

The Great Simplification

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[00:00:00] **DJ White:** We are all space travelers now. We are on a great spaceship, which through luck is perfectly tuned to humans. During the course of this interview, we'll probably travel a million miles farther, certainly than, any of the moon missions that are coming up. We've got radiations shielding, we've got air.

[00:00:20] There is no single square inch of earth on top of the ocean, on the crust of the seabed on Antarctica. That is not a million times better to colonize than any other planet in the solar system. All the real profound stuff is here.

[00:00:40] **Nate Hagens:** Today I am rejoined by two friends of mine who have both been on the show multiple times, Tom Murphy and DJ White for a Biophysically Grounded discussion about the increasingly popular and fantastical ambitions to mine and colonize outer space. Tom Murphy is a professor emeritus of the Department of Physics and the Department of Astronomy and Astrophysics at the University of California San Diego.

[00:01:06] He retired in 2023 and moved to Washington State to focus more on the predicament of modernity and its ecological incompatibilities. Tom is the author of Energy and Human Ambitions on a finite planet creator of the Metastatic Modernity Video series and continues to explore long-term human success through his do the math blog.

[00:01:30] DJ White is a co-founder of Greenpeace International and founder of Earth Trust. He has played a leading role in protecting dolphins, whales, sea turtles, and countless other marine animals, including successfully stopping a

The Great Simplification

national dolphin drive kill, and breaking the deadlock and capping the Kuwaiti oil fires.

[00:01:51] Additionally, he helped end the world's largest and most destructive global fishery, Pologic drift netting, and created the lab, which first demonstrated self-awareness in the universe outside of the great apes. In this episode, we take a deep dive into the biology, chemistry, physics, and ecology.

[00:02:10] Underpinning why human colonization of space is not as close as many would like to believe and why even dreams of interstellar robot mining are a biophysical non-starter Tom dj and I also explore the underlying philosophies and cultural imagination that has led to an obsession with space for many of the wealthiest among us.

[00:02:34] But the biggest takeaway from this episode is not about the impossibility of these space fantasies, but realigning with the reality that we are already on an earth and space ship flying through the galaxy, and that we might consider appreciating and taking care of our existing ship while we still have it.

[00:02:54] With that, please welcome Tom Murphy and DJ White. Welcome back to The Great Simplification, DJ White and Tom Murphy. I just looked at my old emails, and I've known both of you for about 20 years, which is pretty crazy. so you've both been on the show, multiple times, and you are both deeply embedded in researching, what I increasingly refer to as our more than human predicament, as well as being close friends of mine.

[00:03:30] And, today I've asked you to come back on the podcast to discuss the resurgence of ambitions for space mining and space colonization amongst the leading. Techno optimist, technologists of our age. And I've got a ton of questions for you both, but before we dive in, I was hoping you could each give a little of

The Great Simplification

your own background on your academic and professional experience in, these fields and how you initially got interested in space exploration and those topics.

[00:04:14] Tom, maybe we start with you.

[00:04:15] **Tom Murphy:** Okay. Well, thanks for having me on. well, I think the obvious, statement is that I spent 20 years as an astrophysics professor, so that gets me, you know, one step closer to space. But more than that, my main project. Used the reflectors that were placed on the lunar surface by Apollo astronaut.

[00:04:34] So I built the apparatus that really reaches out and touches those reflectors. And so it's very personal in that sense. The project, in fact, was named Apollo, the Apache Point Observatory lunar laser ranging operation. Our logo was a Saturn five rocket. Our computer, the mission control, if you will, was called Houston.

[00:04:55] another controller. the instrument control computer had two Cs in it, so it had cocoa as its name 'cause of Cocoa Beach where the astronauts trained. We even had a custom piece of electronics that controlled the real-time state of the machine called the Apollo command module, just like the little capsule that the Apollo astronaut sat in.

[00:05:15] I had two decades of continuous funding from NASA that accumulated to something like \$3 million plus a comparable amount from National Science Foundation and reviewed. Over a hundred NASA proposals, many of them for space missions, some of them for Mars missions. so I kind of got a sense of the state of the art and what's practical and what's not.

[00:05:38] I was the principal investigator for a mission concept study to put a spacecraft on FBOs, to test general relativity in the solar system. And, you know,

The Great Simplification

was at the Jet propulsion laboratory in the room where they all sit around with navigation and computation and communication and thermal and all those sort of desks to sort of do a shakedown of the mission.

[00:06:01] but even before all that, I mean, it was seven years old when, star Wars came out and. It rocked my world. You know, you can imagine I had all the action figures and the toys, became a fan of Star Trek. lots of fiction like Hitchhiker's Guided The Galaxy, which I read every few years and am actually reading it now 'cause it's just so fun.

[00:06:22] the 2001 Space Odyssey, the Right Stuff was a favorite movie of mine for many years, and I grew up not far from Huntsville, a Alabama, I was in Tennessee. And so visits to the Space Museum were a real highlight. I mean, this is kind of like my mecca. and I even got a chance to work on a space shuttle project when I was between undergrad and grad school.

[00:06:47] And then even as a 28-year-old, maybe, adult by that point. in graduate school, near the end of my PhD, I started really considering seriously the idea of being an astronaut. I thought that would be a lot of fun. I even got a pilot's license. We had a local hero, John Grunsfeld, who came out of my same department, and was an astronaut.

[00:07:13] Still is. And so, yeah, I've been in the space business, or adjacent to it. Never in space. I've never built anything that went to space, but I've been really close to space hardware, space missions, and NASA for many years.

[00:07:29] **Nate Hagens:** Dj, what about you?

[00:07:32] **DJ White:** Yeah. Well, what an act to follow, right? the, Tom is the real deal.

The Great Simplification

[00:07:37] He's a rocket scientist, and he's, a guy that loves this stuff. I, too am a guy who loves space, and I think it's important we lead off with that because we're gonna be talking reality here. I'm here as a, you know, more of a sci-fi, you know, initially a sci-fi and space geek that's, you know, from early ages, like, I mean, like six or seven.

[00:08:01] we're talking classic sci-fi, you know, here for me because I'm old. But, it was always very important to me. And, you know, of course the moon missions and all of the, you know, for everything, Mer, mercury, Gemini, Apollo, it was nuts. And, Well, I've got a piece of Skylab here on my desk that was given to me, my, by one of my brothers.

[00:08:24] 'cause he and I drove from Indiana down to see the last Saturn five lift off in person. And that was not that easy thing to do for working class guys who were doing factory work and odd jobs for a buck or to an hour to, to mount a triple like that. It, was heavily symbolic for us of, of the cool things about the future.

[00:08:48] And, anyway, getting beyond that, It's, well, I think we've established in the past, I'm kind of an autistic guy. You know, it, it's okay to say that these days. I was very interested from an early age, not really having an internal verbal monologue in nature of intelligence in the universe, the nature of, what is the place of mankind in the universe and all these people around me that believed things that made no sense.

[00:09:21] How, did that work? My quest to learn more about space and my quest to learn about the nature of, consciousness in the universe were the same thing. They weren't like two different diverging paths. And, by college I had, encountered, John Lilly's speculations on dolphins, which had bigger brains, bigger cerebral cord cortices and stuff as we do, but nobody really knew, you know, what they were doing with us, basically, I.

The Great Simplification

[00:09:52] I ended up, pushing my life and what felt to me like both space and intelligence in the universe directions, skipping forward, I got myself into a situation where I was able to maintain a long-term friendship with a dolphin, a non-human abstracting, intelligence. Intelligence, and figure out to my criteria that, holy shit, these are people in every, they're not like dogs are people.

