

2. FILTHY BAGS OF EXCREMENT

Daniel Thank you very much, Carol. A couple of years ago, I was upstairs in the library going through copies of old letters, trying to find out a little bit more about this often-forgotten figure, trying to understand what motivated him, trying to understand in some cases, the old German script.

It's 2005, the Centre for Jewish History in New York. Daniel Charles is giving a speech about a man he dedicated *years* of his life to researching.

Daniel The first question is why would it be worth getting acquainted, spending time with a man who lived so long ago and so far away, why, especially when he seems at first glance, like a thoroughly repellent figure, a kind of monster.

The monster he's talking about is a man called Fritz Haber, a German chemist in the 1900s with a bizarre legacy.

Daniel So he was born in 1868 in a city that is now in Poland, the city that was then called Breslo in, uh, in Prussia at the Dawn on the Eve of the, of German unification at the Dawn of, uh, the second German empire. He was a talkative young man. He was an ambitious young man. Talkative and *ambitious* - traits that served Fritz well. It seemed he had a real capacity for single-mindedness and grew up to become an incredibly focused and successful chemist. And then the first world war broke out. Haber throws himself into the war effort...He moved to Berlin and became in the words of his, uh, friend, uh, Richard Vil. Debter another chemist, he went from a great scientist to a great German

With some professional successes under his belt, Haber started moving in the upper echelons of society, which he loved and he became *hugely invested* in the German war effort.

By 1915, Haber was displeased to see that the war had become something of a stalemate, with much of the fighting bogged down in a trench-warfare. And *he* wanted to do something to help. So, he went to the German high command with an idea.

Daniel He said, well, if we're stuck with soldiers in trenches and machine guns, have no way of driving the enemy soldiers out of the trenches. Well, I have a solution and he proposed chlorine.

Haber was a chemist, so his solution was chemical. Chlorine irritates the lining of the lungs, so much so that if you breathe it in you start producing phlegm and can't stop. In fact, you produce so much phlegm that your lungs fill up with it and you can't breathe. You drown in your own mucus.

The German generals weren't convinced at first: it didn't seem a very honourable form of combat. But Fritz persisted, and eventually they said he could have a trial run as long as he organised it himself.

So, cut to the Spring of 1915, and there he was: on the front line in Ypres, Belgium, with a team of scientists and troops setting out gas valves behind him. It was a cold morning and Fritz, a bald dome-headed man, was wearing his distinctive small round glasses and a big fur coat. He gestured, and the valves on almost 6,000 tanks of chlorine gas were opened.

The gas moved at about 1 metre per second. A huge 15-foot ghostly green wall scouring the land, leaving deadened grass in its wake. It hit the trenches of the enemy and was immediately effective. A new weapon was born, the face of modern warfare changed forever, and thousands and *thousands* of men died horribly in the mud.

This was a huge breakthrough for Haber, and his first contribution to the German military.

His second contribution happened posthumously.

Daniel And there is this macabre footnote to the whole story...

Of course, despite the effectiveness of chlorine gas, Germany lost the war. Which devastated Haber. And once the Nazi's started to gain power, he was forced to flee his beloved country. Remember: Daniel Charles, the man who dedicated his life to researching Fritz Haber, was giving his speech at the Centre of Jewish History in New York; Haber was Jewish.

Daniel Uh, during world war I, as part of His work with poison gas, uh, he also became interested in the uses of poison gas as insecticide for insect control. And there was a whole unit of his Institute that got involved with, um, sort of insect eradication in various military facilities and granary and factories and so forth. And they came up with a formulation toward the end of the war that they called Zyklon.

Zyklon. It was deadly. It was also odourless, so they added a 'warning smell' to make it safer to use when applying it as a pesticide. They called it Zyklon A. But the Nazis, who took over Haber's lab, decided to remove the warning smell. And they called that Zyklon B. Which might sound familiar: it was the gas they used to murder millions of people during the Holocaust, including several members of Haber's own family.

I think it's fair to say Haber, this intelligent and ambitious man, had a catastrophically terrible impact on the world. But what makes him so fascinating is that... this isn't the whole story. Sure, he developed a weapon so inhumane that, in 1918, he was tried for war crimes, but he also - that *very same year* - was also nominated for the Nobel Peace Prize for his contributions to society.

This is because before the war had occupied his formidable focus, Haber had been set on solving a different problem: Germany was running out of food.

If it's hard to comprehend that a country could just *run out of food*, that's because the world produces so *much* these days. *But* that was exactly the problem faced by Germany at the turn of the twentieth century. Their population was approaching 60 million people, and they calculated that they would only be able to grow enough food for around 30 million. That's a lot of empty plates.

Haber wanted to help. And, as with the war, his contribution was chemical. He was a scientist, so he broke the problem down and studied the building blocks of nature. Plants need nitrogen to grow, but their supply is limited to what's in the soil, at that takes time to replenish. Annoyingly, there is nitrogen all around, in the air - but plants can't breathe it in.

Until Haber had a breakthrough. He found a way to combine the nitrogen with hydrogen and turn it into a liquid. And what can you do with a liquid? You can pour it all over the soil. This is what we call artificial fertiliser.

It was one of the single most transformative inventions ever. It meant the amount of food farmers could grow increased exponentially, and growing populations could be fed: not only in Germany, but all over the world. It's thought that as many as two out of every five humans [alive today] owe their existence to Fritz Haber.

