NEXT LEVEL CLIMATE THINKING AND ACTION

CLIMATE ACADEMY

Chapter Three

Spaceship Earth

Draft Version: June 2022

INTRODUCTION:

Spaceship Earth

When considering sustainability, one of the most useful mental images to put in your mind is the image of a spaceship. Planet Earth is like a spaceship[1], floating around in space (and if we really think about it, actually a lot of space). Life in such an isolated existence is more technically known as a "Closed Mass System". In other words: energy comes in (e.g. sunlight) but no matter goes out. We cannot export pollution or greenhouse gas emissions, and there is no emigration of humans off this planet any time soon. There are a few minor exceptions to this situation,, like meteorite strikes (such as the one that hit Mexico) or the moonrocks that we collect ourselves[2].

The fact of the matter is that this is a closed mass place.

Back to the spaceship. Imagine, you are on a spaceship with four other astronauts. Every step of the mission has been planned and executed with meticulous precision. You have a calculated amount of food and water to keep you alive for the duration of the mission, and although there is very limited space on board, you did agree to take a ukulele for a bit of a group vibe under the stars. (Having a limited space and a limited amount of supplies force every space mission to make some tough choices.) Then one of the astronauts starts to take four times the daily supply of food, water, oxygen, everything, causing shortages for everyone and jeopardising the mission. What would happen? Surely, once the other three astronauts found out, they would immediately take strong action to stop it, and fairness and equity would be quickly restored.

All good. However, a few days later, you see another shuttle approaching the docking port of your craft. This was not something that had been planned by your team. These extra four people are a wonderful addition to the cosmonautical community. However, it is quickly apparent that there is simply not enough space for eight people on board the ship and you are astonished and troubled by the fact that they have arrived without any food supplies[3]. Again, the arithmetic of the spaceship life does not work. With no possibility of anyone taking a shuttle back to Earth, there is a major problem in this isolated, floating bubble of life. Not an inconvenient problembut an existential one.

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[1] The original idea for the notion of Spaceship Earth comes from the remarkable man Buckminster Fuller, and it was this image that rocked my world in 2011 when the remarkable Michael Wadleigh (Oscar Winner 'Woodstock', 1970) opened out the consequences of living on a closed mass system for the first time to me at a Club of Rome event. He also introduced me and my students to the spaceship and football field thought experiments.

