The Ins and Outs of Time Travel: 'Quantum Break' vs. ‘Back to the Future'

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Illustration by Sean Noyce

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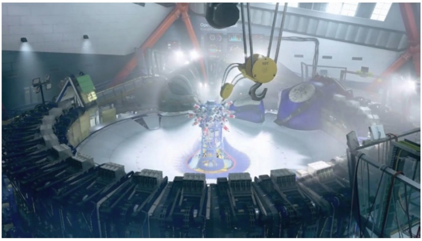
Time travel stories have a tendency to become a bit of a mess. It can be tough to maintain things like “logic” when you’re telling a story about visiting (and usually changing) the past or future, to say nothing of staying kosher with the laws of physics.

That’s why the recently released Xbox One game *Quantum Break* is refreshing, especially as video game time travel stories go. Sure, it’s a game about getting irradiated and, rather than immediately suffering the debilitating effects of your organs dying one by one, gaining the power to control time. But it *also* has a pretty good handle on time travel. It’s not only internally consistent, which is a big part of making time travel work in fiction, but it’s actually pretty scientific! Apart from turning into a time wizard, that is.

But *Quantum Break* has a different sort of time travel than most stories. Compared to the revered *Back to the Future* series, for instance, developer Remedy’s story is a wholly different take. Where *Back to the Future II* in particular is all about tangent timelines and catastrophic alterations to the past, *Quantum Break* is about time loops and the impossibility of paradoxes. The two are different, but equally interesting, approaches to temporal dislocation.

I make it my life’s work to analyze time travel stories for the nerdiest of issues—and I’ve got a book on the subject and a podcast also on the subject. And after having delved into *Quantum Break,* I’ve discovered the game is actually a pretty solid example of how to do a time travel story well—and even how to do one well *with science*. It might be bonkers but, somewhat surprisingly, *Quantum Break* is mostly bonkers in a way that *makes sense*.

Quantum Break sets up a few narrative rules to keep its time travel on the level. Here’s what you need to know:



The time machine is you hanging out next to a black hole. *Quantum Break*’s time machine is basically a big circular machine in the center of a room, with a giant long circular hallway surrounding it. You get in, walk around the hallway either counter-clockwise to go forward or clockwise to go backward, and when you come out again, you find yourself at whatever date and time you set for yourself. Pretty simple.

What’s going on with the whole center part is basically a small-scale singularity held inside the machine—a black hole, in other words. The intense gravity of the singularity actually *bends* the fabric of spacetime around it. When you walk through the hallway, you take advantage of that curvature, coming back out of the machine at some other point in time.

It sounds weird, but actually, this is all pretty on-point, at least in terms of theoretical science. *Quantum Break*’s time machine takes advantage of solutions to the real-life general theory of relativity created by Albert Einstein that seem to allow for time travel. Those solutions are called “closed timelike curves.”

To get your head around the idea, imagine the universe is a 2D sheet of paper. That’s spacetime—the fabric of reality. Einstein theorized that gravity actually distorted spacetime: imagine placing a rock on the piece of paper, and the paper bending as it supports it. That curvature distorts time some, allowing you to skip forward or back. In *Quantum Break*, the time machine uses a singularity to create some crazy-ass gravity, distorting spacetime and allowing you to actually travel backward or forward along the curve. But you can only go as far back (or forward) as when the machine was activated.

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QUANTUM BREAK'S TIME MACHINE TAKES ADVANTAGE OF SOLUTIONS TO THE REAL-LIFE GENERAL THEORY OF RELATIVITY CREATED BY ALBERT EINSTEIN THAT SEEM TO ALLOW FOR TIME TRAVEL.

There are these things called chronons. A big part of what makes *Quantum Break* work is the addition of some fictional theoretical physics to the ones we observe, or theorize about, in our universe. This is the "Meyer-Joyce Field," and you can think of it kind of like gravity, but for time. All around everything in the universe is a field of invisible particles known in *Quantum Break* as chronons, and those particles are what give the universe, uh, time. Time particles. They're a thing.

