that might be allowed to occur if time travel were possible.*

Read Ray Bradbury's short story, *'A Sound of Thunder'*

In your workbook:

6. *List all of the inconsistencies that you note in this fantastic time travel story.*

Read the article from *The Philosophy Gym* - 'Is Time Travel Possible?'

7. *Summarise the causal loop of Superman's Biography that appears in this article.*
8. *Summarise the 'Popular Argument Against Time Travel' that appears in this article.*

Read Jonathan Leake's news article, *'Time Travel Countdown'*

9. *Read the news article on Stephen Hawking and summarise his argument that time travel may be possible in the future.*
10. *Quote the article where Stephen Hawking explores whether time travel into the past is possible.*

11. *Choose **ONE** of the following extended research tasks to complete. This must appear as a single A4 sheet - a kind of fact sheet - that will be stuck up on the wall in S13. It should include written and visual displays.*
*Information must appear in your own words - places quotations from other sources in quotation marks.*

**Extended Homework Task Option 1**
Research and record what Albert Einstein's theory of relativity is and how it can be applied to the question: Is time travel possible.

**Extended Homework Task Option 2**
Conduct some research on Black Holes and Worm Holes in space and how they might allow / be used for time travel.

**Extended Homework Task Option 3**
Research and record Aristotle's theory of time.

# 2.1

**RAY BRADBURY**

## A Sound of Thunder

THE SIGN on the wall seemed to quaver under a film of sliding warm water. Eckels felt his eyelids blink over his stare, and the sign burned in this momentary darkness:

TIME SAFARI, INC.
SAFARIS TO ANY YEAR IN THE PAST.
YOU NAME THE ANIMAL.
WE TAKE YOU THERE.
YOU SHOOT IT.

A warm phlegm gathered in Eckels's throat; he swallowed and pushed it down. The muscles around his mouth formed a smile as he put his hand slowly out upon the air, and in that hand waved a cheque for ten thousand dollars to the man behind the desk.

"Does this safari guarantee I come back alive?"

"We guarantee nothing," said the official, "except the dinosaurs." He turned. "This is Mr Travis, your Safari Guide in the Past. He'll tell you what and where to shoot. If he says no shooting, no shooting. If you disobey instructions, there's a stiff penalty of another ten thousand dollars, plus possible government action, on your return."

Eckels glanced across the vast office at a mass and tangle, a snaking and humming of wires and steel boxes, at an aurora that flickered now orange, now silver, now blue. There was a sound like a gigantic bonfire burning all of Time, all the years and all the parchment calendars, all the hours piled high and set aflame.

A touch of the hand and this burning would, on the instant, beautifully reverse itself. Eckels remembered the wording in the advertisements to the letter. Out of chars and ashes, out of dust and coals, like golden salamanders, the old years, the green years, might leap; roses sweeten the air, white hair turn Irish-black, wrinkles vanish; all, everything fly back to seed, flee death, rush down to their beginnings, suns rise in Western skies and set in Glorious easts, moons eat themselves opposite to the custom, all and everything cupping one in another like Chinese boxes, rabbits into hats, all and everything returning to the fresh death, the seed death, the green death, to the time before the beginning. A touch of a hand might do it, the merest touch of a hand.

"Hell and damn," Eckels breathed, the light of the Machine on his thin face. "A real Time Machine." He shook his head. "Makes you think. If the election had gone badly yesterday I might be here now running away from the results. Thank God Keith won. He'll make a fine President of the United States."

"Yes," said the man behind the desk. "We're lucky. If Deutscher had gotten in, we'd have the worst kind of dictatorship. There's an anti-everything man for you, a militarist, anti-Christ, anti-human, anti-intellectual. People called us up, you know, joking but not joking. Said if Deutscher became President they wanted to live in 1492. Of course it's not our business to conduct Escapes, but to form Safaris. Anyway, Keith's President now. All you got to worry about is —"

"Shooting my dinosaur," Eckles finished it for him.

"A *Tyrannosaurus Rex.* The Thunder Lizard, the damnedest monster in history. Sign this release. Anything happens to you, we're not responsible. Those dinosaurs are hungry."

Eckels flushed angrily. "Trying to scare me!"

"Frankly, yes. We don't want anyone going who'll panic at the first shot. Six Safari leaders were killed last year, and a dozen hunters. We're here to give you the damnedest thrill a *real* hunter ever asked for. Travelling you back sixty million years to bag the biggest damned game in all Time. Your personal cheque's still there. Tear it up."

Mr. Eckels looked at the cheque for a long time. His fingers twitched.

"Good luck," said the man behind the desk. "Mr. Travis, he's all yours."

They moved silently across the room, taking their guns with them, toward the Machine, toward the silver metal and the roaring light.

First a day and then a night and then a day and then a night, then it was day-night-day -night-day. A week, a month, a year, a decade! A.D. 2055. A.D. 2019. 1999! 1957! Gone! The Machine roared.

They put on their oxygen helmets and tested the intercoms.

Eckels swayed on the padded seat, his face pale, his jaw stiff. He felt the trembling in his arms and he looked down and found his hands tight on the new rifle. There were four other men in the Machine. Travis, the Safari Leader, his assistant, Lesperance, and two other hunters, Billings and Kramer. They sat looking at each other, and the years blazed around them.

"Can these guns get a dinosaur cold?" Eckels felt his mouth saying.

"If you hit them right," said Travis on the helmet radio. "Some dinosaurs have two brains, one in the head, another far down the spinal column. We stay away from those. That's stretching luck. Put your first two shots into the eyes, if you can, blind them, and go back into the brain."

The Machine howled. Time was a film run backward. Suns fled and ten million moons fled after them. "Good God," said Eckels. "Every hunter that ever lived would envy us to-day. This makes Africa seem like Illinois."

The Machine slowed; its scream fell to a murmur. The Machine stopped.

The sun stopped in the sky.

The fog that had enveloped the Machine blew away and they were in an old time, a very old time indeed, three hunters and two Safari Heads with their blue metal guns across their knees.

"Christ isn't born yet," said Travis. "Moses has not gone to the mountain to talk with God. The Pyramids are still in the earth, waiting to be cut out and put up. *Remember* that. Alexander, Caesar, Napoleon, Hitler—none of them exists."