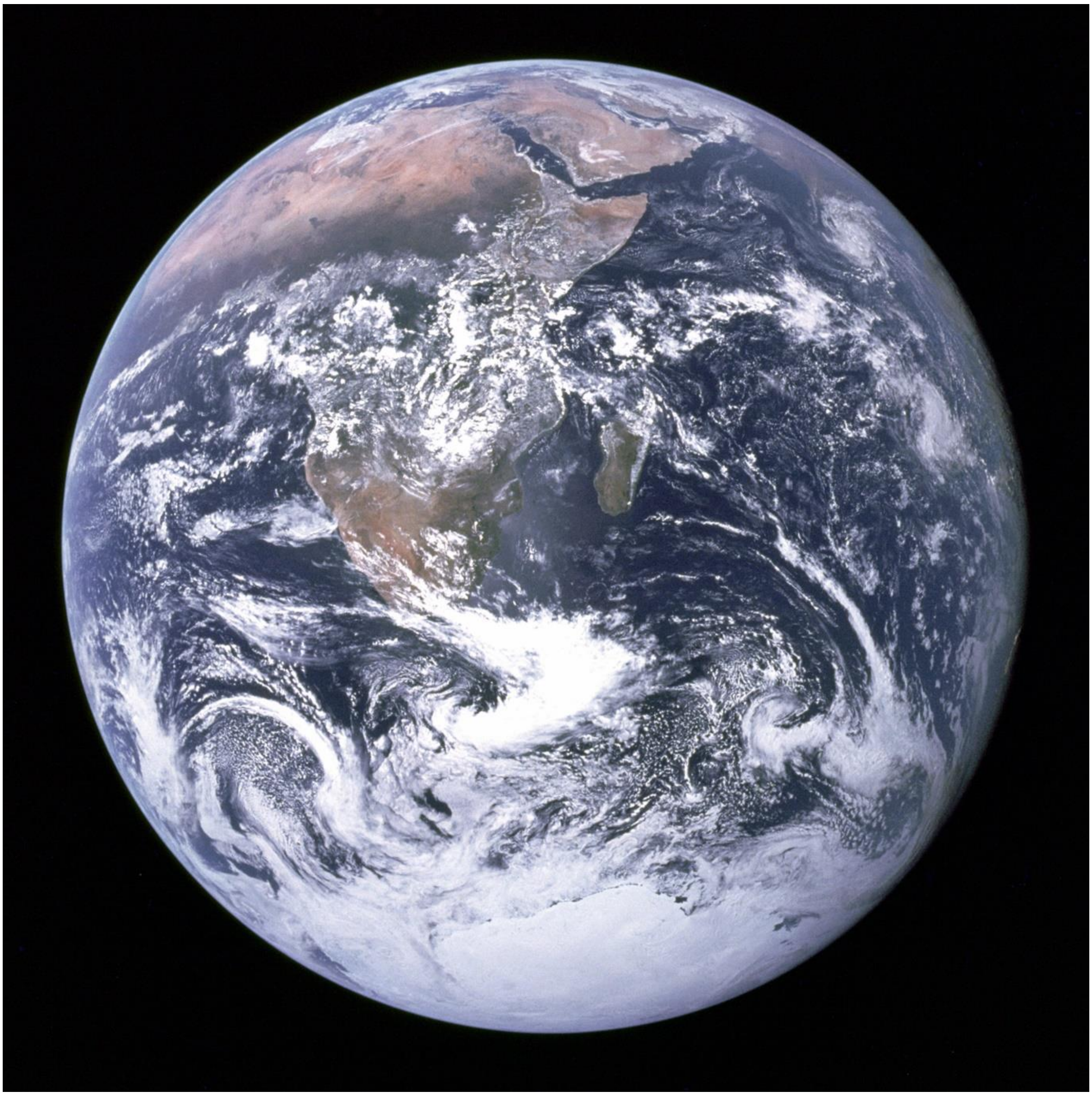
[2] To be precise, 382kg of moon rocks were collected by the 12 Apollo moonwalkers between 1969 and 1972. Three robotic Soviet missions (Luna 16, 20 and 24) also returned a total of 301 grammes in the 1970s.

[3] Just to pre-empt any possible idea that this is a metaphor that might carry some kind of racist message, it is emphatically not the case. In fact, as will become clear, it is the Ultra High Developed nations of the world who are (by far) the biggest consumers of planetary resources.

Thought experiments like this can help crystalise the essential co-ordinates and issues of a complicated situation. They also help illuminate simple truths or problems that are often hidden by the cluttered details of life.

So what are the key issues here?

The first seemingly obvious point is that the Earth is limited. A spaceship might be 100 metres wide[4], and the Earth is much wider - at 12,756 kilometers diameter. However, they both have their limits. Again, to state the obvious, there is only a certain amount of space onboard planet Earth. These simplistic statements need to be held in view for a while in order to squeeze out some consequent truths that we might not have grasped so clearly.



[4] The International Space Station (ISS) is 109 meters end-to-end.

For example, in 2020, 81 million people were added to the planet[5] – a number broadly equivalent to the population of Germany. This figure is in line with the long-term average annual growth of about 1.3%[6]. Back in the 1990's the late Physics Professor Al Bartlett famously calculated that if the world population continued to grow at 1.3% per year, such a growth rate would lead to a population density of one person per square metre on the dry land surface of the earth in 790 years. That is not enough room for anyone to swing a kitten in. Indeed, that one square metre is not just the place where you get to stand and swing a kitten, it is also the land out of which you need to get all your food and water, the land on which you build your house, the land on which factories and shops are built, along with the motorways and roads that link them up… If you want to build some of those things elsewhere, then you really have a problem because everyone has only got one square metre.