[00:10:21] These, this, critter is smarter than I am in some ways. And, is a person, you know, there are other. Peoples on earth who are, you know, even intellectual, they're just non-technological. But realizing that also meant I immediately became, aware that our species was perpetrating multiple Holocaust to be basically wiping them all out.

[00:10:46] And, that placed a heavy ethical onus on me. And I switched from what had been a geophysics career and initially working in the oil industry to, to try and to, save them. And I have been pretty successful, but maybe not ultimately successful. but I also tried to bring space people to it. In other words.

[00:11:12] I, I served on a, on as a one on a three member board of a granting foundation that granted for projects of space exploration and ways of having that also affect earth. In other words, the idea of, yeah, let's do the dirty stuff off planet someplace that let's save our sacred home planet, from destruction.

[00:11:35] But, there were a lot of, there were a number of astronauts that got involved in some of my projects. For instance, Tom mentioned, 2001 Space Odyssey, Arthur C. Clark, I guess Sir Arthur C. Clark, who wrote that, became a friend. And, one of the projects I was doing, which is to interface dolphin lines.

[00:11:54] I, created dolphin lab for dolphin cognition, research. One of my projects to do that was to interface computers with dolphins and try to work out hybrid language. Arthur Clark wrote a fiction book. Called Fountains of Paradise

The Great Simplification

about space elevators, which was a cool enough book. The proceeds from that largely funded what I was doing to hook actual alien minds up with computers.

[00:12:24] So, you know, there's real clear demarcation to write good sci-fi you need to understand the dividing line between fiction and reality, you know, fantasy and reality. So, the guy that wrote a Space Odyssey was, he was our international advisory board, chair. And, because there's reality and there's wonderful things in reality, and they're very exciting and, you know, and there's fantasy's fun, you know, Cinderella had a co, you know, had a pumpkin that turned into a coach.

[00:13:01] That's fun. But increasingly, it seems a lot of people. Have magical stories in place of where they ought to have basic understanding of the limits in, the universe. So that's probably run on long enough.

[00:13:17] **Nate Hagens:** Excellent. Don, I've known you for a long time. I've never actually heard that. Particular story, and I've heard a lot of them.

[00:13:25] thank you. So, with that background and your, bonafides, at least a little bit out in the open, let's move into a topic which I think a lot of people are quite conflated about or just buy into the, memes and the stories. Because in recent years, there's been lots of popular stories about space mining and claiming that once we tap into the metal and mineral stores and asteroids and space like zinc and iron and copper and cobalt, it's gonna solve any scarcity issues on earth.

[00:14:07] And, you know, I saw a presentation by Jeff Bezos a few years ago, and the first third of it was like, oh my gosh. Like, he totally understands overshoot and the things that we discuss, you know, energy limits and such. And then the, last two thirds were, well, in my opinion, delusional. but as, both of you know, these.

The Great Simplification

[00:14:31] Plans for colonizing space and all the things along the way from part fabrication to actually launching a ship, have material costs. So, to the best of your understanding, what would be the energy and material requirements in order to fully construct and maintain an off world mining operation as one example?

[00:14:53] And are those resources currently available to us humans?

[00:14:57] **Tom Murphy:** I haven't really dug into the space mining fantasy in particular. Very extensively. I've looked a little bit at it in terms of, you know, what would the worth of an asteroid be in terms of its trace amounts of platinum and so forth. I mean, these are not giant chunks of pure gold or anything.

[00:15:16] They are precious materials in them. And I've looked at the economics of, briefly into, you know, how much, is an asteroid worth. but you know, it, it's a ridiculous kind of number in the sense that you can ask the same thing about gold just suspended in the ocean and it's a ridiculously it, high number and in market value.

[00:15:43] But, you know, I also get flummoxed over the idea that, yeah, it's extremely hard. It's the hardest kind of material acquisition you could imagine. It's not waiting on some new, say, rocket propulsion technology to do it. The reason it fails economically by all these startups is because it's just. Too hard, too expensive.

[00:16:05] it's not on the real axis as, as I've heard many physicists describe it. it's got a large imaginary component. But, you know, I also hung up on the idea that should you bring, so nickel is one of the elements that you do find in some abundance in, an asteroid and a certain type of asteroid.

[00:16:24] Most of the asteroid mass is just sort of rocky. and we got plenty of rocky stuff here. So it's, the, a special class, the m class asteroids that are, that

The Great Simplification

make the eyes light up and turn to dollar signs in, you know, some of these folks. But, and the don't look up movie was a really great example of that, that me.

[00:16:48] But you know, once you brought that much nickel, if you even could, into proximity, to the earth, so that it could be useful, it's suddenly almost worthless economically because, you know, he flooded the market. So, but you know, the idea that there's this thing called the rocket equation, which talks about how much fuel you need to move a certain piece of material, a certain, you know, give it a delta VA change in velocity and.

[00:17:21] You know, it, it turns out it's, not accidental that a Saturn five rocket is 90% fuel and the cargo, the payload is this tiny little thing at the top, right? And so in order to deliver an asteroid, you'd have to have like several asteroids worth of fuel. You know, where is that gonna come from? So it's, there are a lot of just preposterous elements to this that just don't stand up to any, scrutiny.

[00:17:51] **Nate Hagens:** So it's kind of the space equivalent of, corn or cellulosic ethanol from an energy perspective.

[00:17:57] **Tom Murphy:** Yeah. Yeah. It, really is. But you know, it kind of touches on another aspect, which is that for every hour that a human has spent in space, one of my colleagues really looked into this, a lifecycle analysis of the costs for every hour that a human has spent in space.

[00:18:20] The environmental impact on earth. Is roughly 2000 times a single hour spent by a global average citizen. So it's this entirely, you know, enormous leveraging effect of just how damaging you are, and that is because of materials and fuel and just the effort involved in doing anything. to get out of this gravity well, or move things around the gravity well of the sun.

[00:18:50] It's, enormous. The costs are really enormous.

The Great Simplification

[00:18:52] **DJ White:** Yeah, I think maybe put that into perspective. they had an asteroid, returning mission, went and grabbed some dirt. it was, I think the, was serious wreck mission and returned it to earth. And the cost, and this wasn't. Metal ore or pure platinum or anything, it is just dirt.

[00:19:10] And it worked out to about 132 do thou hundred \$32,000 an ounce. so to be or, not to be, or that is the question. And it's, wrong and not just a little bit wrong. This is a belief that this is going to happen is, like a binary litmus test for, understanding basic physics and, innumeracy and belief in magical thinking.

[00:19:39] I mean, how many orders of magnitude would we have to somehow conjure up to get something from, \$130,000 an ounce to cheaper than we can still get it on, on, on the crappy oars that are still left on earth?

[00:19:53] **Nate Hagens:** So, without naming specific names, but there's a lot of people in our newsfeeds that are talking, very confidently about this.

[00:20:05] Just lumping them all together. And before we get into more details, because I have a ton of questions, why do you think this disparity exists? I mean, you just said that this is not gonna happen. It's orders of magnitude, away from happening. What is it in our human brains that the two of you who are among the smartest people I've ever met, and I've met a lot, are really confident in what you're saying here, that this isn't gonna happen and a lot of other people have the opposite view.

[00:20:39] Just can you speculate on what's, really from a, you know, an aerial view looking down on our species? What do you think is happening?

[00:20:46] **Tom Murphy:** Yeah, it is really perplexing. I mean, because in our culture. Prospect of dismissing space future is to be the outlier. and to me it's insane. It's really inverted.

The Great Simplification

[00:20:59] The, real question is, as you're asking how, basically how can so many people be so gullible in this kind of fairytale? And it's probably a lot of things going on at once. I mean, movies, entertainment, we really get saturated with this, with visions. I mean, we've kind of lived it, we've seen it, we've experienced it.