The men nodded.

"That"—Mr. Travis pointed—"is the jungle of sixty million, two thousand and fifty-five years before President Keith."

He indicated a metal path that struck off into green wilderness, over steaming swamp, among giant ferns and palms.

"And that," he said, "is the Path, laid by Time Safari for your use. It floats six inches above the earth. Doesn't touch so much as one grass blade, flower, or tree. It's an anti-gravity metal. Its purpose is to keep you from touching this world of the past in any way. Stay on the Path. Don't go off it. I repeat. *Don't go off.* For any reason! If you fall off, there's a penalty. And don't shoot any animal we don't okay."

"Why?" asked Eckels.

They sat in the ancient wilderness. Far birds' cries blew on a wind, and the smell of tar and an old salt sea, moist grasses, and flowers the colour of blood.

"We don't want to change the Future. We don't belong here in the Past. The government doesn't like us here. We have to pay big graft to keep our franchise. A Time Machine is damn finicky business. Not knowing it, we might kill an important animal, a small bird, a roach, a flower even, thus destroying an important link in a growing species."

"That's not clear," said Eckels.

"All right," Travis continued, "say we accidentally kill one mouse here. That means all the future families of this one particular mouse are destroyed, right?"

"Right."

"And all the families of the families of the families of that one mouse! With a stamp of your foot, you annihilate first one, then a dozen, then a thousand, a million, a *billion* possible mice!"

"So they're dead," said Eckels. "So what?"

"So what?" Travis snorted quietly. "Well, what about the foxes that'll need those mice to survive? For want of ten mice, a fox dies. For want of ten foxes, a lion starves. For want of a lion, all manner of insects, vultures, infinite billions of life forms are thrown into chaos and destruction. Eventually it all boils down to this: fifty-nine million years later, a cave man, one of a dozen on the *entire world,* goes hunting wild boar or sabre-tooth tiger for food. But you, friend, have *stepped* on all the tigers in that region. By stepping on *one* single mouse. So the cave man starves. And the cave man, please note, is not just any expendable man, no! He is *an entire future nation.* From his loins would have sprung ten sons. From *their* loins one hundred sons, and thus onward to a civilization. Destroy this one man, and you destroy a race, a people, an entire history of life. It is comparable to slaying some of Adam's grandchildren. The stomp of your foot, on one mouse, could start an earthquake, the effects of which could shake our earth and destinies down through Time, to their very foundations. With the death of that one cave

man, a billion others yet unborn are throttled in the womb. Perhaps Rome never rises on its seven hills. Perhaps Europe is forever a dark forest, and only Asia waxes healthy and teeming. Step on a mouse and you crush the Pyramids. Step on a mouse and you leave your print, like a Grand Canyon, across Eternity. Queen Elizabeth might never be born, Washington might not cross the Delaware, there might never be a United States at all. So be careful. Stay on the Path. *Never* step off!"

"I see," said Eckels. "Then it wouldn't pay for us even to touch the *grass?"*

"Correct. Crushing certain plants could add up infinitesimally. A little error here would multiply in sixty million years, all out of proportion. Of course maybe our theory is wrong. Maybe Time *can't* be changed by us. Or maybe it can be changed only in little subtle ways. A dead mouse here makes an insect imbalance there, a population disproportion later, a bad harvest further on, a depression, mass starvation, and, finally, a change in *social* temperament in far-flung countries. Something much more subtle, like that. Perhaps only a soft breath, a whisper, a hair, pollen on the air, such a slight, slight change that unless you looked close you wouldn't see it. Who knows? Who really can say he knows? We don't know. We're guessing. But until we do know for certain whether our messing around in Time can make a big roar or a little rustle in history, we're being damned careful. This Machine, this Path, your clothing and bodies, were sterilized, as you know, before the journey. We wear these oxygen helmets so we can't introduce our bacteria into an ancient atmosphere."

"How do we know which animals to shoot?"

"They're marked with red paint," said Travis. "To-day, before our journey, we sent Lesperance here back with the Machine. He came to this particular era and followed certain animals."

"Studying them?"

"Right," said Lesperance. "I track them through their entire existence, noting which of them lives longest. Very few. How many times they mate. Not often. Life's short. When I find one that's going to die when a tree falls on him, or one that drowns in a tar pit, I note the exact hour, minute, and second. I shoot a paint bomb. It leaves a red patch on his hide. We can't miss it. Then I correlate our arrival in the Past so that we meet the Monster not more than two minutes before he would have died anyway. This way, we kill only animals with no future, that are never going to mate again. You see how *careful* we are?"

"But if you came back this morning in Time," said Eckels eagerly, "you must've bumped into *us*, our Safari! How did it turn out? Was it successful? Did all of us get through—alive?" Travis and Lesperance gave each other a look.

"That'd be a paradox," said the latter. "Time doesn't permit that sort of mess—a man meeting himself. When such occasions threaten, Time steps aside. Like an airplane hitting an air pocket.

You felt the Machine jump just before we stopped? That was us passing ourselves on the way back to the Future. We saw nothing. There's no way of telling *if* this expedition was a success, *if* we got our monster, or whether all of us-meaning *you,* Mr. Eckels—got out alive."

Eckels smiled palely.

"Cut that," said Travis sharply. "Everyone on his feet!"

They were ready to leave the Machine.

The jungle was high and the jungle was broad and the jungle was the entire world forever and forever. Sounds like music and sounds like flying tents filled the sky, and those were pterodactyls soaring with cavernous grey wings, gigantic bats out of delirium and a night fever. Eckels, balanced on the narrow Path, aimed his rifle playfully.

"Stop that!" said Travis. "Don't even aim for fun, damn it! If your gun should go off—"

Eckels flushed. "Where's our *Tyrannosaurus*?"

Lesperance checked his wrist watch. "Up ahead. We'll bisect his trail in sixty seconds. Look for the red paint, for Christ's sake. Don't shoot till we give the word. Stay on the Path. *Stay on the Path!"*

They moved forward in the wind of moaning.