This is, of course, an absurd situation, and one that we could never find ourselves in. There could never be such a population density because there is a date, much earlier than that, at which the Earth (as a closed mass system) will not be able to support the number of people that live on it. This is a real date. It is a real limit.

Just because this date is not known because of all the complex variables that go into population growth and Earth life support systems, it does not change the fact that with continued growth, at some point the human population will hit its limit.. Indeed, well before that limit things would not yet be impossible, but would be very stressed.

To help visualise where we are up to, it is better to think, not in square metres, but in football pitches. In 1990, when your parents were about your age, if the surface of the Earth was divided up into regular blocks of land, then everyone would have had about 4 football pitches to live off. In 2022 that area is down to a little more than two and a half football fields[7].

We have a detailed map of the Earth and knowledge of the different terrain that the dry land surface of the Earth looks like. These details can be summarised and mapped onto the football pitches. Explanation…

So to finish this introduction, here is spaceship Earth as it is equally divided for us. (Stijn image?/chart) We have more than one square meter, we have an area of some 137 by 137 metres for us and all that come after use. And so, just like the astronauts have to give very careful consideration to their space in Space, we Earthlings must do the same.

Questions

1. Why do we struggle to see that the planet has limits?
   2If you could reorganise your football pitch, what would you change? 3If you were an astronaut on this spaceship, with one "non-essential" object, what would it be?

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[5] https://data.worldbank.org/indicator/SP.POP.GROW?locations=1W

[6] 30 year average, UN World population prospects, 2019 revision

[7] Total above sea land surface on Earth: 148.3 million square km (FAOSTAT0. World population data: UN World Population Prospects, 2019 revision.

MAIN TEXT:

Mining Deeper

Professor Al Barlett's point about population growth is part of a talk that he gave 1,742 times over 36 years at universities and institutions all over the world. It can be found on YouTube under the title, "The most IMPORTANT video you will ever see". This might sound a little overstated, but this module will show that Al Barlett was definitely on to something critical.

So far, this module has been limited to two simple co-ordinates: land and population. This simplicity is important because it is surprisingly difficult to remember the fact that we are in a closed space. However, it would not be worth setting up a whole module to establish this simple point if there were not further important implications that flow from this fact.

The consequences of living in a closed mass system really gets interesting when you push the Physics a bit harder.

Closed Mass System

If you were to look up "closed mass systems" you would almost certainly find yourself on a webpage devoted to Physics, or more specifically, The Second Law of Thermodynamics. If you can feel your brain going into shutdown mode, just hold on for a few more paragraphs because the consequences of living in a closed mass system are not trivial. And with the help of the spaceship image, there are a number of truths that can be understood in a simple way. Fortunately, you don't always need a PhD in Theoretical Physics to have your mind melted.

In a classroom, the answer to the question, "Where does gold come from?" is normally answered with the words, "a mine". If a class of students is pushed for more answers, then they often say, "a river", or "a shop"; the more inventive say, "a bank" or once, "my mum's jewellery box". But these answers are not deep enough. "Where does all the gold on the planet *actually* come from? Before the mine?" Very few students know the answer to that.

The answer is rather cosmic. The answer is: a supernova. All the gold on the planet was forged in the unique conditions of a supernova. These conditions cannot be replicated. Jamie Oliver can make cooking look easy, but even this is beyond him. He would need an oven of the most unimaginable power and pressure.

A supernova happens when a massive star collapses[8]. Our Sun is much too small and puny for this; you need really a major star to fold in on itself. At the beginning of this process, the Hydrogen reserves of the star are burnt at a phenomenal rate, but this massive energy release stops once it is exhausted. During stage two of this process the temperature is 100 billion degrees Celsius, and the burning of Helium reserves now causes the production of carbon and oxygen. Brian Cox notes, "every molecule of carbon in my hand, every molecule of carbon in the universe comes from the heart of a dying star". After this stage there is a cascading sequence of rising temperatures and more dynamic and quicker reactions as different elements are fused together and new, heavier ones are born. The monumental exercise of gravitational force squeezes the inner core of the star into a dramatic final act. In these last few extraordinary seconds, the cosmic guts of the supernova, full of all the most exotic raw materials of the universe, are flung out into the vast expanse of space. You can find the full of list of elements in the Periodic Table, or for the musically inclined, the list can heard in the Monty Python song which finishes, "Bohrium, Hassium then Meitnerium, Darmstadtium, Roentgenium, Copernicium, Nihonium, Flerovium, Moscovium, Livermorium, Tennessine and Oganesson, And then we're done".