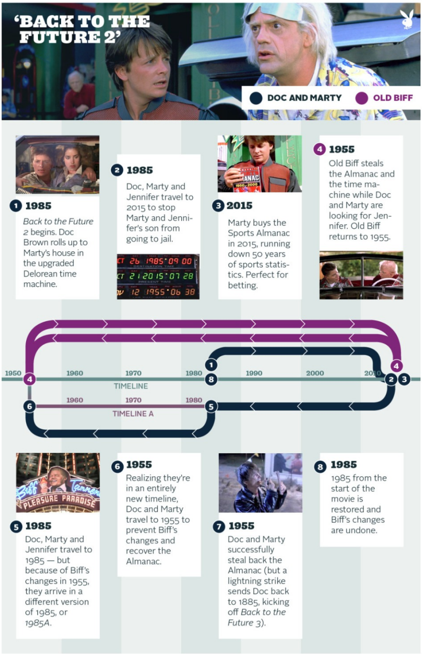
It's actually not that out-there a concept. Chronons are to time what photons are to light, for instance, and physicists theorize there could be a particle that makes gravity work called a graviton.

When the time machine at the beginning of the game goes *kapow*, it creates a fracture in the Meyer-Joyce field that starts to disrupt time, creating freezes in which there's no flow of time at all. The somewhat dumb-sounding "end of time" the characters are all worried about is just that: the Meyer-Joyce Field breaking down, running out of chronons, and freezing humanity in place forever with no time flowing to allow them to move or save themselves. Everything just freezes in a single moment, suspended, forever.

Upshot, though: blowing up a time machine, destroying the universe and getting totally baked with chronon radiation turns you into a literal time wizard! So it's not all bad.

You can't actually change the future (or can you?). Whether or not it's possible to actually alter the timeline of reality is a key component of every time travel story, and it usually works in one of two ways: either time travel to the past in a story rewrites the future that will come after it, or time travel to the past only creates situations that always existed, and it's impossible to actually alter the future.

That's a bit confusing, so let's look at a well-known example: *Back to the Future*.



'BACK TO THE FUTURE 2'

● DOC AND MARTY ● OLD BIFF

1 1985
Back to the Future 2 begins. Doc Brown rolls up to Marty's house in the upgraded Delorean time machine.

2 1985
Doc, Marty and Jennifer travel to 2015 to stop Marty and Jennifer's son from going to jail.

3 2015
Marty buys the Sports Almanac in 2015, running down 50 years of sports statistics. Perfect for betting.

4 1955
Old Biff steals the Almanac and the time machine while Doc and Marty are looking for Jennifer. Old Biff returns to 1955.

5 1985
Doc, Marty and Jennifer travel to 1985 — but because of Biff's changes in 1955, they arrive in a different version of 1985, or *1985A*.

6 1955
Realizing they're in an entirely new timeline, Doc and Marty travel to 1955 to prevent Biff's changes and recover the Almanac.

7 1955
Doc and Marty successfully steal back the Almanac (but a lightning strike sends Doc back to 1885, kicking off *Back to the Future 3*).

8 1985
1985 from the start of the movie is restored and Biff's changes are undone.

In *Back to the Future II* intrepid intern Marty McFly travels with Emmett "Doc" Brown to the future, where Marty gets hold of a sports almanac running down 50 years of statistics—perfect for making a few bets back in his present, 1985. Of course that almanac gets grabbed by aging would-be rapist and attempted murderer Biff Tannen, who uses Marty and Doc's time machine to travel back to 1955 and give the almanac to his younger self. When Marty and Doc head back 1985, they find a horrible, twisted version of 1985 where Biff has become super powerful and super wealthy. Doc explains the situation pretty damn well **here.**