"Strange," murmured Eckels. "Up ahead, sixty million years, Election Day over. Keith made President. Everyone celebrating. And here we are, a million years lost, and they don't exist. The things we worried about for months, a lifetime, not even born or thought about yet."

"Safety catches off, everyone!" ordered Travis. "You, first shot, Eckels. Second, Billings. Third, Kramer."

"I've hunted tiger, wild boar, buffalo, elephant, but Jesus, this is *it,"* said Eckels. "I'm shaking like a kid."

"Ah," said Travis.

Everyone stopped.

Travis raised his hand. "Ahead," he whispered. "In the mist. There he is. There's His Royal Majesty now."

The jungle was wide and full of twitterings, rustlings, murmurs, and sighs.

Suddenly it all ceased, as if someone had shut a door. Silence.

A sound of thunder.

Out of the mist, one hundred yards away, came *Tyrannosaurus rex.*

"Jesus God," whispered Eckels.

"Sh!"

It came on great oiled, resilient, striding legs. It towered thirty feet above half of the trees, a great evil god, folding its delicate watchmaker's claws close to its oily reptilian chest. Each lower leg was a piston, a thousand pounds of white bone, sunk in thick ropes of muscle, sheathed over in a gleam of pebbled skin like the mail of a terrible warrior. Each thigh was a ton of meat, ivory, and steel mesh. And from the great breathing cage of the upper body those two delicate arms dangled out front, arms with hands which might pick up and examine men like toys, while the snake neck coiled. And the head itself, a ton of sculptured stone, lifted easily upon the sky. Its mouth gaped, exposing a fence of teeth like daggers. Its eyes rolled, ostrich eggs, empty of all expression save hunger. It closed its mouth in a death grin. It ran, its pelvic bones crushing aside trees and bushes, its taloned feet clawing damp earth, leaving prints six inches deep wherever it settled its weight. It ran with a gliding ballet step, far too poised and balanced for its ten tons. It moved into a sunlit arena warily, its beautifully reptile hands feeling the air.

"My God!" Eckels twitched his mouth. "It could reach up and grab the moon."

"Sh!" Travis jerked angrily. "He hasn't seen us yet."

"It can't be killed." Eckels pronounced this verdict quietly, as if there could be no argument. He had weighed the evidence and this was his considered opinion. The rifle in his hands seemed a cap gun. "We were fools to come. This is impossible."

"Shut up!" hissed Travis.

"Nightmare."

"Turn around," commanded Travis. "Walk quietly to the Machine. We'll remit one half your fee."

"I didn't realize it would be this *big,"* said Eckels. "I miscalculated, that's all. And now I want out."

"It *sees* us!"

"There's the red paint on its chest!"

The Thunder Lizard raised itself. Its armoured flesh glittered like a thousand green coins. The coins, crusted with slime, steamed. In the slime, tiny insects wriggled, so that the entire body seemed to twitch and undulate, even while the monster itself did not move. It exhaled. The stink of raw flesh blew down the wilderness.

"Get me out of here," said Eckels. "It was never like this before. I was always sure I'd come through alive. I had good guides, good safaris, and safety. This time, I figured wrong. I've met my match and admit it. This is too much for me to get hold of."

"Don't run," said Lesperance. "Turn around. Hide in the Machine."

"Yes." Eckels seemed to be numb. He looked at his feet as if trying to make them move. He gave a grunt of helplessness.

"Eckels!"

He took a few steps, blinking, shuffling.

"Not *that* way!"

The Monster, at the first motion, lunged forward with a terrible scream. It covered one hundred yards in four seconds. The rifles jerked up and blazed fire. A windstorm from the beast's mouth engulfed them in the stench of slime and old blood. The Monster roared, teeth glittering with sun.

Eckels, not looking back, walked blindly to the edge of the Path, his gun limp in his arms, stepped off the Path, and walked, not knowing it, in the jungle. His feet sank into green moss. His legs moved him, and he felt alone and remote from the events behind.

The rifles cracked again. Their sound was lost in shriek and lizard thunder. The great lever of the reptile's tail swung up, lashed sideways. Trees exploded in clouds of leaf and branch. The Monster twitched its jeweller's hands down to fondle at the men, to twist them in half, to crush them like berries, to cram them into its teeth and its screaming throat. Its boulder-stone eyes levelled with the men. They saw themselves mirrored. They fired at the metallic eyelids and the blazing black iris.

Like a stone idol, like a mountain avalanche, *Tyrannosaurus* fell. Thundering, it clutched trees,

pulled them with it. It wrenched and tore the metal Path. The men flung themselves back and away. The body hit, ten tons of cold flesh and stone. The guns fired. The Monster lashed its armoured tail, twitched its snake jaws, and lay still. A fount of blood spurted from its throat. Somewhere inside, a sac of fluids burst. Sickening gushes drenched the hunters. They stood, red and glistening.

The thunder faded.

The jungle was silent. After the avalanche, a green peace. After the nightmare, morning.

Billings and Kramer sat on the pathway and threw up. Travis and Lesperance stood with smoking rifles, cursing steadily.

In the Time Machine, on his face, Eckels lay shivering. He had found his way back to the Path, climbed into the Machine.

Travis came walking, glanced at Eckels, took cotton gauze from a metal box, and returned to the others, who were sitting on the Path.

"Clean up."

They wiped the blood from their helmets. They began to curse too. The Monster lay, a hill of solid flesh. Within, you could hear the sighs and murmurs as the furthest chambers of it died, the organs malfunctioning, liquids running a final instant from pocket to sac to spleen, everything shutting off, closing up forever. It was like standing by a wrecked locomotive or a steam shovel at quitting time, all valves being released or levered tight. Bones cracked; the tonnage of its own flesh, off balance, dead weight, snapped the delicate forearms, caught underneath. The meat settled, quivering.

Another cracking sound. Overhead, a gigantic tree branch broke from its heavy mooring, fell. It crashed upon the dead beast with finality.

"There." Lesperance checked his watch. "Right on time. That's the giant tree that was scheduled to fall and kill this animal originally." He glanced at the two hunters. "You want the trophy picture?"

"What?"