Once things have calmed down a bit, this eclectic community of elements (all with their different characteristics, weights and special features) are attracted together over time by the gentle but determined pull of gravity. Over billions of years, planets are formed. On our little planet, this led to organic life (a very big jump), then humans (a big jump): walking, talking bits of carbon. Or as Cosby Stills, Nash and Young described it more poetically, "We are stardust, we are golden, we are billion year old carbon …(and we got to get ourselves back to the garden)".[9]

Supernovas are therefore the mothers of Mother Earth.

Resource Depletion

The bottom line is that we cannot make gold, or any element for that matter. Whatever lumps of gold happened to get stuck in our Earth's crust, that's it. Fortunately for us, they tended to land in patterns to make them easier to find … and these places often become mines.

Why do we need to know the long history of the raw materials of the Earth? Why is it relevant to now, and to sustainability? The short answer is that this is the moment that the story of the universe goes from startling to rather annoying. This is because life on planet Earth for us humans (like the rest of the universe) is under the dictatorship of something that Physics has called, "The Second Law of Thermodynamics", or more casually, "Entropy".

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[8] Current modelling of supernovas outlines two main triggers for this: either a compact star (like a White Dwarf) has its nuclear fusion button re-triggered, or the core of a massive star suddenly collapses under gravity. Either way, it makes a one hell of a bang.

[9] This is surely the most appropriate moment to recognise the most extra-ordinary lumps of carbon, Michael Wadleigh and Birgit van Munster. It was their work and presentation back in 2011 that caused a supernova of thoughts in my head, and a burst of convictions in my heart to work on sustainability. All the science in here can be traced back to them, and beyond into their sources. Michael's groundbreaking documentary 'Woodstock' (1970, Oscar Winner) featured Cosby, Stills and Nash in the opening track.

Imagine that you are holding a box of chalk, and notice a small stub of yellow chalk, which you pick out. It is easy to think of this stick as a lump of gold taken from amongst all the other elements of the Earth's crust. Now you need to crush this chalk into tiny flecks of dust. In the real world we call all this mining and manufacturing. Now you need to blow all these dust particles into the air as hard as possible so that they scatter all over the place. Then you can brush your hands together to get rid of the rest. In the real world we call this 'sales and distribution', after some efforts by 'marketing'..

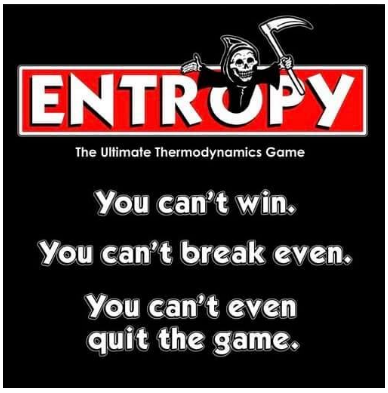
Have the bits of yellow chalk left the room? No. Would it be worth the time and effort to look for them all and bring them back into one useful blob again? No.

This is the problem of entropy. This is the problem of an economy that is almost entirely linear – from extraction to manufacture, to use, to waste. It is a story that does not have a happy ending, because when all the useable gold is found and dug up, used and effectively lost… eventually, there will be none left.

The example of gold is easy to think through, but the same is true for other elements. For example, there are two little tragedies happening when a child loses their grip on an helium balloon and it starts its vertiginous climb out of reach. The balloon and the happy Mickey Mouse face is lost forever, and so is the irreplaceable Helium inside it. Helium just goes straight through the atmosphere and into outer-space. Likewise, when farmers use finite Phosphates and scatter them into the grooves of their deeply tilled fields, it is also effectively lost.

