

# Time Travel

## *A History*

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The notion of 'time travel' is fairly recent, one explanation could be that in the past times did not really change, so the past was thought of more or less the same as the present, and by implication the same thing was of course assumed to hold for the future. Jules Verne, who can be said to be the father of science fiction, did place his stories more or less in the present, with no excursions to the past, but actually with one into the future, trying to imagine how Paris would be hundred years from then. His *Paris au xx siècle* was written already in 1860 when he was still a rather young man. It was refused publication, on the grounds that it would severely damage the reputation of the young upcoming writer, was forgotten, or at least thought to be permanently lost, and then eventually retrieved and published in 1994. More interesting though, and less predicted, is that the master of Fairy Tales - H.C.Andersen - wrote a little known story, perhaps more of a sketch than anything else, by name of *Om Aartusinder*. It was written back in 1852 and tells how future Americans fly over to Europe to see the old sights of the Old lands, doing Europe in eight days. He mentions among other things the canal under the channel between England and France. Before the 19th century there were no technological progress that involved people in general, so one may claim that indeed the quotidian life of people, especially that of the peasants, did not differ significantly between the Medieval ages and the middle of the 18th century; however, the practical applications of science became noteworthy starting with the Industrial revolution and the harnessing of external powers such as steam. Indeed by seductive extrapolation it gave the idea that the future would be very different from the present, and in particular much more comfortable (and exciting? As is well known, comfort and excitement do not coexist comfortably).

However, one cannot in the case of Verne and Andersen talk about true time travel, just imaginative prophecies, the distinction of actually traveling in time, in the fourth dimension so to speak, is due to H.G.Wells in his striking story 'The Time Machine' published already in 1894. This is indeed a striking story involving large time-scales going into the distant future when the Sun turns into a Red Giant<sup>1</sup>. This is the point of departure for the author in his survey of the notion of Time Travel. H.G.Wells was a hard-nosed scientific fellow, or at least he thought of himself as such, and the imaginative exercise gives a splendid opportunity to present some facts of geology, the spirit of evolution, and

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<sup>1</sup> It is commonly assumed that when the Sun engulfs the Earth, the latter will be vaporized. However, if there is no increase in mass, and why should there be, the volume increasing by a factor of  $200^3$  i.e. eight million, would lead to an average density of a billionth of that of water, or a millionth of that of ordinary air. If the energy production would not increase, there would be no more energy reaching the Earth, even when engulfed, than today. This later assumption can of course be debated and researched

cosmology, which he no doubt savored. As such it fired the imagination of the curious more than had it been a 'softer' variant. As an example of the latter one may quote, as the author does, Wells' friend E.Nesbit, writer of children's stories<sup>2</sup>. In her story written in 1906 - *The story of the Amulet* - she makes four children go back to Pharaonic times. Of course this is not so much a question of time travel, although undeniably so, but a literary artifice to bring back the past vividly to modern readers. As such it represents the sentimental aspect of time travel, and such is almost always to the past for obvious reasons, while the attempt of H.G.Wells is more philosophical, trying to explore the potentials of what it would really mean.

The very notion of time is by itself controversial. Already St.Augustinus thought hard, seriously as well as honestly about it. I know perfectly well what time is, he claimed, until I try to explain it. What is the obvious about it, and what makes it so elusive? There are metaphors for time, such as time being a river along which we flow. But if so in what is the river flowing, and what does it banks refer to. Are we watching the river or are we actually floating along with it as noted? As I never tire of repeating, metaphors should never be taken literally, then they become just silly rather than instructive. But what is left of this metaphor? In what sense does it instruct us? The river flows inexorably and we cannot stop it. Is this what we want to convey when we use it? Maybe there are several varieties of time and we are just confusing them? Thus one may also view it as there are two species of time, a distinction made by Newton and then largely forgotten in the centuries to come, between psychological time and physical. One subjective and one objective. Our involvement with psychological time is of course far more engaging than that with physical. The latter is abstract and amenable to manipulation and computation, the former is a prison in which we feel trapped. We can move in space, in particular we can take rigid sticks to compare lengths at different locations, but that does not seem possible with time. Then how can we measure time? The physicists have a ready-made solution, namely using periodic phenomena, and by fiat decide that all periods are of the same length. Luckily there are many periodic phenomena, both celestial and terrestrial giving corroborations<sup>3</sup>. This gives you a clock, and a clock is a way of translating time into space. Newton had the idea of absolute space and absolute time, which fitted his celestial mechanics beautifully. Then Einstein effected a revolution by postulating that the velocity of light is constant independent of observers in different frames of references moving with constant velocity with respect to each other. This was in a sense counterintuitive, although in accordance with experiments<sup>4</sup>. Something had to go, and what went was the notion of simultaneity and the compatibility of clocks in different frames of references. Clocks went slower in moving frames relative one arbitrarily set at rest. The effects were only noticable for speeds close to the velocity of light so Newtonian mechanics did not at all lose its practical applications.