"We can't take a trophy back to the Future. The body has to stay right here where it would have died originally, so the insects, birds, and bacteria can get at it, as they were intended to. Everything in balance. The body stays. But we *can* take a picture of you standing near it."

The two men tried to think, but gave up, shaking their heads.

They let themselves be led along the metal Path. They sank wearily into the Machine cushions. They gazed back at the ruined Monster, the stagnating mound, where already strange reptilian birds and golden insects were busy at the steaming armour.

A sound on the floor of the Time Machine stiffened them. Eckels sat there, shivering.

"I'm sorry," he said at last.

"Get up!" cried Travis.

Eckels got up.

"Go out on that Path alone," said Travis. He had his rifle pointed. "You're not coming back in the Machine. We're leaving you here!"

Lesperance seized Travis's arm. "Wait—"

"Stay out of this!" Travis shook his hand away. "This son of a bitch nearly killed us. But it isn't *that* so much. Hell, no. It's his *shoes!* Look at them! He ran off the Path. My God, that *ruins* us! Christ knows how much we'll forfeit! Tens of thousands of dollars of insurance! We guarantee no one leaves the Path. He left it. Oh, the damn fool! I'll have to report to the government. They might revoke our licence to travel. God knows *what* he's done to Time, to History!"

"Take it easy, all he did was kick up some dirt."

"How do we *know*?" cried Travis. "We don't know anything! It's all a damn mystery! Get out there, Eckels!"

Eckels fumbled his shirt. "I'll pay anything. A hundred thousand dollars!"

Travis glared at Eckels's cheque book and spat. "Go out there. The Monster's next to the Path. Stick your arms up to your elbows in his mouth. Then you can come back with us."

"That's unreasonable!"

"The Monster's dead, you yellow bastard. The bullets! The bullets can't be left behind. They don't belong in the Past; they might change something. Here's my knife. Dig them out!"

The jungle was alive again, full of the old tremorings and bird cries. Eckels turned slowly to regard that primeval garbage dump, that hill of nightmares and terror. After a long time, like a sleepwalker, he shuffled out along the Path.

He returned, shuddering, five minutes later, his arms soaked and red to the elbows. He held out his hands. Each held a number of steel bullets. Then he fell. He lay where he fell, not moving.

"You didn't have to make him do that," said Lesperance.

"Didn't I? It's too early to tell." Travis nudged the still body. "He'll live. Next time he won't go

hunting game like this. Okay." He jerked his thumb wearily at Lesperance. "Switch on. Let's go home."

1492. 1776. 1812.

They cleaned their hands and faces. They changed their caking shirts and pants. Eckels was up and around again, not speaking. Travis glared at him for a full ten minutes.

"Don't look at me," cried Eckels. "I haven't done anything."

"Who can tell?"

"Just ran off the Path, that's all, a little mud on my shoes—what do you want me to do—get down and pray?"

"We might need it. I'm warning you, Eckels, I might kill you yet. I've got my gun ready."

"I'm innocent. I've done nothing!"

1999. 2000. 2055.

The Machine stopped.

"Get out," said Travis.

The room was there as they had left it. But not the same as they had left it. The same man sat behind the same desk. But the same man did not quite sit behind the same desk.

Travis looked around swiftly. "Everything okay here?" he snapped.

"Fine. Welcome home!"

Travis did not relax. He seemed to be looking at the very atoms of the air itself, at the way the sun poured through the one high window.

"Okay, Eckels, get out. Don't ever come back."

Eckels could not move.

"You heard me," said Travis. "What're you *staring* at?"

Eckels stood smelling of the air, and there was a thing to the air, a chemical taint so subtle, so slight, that only a faint cry of his subliminal senses warned him it was there. The colours, white, grey, blue, orange, in the wall, in the furniture, in the sky beyond the window, were ... were ... And there was a *feel.* His flesh twitched. His hands twitched. He stood drinking the oddness with the pores of his body. Somewhere, someone must have been screaming one of those whistles that only a dog can hear. His body screamed silence in return. Beyond this room, beyond this wall, beyond this man who was not quite the same man seated at this desk that was not quite the same desk ... lay an entire world of streets and people. What sort of world it was now, there was no telling. He could feel them moving there, beyond the walls, almost, like so many chess pieces blown in a dry wind. ... But the immediate thing was the sign painted on the office wall, the same sign he had read earlier to-day on first entering.

Somehow, the sign had changed:

TYME SEFARI INC.

SEFARIS TU ANY YEER EN THE PAST.

YU NAIM THE ANIMALL.

WEE TAEK YU THAIR.

YU SHOOT ITT.

Eckels felt himself fall into a chair. He fumbled crazily at the thick slime on his boots. He held up a clod of dirt, trembling. "No, it *can't* be. Not a *little* thing like that. No!"

Embedded in the mud, glistening green and gold and black, was a butterfly, very beautiful, and very dead.

"Not a little thing like *that!* Not a butterfly!" cried Eckels. It fell to the floor, an exquisite thing, a small thing that could upset balances and knock down a line of small dominoes and then big dominoes and then gigantic dominoes, all down the years across Time. Eckels' mind whirled. It *couldn't* change things. Killing one butterfly couldn't be *that* important! Could it?

His face was cold. His mouth trembled, asking: "Who—who won the presidential election yesterday?"

The man behind the desk laughed. "You joking? You know damn well. Deutscher, of course! Who else? Not that damn weakling Keith. We got an iron man now, a man with guts, by God!" The official stopped. "What's wrong?"

Eckels moaned. He dropped to his knees. He scrabbled at the golden butterfly with shaking fingers. "Can't we," he pleaded to the world, to himself, to the officials, to the Machine, "can't we take it *back,* can't we *make* it alive again? Can't we start over? Can't we—"

He did not move. Eyes shut, he waited, shivering. He heard Travis breathe loud in the room; he heard Travis shift his rifle, click the safety catch, and raise the weapon.

There was a sound of thunder.

# 4

# IS TIME TRAVEL POSSIBLE?

PHILOSOPHY GYM CATEGORY
WARM-UP
MODERATE
MORE CHALLENGING

Might a time machine be built one day? Could we use it to visit the future, to find out what lies in store for us? Could we go back and affect what happened in the past? Or is time travel impossible – ruled out on purely logical grounds? This chapter investigates some of the key ideas and arguments.