[00:21:19] We've, we've lived and loved that, that world Childhood fantasy plays a role. I think there's a lot of unexamined explore, extrapolation that we've seen this crazy rocket ride. it's literally become a rocket ride in some sense, associated with this fossil fuel. Boom. It's a very anomalous period in history.

[00:21:46] And so you can easily sort of extrapolate that, Trajectory.

[00:21:52] **Nate Hagens:** Maybe though it's a psychological antidote to an understanding of the finiteness of the carbon pulse, and instead of facing the down slope of the carbon pulse, we replace it with this story. And you might not even have to agree with it or understand it, but the fact that it's there kind of give some sort of, dopamine and hope.

[00:22:15] dj, what do you think?

[00:22:16] **DJ White:** Well, I mean, it's a magical thinking and we've always knew we've got brains that are really tuned for magical thinking. We're even healthier if we have magical beliefs. And, you know, this is akin to, believing that leprechauns fix your shoes every night. You know, most such things are not harmful.

[00:22:38] But in this case, we, it's, well, let's use the R word. This is a religion now. It's, and I think we can, if you want to, I can go more into that, but it's got it all. It's, the new tech religion. I mean, we've, got the prophets who are making profits, are now talking about, at, you know, tech singularities where AI are gonna become gods that we control, where we get immortality by uploading our souls in a robot bodies where we expanded space and build you.

The Great Simplification

[00:23:15] Encasing, Dyson spheres around stars. And, it's just nuts. And I think it goes back, flipping it back away from religion one, one of the key things that people don't understand is the concept, that I've tried to push called energetic remoteness. which I think tell our aliens from reality 1 0 1 wanted to call.

[00:23:38] But it's a basic concept that most people, don't really get. it's related to entropy, but it's, really cool. What is beyond our, our thresholds of possible possession, with the energy materials that we have, and, most things in the universe are, there's no actual limit effectively in the universe how much stuff there is.

[00:24:04] There are huge energetic and complexity limits to what we can get and hold in our hands and process. And those, thresholds are pretty extreme. Like there, there are oceans of methane on Titan. Can we bring it back here and use it in trucks and burn it the way we do methane? No single word answer.

[00:24:27] Why not? What e energetic remoteness, man. It's, and it's, yeah. I am using this. we'll see if this word, if, you don't cut it out, we'll see if this word catches on, but it's energetic. Remote modus doesn't work. And actually, if you take energetic remoteness plus an understanding of aggregate probability of doing difficult things that each require on everything going right, you quickly come to the point of, you know, you get back to na your what can happen, what won't happen, and what might happen.

[00:25:03] And this is Tom and I love space studies, I love the space telescope stuff and everything. But so much of what people now. Our believing with motivated beliefs is in a religious way, about stuff that is no more real than Cinderella's pumpkin carriage.

[00:25:24] **Nate Hagens:** So, just to clarify, what you're saying is there's, in the example of Titan, there's enormous amount of, hydrocarbons there, methane.

The Great Simplification

[00:25:35] but the, energy required to get it to where we could use it, would dwarf the amount of energy that's there despite its size.

[00:25:43] **Tom Murphy:** Yeah. And you could also call that stranded resources, but I like fu I'm guessing that's FWU

[00:25:50] **DJ White:** Yeah. that's the way. And there's actually a backstory where that term came from that I would won't divulge unless it's, widely adopted, which by the, it should be, it needs a single syllable, you know, aggregate probability needs a single syllable too.

[00:26:03] But we'll tackle that of different types.

[00:26:06] **Nate Hagens:** We need a lot of words that to have single syllables that are tethered to reality and relevant to our more than human predicament

[00:26:12] **Tom Murphy:** for sure. If I could just pick up on some of that and say, you know, this kind of belief, this faith, part of that faith, I believe is, is this unshakeable faith in human greatness and ingenuity.

[00:26:26] So we're really proud of the, things that we've accomplished and see no limits because we don't really, as a whole understand how limits work. And so anytime somebody says ingenuity is unlimited, it's a real biophysical ignorance. But I think we're also persuaded by empty metaphors about evolution.

[00:26:49] You know, crawling out of the water onto land and taking flight to the air, then humans take to space. It's, a, it's an empty, metaphor. That earth is a cradle, empty metaphor. It's just a word. It's not, doesn't mean it's an actual cradle. the idea of new worlds and exploring and finding new continents or new planets, you know, continents are a lot different 'cause they're connected by water that you can sail across while breathing the air and fishing, you know, for food.

The Great Simplification

[00:27:18] And you're still part of the whole ecology or the final frontier. So these are empty metaphors that really fuel it undergirded by a complete. Ecological ignorance. And so I think that allows these religions to flourish because if you don't understand ecological constraints, then you know your imagination can run off with all kinds of fun fantasies.

[00:27:46] but it's a little embarrassing for adults to, continue holding these fantasies. And it'd be nice to see the spell broken, although I'll say that it doesn't matter whether we break the spell or not, because the universe will protest more loudly than either I or DJ or anybody else could. It's simply not going to happen.

[00:28:08] Guess what? So it's kind of sad to see the people really invested in this because there's no amount of emotional investment that will overcome the real limits.

[00:28:18] **Nate Hagens:** So adjacent, but separate from space mining. When we're talking about humans colonizing space, where exactly in space are we talking about and can you describe some of the most popular ideas or what, that might look like in a pro forma sense?

[00:28:37] **Tom Murphy:** Well, so the two that really come up most, are Moon and Mars. Moon usually not very, sexy. It's just sort of what you gotta do before you can go do Mars, as it's some somewhat understood. but, you know, just to put things in perspective, we haven't had humans on the moon since 1972. It doesn't mean it will never happen again, but it was a stunt then.

[00:29:02] And it will be a stunt if it happens again. And the reason I say a stunt is because, you know, the, proponents would say, no, these are baby steps. They're not stunts, they're baby steps. Well, that depends on the ultimate future. If nothing ever develops, if we don't have space colonization. Then they're not baby steps, they're just stunts.

The Great Simplification

[00:29:24] And so in my framing, all of these are stunts. So you've got the moon, which is pretty stupid because there's no air, no water, no food, huge thermal swings. radiation is really difficult. But even then, you know, this is something that's super hard. The Apollo program spent a hundred billion, sorry, \$1 billion per astronaut, day of space, time of time and space.

[00:29:58] you know that the International Space Station is a thousand times cheaper than the moon. But that's still a million dollars a day. Like what's the most expensive place you've ever stayed was in a million dollars a day. That's just to keep it supported with air and water, all from earth, like expensive launches that are basically umbilical cords that are deeply tying the International Space Station that's not living in space, that's living with a straw that's sucking earth resources actually at quite an alarming rate.

[00:30:30] There has been no living in space and Mars is 600 times further than the moon on average and as hard as the moon is that it's prevented us, the cost has prevented us from being there for, you know, over 50 years. Mars is 600 times farther and would be, you know, a hundred million dollars a day roughly.

[00:30:55] It's cold. It's got a 95% CO₂ atmosphere. We complain when ours is 400 parts per million. it's got a 950,000 part per million, CO₂ atmosphere. That's only less than a percent as dense as our atmosphere. So it's almost a vacuum. It's really like 99.4% vacuum compared to earth atmosphere. radiation, big deal, low gravity, big deal for bones and physiology.

[00:31:30] **Nate Hagens:** How so? The, bones part, I don't understand that

[00:31:33] **Tom Murphy:** our physiology is really fully adapted to one earth gravity. any time astronauts. So astronauts who spend time on the space station and kind of effectively zero gravity, it's just a free fall. It's, I think 90% of earth gravity is present, but you're just falling all the time so you feel weightless.