It is in this fuller sense that a closed mass system has profound implications for life on Earth.

Although Physicists will wince at this definition, the Second Law of Thermodynamics can be (very) roughly caricatured as "You use it, you lose it". The universe has an arrow of time that only points forward, and this is underpinned by the fact that it is continually moving from a higher ordered state to a lower one. Even if you try to fight the tide and put things back into an ordered state, if you look over your shoulder, you will see that you have caused more chaos somewhere else in the process.



It will be left to the smiling face of Brian Cox in the YouTube video links at the end of the chapter to provide the fuller explanation, but the Physics actually just comes down to quite simple mathematical probability: If I was to throw a box of chalk into the air, there are simply billions of ways that they could all fly, land and roll. There is a possibility that they land and line up to form the words, “This is an existential crisis”. But that ordered state, of letters and meaning, is *so* much more unlikely than the chalk simply looking like a mess.

There is an extremely restricted number of combinations for the final placement of the chalk for that phrase to present itself to us. There is a tiny bit of wriggle room for the odd stick of chalk to just roll a bit to the side, yet leave the phrase legible. However, there are simply overwhelming numbers of possibilities in which this phrase does not appear. In fact there are an overwhelming number of possible results in which nothing at all distinct appears. And this basic game of probability plays out with every move that is made in the universe all the time. In the great big scheme of things, our universe is slowly, inexorably, moving from a more ordered state to a less ordered state.

And there is no arguing with this, it underpins time itself. The universe will eventually run out of useable energy. But this is not something that anyone alive today needs to worry about – because scientists estimate that it will happen in: 10,000 trillion, trillion, trillion, trillion, trillion, trillion, trillion, trillion years.

However, entropy will be a big problem if you are due to be born after the year 2300. We are currently extracting a mind-aching 3000 tonnes of material from the Earth every second. By roughing up the blobs of order to be found in all the precious metals and minerals of the Earth at this speed, it is very likely that valuable resources that you might want for your society will already have been used and effectively lost.

The good news is that the United Nations is on the case; in 1972 they formed the United Nations Environmental Programme (UNEP). Then, in 2007 they established the International Resource Panel (IRP) who have started to track the amounts of materials we are extracting and consuming, and have estimated what a sustainable level of extraction would be.

The bad news is that there are no binding agreements in place to control our mining[10]. Therefore, unsurprisingly, some materials are close to exhaustion already. The most acute resource problem is arguably the case of phosphorus, because our agricultural yields (our food) are so dependent on this chemical boost. Yet, there is only a very limited supply of phosphorus it is mainly in the Western Sahara; there are little bits in China, Egypt, Algeria and Syria.[11] [12] More generally, every flatscreen TV that is manufactured has very real consequences for the reality of the crust of the Earth. For every luminous diode that lights

[10] Mining is also one of the most exploitative industries on the planet. This chapter is about the unsustainable acceleration in resource extractions, and that recklessness is mirrored in the way in which the mining industry goes about its work that also involves many harmful impacts. The Responsible Mining Foundation provides useful information on how to minimise the harmful impacts of mining.
[11] Notably, Europeans do not have any.
[12] US Geological Survey

up a TV Quiz Show or a David Attenborough documentary, rare Earth elements (REE) [13] like Lanthanide, Scandium and Yttrium are extracted.[14]

If there was time, many more examples could be put onto the table. Fundamentally, they would all underline the essential fact that it is simply not possible to make an infinite number of laptops, mobile phones, car batteries, solar panels… and so on. Indeed, the key word is *infinite.* **This is a closed mass system**. Every TV or mobile phone that is produced uses up rare earth materials that will then be unavailable for people in the future.

Such a reflection might seem too abstract to have moral significance. We might imagine that the fate of many of the Earth's materials lies too far into the future to be of concern to us. We might adopt a cynical attitude to those people who await the arrow of time to nudge them into existence in so far in the future. This is not the place to open up a wide ethical section about those not yet born. However, that is not because it is not relevant, but because the crisis of sustainability of resources is absolutely not a distant problem. There are many key stress marks already, and what is at stake is actually our own security of life and of those close to us.

