Desperately seeking eternity

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Just how large is our future? We often have a feeling it is something big and imposing. But it can also be small. William Blake's often quoted Auguries of Innocence begins with the famous lines:

> *To see a world in a grain of sand,*
> *And a heaven in a wild flower,*
> *Hold infinity in the palm of your hand,*
> *And eternity in an hour.*

It suggests that we can at least perceive the macroscopic in the microscopic and everyday. In fact, much of the time we do not think of our future as something grand or big, simply because we do not think of it at all. We take it for granted. Then we get reminded of our mortality and it looms again. We distract ourselves, and suddenly experience a timeless, self-less moment when enjoying music. Our *experience* of the future is something mercurial, infinitely compressible or stretchable.

Normally we think of a clearly defined future: next week, next year, our lifetime. But just like the past is deep, the future is deep.

Just how much future time is there, objectively speaking? Modern science, especially astrophysics and cosmology, has a fair bit to say about that.

Our current understanding of the universe is that it had a beginning, but likely no end. It once was far smaller and hotter, starting at essentially zero size 13.8 billion years ago. That expansion is continuing: remote galaxies are moving away from us. Not because we are sitting at the centre, but simply because the space in between is growing at an increasing rate, due to mysterious dark energy. We may not know what dark matter and dark energy are, but we can see their effects in how they make galaxies move. Unless we are badly wrong about what is going on this expansion will continue indefinitely. .

Meanwhile stars are born, shine and die. Some, like our sun, will continue for a few billion years before they swell up as red giants, blow off their atmospheres as a brief nebula, and become a dense white dwarf star that slowly cools. That will be the end of our earth. More massive stars will burn brighter and more briefly, detonating in supernova explosions before becoming even denser neutron stars or black holes. Meanwhile the ubiquitous but dim red dwarves can shine for trillions of years before gently going out.

In the truly long run – many trillions of years in the future - the era of stars will come to an end. Some white dwarves will slowly crystalize into gigantic diamonds. Occasionally a flash from a star being eaten by a black hole brightens an otherwise dim universe. Over even greater timescales black holes and matter itself slowly evaporate. Eventually nothing will remain and

nothing will happen evermore: the end of history, even if time is technically still unending. Eternity in the future is surprisingly boring.

This might sound depressing. But some of us are moved not by the eventual dissolution but by the sheer size of this deep future. There might even be more currently unknowable history in the colder eras beyond. The timescales are vast beyond human imagining – we can hardly contemplate a million years, let alone a trillion or the even larger timescales beyond revealed by physics. In fact, to many the sheer *size* of these empty spans is terrifying. As Blaise Pascal wrote when contemplating the universe, "The eternal silence of these infinite spaces terrifies me".

One part of why this vastness is unappealing is that it is so impersonal.

Another part is that we compare ourselves to the universe and realize we are microscopic. Then we make a crucial but serious mistake: we assume being microscopic means we are insignificant. But if our significance is not affected by whether we are standing in a small or a big room, why should we think the same about a big or a small universe?

The future does not just go tremendously far ahead, it can also be tremendously *broad*. The number of future generations, future minds and future events is just as unimaginably large as the timespan. And we *do* have a unique, tremendously important role: we exist near the start of it all.

Let us return to the here-and-now on planet Earth, inhabited by us 7.4 billion 21st century humans.

Although it often is hard to imagine it when reading the news the world is in many ways better off than ever. Infant mortality has plummeted since 1900, as has he number of people living in extreme poverty . For most of history *all* humans lived in what is now regarded as extreme poverty. Average per person income has increased fivefold. Literacy worldwide is now 84%, and 34% have Internet. Wars – despite the horrors on our screens – have become less deadly on average than in the past.

We also live longer than ever. Globally life expectancy more than doubled over the 20th century. This is a dramatic change in how our lives are shaped. Once upon a time marriage tended to be till death do us part simply because one of the couple was likely to die within a few years – especially women, who often died in childbirth. People had to grow up fast, since there would not be that many years before a child would be alone in the world. Bodies were worn out by backbreaking work in their 30s and 40s. It is often claimed that the reason retirement age was set at first 70, then 65, in Bismarck's Germany was that few would reach this age, so the cost to the government was low.

Why are we living so long? The biggest gains were because of better hygiene, better nutrition, antibiotics, and vaccinations. The fridge and toilet are powerful life extension tools. While we may be proud of the wonders of modern medicine, hospital care is generally less effective in giving us extra years of health than preventive medicine. Reducing smoking, workplace safety, seatbelts and screening for some conditions are more powerful than heroic surgery or medication... so far.

People have tried to extend their lives since time immemorial. The oldest great work of literature, the epic of Gilgamesh is partially about the king's search for the herb of immortality. Up until recently we did not have any deep understanding of what ageing truly is, so doing anything about it was hard.