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Germany, but all over the world. It's thought that as many as two out of every five humans [alive today] owe their existence to Fritz Haber.

Daniel There was a student of his, um, a protege who in the fifties decided to take on the job of writing Fritz Haber's biography, a German man named Johanna Yanek. And for decades, he laboured on this task. He worked and worked and collected and collected and never produced a thing. He just could not write, or perhaps he couldn't come to terms with sort of the ambiguity of his mentor's legacy, uh, the darkness and the light.

This is the reason why it's worth knowing about a man who, as Daniel Charles said, is otherwise repellent, almost a monster: this ambiguous legacy. Darkness and the light: a Nobel Peace Prize and a War Crimes tribunal, cultivation and destruction *war and food*.

It's so *contradictory*... or is it?

Series Intro

My name is Tilly Robinson and you're listening to The Water We Swim In. A 7-part mini-series that explores what system-change really means. Each episode investigates a story that helps us understand the way our society's been designed, so we can see the invisible forces leading us towards the climate crisis...because in order to know where you're going, you first need to know where you *stand* and how you got there.

Last week, we looked at our propensity to focus on the effects rather than the causes, and why this approach leaves us feeling disempowered, even bored. In this episode, we're going to find out *why* we struggle to see the bigger picture - and exactly how much bigger that picture is.

To do that, we're going further back in history than any other episode, down to the roots of our relationship with nature... and finding out what believing in a soul has to do with our agricultural model?

Part 1: THE MEETING PLACE OF LIFE

Fritz Haber's life and legacy may sound contradictory and strange... when it's *considered in isolation*. But if you take a broader look at the industries he contributed to - agriculture and war - you start to see that they're not so different.

Habers invention - Ammonia - turned out to have a double use: it also made a pretty mean explosive. When the first world war broke out, newly built agricultural factories stopped making fertiliser and started making bombs instead - they already had the ingredients.

And the same gas that was used on the soldiers, was also used as a pesticide, which became used *everywhere*. The pesticides were even sprayed over the fields using the same fighter planes from war.

It wasn't just the technology that was shared; the mindset sort of carried over too.

Voice Actor *"A warfare that will know no armistice! Man's civ-i-liza-tion, his future, his very life are at stake!"*

That's a line from a farmer's manual, talking about eradicating pests from crops. In some publications, insects were referred to as 'fifty billion German allies'. The war against the Germans had been won, and much of that intense wartime productivity was redirected towards a new goal: food production. And it *just* so turned out that the technology and infrastructure were two sides of the same coin.

Environmental historian Edmund Russell is one of the few people to have researched this link. He writes -

'War and nature coevolved at this time. The control of nature expanded the scale of war, and war expanded the scale on which people controlled nature. We created an infrastructure around a single type of industry, and split them'.

Armed with the advances of modern technology and a wartime mindset - the modern agricultural system that was built is nothing short of astounding. It's given us unimaginable plenty, so much food and choice and luxury!

Sounds of food adverts, restaurant jingles, cooking shows

And for a long time it's worked really, really well....

This Morning Theme Tune

Josie Breathe in, stretch out, as we meet the world's most famous yoga guru.

Phillip His spiritualist techniques have gained him millions across the world, and we welcome him, Sahguru, welcome...

Sadhguru Good morning

This is an episode of This Morning from last year. The hosts talking to Sadhguru, who has a yoga and spirituality foundation, as well as a popular Youtube channel. Sadhguru is sitting on the This Morning sofa, looking resplendent with a white turban, a long white beard, and a huge scarf spread out over his legs that makes him look like he's wearing giant pantaloons.

Philip Scholfield tries the usual interview style, but I think it's fair to say - he finds it quite hard. Sadhguru doesn't 'do' chit-chat answers.

Phillip Um, most watched Yogi on Youtube, 2.5 billion views in the last year alone. Is this, do you think, because we are all now looking for some kind of inner peace?

Sadhguru Peace can only be inner, all human experience can only be inner, whether pain or pleasure, joy or misery, agony or ecstasy, all happen within you.

His answers are...deep, as you'd expect from a guru. And it's not long before he starts steering the conversation in the direction of what he's really there to talk about: soil.

Sadhguru One massive problem, that everyone is avoiding talking about, for whatever their own reasons, I don't want to get into the politics of it, *but* 71% of the world's land is under-farming, alright? And that is in a super bad condition right now. To the point where UN agencies are pointing out we just have 60-80 harvest left, which is 45/55/60 year's time. If by 2040, very clearly every responsible scientist is saying we will be producing 40% less food than what we are producing right now. And our population will be well over 9 billion. That's not a world you want to live in?

Phillip So what's the answer? -

Sadhguru - That's not a world you want to leave your children in?

Phil (& Josie) ...No. (No).

Sadhguru Because you are asking for the answer because you got the point. But most people don't get it, that's why I'm talking about their children. At least there they must get it.

Phillip What you're doing, you're actively working very hard to raise awareness on this issue. You have a 100 day cycle journey going from London to Southern India

Sadhguru I am doing this is because people are not understanding the urgency of what it is. People are thinking 'ah, any number of issues, one more issue...' this is 'not one more issue'! UN agencies, world food program clearly predicts by the time it is 2035 there will be dozens of of civil wars across the world because of food shortages -

Phil Yeah -

Josie And where are you off to next?