A Circular Economy

Major talks are now quite rightly taking place to close the two ends of our linear economy to create a circular one. This loop takes what is waste material in one industry or sector and feeds it as a resource into another. The circular economy also reduces waste through recycling. This improvement to our economic model is an important step, but there are two major problems.

The first problem is a practical one, and that is that only 8.6 % of material is currently recycled[15], and this amount is decreasing. In principle this is fixable; however the second problem is more fundamental, and it is a problem of thermodynamics again. Even if the efficiency and recycling processes are radically improved, you will need even more energy to re-extract resources from waste; and with the principle of Entropy in the background, the energy requirement for some will be prohibitive.

The final good news is that although we live in a closed mass system, we are very much open to energy. And with luxurious excess. This energy is poured into our system by the Sun's radiant beams every day. It is an energy that is diffuse; it is not compacted and focused like the intense implosion of a supernova. However, even though it cannot provide us with nuggets of gold, chunks of copper, lumps of lithuium or banks of phosophorus, it has another five billion years of its own well stocked resources to satisfy our basic needs.

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[13] China currently supplies around 70% of these elements. 'Rare' elements is a bit of a misnomer; it is not so much that they are only found in very particular places: the issue with these elements is that they are very difficult to extract from the earth in meaningful quantities so it takes a huge amount of energy and waste to get them.

[14] Along with a massive dump of industrial sludge and another incursion into the biodiversity of the planet.

[15] The Circularity Gap Report 2022

Resource Extraction

The main consideration of this module is concerned about what this growing population is doing on the surface of the Earth. The answer to that question has changed dramatically in the last 250 years; and that drama has taken on truly epic proportions in the last 50 years ('The Great Acceleration'). However, for a proper perspective on these last explosive decades of human history, we need to zoom out to a much wider vantage point.

For hundreds of thousands of years, people lived in a more or less sustainable way with nature as hunter gatherers. Our subsistence lifestyle could be summarised as one unit of labour that had the capacity to produce one unit of goods. During our time as agriculturists, with the extra horse power at hand from animals and wind, our productivity doubled to two units of goods.

If we briefly pause at this junction in the development of human civilisation, we can find a powerfully symbolic text. The biblical story of the twins, Cain and Abel[16] (Genesis 4) points at the tension between the settled life that emerges out of agriculture (Cain), and the roaming pastoral life (Abel). It is the humble offering of the shepherd, Abel, that God prefers. However, after Cain murders his brother, it is his more organised and fixed way of life that prevails.

Or we could say in more familiar terms – it is the urban that comes to dominate the rural.

There are of course, many layers to the mythical text about the first sons of Adam and Eve. But it is telling that after the murder of Abel, God still gives his protective 'mark' to Cain – who within a few lines of verse has already started to build the city of Enoch. It is as if divine wisdom decrees that the development of urban life is both inevitable and yet it will be characterised by greater moral jeopardies.

The deep contrast between urban and rural life, and the huge cultural consequences that flowed from the development of city life became stunningly clear during the Industrial Revolution. When human life gets into industrial gear, productivity rates take off like a rocket. A nod to Stephenson's famous "Rocket" train (1829) would be relevant here, as the steam engine was so important in this revolution. However, by today's standards an average speed of 12mph and top speed of 30mph does really do justice to the staggering exponential acceleration of economic activity and resource extractions.

Now, to zoom in on some details.

For every product, resources are ripped out of the Earth. This happens at an ever decreasing rate of efficacy and requiring ever more energy, because the easy deposits have long gone. In 1900, humanity only consumed seven billion tonnes of resources, by 1945 that had

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[16] The ancient Sumerian myth, '*Inanna prefers the Farmer*' (https://etcsl.orinst.ox.ac.uk/section4/tr40833.htm) predates the Biblical text. This powerful and often illuminatingly erotic text also depicts the fundamental struggle between the farmer and the herdsmen, and (eventually) the urban and the rural.

doubled, then doubled again by 1970.[17] In the past 50 years, resource extractions have more than tripled, from some 30 billion tonnes per year to an utterly unsustainable 100 billion tonnes per year today. If such a trend prevails, in 30 years, humans will have further increased from 100 to 200 billion tonnes by the year 2050.