The Great Simplification

[00:31:53] bone loss is a huge problem. Eye degeneration is a huge problem. So, you know, the shape of the eye changes and, and so, you know, even though in the Space Station they spend hours per day strapped to a treadmill, and that's no fun way to live, right? Hours per day. And it's still not enough.

[00:32:15] When they get back to Earth, earth, they can't walk. They, you know, they're, immobile. It takes like six months or a year for them to sort of recover normal strength. so low gravity, we haven't spent much time in low gravity. It's either been kind of effectively no gravity or earth gravity, and no gravity is problematic that, you know, any betting person would put money on Mars is gonna be problematic.

[00:32:42] Physiologically, I mean, just our muscles and our bones are not gonna adapt well. But yeah, the soil is, toxic, on Mars.

[00:32:52] **Nate Hagens:** But Matt Damon planted potatoes there.

[00:32:54] **Tom Murphy:** Yeah. and, I'm sure that the actor Matt Damon was not eating Mars per chlorate, riddled potatoes, or we wouldn't have a movie 'cause he would've died.

[00:33:05] **Nate Hagens:** Yeah, that was, pretty incredible. But the, we're gonna science, the shit out of it is kind of a popular meme. It, hits our hot buttons

[00:33:13] **DJ White:** on that. I'll just say, if you science the shit out of this, you don't go full stop. You know, that's what san's for, that's what, you know, that's why it talked to guys like Tom.

[00:33:25] it's like, no, there isn't, a path. I mean, I'm, not a space scientist, but my expertise such as it is, has been finding narrow paths to possible outcomes that, that others would think to be impossible. And that's given me, yet a real

The Great Simplification

appreciation, In addition to that, it just, how thin a path you have to walk to have a successful space mission.

[00:33:50] You can't just screw around. you need things to be done. Need to be done. Very exactly. You need a husband, your propellant, and you, you know, get your gravity assists and everything like that. and yeah, and of course Mars, Tom has really given a, even a short list of their, you'd be, you'd have to be living in a cave, but the first thing you do when you get to Mar is probably dig a cave and hunker ne hunker there, hoping your pressure shoot doesn't fail, so your blood boils and, eating your perchlorate filled potatoes while, you know, write it, writing your memoirs.

[00:34:23] 'cause it's gonna be a one-way trip. any of the vessels that they're developing now, excuse me, you're not gonna see any billionaires writing those. It's basically if they ever launched to Mars, and I don't think they will, but if they do, it's a suicide mission and, You know, that's the way to bet.

[00:34:42] **Nate Hagens:** So there's a tendency, when we discuss these things to fixate on the actual getting to space part, of the story while we ignore basic prerequisites to these super complex operations. So what are kind of the foundational issues with this line of thinking?

[00:35:02] **Tom Murphy:** Yeah, I've, used this analogy recently that, it's, kind of like going to up to a 25-year-old and saying, Hey, we have, we're holding a position for you open, for chief neurosurgeon at this prestigious hospital.

[00:35:19] And. Well hold it for 10 years and all you've gotta do is prepare yourself for 10 years and by 10 years if you're ready for the job, it's your for life. And it pays well. And so it's, as if this guy, this 25-year-old says, all right, well what I need to do is work out what sweet ride I'm going to use to commute.

The Great Simplification

[00:35:40] And it can't be a normal vehicle. It's gonna have to have maybe iron propulsion or you know, some, it's gonna be really amazing and 10 years is short. But I'm, this is amazing opportunity. I'm gonna really commit to it. I think I can work out my commute in 10 years without what is a guy missing?

[00:36:01] The first bit of knowledge of what it means to be a neurosurgeon. I mean, so that's what it's like in this sort of space. Fe fetishizing where. The focus is on how we get there and not on the actual hard job of living there, because that requires ecological, what's the opposite of ignorance? It requires you to know the first thing about ecology, and that's just not where the focus is.

[00:36:31] **Nate Hagens:** So. There, there's a movement called Effective Altruism that's quite popular. And some of the logic in these, circles is that anything we do right now, we're in adolescence and the success of humans, well, well into the future is we will eventually be star bound. And that maybe someone of that philosophy listening so far to this conversation might say, well, they have a point now, but humans are clever and we're gonna innovate and these things will get cheaper over time, and we, have the ability to overcome these challenges over time.

[00:37:17] what would you say to that?

[00:37:19] **DJ White:** Yeah, I think this cuts down to the core of one of the, one, the big magical thinking. You know, things that are suffused in our culture now. And that's the, bizarre assumptions of neoclassical economics, which are interwoven into these people with who are the effective altruists, which is, you know, I think it's a good name that, it'd be nice if it was attached to, some, you know, more realistic ideas.

[00:37:50] but central to neoclassical economics is the power of human demand can create anything from nothing forever.

The Great Simplification

[00:38:01] **Nate Hagens:** If the price gets high enough.

[00:38:02] **DJ White:** Yeah. Well, hey, if the price and why wouldn't the price get high enough? Basically, if you got price signals that you can create, you can even create your own gods.

[00:38:11] You can create your own robot bodies and mortality as long as humans demand it. And of course, You know, as, you know here on this channel, no, it's about we've had like, 500 million carbon slaves and we're cresting the peak, sometime soon of the carbon pulse. And so the thing that allowed that magical thinking to be underpinned, like it seems like we could do magic.

[00:38:38] Well, no, that's not the case. You need to have possible courses of actions and, you know, the last couple hundred years it seems like we can do magic, but you know, you can't. And, moreover, something that hasn't been mentioned, yet, there's something called the, Great Simplification coming that is human economies are, cresting a point that they're gonna parallel the carbon pulse and the globalization is gonna disaggregate and things are gonna get simpler and it's gonna feel kind of collapsy and, You know, it's things like launching people into space. you, they don't rate very high when people can't keep their electricity on in the winter

[00:39:26] **Nate Hagens:** unless it's a bread and circuses sort of thing.

[00:39:28] **DJ White:** Well, and, it will be.

[00:39:30] **Tom Murphy:** Yeah. I fully agree. I mean, the context here is gonna change out from under our feet.

[00:39:35] And so all of this will seem very silly, but, you know, the fact is, you know, so the folks who believe that yes, we're going to, science the shit out of it,

The Great Simplification

or we're going to, you know. Work our way towards this. We've got, you know, untapped innovation. The problem, just like our neurosurgeon example, we're not even working on the actual challenge of living in space.

[00:40:04] It's, and, I think it's reason is it's just too hard. So failure is not as fun as stunts and so we're focusing on the stunts and not on what's actually hard. So consider the fact that no one has made a closed environment that can even support a shrimp or a cockroach or something like that for more than a few years.

[00:40:26] And those are simple. You know, we're talking about nuclear Armageddon survivors here, right? Cockroaches, we always talk about surviving almost anything. Well, you can kill 'em really fast by trying to. Put them in a closed ecological system, they're gonna, they're gonna be gone pretty quick. We can't do that.

[00:40:45] It's not even on the radar. That's even in a room temperature environment with low radiation. I mean, you know, hundreds of times lower than in space, non-toxic environment, having all the resources available to us and a full biodiversity to choose from, and we can't do that. That simple thing, like even for a decade or two, like, show me that for a cockroach and maybe I'll be 0.2% of the way there to believing you can do it for a human, but come on, don't be just absolutely ridiculous.

[00:41:21] They're not even working on the actual difficulty here because they, they're ecologically ignorant and that's not. Not on the radar.

[00:41:28] **DJ White:** I think that kind of leads into the fact that we are all space travelers now. We're on a great spaceship, which through luck and not our wrongdoing is perfectly tuned to humans or used to be.