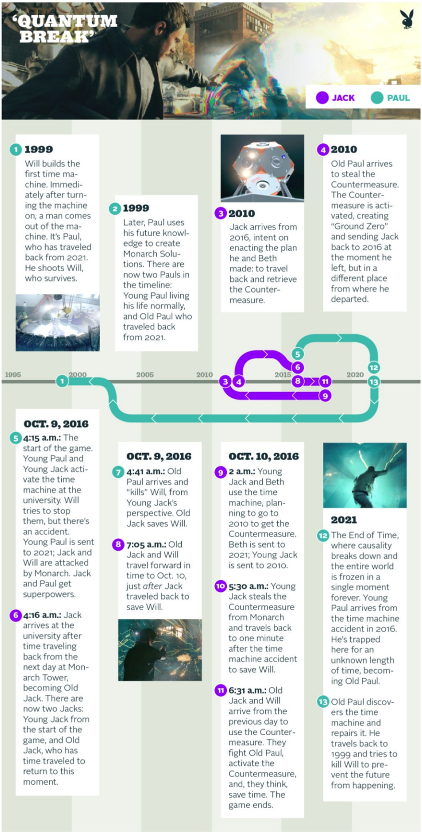
That's how your usual time travel stories go: travel back in time, change the past, the future is altered. But that model doesn't really work when you check it against the theoretical and quantum physics of our world.

Quantum Break takes an entirely more sciency approach: in its universe you can't change the past. In *Quantum Break*'s version of time travel, the past, present and future exist, more or less, simultaneously. Reality is set in stone and any attempts to go back in time and change events only help to bring about the inevitable.

It doesn't need to make sense right away. It's a confusing concept because it's not how humans relate to the universe. Here's an example of a situation described in *Quantum Break* that might help illustrate this:

> *Paul Serene travels in time from 2016 to 2021, then back to 1999, putting him in prime position to prevent the terrorist attacks of Sept. 11, 2001. He starts making calls to federal authorities warning them of the impending attacks, but nobody believes him. Before long, all his attempts to prevent 9/11 from happening start to shift authorities' attention onto him. Because they're investigating the wrong guy, FBI agents miss key intelligence about the actual terrorists—and 9/11 still happens. In a very real way, Paul's attempts to prevent the event actually help cause it.*

Quantum Break characters at several points mention the "Novikov Self-Consistency Principle," a real scientific postulate about time travel. Igor Novikov's theorem suggests that, for any action taken by a time traveler in the past that would change the future they know, the probability of that event is zero. You can't change the past in *Quantum Break* because it already happened. It's Novikov's theorem for how to deal with closed timelike curves under general relativity.



1999

① Will builds the first time machine. Immediately after turning the machine on, a man comes out of the machine. It's Paul, who has traveled back from 2021. He shoots Will, who survives.

1999

② Later, Paul uses his future knowledge to create Monarch Solutions. There are now two Pauls in the timeline: Young Paul living his life normally, and Old Paul who traveled back from 2021.

2010

③ Jack arrives from 2016, intent on enacting the plan he and Beth made: to travel back and retrieve the Countermeasure.

2010

④ Old Paul arrives to steal the Countermeasure. The Countermeasure is activated, creating "Ground Zero" and sending Jack back to 2016 at the moment he left, but in a different place from where he departed.

OCT. 9, 2016

⑤ **4:15 a.m.:** The start of the game. Young Paul and Young Jack activate the time machine at the university. Will tries to stop them, but there's an accident. Young Paul is sent to 2021; Jack and Will are attacked by Monarch. Jack and Paul get superpowers.

⑥ **4:16 a.m.:** Jack arrives at the university after time traveling back from the next day at Monarch Tower, becoming Old Jack. There are now two Jacks: Young Jack from the start of the game, and Old Jack, who has time traveled to return to this moment.

OCT. 9, 2016

⑦ **4:41 a.m.:** Old Paul arrives and "kills" Will, from Young Jack's perspective. Old Jack saves Will.

⑧ **7:05 a.m.:** Old Jack and Will travel forward in time to Oct. 10, just *after* Jack traveled back to save Will.

OCT. 10, 2016

⑨ **2 a.m.:** Young Jack and Beth use the time machine, planning to go to 2010 to get the Countermeasure. Beth is sent to 2021; Young Jack is sent to 2010.

⑩ **5:30 a.m.:** Young Jack steals the Countermeasure from Monarch and travels back to one minute after the time machine accident to save Will.

⑪ **6:31 a.m.:** Old Jack and Will arrive from the previous day to use the Countermeasure. They fight Old Paul, activate the Countermeasure, and, they think, save time. The game ends.

