

Question 1:

Dear Cheap Astronomy – Is time travel into the past really out of the question?

That's a nicely-phrased question, since of course time travel into the future is relatively straightforward. We are all travelling into the future at a leisurely pace and we can confidently expect to get there tomorrow, or next week or maybe even next year – as long as our health holds out.

If you want to get to the future at a quicker pace than everyone else, you just need an energy source to accelerate yourself. For example, you could eat a pizza and run around the block a couple of times, which would get you a fraction of a nanosecond further into the future than your couch-potato neighbour. Or you could try surfing the wavefront of a supernova explosion, using its 99.9% light speed to transport you into the far future.

So, time travel into the future is just a question of engineering. Time travel into the past is more troublesome. Right now, like today now, time travel into the past is absolutely impossible. The idea that you can just keep accelerating until you breach light speed and then find yourself travelling into the past is just ludicrous. Relativity physics clearly shows that as you approach the speed of light you will see the Universe's lifetime begin to accelerate around you and long before you reach the speed of light, the Universe as you know it will have ended.

But that's not to say we might not be able to travel into the past at some point in the future. The presence of intelligence-driven technology raises the possibility of some kind of time travel mechanism that could never had occurred naturally.

Relativity physics, at least on paper, does allow for some extraordinary time-space warping that may conceivably create a tunnel that would enable travel from the future into the past and vice versa.

But such a tunnel needs gateways at both ends. And before you can have a gateway in the past, you will need a sufficiently-advanced technology that can construct such a gateway. We can't do this today and certainly no-one could have done it in Julius Caesar's time.

So, for now, we continue to live in a privileged era that no-one from the future will ever be able to access. But that may not be the case that for our childrens', children – or perhaps, their childrens', children.

It is quite possible that there will come a time in our far future when someone figures out how to build a 'past' gate that people from the future can then connect with. From then on, every future generation will be able to travel back as far as the first 'past' gate that was ever built. But they will never be able to travel back to 2014 – or to 1420 or 1420 BC. Once there are 'past' gates, people should be able to live everything over and over again and can even take a break to enjoy a meal at the Restaurant at the End of the Universe – although for them, the Universe never will never really end.

But, even from a primitive 2014 perspective, this doesn't seem an altogether-plausible scenario. Surely there must be some kind of energy cost every time someone goes back from a future gate to a past gate. Their trips back would progressively remove free energy from the future and so hasten the inevitable heat death of the Universe.

This means that future gates would begin to shut down as the Universe that had once supported them no longer could. People could still retreat further into the past, but that would just keep on taking energy from what was left of the future. And so it might eventually come about that, from the moment the first past gate gets built, the future of Universe comes to an end.

And so, in a nutshell, time travel into the past really is out of the question.

Question 2:

Dear Cheap Astronomy – Do you think intelligent aliens will be humanoid, like in the movies?

The human body-form is partly the result of historical circumstance and partly the result of the particular environmental conditions that exist on Earth.

As we've discussed before on this podcast, a carbon and water-solvent based biochemistry is likely to be a relatively-common basis for complex ecosystems across the Universe. There are some possible alternatives, but by and large such exotic biochemistries would be limited to very cold environments where non-water chemical solvents can exist in a fluid state.

And carbon is an incredibly versatile element for building diverse molecular structures. The next best element, silicon, is kind of blunt and stodgy. Silicon is useful for building a house, but you'd be hard-pressed to build a silicon-based elephant that could eat silicon-based acacia trees.

While all this may just be a massive failure of imagination, in the absence of more data there are compelling reasons to think that another intelligent life form is most likely to be water and carbon-based and hence it is most likely to arise under roughly similar conditions to what we have had here on Earth.

So, if it is all about water and carbon, the only environments able to support a liquid-water based ecosystem are going to be Goldilocks zones, either on a planet with an atmosphere or in a sub-surface ocean, remembering that water will quickly sublime into a gas if it's not contained under pressure.

But we cannot assume that the one ecosystem that we are familiar with has adopted all the best strategies and solutions that may be possible under these circumstances. For example, building large organisms from microscopic cell-based units may not be the only way. An organism of substantial size might develop in a very simple form and then begin to evolve, gaining greater structural complexity and size in the process of taking advantage of new and varied food sources. This would represent an ecosystem of immortals.

Nonetheless, as a thought experiment, let's assume that competition between multicellular individuals does arise as the foundation of an alien ecosystem. Even then, we should expect that many of the entities in that ecosystem will be plant-like organisms, either living by photosynthesis or, particularly if they evolved in a subsurface ocean, by chemosynthesis or even thermosynthesis. So, we can't rule out the possibility that plants can develop intelligence and technological capability.

And if not the plants, then intelligent animal-like organisms that live off the plants are just as likely to develop underwater as they are on land. So, we can't rule out the possibility of smart fish. About the only common feature of all the animal body-forms on Earth is that they are built around a tube – a tube that starts with a mouth and ends with a butt. Around that tube, you can have eyes, ears, whiskers or electroreceptors – and you can have two, four, six or eight legs, just like you can have two, four, six or eight fins.

So, if you ever do meet an alien being, it is very likely to be a water-solvent, carbon-based entity. Beyond that, we can only guess that it might be something kind of leafy, like a plant – or otherwise it might be something that has a mouth and a butt.

And really, if they are aliens from an advanced civilisation, what you will probably meet is one of their robots. Genuinely advanced aliens would sensibly stay home and watch the whole encounter on the tellie – and they'd probably fast-forward through all the boring bits, particularly the speeches.