The Great Simplification

[00:41:43] We're stripping it for parts. We are going, during the course of this interview, we'll probably travel a million miles relative or more relative to the cosmic microwave background radiation. Farther certainly than any of the moon missions that are coming up. We are on a spaceship and we need to adopt that kind of a, mentality.

[00:42:03] I think Carl Sagan used to say that, it's still true. You know, the pale blue dot. We're hanging out here in the midst of everything. We've got radiation shielding, we've got air. There is no single square inch of Earth on top of the ocean, on the crust of the seabed on Antarctica and the puddling, the in the glaciers of Greenland.

[00:42:27] That is not a million times better to colonize than any other planet in the solar system. And cheaper. You could still order from Amazon at those places. I mean, it's, this becomes very surreal, very quickly and, you know, I could do an aside, it's, I become embarrassed for people who are working as professional scientists who believe all this magical stuff.

[00:42:54] You run into 'em and you mention, and you realize they're fully bought in to the Cinderellas pumpkin coach, and it's, oh geez. And you, there's no known place for the conversation to go.

[00:43:09] **Nate Hagens:** So while, I have you both, I wanna make sure that we really, answer the, questions that I can imagine others might have.

[00:43:19] So, Tom, earlier you gave a little bit of rundown on gravity and what that does to bones. But again, let me ask this again, in a different way. Say we do get to humans, humans into space, whether it's 10 or a thousand or more, what are some of the other major biological and medical risks that humans would face traveling or living long term off of Earth?

The Great Simplification

[00:43:45] And how long would it take for those to manifest? You mentioned gravity. what else is there?

[00:43:50] **Tom Murphy:** Well, radiation is the big one. So we're extremely well protected on earth by a thick atmosphere above everything else, above, literally, the magnetosphere contributes a little bit, but it's mainly the thick atmosphere.

[00:44:05] That's about like 10 meters of water. Okay? 30 feet water. So that's kind of what we're living under. And that's a big shield, that's a huge blanket. It's very important so that on the surface of the earth, I'm gonna give you some numbers to sort of put this all in context. our typical radiation dose on earth is two milli verts per year.

[00:44:26] So I'm gonna use this term of seavert. And so two milli verts, two thousandths of a seabird per year. That's from cosmic rays. That's from, you know, coming from space, that's from the ground, from, you know, radioactive materials in the ground and in the air, like radon and the food that we eat. So. There's no escaping it.

[00:44:46] You're gonna have some low level of radiation. But on the International Space Station, that goes from two to somewhere like 150 to 250 depending on how puffed up the magnetosphere is at the time. So roughly an order magnitude, two orders of magnitude rather, increase by the time you get to the moon surface or Mars surface, that's 300 per year.

[00:45:09] So we're talking about 150 times the background that we're used to. And if you're out away from a surface, 'cause the, 'cause what happens when you're on a surface like the Moon or Mars, that big body shields, half of your. Space, and you only have half space of exposure. But if you're out in space on, you know, travel for the half a year it takes to, get there.

The Great Simplification

[00:45:35] or if you do an O'Neill type colony out at asteroids and rotating shells, you don't have that protection. And, it's 600 millis per year. So it's double what you would have on the surface of a big body. and now that's, you know, 300 times what we're used to. I'll put that in context in a minute, but first I wanna say that being in a spacecraft doesn't really shield you because, the cosmic rate comes in or the, you know, high energy particle, basically, these are bullets, you know.

[00:46:08] Very high energy bullets that could damage DNA, that can cause cancer and that kind of thing. These bullets will hit the spacecraft and make a shrapnel and lots of other bullets that come in and, hit you anyway. So you have to have something like 10 meters worth of material, or the equivalent 10 meters of water, something like that in order to have effective shielding.

[00:46:34] And so that's why caves, right? You'd have to be a caveman on Mars of the moon. And I'm sure that just sucks. I mean, how could that be living the good life? What does this mean? So 300 times the, or a few hundred times the, radiation, but what does that translate to? Well, the definition of the seavert is that one seavert of exposure increases your chance of lethal cancer by 5.5%.

[00:47:04] Okay, so that's still somewhat modest, but. What that means is that by the time you get seven Seavers, you've doubled your risk of cancer death from like 40% for all of us here on Earth to something like 80%. And that happens in 12 years in just sort of remote space, or 25 years on a surface like the Moon and Mars, which means that a lifetime living in space is basically guaranteed to end in cancer death, a premature cancer death.

[00:47:36] But I'm only, I'm kind of joking there, because what really is gonna get you as a asphyxiation, desiccation, starvation, decompression, bone loss, you know. Cancer is also waiting there. So it's just a killer in, you know, coming at you from every direction.

The Great Simplification

[00:47:55] **Nate Hagens:** Don, I don't know what more you could add to that, but Go ahead.

[00:47:58] **DJ White:** I'll throw in the, the brain thing, which is that psychologically you're talking about extreme isolation, extreme conditions, immobility, you, know, suicidality, you know, e even you get people wanting to commit suicide in low earth orbit. What if you are away the hell? Well, you're a couple days maybe away from splashing down.

[00:48:23] Once you, once there's no Yeah, well that's if you got a, got one on the pad. Yeah.

[00:48:28] **Tom Murphy:** I mean, you can get back down, you can escape back down. They've got,

[00:48:31] **DJ White:** oh, that's right. You capsules. No, so it's close, but you're, if you're, you know, halfway to Mars or something like that, there is no turning around. You're there and, you're stuck with whatever situation.

[00:48:42] There are no doctors, you know, if you need surgery. You're gonna need probably a lot of heroin and zip ties, because some people are gonna go bug nuts and wanna vent the atmosphere, and you're gonna need to medicate 'em and strap 'em to their thing and then live with them the rest of the time.

[00:49:00] **Nate Hagens:** Here's a thought I had while you were speaking, both of you.

[00:49:04] well, firstly, I missed talking to you. there's so much craziness going on in the world right now with AI and war and all the things, and I just miss talking to my earth centered, systems, ecology, friends. But when you were talking, I have a PhD, not, I'm in, not in either of your, IQ quotient league.

The Great Simplification

[00:49:30] And this is a topic I don't know well, but I read science and I understand it. But even while you were speaking, my reaction was. Based on all the movies I've seen in my life where this didn't happen.

[00:49:50] Which is fantasy. Of course. It's fiction. There are movies for entertainment and yet that's built up in my system over decades.

[00:49:58] You bet. And so that was my initial emotional reaction to your science led explanation of this. Isn't that interesting?

[00:50:06] **DJ White:** Yeah. Fascinating. It's very human.

[00:50:09] **Nate Hagens:** So some of the ideas for space colonization are based on, the prospect of interstellar travel and what's called a generation ship. can you explain, maybe Tom, start with you what a generation ship is and what it would take to build one and naturally I'll ask what our current, energy and material resources would be anywhere near sufficient for such a project.

[00:50:39] **Tom Murphy:** Yeah. I kind of feel like. I should start by describing in, exquisite detail what Santa Claus's workshop on the North Pole looks like and how it works. because it is fantasy, and I'm not really into writing science fiction here, but I mean, the idea is, a ship where you're in some sort of stasis and or, can have, you know, generations of people, you know, for the long haul in space.

[00:51:08] And it's just so thoroughly absurd. again, completely ecologically ignorant and based on this fallacy that we are somehow separable from earth. We're really not, we're deeply embedded as a fruiting body of many, one of many fruiting bodies of the earth as our mushrooms and everything else. So yeah, we can do these short term stunts, but, I, I think when I think about Generation Ship now, I think about the don't look up movie where, you know, this was the sort of ultimate solution for the elites who had a backup plan. And I was really hoping

The Great Simplification

that, so they did a fair bit, a fair job in that movie of showing failures, technological enthusiasm and hubris that just fell flat, right?