Sadhguru London city right now, thousands of years of civilisation...three days if there is no food for 50% of the population, your civilisation will evaporate *clicks fingers* in three days time, your *humanity* will evaporate in three days time.

Phil Um, no, unfortunately...we have to stop because you have to go....

It's quite an awkward interview: the earnest warning jars with the standard daytime telly chit-chat. I mean, what do you say when someone is telling you that soon you'll run out of food, and that when that happens your civilised society will crumble into violence? ...Now on Gino teaching us how to make a quick pasta al forno!!

But there Sadhguru was, saying that we might only have 60 harvests left.

This is, by all accounts, very alarming. And yet - I don't know about you, but I haven't heard many alarm bells being rung. Do we *really* only have 60 harvests left? It's a pretty bold claim to make at 9AM on that teal sofa. And food production doesn't *seem* to be slowing down - food is still flooding in from all sides, thanks to Fritz Haber.

But I thought it was a claim that was worth examining. So I decided to go to the source, where Sadhguru said he got his information. I decided to talk to the UN.

By the way, in case it's not already obvious, I'm not someone who's always having a chat with the United Nations. And the United Nations isn't really in the habit of having chats with 'unofficial bodies'. But after several emails back, interviews and lawyers, *this* 'unofficial body' ended up at the UNCCD – the UN's Convention to Combat Desertification.

Abdoul Okay. So, Good Afternoon Tilly. My name is Abdoul Salam Bello senior project manager at a United Nations Convention to Combat Desertification. I'm currently focusing on Sahel related matters within the organization prior to joining the UNCCD I have been working for the world bank for six years. And before that I have been working with African union for three years.

Abdoul is the senior project manager at the UNCCD. He's the person to talk to if you want an official opinion about *soil*.

Tilly So a very busy man, basically!

Abdoul Busy, I don't know, but I try [laughs].

He told me that soil degradation, or 'land' degradation, is where the quality of the soil drops to such an extent you can't grow anything in it. And then, in a worst case scenario, this leads to something called desertification, where the soil turns into dirt and just... blows away.

Abdoul And so when we talk about desertification, definitely it speaks to a definite loss of that land that has become totally, totally not usable actually, either for the human being or for the animals, for the ecology, going forward.

Tilly Right. Okay. I see. So, what would you say is the scale of this issue at the moment? Is there much desertification going on...

Abdoul Yes, if the current state is I mean, there are the rates of how we are using

addressing the land, if we keep that trend actually to give you an idea of the magnitude by 2050 we face about 95% of the lands on the planet that will be degraded.

Tilly Oh, wow. Wow. I didn't realise, I didn't realise it was that soon. Um...

Abdoul Yeah. It's in 30 years, actually. Yes.

95% of our food is grown in soil, and, according to Abdoul and the UNCCD, in the next 30 years, or sooner, 95% of that soil will be degraded.

So, I got my answer: our soil is in big trouble.

But why?

To find out, I talked to Anna Krzywoszynska, assistant professor at the University of Twente in the Netherlands. The first thing you should know about Anna is that she has this incredibly kind, warm, likeable face, which is very reassuring when you've just been talking about desertification and civilisation collapse.

The second thing you should know about her is that she *loves* talking about soil... I mean, really *loves* it.

Anna So I would describe myself as an environmental social scientist. And for the last four years now, I think it is, I have been completely and utterly obsessed with soil and everything that has to do with soil.

The reason Anna is so obsessed with soil is because of how *vitaly* important it is.

Anna I mean the short answer is very simple. No soil, no life. Soil is just the condition of existence on the surface of a dry planet. We could think of soil as, um, the place where all the most important life supporting relationships happen. So I really like to think about soil as this meeting place.

Soil allows life to happen because it *connects* all the important things - it's a meeting place, as Anna says - and there's a whole, complex world going on inside it: a mix of materials, organic matter, carbon, water, and teeny tiny living things - in fact, there's 50,000 different organisms in

1 gram of healthy soil. It's these organisms that make soil *soil*, rather than just lifeless mud - because, make no mistake, soil is very much alive.

But unfortunately, we're acting like it isn't.

Anna So in our modern agriculture is based on a model of a relationship of soil in which we take things away and then we try to give them back. So we take away the nutrients in the form of a crop and when we give them back, but in a different form in the form of chemicals.

That magical fertiliser that Haber developed is amazing in that it boosts the amount we can grow in soil but it's also just a chemical substitute and over time it makes the soil weaker. The structure of the soil starts to collapse, which means all of the pockets that were there, holding important things like oxygen, get washed away and the organisms can't survive, so those microscopic biological exchanges, the ones fundamental to life, stop happening.

Anna Soils degrade when they are no longer connected to everything that they need to be connected to. Soils degrade when they can't perform this function as the meeting place.

This is what soil degradation is; the biology of soil no longer performs as it needs to. And because of that you need to keep feeding it more and more synthetic fertilisers in order to keep growing crops. It's like a drug addict needing a bigger and bigger fix of the drug that's killing them in order to function. And it means we're losing a lot of healthy soil.

In fact, soil - or technically 'topsoil', which is the alive bit we're talking about - takes about 100 years to form an inch. And we've lost *half the topsoil on the planet since the turn of the century*.

