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## Back to the past

Thoughts on time travel and the studies of our daughter by Rainer Ibowski



My flux capacitor is sputtering. Can I make it back thirty years with the model that needs maintenance? Why exactly a time travel of thirty years into the past? Our daughter has just told us that she is doing a course in Costa Rica as part of her studies in forensic psychology. Besides the respect and pride of parents, people in their mid-seventies also wonder why only now

and not thirty years ago. My wife adds that she could then be a famous psychologist today.

This is by no means a negative statement about our daughter's life. We are of course aware of the difficulties she has had to overcome. The recognition and respect she deserves equally encompasses the fact that she has, as they say so loosely, "got her act together", by the way, for quite a few years now. My grandma would say, "Better late than never."

Nevertheless, and not only in this family case, it is inherent in us humans to constantly question what if happened. Graduation? Job? Family? What would have changed if we had decided differently at crossroads? As much as these questions often haunt our minds, they are senseless. The past was yesterday and cannot be corrected. We live every second on the threshold of the future in anticipation of what will happen next. Intervening in the past, if it were possible, would in turn have incalculable consequences for development. A German proverb by an unknown author says, "What good is the knowledge of the past? It only reveals one thing: time passes."

The nonsense of this question can also be approached scientifically. We are convinced of the causality of all events. Cause produces effect. That an effect produces a cause is impossible in the macroscopic world. If everyone could "fiddle around" in their past, galactic chaos would be perfect. But if all the connections between causes and effects are known, then we could, so to speak, simulate the possible results of a change in the past with a computer and in this way rule out self-destructive interventions - couldn't we? The helpless answer is yes and no. In every fraction of my lifetime, millions and millions of decisions are made. Even if I knew them all, we would need a supercomputer with a computing power of quetta-flop ( $10^{30}$ , quintillion computing operations). Our universe is probably about one exo-second old ( $10^{18}$ , a trillion seconds). So we would have had to perform a billion calculations every second since the Big Bang. I can also illustrate it as in chaos theory. The flap of a butterfly's wing in the Amazon rainforest can cause a tempest in the Bay of Cologne - in less flowery terms, marginal changes cause huge effects.

However, it is not only the number of quintillions, which is almost inconceivable for us humans, that makes us shudder. In principle, decisions are not exactly repeatable. Our world is not determined by facts, but by probabilities. This insight of quantum physics can be summed up simply at the pub table: "Nothing is known for certain." More factually, the Austrian physicist Erwin Schrödinger formulated an equation in 1926 that earned him the Nobel Prize. The Schrödinger equation describes a system by means of a time-dependent wave function, with which we can, for example, specify the whereabouts of a particle only with a certain probability. This is crucial for the microcosm, the world of the smallest. Although we do not feel any effect in the larger world, the primarily philosophical significance applies equally here and there. Our actions are based on probabilities. A targeted correction of the past is in principle not possible.

Is time travel exclusively science fiction? Do I have to scrap my flux capacitor? Let's take a look at Albert Einstein's four-dimensional space-time and his theory of relativity. Here, time is nothing special, but merely one of four numbers for determining a point. Nothing restricts me from travelling in all directions spatially and temporally. All points in this four-dimensional world are events. In everyday life, we mentally separate space and time. We arrange to meet "at 3 p.m. at the taxi stand at the station". What works naturally is no longer so simple in the four-dimensional world. Space and time are coupled. In my example, which has a very strong limp, the taxi stand only exists at 3 pm. Mathematically correct, I have to demand that space and time are linked in such a way that causality, the sequence of cause and effect, is not violated. Let's keep it like that and leave out the mathematics behind it.

However, a kind of time travel into the future is possible, even if there is no possibility of returning. The reason for this is the insurmountable limit for the speed of light of around 300,000 kilometers per second. When I move at a speed that comes close to this limit, I experience amazing phenomena. My ruler becomes shorter and shorter for the stationary observer and my clock ticks slower and slower. If I leave my twin brother on Earth in an extremely fast spaceship, I age much more slowly than my brother. If ten years have passed on my life clock, a few more years have passed on Earth when I return. I land with my spaceship in an alien world of the future.

So I have to replace my flux capacitor with a cruise control. With the speed of my spaceship I determine my destination time in the future. But beware: I have to travel very fast to make a significant leap into the future. If I travel at ten per cent of the speed of light, i.e. at a good billion kilometers per hour, when I return to Earth after ten years of travel, just half a month more will have passed. At 90 per cent the speed of light, it is just under 23 years, and even at 99 per cent the speed of light, only a little more than 71 years. In reality, it might even be a little less in all cases, because we still have to account for the times for acceleration and deceleration.

Now don't think I've gone among the science fiction writers. Time dilation and length contraction, as Einstein's theory of relativity puts it in physically correct terms, have long since been demonstrated in nature. Anything else that seems crazy? If I move at the speed of light, my time stands still. To put it jokily, when I'm on a merry-go-round at the speed of light, I'm looking at my own backside. Such cosmic merry-go-rounds presumably exist at the edge of a black hole.

This brings me to the view of the past in astronomy. When I look up at the night sky, I don't see the now, but solitary how and what happened when light was emitted. Light takes a good eight minutes to travel from the sun to the earth. Even from the moon it takes 1.28 seconds. With the latest space telescope, we can dive almost 13 billion years into the past. There is only one thing we cannot do. We cannot influence the past. We can only look at it, understand it better and better and appreciate it.

This brings me back to the starting point of my thoughts. The past is what it is, unchangeable. The only thing that counts is the future. We may be able to influence it a little. Lü Buwei, a Chinese philosopher from around 300 before the turn of time, sees it this way: "The wisest understand the future, the less wise the past, the even less wise the present."

Well, let's leave it at that. We wish our daughter new experiences in Costa Rica that will contribute to the success of her studies.

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