[00:52:00] Their, attempt to, to divert or explode this, asteroid so they could use the parts for, you know, valuable resources, mineral resources. But, but they had this kind of generation ship, or, at least a stasis ship that went away. And I fully expected that one of the, you know, it was flying through all this debris from the Earth and I thought, okay, one of those things is gonna hit it and.

[00:52:30] Like 20 seconds into its journey, it's dead. You know? That's, what I wanted to see. But it failed in a more humorous way, I'll say. But yeah, none of this is, I mean, what, device do you have that still works after even 25 years? Right? And so, and this is in a low radiation environment with environmentally, you know, decent temperatures and, pressures and, so forth.

[00:53:05] so it, it's pretty. Outlandish, you should be ashamed of yourself for even using the words generation ship. Not you, Nate, but anybody you're, wanting us to sort of shed light on this and I'm saying it's an embarrassing thing to even talk about.

[00:53:23] **Nate Hagens:** Well, I know DJ has at least one piece of technology that still works after 25 years.

[00:53:28] His old green Honda, that I've driven in. Don do you have anything to add to that?

[00:53:34] **DJ White:** Oh, well, probably the best answer to generation ships is, not too much. it's like, like there, there's, e energetically materially, it's beyond the thresholds of what we will ever be able to possess or deploy.

The Great Simplification

[00:53:48] Because if you build something that huge with, you know, 10 meters or more radiation shielding, then you somehow gotta boost it to a, if you don't want it to last forever, to get to even the nearest stars, you've gotta boost it, which with. Just ungodly amounts propellant, it would exhaust the entire resources of Earth to even get it going fully.

[00:54:08] So here's the thing. Every good science fiction, book, and certainly I've read a lot of them, you need to fudge reality some way. And you, could pretty much go down the list of, okay, how is reality fudged to make this storyline work at all? 'cause otherwise you've got just depressing stories about, about people being deluded and dying in space and, you know, that's it.

[00:54:33] **Nate Hagens:** Yeah. So let's go there, briefly because I know all three of us were big fans of Star Trek. Don in past years and decades, you and I often referenced, In our books together, we referenced, star Trek. So science fiction writ large often invokes, lightspeed or faster than Lightspeed travel or these special fuels, to solve some of the issues that, that we've discussed.

[00:55:04] So can you briefly explain some of the concepts that are used in this way, like maybe from Star Trek, warp drives or nuclear propulsion, or di lithium crystals, and talk about why these remain firmly in the realm of fiction.

[00:55:21] **DJ White:** Well, first off, D Lithium crystals is what Alfred Hitchcock called the McGuffin.

[00:55:25] It's like a made up thing to, to move a plot along. and in, in Star Trek, they actually didn't get energy out of d lithium crystals. They used it to channel flows of anti-matter. Where'd they get the anti-matter? They didn't say, and it just as well, they didn't. Now anti-matter is a thing. We actually make it regularly for medical scans, but lots of luck bottling up a bunch of it and carrying it around,

The Great Simplification

much less having a giant magnetic bottle of it in space and then doing it for anything useful other than creating, gamma rays.

[00:55:56] **Tom Murphy:** I actually did a survey, of physics, professors of physics graduate students and physics undergraduate students back in, I think around 2012. And it's on the, do the math blog. I think it's called futuristic Physicists or something like that. It was a survey, it was, you know, professors and graduate students from the top institutions in our country, and, open survey to them.

[00:56:25] So it wasn't selected, you know, it was just anybody who was interested in taking this. And, you know, the results were kind of fascinating in the sense that you could see a progression from undergrad, enthusiasm and optimism into, you know, a harder stance, among the faculty so that, you know, basically you could forget things like warp drive, teleportation, wormhole, travel time, travel, artificial gravity, other than say, rotating.

[00:56:55] You know, that's a cheap trick, but, you know, just, sort of. Dead, forget about it. And then basically forget about, you know, food synthesizers or jet packs. You know, I've threw that one in, as well. And there were a lot of sort of fun ideas. But even things like Mars colony and colonizing and terraforming, were put out beyond 5,000 years by this cohort.

[00:57:21] so definitely not in our lifetimes and even not within 500 years would we expect to see a lunar colony or changing life expectancy to 200 years.

[00:57:32] **Nate Hagens:** And these are the experts saying this,

[00:57:33] **Tom Murphy:** these are the experts, these are physicists,

[00:57:36] **Nate Hagens:** but not the ones working at the spatial exploration companies that are in the news.

The Great Simplification

[00:57:43] **Tom Murphy:** That's right. These are just kind of a random pool of physicists. And, you know, in 500 years, we all know that the. This place is gonna look a lot different. We're not gonna be doing fossil fuels, we're not gonna have growth-based economies.

[00:57:57] **Nate Hagens:** Hopefully, we'll still have a functioning biosphere

[00:58:00] **Tom Murphy:** That is the only goal worth, focusing on.

[00:58:05] Yes.

[00:58:06] **DJ White:** Yeah. We're not, gonna probably have ambulances, air conditioners, or any of that basic stuff in 500 years, either. We're going the other way. So, so Mars colonies much less Mars terraforming. It's, just fairy stories.

[00:58:20] **Tom Murphy:** Yeah. That's all.

[00:58:21] **Nate Hagens:** So there are two overlapping, yet distinct space travel ambitions, that I've cursively seen, sending machines to extract resources remotely and sending humans.

[00:58:38] To live beyond Earth. And what sort of relationship do these two camps have to one another, and why might each of them face their own, unique barriers?

[00:58:49] **Tom Murphy:** Yeah, I would say that, I mean, there's a night and day difference between those two in the sense that, I mean, obviously we do a lot of robotic probing of the solar system now in environments that humans can possibly, imagine being, it tends to be, you know, orders of magnitude cheaper.

[00:59:06] I mean, we can send something to Mars for a few hundred million dollars, not a few hundred billion dollars. So it's a huge difference. and so you're

The Great Simplification

not trying to do this impossible task of trying to recreate an ecology, which is something far beyond our means. and nobody's even thinking or working.

[00:59:31] On that we can't even understand the ecology that is, is that, that we're born into, because it's too complex for our meat brains as I call them. and so yeah, I think there's some absolute difference in those two modes. But then the question becomes what is the underlying motivation of those activities?

[00:59:57] Because they still are very expensive, very materials heavy. and you know, to what end, what is the end goal? I mean, I benefited tremendously from all of the, Knowledge that we've gained, but I've only benefited in some sort of intellectual sense. it's actually hurt me more than it's helped me because it has contributed to the overall, you know, lead up and initiation of a six mass extinction.

[01:00:32] And so you can't separate these things and say, oh, well let's have only the good parts that we like and just get rid of the bad parts that are causing things like extinctions. It's all of a piece. And so in the net balance, what I rather have a healthy ecology or sharp pictures of Jupiter's cloud belts, it should be a no brainer.

[01:01:01] And again, you can't. You, well, you can separate those in your head, but that's just your meat brain and reality. How do you carry out one without perpetrating the other? Nobody's demonstrated anything like that kind of separable capability, and so, so I get it. The space exploration, the robotic side of it, but to what end and at what cost, ultimate cost.

[01:01:27] **DJ White:** Yeah, I'll have to say I love the kind of images we're getting back from the James we, space telescope. I think that is an example of how non-human machines can do wonderful things to help us answer profound questions about the universe and, stuff like what's out there. I love that. I love that.