Sadhguru was right: we're in trouble. Our agricultural model, with all of its scientific advancement, technology and power, seems to fundamentally misunderstand the soil it farms. And if we keep going as we are, we could be faced with that almost inconceivable notion: running out of food.

Why are we here? Why are we in this position?

What if I told you that the answer goes back *further* than Fritz Haber, *further* than our military and agricultural industries becoming intertwined. What if I told you that Fritz Haber wasn't the *cause* of this...but rather, the logical consequence of foundations laid years before.

To really understand how we arrived at this problem and to understand what we need to do about it, it turns out we need to go back to the beginning.

Right down to our deepest roots.

Part 2: THE ROOTS OF REDUCTIONISM

Jeremy It's almost like, imagine if somebody built a house on a, a flawed foundation, you know, but it was just a kind of a small house, like one or two stories. And there were cracks in the foundation, but it didn't really make much of a difference for that one or two layers. But then imagine that over time that house got built on and built on and built on until it became basically like a skyscraper, but the foundations were faulty. (06:59)

This is award-winning author Jeremy Lent. Jeremy has thick-lensed glasses that make his big eyes look even bigger and more curious than they already are - and he *is* a curious man. A lot of us want our life's work to have meaning, but Jeremy wanted meaning so much that he ended up researching, for about *15 years*, how humans go about creating it. All that work went into his two incredible books about the cognitive patterns that have shaped society since we were hunter-gatherers.

If there's a reason we're struggling to understand something, as a society, then I reckon Jeremy's ya best bet to pinpoint why that is.

Jeremy And that is really what I see as where we're at right now, when there's, there was flawed ideas basically about like, about the universe that led us onto a path these last few, basically 500 years or so. Um, which at first, actually, even though they might have been flawed, they were so different things that led to a lot of success. But now we are living in a place where those initial, relatively small, uh, problems with the foundation have become massive gaping fissures in our well, in our civilizational, uh, trajectory. And that's why we need to understand them so well.

Jeremy thinks that we've been on a wonky path for a while now. So let's go back to the beginning.

First though, I want to try a little experiment. I'm going to tell you a simple story, and then follow it up with a question. It's the same scenario and question a psychologist posed to the participants of a study, and the answer might give us some insight into that 'foundational way of thinking' Jeremy was talking about.

Ok, so the story starts with a man called Richard. Richard is a 37-year-old history teacher, and one morning he's driving to school, tired and stressed, because the night before he'd had a huge fight with his wife about her suspected affair, and he's skipped breakfast to try to do some last-minute prepping for his students. At a busy junction he leans over to close the passenger window, and his foot slips on the accelerator - the car shoots forward into a telephone pole. He's thrown through the windshield and hits the pavement, dying pretty much immediately.

Now, here is your question: "Do you think Richard wishes he had kissed his wife goodbye before he left for work this morning?"

The interesting thing about this question is what your answer depends upon. Was your knee-jerk reaction, 'Yes, of course, because he loves her', or 'No, he doesn't because he no longer exists'.

It sort of comes down to whether or not you believe in consciousness after death, right? That's what this study was about, understanding our beliefs. The study posed a longer version of the story, and then a whole series of questions, and the answers generally followed along the pattern you'd expect: religious or spiritual participants answered in favour of continued consciousness, and atheists answered no.

But here's the thing: *not always*. Some participants who stated an explicit belief that death is *final*, struggled to reflect that in their answers, and said things like 'Yeah, of course he wishes he kissed his wife this morning!'. One participant, when asked whether Richard knew he was dead, answered: 'Yeah, he'd know. I mean, I don't believe in an afterlife. It's non-existent. But he would see that now'.

It's weirdly easy to get muddled. When *you* were answering the question, even if you reasoned no - did a small part of you feel conflicted about it? Like, for some reason it's hard for us to believe that who we are, our *essence* is just cells and tissues, neurological signals that can be cut off in a moment?

And that is, perhaps, because the concept of a *soul* or a consciousness that exists separately to the body, is *deeply* rooted within our society.

And this, according to Jeremy, stems aaaaalllll the way back to 400 BC. Athens, to be exact. Picture a lot of Greek men in robes trying very hard to figure out *life*: "what's its purpose?" "what are the rules that govern it?" "are there universal truths?". And one of these men you've probably heard of: a guy with a big white beard, called Plato.

It is hard to overstate Plato's influence on society. His philosophy would essentially become the foundation for European thought for the next two millennia. And his main 'thing', was that he believed that the soul and body were two separate entities. This is called *Dualism*, and despite its familiarity now, it was a *very* new idea to most people at the time.

Plato posited there were two realms: the eternal, *ideal* dimension, which only the soul could inhabit, and the changeable *material* dimension, where our bodies exist. For Plato, we were trapped in this material dimension until we discovered the capital-T 'Truth' - whereupon we would be rewarded with eternal life. Understanding the 'Truth' was achievable through our capacity for abstract reasoning - and it was *this* that gave us a soul...our *bodies* something cumbersome to be shed, tombl-like, he put it.

So, the soul and the body are separate, and one holds more value than the other - this is where that idea first took hold.

Its reach *really* permeated Western culture when it became an integral part of the most practised religion in the world. About 400 years later after Plato, a man known as Jesus Christ was born, lived a pretty eventful life and died (and then, depending on your version of events, come back). And over the next few hundred years, a new 'grassroots' religion was formed around his teachings: Christianity. And many of the Church Elders who were involved in this formation, had previously belonged to some *extremely* dualistic religious sects.