That has changed radically in recent decades. We now understand why we age (evolution simply doesn't care about our bodies holding together far beyond our reproductive years), and can in the lab even slow it down in test animals. Some treatments can prolong animal lifespans by up to 40 per cent whether by removing senescent cells, reducing caloric intake, or influencing certain metabolic pathways. While none of the methods are likely to carry over straight to humans, the fact that we have gone from ageing being an immutable fact to something that can be manipulated is already revolutionary.

Even if the first clinical methods for slowing ageing arrive a few decades ahead, that is still good news for the majority of people living today. Especially since slowed ageing gives you more years of medical progress. While nothing is certain, it looks like in the long run ageing may become just another treatable chronic disease.

Some would argue that slowing ageing is all about achieving immortality. But treating ageing directly makes sense simply in terms of health: ageing is a direct contributor to heart disease, diabetes, weakened immune system, Alzheimer's and many other maladies.

Life extension cannot give us eternal life: besides ageing, we are killed by diseases, accidents and violence. And if we fix those, we are still finite beings in a universe ruled by probability. Sooner or later we will be unlucky and perish. But we can maybe make this probability so low that it does not matter much in practice. The real issue might be what we would do if we had indefinite lifespans.

Every time someone dies, a library burns. The experiences, skills, and relationships painstakingly built across a lifetime disappear forever. We cannot prevent any particular library from eventually having a fire, but we can make sure the fires are rare. Humans are precious, and that is why we should not wish them to age.

Some might say we need a change of generations to keep our culture youthful. Yet, to continue the library metaphor, few people think the way of maintaining a successful culture is to burn the archives and art museums. There are better ways of changing things than killing the old guard. The physicist Max Planck said that science advances one funeral at a time, but in practice many radical new ideas do sweep the scientific world faster than scientists are being replaced. In the social arena we have seen struggles to extend human rights succeeding faster and faster, despite people living longer: compare the time it took for female suffrage to go from academic idea to political practice with the time it took gay rights to make the leap from unthinkable to orthodox.

Even if it was true that our culture would change more slowly if we lived longer this may not be a bad thing given the longer lifespans: maybe a more cautious approach would be desirable. However, as the human rights examples suggest, there are areas where we may want to hurry our own maturation. We do not want to wait centuries for a solution to pandemics or climate

change, since by that point the problems would have already overwhelmed us. At any rate, if long lives actually do slow social changes there are still better ways of speeding it up than letting people die prematurely. We have term limits in politics: maybe we should have them for professors and CEOs too.

I have met 18 year olds claiming they do not want to live beyond 20 because they will be old and decrepit, while my 105 year old grandmother still potters on since dying is simply not done. Some people find new meaning again and again, others feel suicidal about Sunday afternoons.

It is not uncommon to envision one's life as a book, and then assume it must have a beginning, a middle and an end. This is reasonable since we tend to construct our identities as narratives: we often tell stories about who we are, what we have done, and where we are going, so thinking of a life this way comes naturally to us. But a book can be a short pamphlet, a thick epic, or maybe a never-ending fantasy series... which one would we want to be like?

I suspect most of us want to have some sense of cohesion across our lives. Merely going on is not entirely satisfying.

Many people who wish for radical life extension are afraid of dying. This is a bad motivation: sooner or later they will run out of time anyway, and living just to avoid something is a diminished way of life. They are not hoping for something of value, merely the avoidance of loss.

The problem with death is not just that it can be painful, but that it also irreversibly prevents any more experience, any more action. Our social bonds are broken. Pain can be dealt with, but these other factors point at what makes life worth living. We should seek to live longer because we love life. We should wish to experience good things, gain wisdom, and interact with people in important ways. A long and healthy life is quite useful for this.

If we lived as long as we wished, we would need to recognize what makes our lives improve and what diminishes them. We would need to know when to stick and when to twist. These are virtues that already make sense in our current human condition, but they become paramount in a technologically enhanced posthuman condition.

Blake's poem reminds us that we do not need enormous spans of objective time if we can find eternity in an hour. But learning to see the world like that is hard and takes experience. I suspect we might need extended lives to have a real chance of achieving it.

We are growing up as individuals and as a species. Slowly and haltingly, yes, and quite often by making serious mistakes.

We are unusual - the first intelligent, technological species on this planet. For the 4 billion years that life has existed on Earth, no organism intentionally left the atmosphere before we did it in the 1950s. There is no reason our species has to disappear like any many species on this planet: we are acutely aware of the risks of extinction, and we may set our own rules to avoid it. If humanity survives I believe it is going to spread life and intelligence to the stars.

Those vast, empty spaces of the cosmos are only empty and frightening because nobody has settled them. There is room out there for our children, whether human, posthuman or just new ecosystems seeded because we cherish growth and complexity. There is time to grow this universe to something fantastic.

Being small compared to the universe does not make us insignificant when we have minds that can change it. Awe may give us a healthy sense of humility, but it does not rob our lives of meaning. We are tremendously powerful, fallible, and close to the start of history: if we can manage to grow up we may grasp eternity.