The Great Simplification

[01:01:48] That's the best uses of my taxes ever. Whereas the human missions are a stunt, you know, in the past, those stunts may have, you know, with better than having a nuclear war with the Soviet Union, let's race to the moon. But it's, stunts and, it's very expensive stunts and there's no actual reason for it there.

[01:02:06] There's, I don't know, a moon mission. the, reflecting things that Tom has bounced lasers off of those were cool, but they're there. And two, more of them could be landed without humans, but we're not gonna be mining helium three. We don't even have fusion reactors that'll burn helium three yet.

[01:02:24] And we're not gonna, we're not gonna have robotic factory crawlers that scrape off hundreds of square miles of the top regular and then separate the helium isotopes. That's just bunkers. So, you know, they're stunts. And, I say this as a guy who, loved that and who understands it and who was back when I was college age and nobody really knew this stuff.

[01:02:50] I was into O'Neill colonies.

[01:02:51] **Tom Murphy:** Yeah. On the stunt thing. I just wanted to point out that, and this ties back to something that we were saying before, that, you know, look, at the, there, there's a common theme that we're natural explorers, right? That this is part of just humans being explorers. And we can't stop that element about us.

[01:03:10] And so, but think about the fact that all the places that Jacques Cousteau explored, or Sir Edmund Hillary climbed, not a single person lives there, right? Those are not, we don't connect those in our, Heads that to explore is to colonize. I mean, yes, it did happen in some cases,

[01:03:34] **Nate Hagens:** but may, maybe it's just the, dopamine.

The Great Simplification

[01:03:36] We did it because we can, and now what do we, what, is next? It's, some flaw in our wiring.

[01:03:43] **Tom Murphy:** Yeah, it is.

[01:03:44] **DJ White:** Yeah. And getting back to the question of. The profundity, you know what, what's profound about doing that's, of sending, a person off towards Mars or circling the moon with a flush toilet or anything like that?

[01:03:59] I suppose the ultimate would be finding fossil bacteria on Mars or something like that. 'cause then we would know something about life in the cosmos and, I think you could, that's not that profound compared to other stuff that we have that we could focus on. There probably is microfossils, bacteria on Mars just from splashing in the early, universe.

[01:04:22] Venus probably had, you know, if we could ever get there, which we won't 'cause it's too hot and high, pressure. There's probably microfossils of bacteria on there too. maybe fish fossils for all I know it, it lasted a long time before it cooked, but. What's real profundity, and I think maybe it's the kind of thing that had Arthur Clark writing about space elevators while funding my work is that we are on a planet and we share it.

[01:04:52] With alien minds, there are brains four times the size of ours singing songs to each other under the ice now, and we've turned them into dog food and they're looking to go extinct. I've had Dolphin, I've introduced dolphins. To computers, to learning computers and you know, how long these are animals that, that are, you know, don't have a common ancestor with us for 60 to 80 million years at least.

[01:05:22] And yet you give them the opportunity to use a computer and learn it. And they learned as fast as a kid does. It's essentially immediate. So they are

The Great Simplification

brains that will do what our brains will. They're just a non-technological species, so we're murdering them. It's like I would suggest to everyone who thinks space is exciting, realize we're on a spaceship and.

[01:05:46] There are aliens here we can talk to. I've known them. I've hugged them. I've loved them. They're here. I've also been exposed to the horrible massacres and actually trying to save conscious species that are now extinct. Well, at least one it's now extinct. the baiji in China, we had 'em there. We tried, to get funding to keep 'em alive and nobody gave a shit.

[01:06:12] that's the huge disconnect for me. 'cause to me, the profundity of life and the, big bang, the start of everything. And what else is there out there? it, all, the real profound stuff is here on the spaceship. on the spaceship we're on, and the beautiful diversity of stuff that we're wiping out as we strip the spaceship for parts, it's like, yeah, I know I'm, autistic.

[01:06:40] It's like, maybe I'm missing what normal people can see. But, I mean, folks we're wiping out all the other conscious species we know of in the universe with brains larger than ours and their equivalent of language and brains that in, in their own way, process far better than ours do.

[01:07:02] **Tom Murphy:** And not only are they singing songs, they're telling stories.

[01:07:05] **DJ White:** Oh, absolutely. Are you give a, you give some dolphins who, have, can't see each other a telephone, and they will immediately use it and adopt the limitations of the foam without talking over each other back and forth and exchange information. just because they can, in other words, like you could.

[01:07:26] And yeah, I'm sure a gorilla could learn to use a microwave oven and, I'm sure the average human would be no more likely to be able to build a

The Great Simplification

microwave oven from scratch than a gorilla would. you know, it's, We're in an amazing place and we're killing off. I mean, I would've rather been a comedy writer, frankly.

[01:07:48] I didn't wanna do this kind of eco hero jedi crap for until I'm 75. But ethically, once you realize that you're sharing the planet with these other species and wiping them out, what el what else is there to choose? I've never seen why anybody felt that there was any other thing to do.

[01:08:09] **Nate Hagens:** I want to get back to, the space discussion, 'cause I have a few more questions, but on your, logical. Science tethered spiritual appeal there, Don, why isn't something like that? The religion that we go towards, instead of trying to science the shit out of it on Mars and colonize outer space in a effective altruism long-term story. It seems like we evolved as part of the Web of Life and the story that you shared just now, and you've shared a lot of other stories with me over the years about your citation friends, and maybe we have a dedicated episode where you can tell some of those stories, without me interrupting sometime, but why that resonates with me.

[01:09:01] And I would think a lot of people listening to this show, why haven't we gone in that direction with our, religions and fanaticism and beliefs?

[01:09:10] **DJ White:** I would say, and to may have something to say on this too, but, it's because we tend to measure things that we're good at. It's like I've, had people walk up to me and say, well, if dolphins are intelligent, why don't they build skyscrapers?

[01:09:24] Like what? it's, like, well, if whales are intelligence, why haven't the, why haven't they conquered space? and it's like total disconnect. and, we tend to measure others on things that we think we are good at. And like then, you know, not that this is about ai, but AI is part of the tech singularity.

The Great Simplification

[01:09:47] And now we think that, oh, well, we're smarter than anybody else. Therefore, if we build machines that are a million times as good as we are, then they will give us miracles and we'll have miracles. And the, that's very much not necessarily so at all. But, we love believing the magic we lacked of magic.

[01:10:05] And, we, nobody tries given, nobody tries giving, IQ tests of nobody had even tested. Non primates for self-awareness by human criteria until I did it in a lab that I made outta my back pocket and put together. I'm a, you know, I'm a four year geophysics student. Why should a, why should that guy be the guy that first demonstrates self-aware consciousness by human standards out outside primate lineage?

[01:10:40] It shouldn't be

[01:10:40] **Nate Hagens:** because he did.

[01:10:41] **DJ White:** Science needs to change its priorities and get its head out of its goddamn ass.

[01:10:47] **Tom Murphy:** Well, riffing a bit on, you know, if they're that smart white. So if, dolphins, whales, chimps, whatever, we're smart. as smart as we are, why haven't they initiated a six mass extinction?

[01:11:01] So, I mean, that's the. That's the other side of the coin of all the things that we're proud of, the skyscrapers. And so why should we be proud of something that's really part of the most devastating story that the planet has seen since, an impact 66 million years ago. But I think that, you know, the core of it and the kind of religious angle that I imagine is, The religion that was prevalent on this planet among humans for 99% of the time humans have been on the planet is an animistic kind of, religion. And it's not really a religion, it's just sort of a, almost a metaphysics belief system about the nature of the world. And you know, the thing

The Great Simplification

that the whales have done and the dolphins have done that we recently haven't is lived ecologically sound lives embedded in a community of life.