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<sup>2</sup> which allowed her to support a growing family and a good-for-nothing philandering husband, who may have contributed nothing to the household but his illegitimate off-springs

<sup>3</sup> One is of course reminded of Galileo measuring the length of periods of pendula using his pulse, of course the pulse is not as regular as a pendulum, as will only transpire when many regular phenomena are considered.

<sup>4</sup> the famed Michelson-Morley one which puzzled physicists and all kinds of ad hoc solutions were proposed.

The assumption is that biological clocks are related with physical ones, biology is after all a consequence of physics, so if you travel at speeds close to that of light you could in a reasonable amount of time cover very large distances, because your biological time would follow physical time<sup>5</sup>. From a terrestrial observer it may take you eight years to get to Sirius, but if you go fast enough it will not take eight years for the travelers. This opened up possibilities, as well as producing paradoxes of its own<sup>6</sup>. Einstein's relativity theory engaged the untutored imagination of people, although few really understood it (including many physicist who only had a formal understanding amenable to computation, but not conceptual), which of course only added to the mystique, and the possibilities of exotic initiatives. Fashionable philosophers, such as Bergson, entered into the debate, but had of course nothing at all to contribute.

In spite of all the hype that Einstein unwittingly introduced, the objective time is not in sync with the psychological time, time passes very slowly when we are children and frightfully fast when we approach the end<sup>7</sup>. When we are having a good time, it may feel as if it goes quickly, but in retrospect it has significantly lengthened our lives, and the other way around when you are bored. But more importantly, what is past, will never come again, and what is in the future does not yet exist. And the present, how long is that? Mathematically it is but a point in the continuum of time, psychologically you may

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<sup>5</sup> You need to accelerate to a velocity close to the speed of light, and the biological mechanism is indeed sensitive to acceleration. But if you were accelerated at a rate of 10m/s (that of gravity) it would only take you a year to come up to the speed of light. However this a naive calculation, when you get close to the speed of light your mass becomes much bigger and more force is needed and it is not clear what this means biologically. But such fine points science-fiction does not bother about. If we do not get up to speed close to the velocity of light, the relativistic effects will be marginal. Getting to half the speed of light, would make a factor of half the square root of three, i.e. 0.866, but the energy needed to get you to that speed would require the destruction of matter with a weight a sizable fraction of that of your body. But this is never discussed in the speculation of space travel.

<sup>6</sup> The so called twin paradox. If your twin travels to a distant star and comes back he may only have aged a few years, while his twin has aged fifty. But how can you distinguish between a traveler and a man at rest, what is at rest is but a convention? One obvious explanation is that one has a universe with masses, and with respect to those masses, stars and galaxies, you can distinguish between who is at rest visavi the furniture of the universe, and who is an explorer. Penrose points out that you need not go to general relativity, the paradox is explainable within special relativity. One twin follows a geodesic lifeline, the other not. The geodesic singles out the twin at rest, but contrary to Riemannian manifolds (definite quadratic forms) in so called Lorentzian manifolds (indefinite quadratic forms), geodesics do not locally minimize length, but maximize instead. This explanation requires much machinery, too much as already indicated for a mere footnote.