In fact, these sects were so committed to dualism, to the division between the spiritual and the material, that they *loathed* the human body. Monks wouldn't watch each other eat, not wanting to witness such a base bodily need, and women weren't allowed to bathe in case they accidentally saw their *own* body. The body was, and I quote 'a filthy bag of excrement and urine', and the material world in general was considered an uncompromising evil that actively obscured God's love.

It's hardly a surprise, then, that Christianity went on to teach us a *distaste* for our physical bodies, and desire to escape a physical world which holds no inherent value. This is what Jeremy Lent calls a *root metaphor*. A root metaphor shapes our internal understanding of the universe, and so it ripples out, having profound effects on culture and society. It's the foundation to the

skyscraper that he mentioned earlier.

So - why is this important? How has this belief affected our agricultural approach? Well, if we saw 'the physical' as having no inherent value, including our own bodies, how do you think the *natural world* was seen?

Preacher In the name of the Father, the Son, and the Holy Spirit. Amen. The reading that we have not read yet, or a lot of people haven't read yet for Vespers, tonight is containing the most important scripture in all of scripture, the most important verse. So if somebody asks you what's the most important scripture? You can say it's from Genesis, and it, it's when it says, let us make man according to our own image and likeness, and let them have dominion over the fish of the sea, over the flying creatures of the earth, over the cattle and all the earth and over all the reptiles that creep on the earth.

Preacher When God creates man and woman in his image he created them he told them to fill the earth and subdue it and twice said that he gives us dominion authority over the created order so that it is not gus that has dominion over the world it is me and you we're the ones with dominion we exercise authority we are the ones who bring order into chaos it's not animals animals are chaotic we bring order into their chaos.

If the soul is what gives us value, and nature is just *material*, then surely...nature has no inherent value. It exists only to serve us. This is what formed the metaphor at the foundations of Western thought: "Nature has no inherent value, it is ours to conquer and control".

Here's Jeremy again.

Jeremy Because, um, and that's the, the, the thing is that it's really, these ideas can be so deeply embedded in us that we don't actually even realize we are making presumptions about them. And that's what, what I describe actually is like the, a world view, like, so we have a dominant world view and a worldview is a little bit like a lens through which we see the world, which may, and, and just like we see the world through our eye, which is a lens, but we don't realize it's a lens. And in fact, it's doing all kinds of distortions to the world the way it is, but then it makes sense to us cuz that's the pattern of meaning we put into it.

A root metaphor is very powerful, because it's the lens through which we see. And this means it doesn't just affect our philosophical framing of the world around us, it affects the way we *investigate* it. In fact, it's shaped our entire scientific model.

Descartes I think therefore I am

And this starts with Descartes, a French philosopher in the 17th Century. He kind of modernised the 'split' of dualism, theorising that the *mind* is the source of our true identity, and our bodies, again, are mere matter with no intrinsic value. Sounds familiar. The difference was that, by the 1600s, people were making complicated machinery, like clockwork, and so Descartes could update the metaphor. Our bodies weren't just material - they were *machines*.

Descartes 'I do not recognise any difference between the machines made by craftsmen and the various bodies that nature alone composes'.

Descartes hypothesised if God was our architect, then our bodies - and the natural world - must operate according to rational laws he designed: like a machine. And this idea was revolutionary in terms of scientific investigation.

If you want to understand a machine, what do you do? You take it apart: separate the pieces, down to the smallest component, analyse them and then put them back together. And so this - the idea that nature worked like a machine - was the scientific foundation upon which Europe entered the Enlightenment. And stuck *because it worked*.

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And it's still the basis for how we approach things scientifically today. It's called Reductionism: we break a complex phenomena or entities down to their elementary parts; study those, often as separate specialties, and then draw conclusions about the whole thing. Just like you would a machine. Reductionism operates on the assumption that - like a machine - a whole is the sum of its parts. So by understanding the parts, we can then predict how it will behave, and if we like, interfere and alter that behaviour or outcome. It gives us control.

And boy, has it been successful. By isolating nature's building blocks and analysing them down to the tiniest detail, scientists have been able to split the atom, create powerful computers, analyse and change the structure of the human genome.

Breaking things down is exactly what Fritz did. He analysed the chemical processes involved in fertilisation and mimicked that life-giving capacity by extracting nitrogen from the air...changing the way we grow food forever.

How did this root metaphor shape the world? Dualism gave us the desire to conquer nature. And reductionism gave us the ability to do so. It's given us unparalleled progress. It's given us longer, more comfortable lives, endless food, pleasure, ease and exploration.

It's helped us build our house sky-high. But...it's also why the whole thing is in danger of falling down.

Collation of news-headlines covering ecological degradation and species extinction

Part 3: A NEW WAY: SYSTEMS THINKING

Of course, there is not one way to view the world. Let's go back to the beginning again. Back to 400BC.

Now, as we know, Plato's idea really *travelled*; Dualism spread across Europe. But one place they didn't really take off... was China. To get from Greece to China in 400BC, you'd have to go through Turkey, Iran, Afghanistan, probably Nepal, and somehow get *over* the Himalayas. When the fastest mode of transport you have is a horse and cart, or a dug-out canoe, that's a long and treacherous journey. So back then, when China was *also* trying to figure out the meaning of the universe, they were doing so almost totally separated from the idea of Dualism. **3.1** And what they came up with was startlingly *different*.