## Bassett's Time Machine

*The scene: a laboratory of the future, in the year 4645. Ms Meers, an inventor, sits at a table, distractedly playing with her pencil. Suddenly, the door opens and in rushes her excited colleague, Bassett.*

*Bassett*: I've just created a *time machine*!

*Meers*: You've been drinking again, Bassett.

*Bassett*: No, really. I have. My new invention will allow me to travel through time and visit the future and the past. It's next door. Come and see.

*Meers*: I will not. There's no point. Time travel is *impossible*.

*Bassett*: No, it isn't.

*Meers*: Yes, it is. And I don't mean it's just a *technological* impossibility, either. It's currently technologically impossible for us to build a spaceship that can travel close to the speed of light. But perhaps one day we will succeed. Nor do I mean that time travel is made impossible by the *laws of nature* – in the way that, as Einstein pointed out, travelling *faster* than light is impossible. What I mean is: talk about time travel simply *doesn't make sense*.

*Bassett*: Doesn't make sense?

*Meers*: Yes. To suggest that you have created a time machine makes as much sense as to suggest that you have created a round square or a female stallion. These are *contradictory* notions.

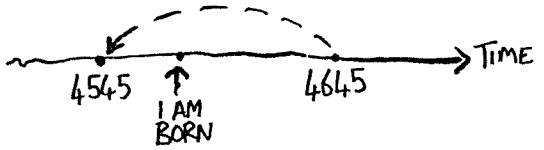


*Bassett*: I do see that talk about round squares and non-male stallions involves a contradiction.

*Meers*: But the same is also true of your claim to have constructed a time machine. Time travel is ruled out on purely logical grounds. Just as we can know, *just by thinking about it*, without our having to do any scientific research into the matter, that there are no non-male stallions out there in the world, so I can know, just by thinking about it, that there are no time machines.

*Bassett*: I'm afraid I don't see why there is anything illogical about the notion of time travel. Do please explain.

Meers takes a piece of chalk from her pocket and walks over to the blackboard. She begins to draw a diagram like this:




*Meers*: OK. Imagine that a machine is built that will allow me to travel a hundred years back into the past, to a time before I was even born. I get into the machine, dial in the year 4545 and press the start button. I suddenly find myself back in 4545. Then it's true of me back in 4545 both that I *had* been born – how could I be standing there if I hadn't been born? – and also that I *hadn't* been born, for the date of my birth would not yet have arrived. So you see, there's a *contradiction*. I would have been both born and not born. The idea makes no sense.

Bassett sits down in Meers's chair and looks pensive while Meers paces up and down in front of the blackboard.

*Bassett*: Ah, I see where you've gone wrong. Actually, there's no contradiction. You merely need to distinguish two notions of time: what one might call, after the twentieth-century philosopher David Lewis (1941–2001), *personal time* and *external time*.

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*Meers*: Two kinds of time?

*Bassett*: Yes. Your personal time is the sort of time that is measured by, say, your wristwatch. External time, on the other hand, is the sort of time through which you might travel. Now, in the situation you describe, you go back in external time to a point before you were born. But, of course, your birth continues to be part of your *personal* history. Your birth still lies in the past in your personal time, but now also lies in the future in external time. So you see, once we separate out these two notions of time, the appearance of a contradiction disappears. There's no *single* sort of time in which you are both born and not born.

Meers puts the chalk back in her pocket and stands quietly for a moment.

## The Case of the Slow Pill

*Meers*: Perhaps you're right. But I still think there's something fishy about the very notion of time travel. In fact, I myself was once very interested in building a time machine. And in a sense I succeeded.

*Bassett*: Really?

*Meers*: Yes. My 'machine' took the form of a pill. I called it the 'slow pill'. On swallowing the pill, all my body's natural processes would slow down dramatically. My heart would beat just once a minute. Even the electrical activity in my brain was reduced to a crawl. From the point of view of an external observer, I seemed to be frozen. You would have to watch very carefully to see me move. It took me a full five minutes to take a couple of steps across the floor.


*Bassett*: How extraordinary. What was it like for you?

*Meers*: In fact, from my point of view, I didn't appear to slow down at all. Rather, everything else appeared to speed up. People buzzed about like flies. The hour hand on my watch shot round once a minute. Outside I could see clouds flying past like pigeons and the sun flashing along as if pulled by a wire.

*Bassett*: Fantastic! But, of course, this pill of yours wasn't *really* a time machine, was it?



*Meers*: No. That's my point. I hope you haven't just reinvented my pill. For all the slow pill succeeded in doing was to slow me down. I merely had the *subjective impression* of time speeding up. But the pill didn't *really* have any effect on time at all. And, of course, the slow pill certainly *didn't* allow me to travel *into the past*. You say your machine can do that?

## Travelling Close to the Speed of Light

*Bassett*: That's right. In fact, as you know, a *kind* of 'time travel' is already allowed by physics. As the physicist Albert Einstein pointed out, if you get into a spacecraft and travel very, very fast, the ship's time will slow down relative to things that are stationary.

*Meers*: I know.

*Bassett*: So by travelling very, very fast one has, in a sense, travelled into the future.

*Meers*: In a sense. But again, is this *really* time travel? Certainly, you can't *go backwards* in time using a spacecraft. The most you can achieve is to slow the ship's time down a bit relative to what's going on back on earth. You can't disappear from the universe to reappear again with a 'Pop!' at some point in the future or past.

*Bassett*: But that's exactly what my new invention *will* allow.

## H. G. Wells and *The Time Machine*

Meers remains wholly unconvinced.

*Meers*: What utter rubbish! So tell me, Bassett, have you actually *used* this machine yet?

*Bassett*: Er, no. Not yet.

*Meers*: What do you think will happen when you set the controls for, say, one year into the future and press the start button?

*Bassett*: Have you ever read the book *The Time Machine*, written by H. G. Wells? In Wells's story, a time traveller gets into his machine and pushes a lever, sending him into the future. Suddenly the sun starts to move more swiftly across the sky. The clouds scud past. Night follows

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day follows night follows day with increasing rapidity as the time traveller accelerates into the future. Decades soon fly by. Civilisation eventually starts to crumble around him. I expect time travel will be like that.