<sup>7</sup> I once wrote a piece for the year book of the Swedish Science Foundation explicating the logarithmic nature of our sense of time passed. If we set our age 1 at zero, we go from minus infinity, in a sense we have always existed, thus 2 at 1, 4 at 2, 8 at 3 etc. Most people get to be six, no one gets to be seven. Thus we have been given a life of infinite extension, yet mortal, no matter at what time you die, what you miss is minuscule compared to what you have lived. This corresponds roughly to that the experienced length of time is proportional to what you have experienced. This can of course be made mathematically precise.

think of it as having a finite extension of a second or so<sup>8</sup>. In what way does the past exist? or the future? R.G.Collingwood speaks about history as reconstructing the past in the present<sup>9</sup>. The point being that we can never move the past into the present, only reconstruct it, and as our knowledge evolves, our perception of the past will invariably change. However, the point of the Proustian moments of remembrance, as explained at the end of his long suite, is actually to bring a piece of the past into the present, not just a reconstruction. Memories are of course reconstructions, and as such notoriously unreliable, as illustrated by witness psychology. Every time we recall something we change it in subtle ways. Precious memories should not be overused, on the other hand if not periodically recalled they will fade and disappear. There is no way you can hold onto the past. The written word does in a sense freeze the past, on the other hand it is very abstract and need to be interpreted and reconstructed to make sense. The photograph is different, and therein lies its greatest fascination. To look at old photographs, is really to get a window into the past<sup>10</sup> the reason being that the photo shows everything, even the unintended details, while a painting, however realistic, involves a filtering through the artist. Thus until the not so recent past photographs could be exploited forensically, now with the advent of digital photography it can all be fake<sup>11</sup>. The Past is a foreign country to which we really want access, meaning ideally being implanted there in order to feel what it really

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<sup>8</sup> This depends. The British philosopher of history R.G.Collingwood claimed, rightly of course, that different things take different amounts of time to fathom, hence one may, think of the present as having different extensions given the context.

<sup>9</sup> This of course requires an extended presence, would you want to be pedantic

<sup>10</sup> I recall what a jolt, really amounting to a kind of vertigo, when I realized in my teens that photography really went back much further than the cinema which was of the turn of the century, while at the time, photography went back a century, and I gazed in bewilderment on pictures of the Crimean War and the Civil War. Could our gaze really penetrate so deep into the past?

<sup>11</sup> Our sensations are very different in nature. Sight is our most precious, but also most abstract sense, and one I believe most dependent on mental reconstruction. Hearing comes a second. We can all imagine in our minds pictures, although some of us are better than others in vivid visualization. The fact that we can imagine something a visual scene without it interfering on an actual visual field in front of us has puzzled me since childhood. We can sense it but we cannot really draw from it. There are reports of so called photographic memories, but I do not believe in them, admittedly on no stronger basis of not having experienced it myself. With hearing it is different, some people may actually be able to play a piece of music in their head as if they were listening to it. I believe it, although such a feat would be beyond me personally, on the other hand I have at times heard a word or a short sentence without getting it, and then being able to repeat it in my head and listening off. If you spot a street sign and have not time to read it, you cannot play it in your mind and read it from that. This would be photographic memory indeed, Typically when we recall something visual or aural, we recall the sense not the details. We know how the Eiffel tower looks like, but we cannot count how many steel balks it is made of, nor do we ever recall the exact words from a conversation with a friend. With smells it is very different. We cannot start imagine a smell with the same vividness as a visual or aural memory. When we perceive a smell it is very direct, it is as if no mental reconstruction is needed nor even possible (thus memorization and vountary recall of it is stymied). One may even think about it as if the culprit molecule attached itself directly into the brain (this may very well be the case with insects). Thus when we encounter a smell which we have encountered

was like, meaning how reality really appeared with all its inconsequential details<sup>12</sup> to go back to the story by Nesbit. The point of the time travel is really a desire for intimacy, to feel what it was really like, to breath the dust of the streets.