Instead of imagining two realms, the physical and the spiritual, they just had the one.

Voice Actor "Tao everlasting is the nameless uncarved wood. Though small, Nothing under heaven can subjugate it."

Tao (spelt T A O) was what they called the organising principle of the universe, the source of existence, and it was in everything.

Here's Jeremy again.

Jeremy There's this beautiful passage. Um, in one, in a book by somebody called who's one of the great sages, um, of from Dallas and from that time, and he is walking in this garden with this, um, other kind of constitution stages, trying to understand Taoism and this person it's a little bit like, imagine like a Western person might have been saying, and, and the person is saying to Truda, where is the do then? Is it in the sky? And Truda says, yes. He said, well, is it in, is it in the earth? And he goes, yes. And he says, well, is it even in the, kind of in those weeds down there? Um, and he goes, yes. And he goes, well, what about the shit, he said it can't be in that and Truda says, yes, it's there too. It's like, it's everywhere all around.

The material *is* spiritual. Tao, the source of everything, *is in* the piss and shit. Everything here has value because it's part of the universe. It's a bit different to 'filthy sack of urine and excrement' being the antithesis to God's love.

Overtime (the way that dualism developed with Christianity) Taoism was developed by the Neo-Confucians. And they believed Tao was made up of two things. Qi and Li.

Qi is life's energy - what animates the entire world. It is both material and spiritual and is in *everything*. It is always shifting, always in flux. Like the world is.

Li are the organising principles. They allow elements to work together cohesively, even whilst those things are always changing. Like your cells renewing constantly but you remain the same person.

Qi meant that everything had value. Li meant that everything was connected. The sages saw nature, not as a machine, but as a living organism. And they saw the universe as a web of life, on which humans were dependent.

Jeremy And they saw humans not as separate from it, but is embedded in this web essentially as kind of connecting heaven and earth as part of this, um, this kind of cosmic, uh, flow of, um, of connectivity. So they saw, um, the true, uh, sort of meaning of life was to learn how to harmonize with the rest of life rather than to control it. The idea to them of dominating nature or humans being fundamentally separate from nature was kind of unthinkable.

"Tao everlasting is the nameless uncarved wood. Though small, nothing under heaven can subjugate it." Instead of conquering nature, their root metaphor was to live in *harmony* with it.

Now, this root metaphor didn't expand across the world in the same way as Dualism. If it had, perhaps it would have laid the foundation for a more sustainable society. A desire to live in harmony with nature, instead of a desire to exploit it.

But, in this alternate reality, we wouldn't have had the building blocks for scientific advancement in the same way. Because, whilst it's a nice philosophy, it's not the basis for a scientific model...
Right?

Matthew OK, so in the 1960s, there was this mathematician called Edward Norton Lorenz, and he was trying to predict the weather.

This is Matthew, my editor. He did some research into an important moment. The moment where it became apparent, at least to one man, that modern science had overlooked something important.

Matthew So, Lorenz was trying to make his own model of the weather on a state of the art computer, something that hadn't been done before. One day, in a rush to go and get a cup of tea (entirely understandable) he rounded off one of his numerical inputs. He punched in 0.506 instead of 0.506127 or something. An *infinitesimally* small change. Then he went off, made his cup of tea, and when he came back, he couldn't believe what he saw. The entire weather prediction had changed...think 'sunny sky to raging storm'.

Which didn't make sense. If nature is the sum of its parts, and works like a machine, small change should equal small difference.

Obviously Lorenz, being a scientist, became *obsessed* with this. He spent the next decade researching the implications. And about 10 years later, he came up with a theory that shook the scientific community.

He was obsessed with understanding this mistake because if Reductionism is based on the premise that the whole is the sum of its parts, then a *tiny* change shouldn't have altered the entire system. It didn't make any sense. But after the efforts of many scientists, Lorenz included, we now have a better understanding of why this happened, and a *whole new school of scientific* thought to help explain it: Systems Thinking.

Systems Thinking (if you haven't already guessed from the name) established, the astounding

truth, that the basis of *all living things* - all of nature - is...systems! You know, systems, networks, *connections!*

And that's...*very different* to reductionism, which breaks things down, and looks at the parts separately. Systems Thinking focuses *instead* on the relationships *between* things, because it views these interconnected systems as a whole.

Ok, so this is all pretty confusing science, but bear with me because, later on we'll go and look at a real example of this and when you get it, you'll understand how nature works, in a way that - as a society - we currently fail to.

Reductionism see's nature as a machine, right? Like say...a jet engine. A jet engine is what you would call a complicated system: there are lots of tiny components required for it to work, but when you put those little bits together, the system works the same every time. It's *linear*, the relationships are set, which means you can predict exactly how it will work. If you couldn't you probably wouldn't want to catch your flight.

Well, Systems Thinking shows us... *nature doesn't work like that*. Consider something as seemingly simple as a *worm*. A worm is also a system, a living system... it's made up of networks of tissues and cells, and *those* cells are systems of networks and molecules. And the worm is part of a larger ecosystem. Well...all these elements that make up a worm interact and *influence* each other - in ways that AREN'T the same every time - they feedback into the system in a *non-linear* way. The worm is a *complex* system.