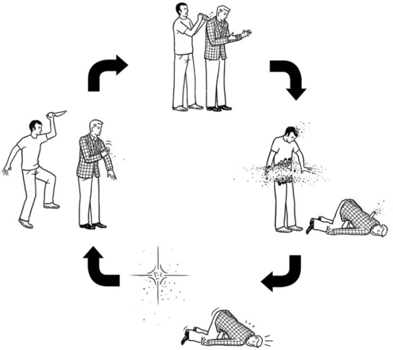
2021

⑫ The End of Time, where causality breaks down and the entire world is frozen in a single moment forever. Young Paul arrives from the time machine accident in 2016. He's trapped here for an unknown length of time, becoming Old Paul.

⑬ Old Paul discovers the time machine and repairs it. He travels back to 1999 and tries to kill Will to prevent the future from happening.

I know, I know: but time travel though! Shouldn't you be able to go back in time and change events? Isn't that the whole point?

One might believe that would be be the case, but according to Novikov's theory and the rules of *Quantum Break*, it's impossible. If alterations in the timeline spun off into *new* timelines (like in *Back to the Future II*), then past changes could alter the future. But if there's only one timeline, changing past events creates paradoxes—which, under Novikov, are impossible. Basically, the point is this: you can't change the past because the past is necessary to create the future that includes you and makes you want to go back and change the past. If the past is changed, then you wouldn't feel the need to go back and change it, so you never would, so the past wouldn't change. See?



Source: So You Created a Wormhole: The Time Traveler's Guide to Time Travel

What's a paradox again? So a "paradox" in time travel lingo is a situation in which the cause of an effect ceases to exist because of that effect. We'll go with the classic: the Grandfather Paradox. If you go back in time and murder your grandfather before your father is born, you've undone the series of events that leads to your existence—and then who would travel back in time to murder your grandfather? Since you changed the past that creates the future that changes the past, what you wind up with is a paradox, which seemingly can't exist. Novikov came up with an idea to explain why some solutions to Einstein's General Theory of Relativity can sometimes seemingly lead to paradoxes.

Novikov's idea is to explain how you can get time travel without winding up with paradoxes, mostly by suggesting that paradox-inducing events simply can't happen. In *Quantum Break*, it gets a little weirder in practice. In our 9/11 example, Paul can't prevent the attack because Paul *didn't* prevent the attack. Put another way—the 9/11 Paul remembers from his youth already was influenced by future Paul attempting to change it. Both Pauls were already there in the timeline. The event never happened in a way that didn't include Paul's influence. Even though in the future he went back to change the past, he'd always been there. He was never not going to go back and 9/11 was never not going to happen. It's exactly like the ending of *12 Monkeys* or *Timecrimes*, and an equally large bummer.

Even if you choose to go back in time to try to prevent something, under Novikov, the event you're trying to prevent already occurred despite your attempt to stop it. It must have happened because otherwise you'd never go back to stop it.

Wait; so there's no free will? It would sure seem that way! We're all puppets on a pre-ordained course and no matter how many people we shoot in the face or explode with time magic, we'll never be able to save the ones we love or stop our inexorable slide toward entropy and eventual nothingness. Since everything that happens already happened, you can't change anything. You can't travel to the past to undo something that happens in the future—because you did. Both. Already.

In the world of *Quantum Break*, this makes sense, and the story sticks to it. All instances of time travel are accounted for and whenever anyone thinks they can change anything, it's only that they're operating on the wrong information. Every time someone travels back to the past, it turns out they were already there—the future traveler was part of the events in the past that made them want to travel back in the future. It's consistent.

So free will gets a little, uh, messy. If you're deciding to travel back to the past from the future, but you were already there in the past and didn't know it, did you really decide anything? Yes and no. You did decide, you just didn't know that you had already decided, and the consequences of that decision are already part of your decision. Yeah, it gets weird.

WE DON'T REALLY KNOW WHERE PARTICLES EVER ARE—THEY'RE EFFECTIVELY IN MULTIPLE PLACES, AND MULTIPLE STATES, AT THE SAME TIME.