*Meers:* But wait a minute. Suppose you get into your machine and press the start button. Then you sit and watch as one year passes in just a few minutes. You see the clock on the wall whizzing round, people buzzing about like flies, the sun rise and set 365 times. Then the machine comes to a halt and you get out and you are one year into the future.

*Bassett:* What's the problem with that?

*Meers:* Well, for a start, if you were there to witness the clock whizzing round, the sun flashing across the sky, and so on, *then you must have been in the room during that whole year.*

*Bassett:* I suppose so.

*Meers:* But then *you didn't disappear from the room*, did you? So people coming into the room would see you sitting there aboard your machine, apparently quite motionless. If they were to study you more intently, however, they would discover that your heart was still beating, though only once every few days. So all you have really described is a situation in which all the processes going on inside the machine are *slowed down*. So you don't *really* time travel at all, do you? You just get very *slow*. In fact, it's as if you had taken my slow pill.

*Bassett:* Ah . . . I hadn't thought about it like that.

It seems Meers is right: the machine that both Bassett and H. G. Wells describe seems to have much the same effect as Meers's slow pill. It's not so much a time machine as a machine that slows down all your bodily processes.

## 'Time Hopping'

Bassett scratches the back of his head. He now starts to change his tune.

*Bassett:* Perhaps reading H. G. Wells has encouraged my imagination to run riot. Now I think about it, I see that, of course, my machine *won't*



remain in the room for the entire period of time through which I travel. Travelling forwards in time using my machine is *not* like taking a slow pill. My time machine doesn't travel in time in the way Wells's machine does. It's as if the traveller in *The Time Machine* travels back and forth on the river of time in a sort of 'time boat'. To get from one moment in time to another, he has to travel through, and so exist at, all the intervening moments of time.

*Meers:* That's right.

*Bassett:* But my machine doesn't work like that. Rather, it simply *takes me out of* the river of time and then drops me in upstream or downstream. I don't travel *along* the river. If I dial in a hundred years into the future or past and press the start button, I'm transported instantly to the time in question, without either me or the machine having to exist at any of the intervening moments. In fact, my time machine doesn't travel 'through' time so much as make time 'leaps', hopping from one moment to another.

## Superman's Biography and Causal Loops

Meers sees that to travel forwards in time would not be like taking a slow pill. Still, she remains convinced that no such machine is possible. The problem, according to Meers, is that such a machine would make possible what is clearly impossible: the existence of *causal loops*.

*Meers:* Ah, I see. Interesting. But I think I've now spotted a logical flaw in the suggestion that you have a time machine. Let me tell you about a Superman comic I read many years ago. In the story, Superman's friend is trying to write a biography of Superman. This writer tries and tries but suffers terrible writer's block and gets nowhere. Superman takes pity on him, wraps the writer up in his indestructible cloak and takes him through the time barrier into the future, where the writer's biography of Superman is on sale. The writer buys a copy of his own book, then takes it back to the past, where he copies out his own work and submits it for publication![*]

*Bassett:* He plagiarises himself. That does sound odd.

*Meers:* Yes. There's clearly something *illogical* about this story, isn't there?

[*] I am indebted to Stephen Williams for this example.

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*Bassett*: It involves a kind of *causal loop*. The writer can plagiarise the book now only because he has obtained it from the future. But he can obtain the book from the future only because he plagiarises it now.

*Meers*: Exactly. And that doesn't really make sense, does it? For while each of the two events is the cause of the other, there is no cause of *the pair of events together*. And that's nonsensical.

*Bassett*: So you're saying that as a time machine would allow such causal loops to be created, and as they are ruled out on purely logical grounds, so time machines are also ruled out on purely logical grounds?

*Meers*: Yes.

Bassett stares vacantly out of the window towards the setting sun.

*Bassett*: Well, I'm not sure causal loops *are* nonsensical. Is there anything illogical about a causal loop? I don't think so. *Logic* doesn't demand that every event has a cause. There's no contradiction involved in supposing that there are uncaused events. In fact, physicists now tell us that some subatomic events *have no cause*. They *just happen*. So there's clearly nothing illogical about uncaused events – they actually occur. But then why is there anything *illogical* about an uncaused causal loop? I don't see that there is. I admit a causal loop is *very weird*, but that doesn't make it illogical.

Bassett appears to be correct. Causal loops may be bizarre in the extreme: it doesn't follow that they are ruled out on purely logical grounds. So the mere fact that a time machine would allow them does not by itself show that time machines are impossible.

## The Terminator Case

*Meers*: Very well. Forget causal loops. I still believe the very notion of a causal loop is incoherent, but let it pass. Here's a quite different logical problem with time travel.

*Bassett*: Fire away.

*Meers*: One of my favourite films is called *Terminator II*. In the film, a machine called a *terminator* is sent back from the future. This machine, played by Arnold Schwarzenegger, plays a vital role in preventing the occurrence of the nuclear holocaust that gave rise to the need to send the terminator back in time in the first place. It was only as a result of the holocaust that the terminator was ever built. So, as a result of the terminator's actions, the holocaust no longer happens. But if the holocaust doesn't happen, then the terminator will never be built. But if the terminator is never built, then the holocaust will happen. You see, there's a contradiction.



*Bassett*: I do see. If the terminator is built, then it isn't, and if it isn't built, then it is! That's a lot like the famous time travel paradox generated by a man going back and shooting his parents prior to his own birth. If he is born, and then he uses a time machine to go back in time and shoot his parents, then he won't be born. But if he won't be born, then he won't be able to go back and shoot his parents, in which case he will be born.

*Meers*: Exactly. So do you now agree that the very idea of time travel makes no sense?

*Bassett*: No.

*Meers*: Why not?

*Bassett*: Maybe there are *parallel universes*.

*Meers*: Parallel universes?