Is time travel possible in any literal sense? To argue against its impossibility is somewhat autistic. Wells never thought it was, it was just a flight of fancy momentarily suspending disbelief and the laws of logic. If we are given a fourth dimension to move along, we do away with many of the silly objections having to do with two material bodies not being able to occupy the same space. But there are obvious logical problems everybody who gives the matter more than a fleeting thought is bound to discover. I thought as a child what about meeting your mother as a young girl and killing her, not out of malice (hardly aforethought!), but out of pure mischief, as the act would make itself impossible. In fact the spirit in which it would be done would be in the spirit of Cantor's diagonal argument, the single most powerful idea in logic. Now in the book I learn that this has of course been thought of previously but now involving your grandfather, or some other even more distant relative, instead of your mother, an act against whom would be considered too brutal. The upshot is that time travel inevitably involve logical contradictions, at least when it comes to the past, maybe the future would be different? The past we can know but not change (read-only) while the future we cannot know but we can change (write-only)<sup>13</sup> But if everything would be deterministic as it is in classical physics<sup>14</sup> we could do away with all those logical objections as nothing 'illegal' could be done. But if so what is time? In a deterministic universe does time really exist except in a formal sense. As the philosopher Popper used to taunt Einstein, naively in my opinion, the space-time continuum is but as Parmedisesan construct, timeless and unchanging in its totality, And in fact Laplace's hypothetical omnipotent intelligence, who when given the initial positions and velocities of all particles in the universe could instantly [sic] compute both future and past events. In what sense would time exist for it? Laplace does not specify whether or not this Deity is part of the universe or just a disinterested observer. In the same spirit mathematics, as a Platonic entity, is timeless, only the efforts of mathematicians take place in time.

It is hard to think psychologically that a given cause could have different effects. If so there would exist hidden causes that would bring us back to the fold, which is most likely

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before, maybe decades before, it gives us a jolt, as it provides a perfect match with memory, so perfect indeed that you cannot distinguish between the smell and the memory of it. Thus, more abstract memories associated to the smell, get a free ride and obtrude on you, as if they had been unchanged. A real piece of the past getting at you. If you agree this could be a explanation of the charm of Proustian memories.

<sup>12</sup> Take the life of Kant. What remains is mostly his writings, which to a large extent are timeless, as far as mankind is concerned; but Kant also had a humdrum quotidian life, in which he worried about horse shit on the streets, the taste of beer, the fashion in shoes, and all kinds of things no longer seen as of any encompassing interest and highly irrelevant to his writings, yet at the time, such diddly things probably took up a large part of his mental life.

<sup>13</sup> One may surmise that people who are more interested in knowing than doing would prefer the past to the future, while the others would prefer the other way round.

<sup>14</sup> Quantum mechanics is supposedly non-deterministic, much to the reported dismay of Einstein, but in fact it provides excellent predictions, far more precise than anything else in physics.

what Einstein thought<sup>15</sup>. If different effects would be possible prediction would be impossible and chance would play too decisive a role for our taste<sup>16</sup>. It is, however, much easier to reconcile yourself with the fact that a given effect may have different causes. In fact this is what historians are concerned about, not the future, as admonished by Collingwood. Also in mathematics there may be very different proofs for the same theorem, but mathematics is not embedded in time, illustrating that logical cause and effect, as expressed by implication, has nothing to do with time, except metaphorically. But if so history forgets, not every event leaves a mark in the presence, and the complete reconstruction of the past, given the traces left in the present is an impossibility. When Caesar was knifed in the Senate, had he had any grapes for breakfast, and if so how many of them, and where had they grown. The latter is a question of no historical significance yet we instinctively feel that the question nevertheless has a definite answer even if we will never be able to find it. It is also a type of question you can ask about the historical past, as opposed to the fictional world. It does never make sense to ask the color of the eyes of Sherlock Holmes maternal grandmother (did he have one? Surely he must, but do the fairies in Sleeping beauty?). If every event in the past left a trace in the presence, the past would be determined by the present, and we could in principle find out everything about it, given enough time. If there is forgetfulness, going back in time is no deterministic process, and leaves open the philosophical question of whether there is a unique past. From a pragmatic point of view<sup>17</sup> this leaves open the question of multiple past, each one with its own and unique claim to existence. In this way travel back to the past would not be entirely logically impossible provided the excursion would be carefully undertaken leaving no traces into the present. In other words a kind of ecological time travel. This idea of mine, has also been anticipated in science fiction I learn from Gleicks survey. It is very hard to come up with new ideas in philosophy, and also, it seems, in science fiction. To make the idea interesting one has to figure out a way of making it more precise and amenable to computations. The idea of multiple past has not become as popular as the idea of multiple futures, that everything is possible and realized, if in a different universe. Every time we make a decision the universe splits and our lives fork. Of course the idea goes back a very long time, and we often tend to ask ourselves what would have happened had I not done that and that (such as marrying your wife) as if the alternate future had some kind of reality if inaccessible to us. Of course before the event both potential universes were indeed, as said, possible, in fact roughly equally, provided that the universe is not deterministic. But of course it is not clear what the ontological status is of realities inaccessible to us? From a pragmatic view it is clearly nonsense if taken literally. However, one should take the notion of inaccessible with a grain of salt, its meaning and scope, changes with time [!]. Until fairly recently the celestial world was inaccessible to us, except by sight. In particular it was read-only not