In Olympic diving, judges give their marks for the execution and the beauty of a dive. Yet, this is not the only thing that matters. Every diver must choose, ahead of time, the difficulty of the dive that they are going to perform. Their marks are then multiplied by the value of that dive according to its complexity; for example, a Reverse 2 1/2 Somersault (305C) has a difficulty rating of 2.7 but a formidable Back 2 1/2 Somersault 2 1/2 Twists Pike dive (5255B) gets a difficulty rating of 3.8.

If we consider the background exponential population growth and the dry land surface of the Earth as the first co-ordinates in our thinking about sustainability, it now becomes clear that we have to add a major multiplier to those numbers.

There is a big difference between 10 people living a simple life of subsistence and just three people living an affluent modern lifestyle with all the resource extractions that this necessitates. This disparity between the Ultra High Developed (UHD) lifestyle and the Low Developed (LD) lifestyle has led some thinkers to propose a different geological label for the "Anthropocene". There have been proposals to call our period the "Kleptocracene" or the "Misanthropocene".

To illustrate why such qualifications to the Anthropocene are justifiable, here are some examples of how many tonnes of raw materials each person on average is ripping up from the Earth's crust every year:[18] The average Brit (18 tonnes) and the average American (30 tonnes), the average Singaporean (50 tonnes), and the average Luxembourger (45 tonnes) are causing so much more resource depletion than the average human (12 tonnes). And looking in the other direction from the average human, Medium Developed nations use only an average five tonnes, and the Low Developed nations only three.

All the latest national data for resource extractions can be found at cutxpercent.org, alongside all the latest emissions data in the table. The two issues are deeply connected.

To live sustainably, the IRP has put forward an average of seven tonnes per person per year of resource extraction[19]. As Michael Wadleigh and Birgit van Munster have noted, "The alarming evidence is that the destruction of nature by global extraction of natural resources has nearly quadrupled in the last 50 years. Astonishingly, the next 35 years of natural resource extractions and fossil fuel emissions are projected to equal the last 300,000 years (the entire time our species has walked on the Earth)."

[17] Source: Krausmann, F., Lauk, C., Haas, W. and Wiedenhofer, D. From resource extraction to outflows of wastes and emissions: The socioeconomic metabolism of the global economy, 1900-2015 Global Environmental Change 52 (2018) 131–140

[18] UN International resource Panel, Global material Flows dataset (2022), Material Footprint

[19] United Nations Environment, International Resource Panel. Managing and conserving the natural resource base for sustained economic and social development (2014).

The Club of Rome put it very succinctly back in 1972: there are "Limits to Growth".[20]

The conclusions of that groundbreaking work were hotly disputed, and it still causes Libertarians sleepless nights (for the wrong reasons). Driven by data, savvy modelling and the new power made possible by the invention of the IBM computer, "Limits to Growth" plotted out long term environmental scenarios. The forecasts made 50 years ago have proven to be robust. Yet, even if they were to have been entirely wrong in their details, the basic assumptions of the book remain extremely pertinent. Namely, that on a finite planet there will be limits to growth, and once those limits are understood we should measure, as best we can, the wisest pathway towards them.

The problem is that we live in a culture in which the thought of a limit creates a tremendous range of cognitive dissonances. Our culture is predominantly a capitalist one; of course there are innumerable cultures and subcultures, but the background grammar of how we think has been strongly flavoured by the emergent capitalist economy. The ground rules of capitalism have become so normalized at both an economic and social level that is genuinely difficult to imagine human civilization functioning inside another paradigm of values.[21]

The capitalist operating system might bring many advantages, but we should not be shy about pointing out all the fundamental disadvantages. Indeed, these disadvantages can no longer just be considered as "lefty" ethical concerns about equality and alienation. These disadvantages must now be upgraded to a different category of consideration: existential threat.