*Bassett*: Yes. Maybe what happens in the *Terminator II* story is this. In *this* universe, the nuclear holocaust happens. Then the terminator is sent back in time. The terminator then prevents the holocaust. But in so doing, it brings into existence a parallel universe, a universe in which the terminator is never created. That creates a second future. There's no contradictory situation involved because there is no universe in which the holocaust both does and doesn't happen or in which the terminator both is and isn't created. Rather, a holocaust happens and the terminator is created in one universe but not the other.

*Meers*: This all sounds very confused to me. For a start, I no longer understand the *point* of trying to send the terminator back in time to try to change the past. Suppose we're the people who send the terminator back. Even though the terminator succeeds in its mission and, indeed, actually prevents the nuclear holocaust, that won't help

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*us* one jot! Because in our universe, the holocaust still happens! It's not much consolation to know that the terminator has created a parallel universe in which it doesn't!

*Bassett*: Er . . . that's true, I suppose.

*Meers*: I just don't think the suggestion that we might change the past makes sense.

## The JFK Case

Even if we can't *change* the past, does it follow that we can't now go back and *affect* what happened in the past? You might think it obvious that it does follow. But Bassett now questions this assumption.

*Bassett*: OK. Perhaps you're right. Perhaps we can't change the past. Let me concede that we can't, at least for the sake of argument. It doesn't follow that time travel into the past is impossible. In fact, a time machine might still allow one to go back into the past and have a *causal effect* on what has happened.

*Meers*: How?

*Bassett*: I might use my time machine to go back into the past and make something happen *that did in fact happen*. For example, suppose I get in my time machine and travel back to Dallas, Texas, on 22 November 1963. I take a rifle with me. I sit behind a white picket fence on a grassy knoll. President Kennedy drives by, and I shoot him several times. My time machine *can* allow me to do this if it is in fact true that I shot Kennedy from that grassy knoll. There's no contradiction here, is there? I don't go back and make what is true, false. I go back and make true what *is* true. It *was* I who shot Kennedy. So the past doesn't get changed from what it actually is. Yet I *do* get causally to affect how things turn out. For if I hadn't fired that bullet on 22 November 1963, Kennedy wouldn't have died that day, and the course of history would have been very different!

The case Bassett describes does avoid those problems for time travel raised specifically by the suggestion that we might go back in time and make false some true statement about the past. Even if we can't go back and change the past in *this*



sense, might we still not be able to go back and *make things happen*, so long as they are things that *did* happen? The situation Bassett outlines does appear to be such a case.

## A Popular Argument Against Time Travel

But Meers thinks she's spotted a fatal flaw in the scenario Bassett has just described.

*Meers*: Ah, I think I finally see the problem. Look at the situation this way. Either JFK was shot from the grassy knoll on 22 November 1963, or he wasn't. Now, suppose it did happen. Then there's no point in your attempting to make it happen, because it happened anyway. So any efforts by you to make it happen will be superfluous; they can make no difference. Suppose, on the other hand, that Kennedy wasn't shot from the grassy knoll. Then whatever you try to do now to make it happen must fail. So either way you're unable to have any effect on how things turn out. So you're wrong: *there's nothing you can do causally to affect the past.* It's impossible for you to go back and make things happen. But as a time machine would make this impossibility a possibility, time machines must themselves be impossible.

The line of argument just presented by Meers has a certain superficial appeal. It's something like this reasoning that no doubt lies behind the reluctance of many to accept the possibility of time travel. But the argument is, on closer inspection, fallacious, as Bassett now points out.

## Fatalism and a Muddle about Time Travel

*Bassett*: Interesting argument. But no good, I'm afraid. Here's an analogous argument. Statements about the future are true or false. For example, it may be true that tomorrow I will be killed in a car crash. Or it may be false.

*Meers*: I hope it's false.

*Bassett*: Thank you. Now imagine someone were to argue like this. If it's true that I'm going to be killed in a car crash tomorrow, then it's true

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*whatever I might try to do about it.* So any attempt I make to stop myself being killed in a car crash tomorrow must be fruitless. If, on the other hand, it's false, then again it is false *whatever I might try to do about it* – in which case any efforts I make to stop myself being killed in a car crash must be superfluous, as it isn't going to happen anyway. So, *either way*, I'm unable to have any effect on how things turn out. But then there's no point in my doing anything to try to prevent myself from dying in a car crash tomorrow, such as driving carefully or wearing a seatbelt. None of these actions will have any effect.

*Meers*: But that's absurd! Wearing a seatbelt *can* save your life.

*Bassett*: I agree. Absolutely. The conclusion I have just drawn is clearly ridiculous – driving carefully and wearing a seatbelt *can* affect how things turn out. But notice that the argument I used to reach the absurd conclusion that it's pointless wearing a seatbelt is exactly analogous to the one you used to try to show that I can't go back and affect what happens in the past. If your argument was good, it would also rule out the possibility of our having any effect on the future. Yet clearly we *can* affect the future.

*Meers*: So *neither* argument is any good?

*Bassett*: Correct.

It seems to me that Bassett is right. The view that there's no point in wearing a seatbelt or driving carefully because 'what will be will be' is that of the *fatalist*. Fatalists take the view that all our actions are in vain. They say things like: 'If it's true I will be killed tomorrow, then it's true I will be killed tomorrow, so there's no point in trying to do anything to prevent it.' Fatalism should not be confused with *determinism*, the view that all our actions are determined in advance by the laws of nature (for a much more detailed explanation of determinism and its consequences for free will, see Chapter 15, Do We Ever Deserve to Be Punished?). Determinism seems, on the face of it, to remove our ability to act freely. But, unlike fatalism, determinism does *not* deny the obvious fact that our actions have causal consequences and that it's worth trying to avoid danger. Determinism may be true; fatalism, on the other hand, seems absurd.

Now, if it's true that Meers's argument is exactly analogous to the fatalist's bad argument, then it, too, is a bad argument. It may not be clear precisely *what's* wrong with Meers's argument, of course, but, if Bassett is right, there is certainly *something* wrong with it.



## Conclusion

Might we one day develop machines that will allow us to travel into the future or the past? It's certainly an extraordinary prospect. While many suppose that the very idea of time travel makes no sense, it's not easy to see *why* the idea makes no sense.

Can we know, just by thinking about it, that Bassett must have failed in his quest to build a time machine? Perhaps. The problem is that none of the arguments presented by Meers establish that conclusion.