So what about the choices players make in *Quantum Break*? That's right! *Quantum Break* tempers all this discussion of unchangeable fate, or "predestination," with a very interesting system: a story that changes based on player decisions. Those decisions, in fact, are made by Paul Serene, the villain of the game, who has the power to see some potential futures before they happen.

In the story, Paul can make choices that alter how things go forward. For instance, he can direct his company, Monarch Solutions, to cover up the game's opening attack on a university with either an elaborate PR campaign, or by murdering all witnesses. Either choice changes some aspects of how the story goes forward—but certain things always happen no matter what you do.

The choice aspect of *Quantum Break* adds a weird bit of flavor to the game. If everything that happens has already happened and you can't change the past, how come Paul Serene can see, and seemingly alter, the future? It gets a little quantum physics-y from here, so get ready.

OK, remember Erwin Schrödinger? He's the dude who's famous for killing a cat in a box. In reality it was a thought experiment, and no cats were harmed in its conception—that we know of. I wouldn't hang out alone with Schrödinger in any event.

So the cat experiment goes like this: Schrödinger tosses a cat in a box, along with something that can emit radiation, but intermittently and unpredictably. Inside the box is also a thing that, when it detects radiation, will emit poison, killing the cat. Once the box is closed, you don't know if the cat is alive or dead. According to quantum physics, the cat is *both* possibilities *at the same time*, and doesn't become one or the other until you actually open the box and observe the cat.

This actually comes up in quantum physics in a non-animal cruelty way. In at least one view of quantum physics, we don't really know where particles ever are—they're effectively in multiple places, and multiple states, at the same time, because we don't know where they are *for sure*, just like Schrödinger's cat. It's only once the particles are actually observed that they exist in a single place and state, and we use very specific rules about particles and probabilities to map out how they behave. The idea of something existing in more than one possible place at the same time is called "quantum superposition" and it comes up in *Quantum Break* also: there are quantum superposition monsters.

They should have just called the game *Quantum Monsters.* I agree. So an effect of getting zapped with a shit load of chronons is that you might become what scientists in *Quantum Break* refer to as a "shifter"—a creature that is caught in quantum superposition. It's basically simultaneously all possibilities of how that person *could* exist, existing all in the same time or place. Both alive and dead, both good and evil, both ate breakfast that day and skipped it, both read *Moby Dick* in high school and just watched the movie, all in the same being. In the game, these guys are super dangerous, because they're real hard to kill. You shoot at a shifter and you might hit one of its states and kill it, but all the other states still exist.

It's probably really painful and sucky to be a shifter. But what's interesting about shifters when it comes to choice and predestination in *Quantum Break* is the idea of probabilities. A shifter can be and is both alive and dead at the same time, just like Schrödinger's cat. *Quantum Break* acknowledges that events can be random and that they have different outcomes: Paul Serene can make choices about possible futures, and shifters can literally *be* multiple different possibilities existing at the same time. If there are multiple possibilities, that seems to confirm that time is not set one way, and that the timeline actually *isn't* set—that there actually is no predestination.

So the questions of whether free will exists, and whether you can change the past, aren't quite clear in *Quantum Break*. Even though the game is very consistent on its time travel and on Novikov's rules, it still acknowledges that quantum physics is full of randomness and probability. The answer to whether you can *actually* change the past is: maybe? Nobody in the story has been able to do alter events, but it's possible they've just never had enough information, or the right tools.

DO NOT ENTER

And that's kind of the best part of the game's story. *Quantum Break* is a very solid time travel tale in terms of paying attention to science and sticking to the rules of its universe. There really aren't any plot holes, gaps, logic leaps or paradoxes in the story when it comes to time travel. For someone who has watched *a lot* of time travel movies and read a lot of time travel fiction (and even written some), that's impressive.

At the same time, *Quantum Break* leaves things open. Some characters think the past is set and become despondent, others become bad guys. And some refuse to believe it. *Quantum Break* gives you evidence for both predestination and free will, and leaves it up to you, and the game's characters, to decide what's really going on and how they should respond. Those decisions, and the fact that they actually manage to make sense, make *Quantum Break* a pretty damn good time travel story.

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