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<sup>15</sup> If you toss a coin, the effect could be either head or tail, whatever turns out seems to be a case of chance. On the other hand if you see it as giving a certain coin an initial space and velocity it becomes all deterministic, the element of chance is to be looked for in the initial conditions.

<sup>16</sup> Still some sort of predictions would be possible, one naturally think of the probabilistic kinds, and besides the effects could live very close to each other and thus never transcend their boxes, in particular still exclude a lot.

<sup>17</sup> as expanded by Peirce in his pragmatism to distinguish it from his friend James' pragmatism

write-to. The sociologist Comte notoriously claimed that we would never be able to find out what the stars were made of (but at least he phrased it as if they were made of some stuff within the realm of physics and chemistry, it could as well have been a meaningless question), but now we know (or at least think so) and we are able to put our hands on objects in the solar system (the moon and recently some comet) as if they were terrestrial objects of stone.

One paradox, if it is one, related to time travel, is connected with the exponential rise of super human intelligence. If every intelligence, at least on the human level, is capable of creating an intelligence superior to its own, one is not only tempted but forced to contemplate an exponential (i.e. rapidly) expansion of intelligence per se. How can we be sure that this intelligence eventually will not become so powerful that it can go back in time (to assume otherwise can be seen as a lack of imagination and intellectual timidity and who wants to be accused of that?). In fact let us say back to the Big Bang, and then establish itself as God! In the process erasing time up to then, in order to destroy the traces of its own humble origins. This may have happened, how can we be sure it will not happen? <sup>18</sup>

The book is a pleasure to read, at least initially, but as more and more examples from science fiction are presented, readers who are not aficionados of the literary genre, become somewhat satiated. It has the ambition of being comprehensive, and such ambitions are rarely if ever fully achieved, and thus there is a mixture of the high with the low. To the latter belongs the idea of time capsules. Meaning that time can be frozen and thus preserved until retrieval, be it planned or accidental. In this way we may leave messages to the future. An extreme variant of it is to deep freeze your cadavers, or maybe better still, your body just before it dies, in the forlorn hope that it will be taken care of in the future and reawakened, assuming that the past has left a complete set of traces. This reflects a desperate hope for immortality, but what interest would posterity have in reawakening you? Especially if you would claim huge amount of money in your bank account having accumulated compound interest all those years (so if awakened the further into the future the better, maybe not awakened at all would be the best, poetically justified at least). But why assume that the economy will be steadily growing in the future, would not that by itself lead to paradoxes? The point of extreme examples is to make obvious what in less drastic presentations is merely hidden. This is the way of the mathematician. What to put in a time capsule, and how to make sure that it can be properly interpreted (similar problems, if even more acute, are encountered, but seldom acknowledged, by those who want to send signals to extra-terrestrial civilizations in interstellar space). Context makes all the difference in any kind of interpretation. Our messages to the future only survive as such so long as culture itself does. And you do not need capsules for that. Those that we have encountered, such as the recent Ice-man of 1991, have all been unintentional. It is not clear whether intentional ones, say from the Bronze Age, would have been so much

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<sup>18</sup> It makes you think of the periodic solution to Einsteins equations found by Gdel, and discussed at some length by Gleick. In the end an encompassing intelligence á Laplace emerges, going back in time and becoming the Big Bang, which creates a universe whose sole purpose is to recreate the Deity and so on. Nietzches eternal recurrence, recurring.

easier to interpret in ways they were meant to<sup>19</sup>. And of course all of history is a matter of unearthing time-capsules, and interpreting them is a matter of reconstructing the past into the present, according to Collingwood,

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<sup>19</sup> Tombs were in a sense intentional time capsules, because they were arranged for an afterlife. The tzi in the Tirol, was interesting exactly because it was not a tomb, but gave an accidental, by humans unfiltered, snap-shot of life, be it an exceptional slice of it.