And complex is different to complicated.

Jeremy Any of these systems work according to complex, um, nonlinear feedback effect where lots of parts are there, but they don't just have direct relationships with other parts, but those relationships are nonlinear and the effect of one part will feed back, then change the initial part all the different parts of the system affect the actual system as a whole, and the system as a whole then has an impact on the different parts. But what this means is that you can never exactly predict what that system will do.

Hence why a *tiny* change in a weather system could result in sunny skies turning to stormy clouds.

Living systems work as a *whole*...and amazingly, that whole can be *more than the sum of its*

parts!

If the system - with all that feedback, and all those interactions - reaches a certain level of complexity, it starts to **self-organise!** And new properties emerge that weren't evident or possible when looking at the individual components! It's called 'Emergence'.

You see this in all sorts of living systems, ant colonies, murmurations of birds - even water formation - or...our behaviour! Language, stock markets...even they think...*consciousness* could be the result emergence of networks self-organising.

And...of course... soil! Those complex physical, chemical, and biological interactions between the plant, the animals, the climate dimensions, and everything else - means the system self-organises and you get an emergent property: the ability for plants to grow. Because soil is a *living* system - we know this! Like Anna said, it's the meeting place of life. It's *all* about relationships and connection. [breath]

So, no *wonder* our agricultural industry doesn't understand it! Our agricultural industry is built on reductionism - a scientific model that is about analysing parts *separately*. And, although this method led to Fritz's incredible invention of fertiliser, he was still only looking at one element in a *complex* system. And nobody thought about the rest of the system for *years*, we just pumped the soil full of fertiliser.

And now we're degrading that soil... quickly destroying the prerequisite for *life*.

Reductionism has given us incredible breakthroughs by helping us zone in on specific problems and specific solutions, but it's also led us to ignore the bigger picture, *and not just with soil*. We overlook how interconnected everything is, we might overlook, for example, that healthy soil is one the largest natural carbon sinks in the world, restoring our soil means less carbon heating up our atmosphere.

Reductionism also means we forget how dependent we are on natural systems, and how complex, changeable and fragile the earth's systems are - including its climate. If we assume the climate system is the sum of its parts, then it's all too easy to assume that we have control over it and be tempted to play it close to the line on targets that are life or death.

And it also means that when we've got to fix something complex, *like climate change*, we don't know how to think in terms of systems, to look at it as an interconnected system, to understand

the problem in terms of root causes...rather than trying to deal with isolated effects. Because, as we know from episode one - that doesn't work.

Jeremy But what happened is reductionists got so focused success of their kind of project that they began to think that everything in the universe can be explained by breaking it down into its parts. And there's no other way of even making sense of the universe. That's where they got their sort of blind spot. And what systems thinking does is it doesn't reject that reductionist way of making sense of the universe, but it says, in addition to that, the way in which things relate to each other actually leads to new principles, like emergent new levels of organisation, which can only be understood by actually trying to understand those principles of organisation through which all these things are connecting.

Systems Thinking is a new way of looking at the world that expands and deepens our understanding of it. Or, in fact, maybe *not* so new.

Amazingly, this cutting-edge science lines up with the philosophy of Taoism almost perfectly. To go into all the parallels would take up a whole episode...but remember Li? The organising principles that allow things to work together cohesively? That concept is almost identical to the idea of self-organisation central to systems thinking.

So, this ancient, spiritual way of seeing the world, actually got a lot of the scientific basics right. Maybe its way of conceptualising our relationship to nature - as something interconnected and dependent, in need of harmony - is a worldview that we could learn from.

Lorenz won the Kyoto Prize two decades after his discovery and was said to have 'brought about one of the most dramatic changes in mankind's view of nature since Isaac Newton'. But, despite this - the mainstream approach remains reductionism, systems thinking is relegated to the fringe, and our agricultural industry remains far, far behind, still attempting to divide and conquer, still waging war on the landscape, still destroying biodiversity in an attempt to gain control.

And that's because it's really, really hard to change a root metaphor.

Atmosphere of me driving in my car

Hard, but not impossible.

These are the sounds of me driving down to a farm in Kent: Loddington Farm. It's a fruit farm, grows apples and pears for juice. It's a cold November afternoon, and the sun is just starting to set as I get there, very late for the interview. I've come to talk to James Smith. It's his farm - it's been in his family since 1882 - but the reason I've come to talk to him is because he's trying things *differently* to how they've been done before.

James I've got someone coming here at 4
Tilly Ok yeah
James He's picking up a deer
Tilly Yeah, yeah sure. Ok. Alive? Or Dead?
James Dead
Tilly Ok yeah makes more sense.
James Anyway I think there was a bit of confusion between us
Tilly There was - I had...anyway -
James Nice to meet you
Tilly Very nice to meet you! Sorry it took me so long to get down here

It's very much a working farm (we had to pause the interview when someone came to pick a deer up). There are whirring machines and a lot of mud. But it sits on a hill overlooking a valley covered in green (even in the dead of winter) and smells *sweet*, like fresh apples and blackberries.

James is hard to age; could be anywhere from 30-40; sporting a sandy beard and wellies, he's energetic and he has to be because he's juggling a lot, or 'going like a blue arsed fly', as he puts it. But that's OK, because he's found a new lease of life in the last few years.