We are now crossing many planetary boundaries. The game of capitalism was remarkably productive, but in the absence an articulate, science based ecological framework for that growth, we are now living in on planet that might soon bite back with formidable force.

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[20] "*The Limits to Growth*" (1972), written by Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, representing a team of 17 researchers.

[21] Like with a language, any participant can use its grammatical structures and rules effortlessly without understanding the most basic rules of operation. It is even difficult to explain these rules retrospectively to someone who lives inside that language because everything functions so naturally.

Conclusion

During the time that it takes Pluto to complete one orbit of the Sun (248 years), the drive of capitalism to gain new markets has pushed Western nations into the far corners of the planet with increasing speed. This appetite for material and human resources mostly advanced forward with the uniforms of nationalism in the 19th century, before it really sped up after adopting the corporate suit and tie to travel during the 20th century.[22]

However, well before the surface of the Earth had been fully colonized by the rule(s) of material growth, another type of colonization was well underway. In the 1950s, it was not just the external expansion of a capitalist system that was happening, there was also an internal expansion of the market that was unfolding. Capitalism developed new markets by land and sea, but it also developed new markets in the hearts and minds of people.

Material products were linked to all kinds of psychological impulses, appetites and emotions. Those who pioneered this expansion into the human psyche were led by Edward Bernays (the nephew of Sigmund Freud)[23]. This new guild of craftsman who fused together the subconscious with consumer products were extraordinarily successful in creating a culture of fake necessities. The awesome advantage of this psychological expansion is that, unlike the surface of the Earth, it is limitless. Once human instincts were hooked up with products, our search for community and connectivity, status and security, affection and affirmation would all become impossibly restless.

Yet, oddly, this is good news.

These demands are artificial, they were constructed and they can be deconstructed.

The planetary boundaries that we are facing cannot be overcome by any arguments with the laws of physics and chemistry. However, we can use these hard limits as a reminder of what our true self is, and what true human development is.

Charles Eisenstein writes, “A world of without weapons, without McMansions in sprawling suburbs, without mountains of unnecessary packaging, without giant mechanized monofarms, without energy-hogging big-box stores, without electronic billboards, without endless piles of throw-away junk, without the overconsumption of consumer goods no one really needs is not an impoverished world.

I disagree with those environmentalists who say we are going to have to make do with less. In fact, we are going to make do with more: more beauty, more community, more fulfilment, more art, more music, and material objects that are fewer in number but superior in utility and aesthetics. The cheap stuff that fills our lives today, however great its quantity, can only cheapen life.”[24] After his probing exploration of the modern economic paradigm and Eisenstein looks forward, and notes, “Sacred economics is part of a different

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[22] These trade routes became so extensive and intense that it is not difficult to view the mega-rich oligarchs expansion into the realm of outer space as the next inevitable chapter in that expansionist story.

[23] ‘The Century of the Self’ (2002) is a powerful 4 part series by the BBC that documents the profound but invisible influence that Bernays had on Western culture. It was written and narrated by Adam Curtis and is widely available on YouTube. Episode One is informatively titled, “Happiness Machines”.

[24] “Sacred Economics – Money, Gift and Society in an Age of Transition” (2012), p29. (Available as a free download from his website)

kind of revolution entirely, a transformation and not a purge. In this revolution, the losers won't even realize they have lost".[25]

Further reading:

"Facing the Anthropocene", Ian Angus

"The Shock of the Anthropocene",

Extract from *No Common Sense*

News Decoder leads

News Decoder leads

Videos:

"The Century of the Self" BBC2, Adam Curtis.

https://www.youtube.com/watch?v=DnPmg0R1M04&t=2500s

Brian Cox: *BBC, Wonders of the Universe*:

"Stardust"

https://www.youtube.com/watch?v=DEw6X2BhIy8

"Entropy"

https://www.youtube.com/results?search_query=brian+cox+entropy

[25] Ibid, p64.