Perhaps time travel really is possible after all.

### What to read next

Determinism is discussed in much more detail in Chapter 15, Do We Ever Deserve to Be Punished?.

### Further reading

This chapter makes use of a number of ideas, arguments and examples drawn from the following two rather difficult papers:

Michael Dummett, 'Causal Loops', in his *The Seas of Language* (Oxford: Clarendon Press, 1993).

David Lewis, 'The Paradoxes of Time Travel', in his *Philosophical Papers*, Vol. II (Oxford: Oxford University Press, 1986).

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## Time Travel Could Become Reality

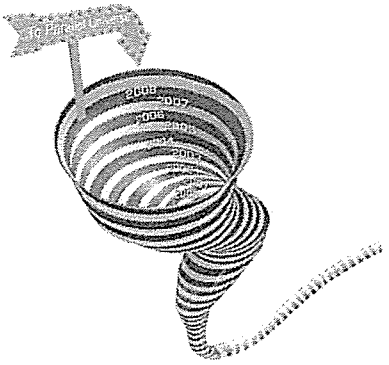
February 27 2008 / by futuretalk
Category: Technology Year: 2008 Rating: 10

*Time Travel could become reality sooner than you think.*

*By Dick Pelletier*

Install a Future Scanner button on your blog.

At a UCLA workshop attended by yours truly and an assortment of future-thinkers, the late physicist Dr. Robert Forward told the group that further understanding of general relativity and quantum mechanics would one day enable humans to travel backwards and forwards through time. "Given the money and the mandate," Forward said, "a time machine will be built."



This workshop convened in 1983, and today, 24 years later, scientists are bringing this bold concept closer to reality. Professor Amos Ori at Technion-Israel Institute of Technology recently created a theoretical model of a time machine based on Einstein's theory of relativity, which would allow people to travel back in time.

Ori's theory, published in the prestigious science journal Physical Review, describes how a future time machine could be built by forming "closed time-like curves" in a donut-shaped area of space-time. A person traveling around this donut loop would go further back in time with each lap.

Although the laws of physics permit time travel, the concept is laden with uncomfortable contradictions. Say we travel back in time and stop our parents from getting together. This would prevent us from being born; we would not exist and our journey in time could never happen. Scientists call this a paradox; we created a past different from the one that already exists.

Clearly, mischievous time travelers cannot change the present. People are not suddenly disappearing because a rerun of events has prevented their birth. Therefore, something is stopping time travelers from changing our present, and Stephen Hawking, Michio Kaku, and other visionaries believe they know what it is – parallel universes.

If we travel to the past and prevent our parents from meeting, we are immediately thrust into a parallel universe, similar to our old universe, but one where we never existed. In this universe, we appear as a visiting time-traveler from another universe; however returning home could pose a problem. If roundtrip procedures have been developed, we're OK; if not, we may be stuck forever in a strange world.

Though construction of Ori's time machine is beyond today's science, many believe that exponentially-advancing technologies could turn this dream into reality by the end of the century.

Advantages to time travel are mind-boggling. A glimpse into the future would reveal what our lives will be like in the 22nd century and beyond. Will we find extra-terrestrial intelligent life? And visiting the past could allow us to scan the minds of lost loved ones before they died and bring them into our time to continue their lives.

Four billion years ago, life was only a biochemical machine capable of self-reproduction. Today, we venture into space and study ideas ranging from general relativity to quantum cosmology. We're already thinking about teleporting people instantly from one location to another; and some bold scientists believe that humanity will one day achieve an indefinite lifespan, eliminating the causes of most deaths.

Who knows how far we can evolve. Will we merge with intelligent machines by mid-century as futurist Ray Kurzweil and others predict? If so, these creations could survive virtually forever with human ideas, hopes, and dreams carried with them. Welcome to our incredible "magical future."

*This article will appear in various print media and blogs; comments welcome. See other published work by Dick at positivefuturist.com and click on the "published work" tab.*

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BOOKMARK

# Time travel countdown

**Jonathan Leake**

HUMANS one day could be able to use time travel to skip generations into the future, according to physicist Stephen Hawking.

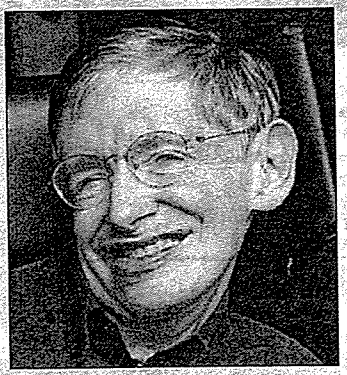
He suggested humans could build spaceships capable of such high speeds that time itself would slow down for those on board.

Such a spaceship could travel thousands of years into the future at close to the speed of light, reaching distant star systems within the lifetime of its crew.

In theory, it could enable humans to "colonise the future", perhaps to even return to repopulate Earth if a disaster caused extinction on this planet during the journey.

"Time travel was once considered scientific heresy, and I used to avoid talking about it for fear of being labelled a crank, but these days I'm not so cautious," Hawking said.

He made his comments in *Stephen Hawking's Universe*, a documentary to be screened by Fox's Discovery Channel from next Sunday.



**Stephen Hawking**

Einstein found that as objects accelerate through space, the rate at which time passes for them slows down.

For objects such as cars and aircraft, the effect is negligible, but Hawking's spaceship would exceed 98 per cent of the speed of light, when such effects would be extremely powerful.

Hawking said such a ship theoretically could reach speeds of more than 650 million m/hr, but would have to be built on a huge scale simply to carry all the fuel that would be needed.

"It would take six years at full power just to reach these speeds. After the first two years, it would reach half light speed and be far outside the solar system. After another two years, it would be traveling at 90 per cent of the speed of light.

"After another two years of full thrust, the ship would reach full speed, 98 per cent of the speed of light, and each day on the ship would be a year on Earth. At such speeds, a trip to the edge of the galaxy would take just 80 years for those on board."

But Hawking dismissed the prospect of time travel into the past, pointing out it would create the so-called mad scientist paradox, where a researcher could travel back in time and shoot his past self, raising the question of who could have fired the shot?