It wasn't always this way.

James At the time we were probably 95% red apples to UK supermarkets. Okay. Yeah. And, and I was struggling... a) struggling to make it work financially and b) in more recent years, I suppose, have been challenging myself with this, what I call human dissonance. So it's the gap between what I love and admire about nature and how I felt we had to farm in order to be commercial fruit growers.

James was farming-by-numbers: traditional farming; applying fertilizer, pesticides, and growing only a few different strains of tree all in neatly numbered rows. But, it wasn't working. He was intensifying his methods and getting *less* money each year: and doing the same thing over and over again expecting a different outcome can make you feel like you're going mad.

So about 6 years ago, he was ready to quit. But then, he went to a meeting where someone was talking about farming in a different way. And James was curious.

James Let's go for a stroll.

Tilly Yeah wonderful

Sound of squelching mud

Deer picked up; we started to walk around the farm so he could show me how he's changed things. The model James learned about is called *Regenerative Farming*. It sees all the elements of nature not as separate parts, to be cultivated in isolation but as a *system*, which requires a holistic approach.

Sound familiar?

It's an approach that comes from the only parts of our world untouched by the dominant culture, where those root metaphors never took hold: Indigenous Peoples. Distinct social and cultural groups that share collective ancestral ties to the lands and natural resources where they live. Their philosophy, their beliefs, and their *root metaphors*, are alien to Western culture. They align much more with that of Ancient China. So, perhaps it's no surprise that despite making up only 5% of the world's population, they protect 80% of the world's remaining biodiversity.

In regenerative farming you look at the specific area of land you're working with, and think: how do the ecosystems work best *here* - because different plants and animals thrive in different places - and then you learn how to support these systems, so as to help create the healthiest land possible.

James ...Well, I think the way I see it is that we, we are looking, what looking at regenerative farming has sort of done for me is that I now look at myself as sort of like an ecosystem manager and see my crop as part of a wider ecosystem rather than the ecosystem. You know very often we focus on the above-ground part of a plant. We look at it, we, you know, we might do mineral analysis, et cetera, but we look at it in isolation. Um, we try and fix those problems in a typical, you know, modern farming way, in that you see a problem, fix it, see a problem, fix it, rather than looking for - excuse me the pun - but looking for root causes and, and addressing, addressing some fundamental issues around the overall health of our land and our soil.

So, there is no one size fits all approach, but there are principles. And the most important one? Protecting and supporting the soil. The soil isn't tilled or disturbed, its structure is protected and supported by cover crops.

James ...But, but what I do know is that if you stop putting chemical on and let plants grow, soil improves. Yeah. It smells better. It looks better. There are more earthworms. There are some real basic things we can do to see the, about, you know, see the function of our soil.

Tilly What, is it literally you can tell by the smell?

And here's the thing. Farmers are starting to apply this principle.. 75% of UK farmers have voiced the importance of regenerative practices for the future of farming. Farmers need to be able to grow food. So they're discovering a new way of doing things out of necessity. And in doing so, it's changing the way they see nature. It's changing the way they feel about it.

Tilly Yeah. Absolutely. And do you think, because there seems to be, you know, more and more farmers in the UK are coming to look at this more sort of natural regenerative style of farming. Yeah. Do you think that's because it works?

James Yeah... if you can show farmers that they can do something that is simple, that is inexpensive and has a direct benefit for their business, then they'll crack on. They'll do it. Yeah. And actually, when they start to do it and, and they start to see the benefits, then they, they, you sort of start to scratch the itch. You know, you, you kind of, you're on the journey then. Yeah. And then it's like, well what else can we do?

And so you're driving around and there's pollen and nectar and there's diversity and there's, you know, it's, and it's, it really is, it really is kind of moving. And I think that's what's really heartening is as you drive around and when you, when you are looking at the countryside with, you know, different eyes, um, you can see it happening you know, there's fewer plough roaring up and down. You know, there still are some, but you know, but the way people are farming and the different crops that are in the ground and, and this move towards, you know, a kind of way of farming is, it's really encouraging.

I started this episode talking about Fritz Haber, the man who changed forever how we wage war and how we grow our food. A man whose legacy encompassed both light and dark: the brilliant light of scientific advancement, which provides us with such abundance and health; and the *dark* of our desire to conquer the natural world, our inability to value and understand systems of which we are inextricably a part. For years, we haven't been able to have the light without the dark. Advancement and understanding has always meant destruction and domination. They are two sides of the same coin.

The reason why talking to James gives me hope is that... he shows that there is a way out of this. A way that allows us to make the most of nature, while also appreciating the complexity of its relationships and *our* relationship to it.

All it takes is a reconsideration of our roots: the roots down in the dark of the soil - and the roots in our past, that determine how we see the world and everything in it.

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You've been listening to *The Water We Swim In*. Next week, we're trying to understand our economic goal, by looking at Derren Brown and Doughnuts.

If you're interested in finding more about Systems Thinking, Loddington Farm, or how to protect our soil, head on over to our website waterweswimin.co.uk, there's a lot of extra cool stuff, including my full interview with the incredible Jeremy Lent.

If you enjoyed the episode, please rate and review on iTunes. We'd really appreciate it.

Producing this episode was me, Tilly Robinson. Co-writing was Matthew Robinson. Mixing by Naked Productions, and original music by Drew McFarlane.