[01:12:00] That's no small feat. That's something that I think we should be proud of and ourselves, but we're not doing that. And for the last 10,000 years we've been on this track a way from that animistic. Past. And a large part of it is exercising control and mastery over the, world, believing ourselves to be separate from it.

[01:12:29] And then we need a God. We need religions that reinforce that sense of, supremacy and separateness. And, so I do think it's very much tied into our religions that we have this faith that we can solve any problem that earth is ours to do with as we want. we have this destiny to, to do that and a destiny and space.

[01:12:54] and that this is a logical step in evolution. And none of that is demonstrably true. All of that is mythology and all of it's dangerous and all of it's, causing a huge problem. So I think that this space religion is really very much a part of that same religious foundation of we are special, we can do whatever the hell we want.

[01:13:15] And we're in control. And that's all delusion.

[01:13:19] **DJ White:** Yeah. And I wanna point out what could be an upside to this because I think a lot of people have looked at humans and the threshold of nuclear war and stuff and wondering, and Drake equation, things like that. And wondering. It's advanced intelligence, inherently self-destructive in this universe.

[01:13:37] And not only have many animals, inclu, including dozens of species of citations developed, cerebral cortices advanced that are larger than our own. They've had them for many millions of years longer. So no advanced intelligence is not inherently self-destructive. That alone is profound. It's, the crap we're doing that's inherently self-destructive, and that has to do with magical thinking and

The Great Simplification

getting our little, you know, dopamine and, our tribal, you know, stimulations going on.

[01:14:12] It's. We can have an earth trek. One of the other things I've introduced is Naya, the trillionth human child. I've named her. Nobody else has even thought about her. there could easily, should be a trillion, at least a human child, human, a trillion human childhoods on planet Earth. It's been roughly a hundred billion so far.

[01:14:33] There will not be the way we're going. She is in the same basket as my friends, the dolphins and the whales, and of course the elephants and everything else. even if you're totally human focused, a humanitarian, you need to look at not breaking the planet because we are taking it away from the planet we evolved on.

[01:14:57] And the little slice of Holocene that, that gave us a boost and we're turning it into something else, that we've never survived in. Intelligence is not inherently self-destructive. Humans acting the way we are now are inherently self-destructive.

[01:15:14] **Nate Hagens:** So at some point, almost every conversation about expansion and growth of the human enterprise runs into the same wall.

[01:15:23] There's only so much energy and stuff for us to use in the universe, and, we can't create something out of nothing. So some voices, some prominent voices claim that human ingenuity and technology and the markets, can break down that wall. So what do you think will happen when humanity finally hits biophysical limits that we can't overcome?

[01:15:52] **Tom Murphy:** I'd say it happens already. It's hap happens all the time that we hit biophysical limits that we can't overcome. I mean, look, we all sleep. Why the hell do we suffer that biophysical limit? Why do we have to go poop?

The Great Simplification

You know, like, what an annoying biophysical limit we have to eat, God dammit, you know? So we are creatures and, we are biophysical, limited Mach, biophysically, limited machines.

[01:16:19] Some people really object to that word machines, but we are made of atoms. So, you know, we have limits all the time and even economically. There are things that we started to do at one point and then just failed to continue because they, were not possible. I mean, supersonic commercial flight, you know, just fell into the dust bin and it wasn't.

[01:16:48] So the trajectory is not always this sort of march. and in fact, I like to play this little game of. Take somebody from 1900 and drop them into 1960 all of a sudden, and then take somebody from 1960 and drop them into 2020. Pre COVID, let's say. and which one is more baffled? More bewildered, more, you know, confused about the world.

[01:17:14] They see most people that you ask, we'll say, well, obviously the later one. And that's the mythology speaking that is our programming that says that. But if you really spend a few minutes on this problem, you realize that the earlier person from 1900 dropped in 1960 won't have ever seen, a freeway, a rock, a satellite, a television, a radio, an airplane like.

[01:17:38] Appliances, in the kitchen and in the home and computers and calculators and just like most of it, you know, are just magic. Whereas the person from 1960 dropped into 2020 will recognize almost everything they see. And even the stupid rectangle you hold to your head, they'll say, oh yeah, that's a phone and it must be radio communication.

[01:18:02] It's not magic. And so, you know, they basically got it. So we've seen a lot of, kind of embellishments and sort of better resolution and higher quality and that kind of development, but the fundamentals were not on this absolute tear

The Great Simplification

that just continues to accelerate. That's not the life that I've seen where very few transformative inventions.

[01:18:28] I mean, I'm not saying zero, but. Way fewer than, you know, my great grandfather experienced, ha have transpired. So I think that, you know, we're hitting limits already. we're. We're not able to do everything that our dreams wish us to be able to do. And that's always gonna be true, and I think it's gonna get even more profoundly obvious.

[01:18:55] **DJ White:** You. Yeah. My grandfather grew up with horse and buggy and, he ended up jet hopping on, jets around the world. I mean, he saw a lot of changes and he, I learned, I, was learning new tech stuff from him. He was totally with it. There's this great wall of fu that, that is, coming. Or you could say it's receding horizons and we are cresting the carbon pulse.

[01:19:20] You know who pick a year? It's, not a hundred years from now. You know, it's fairly soon. And then a lot of things are gonna go down with it. The complexity. We can maintain the number of humans that can be

[01:19:33] **Nate Hagens:** alive,

[01:19:33] but there, there could, be, a much smaller number of humans and an increase in complexity based on some of the tech feudalism and AI stories.

[01:19:45] it's not explicitly stated, but there is an implicit assumption. So, so let me build on that by asking some of the space expansion. Advocates argue that branching beyond earth is about preserving life itself. and, but when people talk about safeguarding life through technological expansion into space, what do you think they're really trying to preserve?

The Great Simplification

[01:20:10] Like. I don't think all biological life, is it human civilization or a particular narrative about progress or a particular subset of humans? what's going on there?

[01:20:22] **DJ White:** it's startups. There's money to be made in, in startups from incredulous people.

[01:20:28] **Nate Hagens:** What

[01:20:28] **Tom Murphy:** is it that's driving it? It's, a number of things and it's different for different people.

[01:20:32] I think there is this, awareness of an existential problem and that, you know, things might go s poorly on the earth and are going poorly in some sense. And, this idea of having this arc, you know, that can preserve humanity. I, get that impulse, but that's just into this impossible realm that we don't know how to even make a little glass ball of shrimp that can live, you know, let alone how to keep humans as an arc that's just completely out of like.

[01:21:07] 15 or 18 or 25 orders of magnitude beyond, you know, what we're capable of doing other than saying the words about it so we can, you know, write some words on it, but we can't actually do much in that regard. So, but it is this sort of myth of progress. It's what we're, proud of, but cherry picking what we don't understand what the consequences are of those things that we're proud of.

[01:21:35] And so I'm not sure we should be proud of the things that many people are.

[01:21:38] **DJ White:** I'll just note without mentioning names, that the leading billionaire proponent of this has explicitly said, fuck Earth,

[01:21:48] **Tom Murphy:** that is true.

The Great Simplification

[01:21:49] **DJ White:** and, the entire, the higher entire idea that, oh, well, it, if there's humans wildly reproducing on some other planet, then we're a multi-plan species, entirely ecologically, blind, and, Yeah, get back to, you know, Joseph Smith and reading with the magic goggles into the, you know, when the religion, it's like, oh yeah, and I need to impregnate a lot of women and my sperm is available. And, that's the way this is going. It's, people are able to enrich themselves. I think Nate, you once called the tragedy of the energy investing commons that you, any string of words.

[01:22:26] 'cause people, most people, not me, most people think in strings of words and strings of words that sound good. Well, you can do a startup and even if it fails, you're still rich. So I mean, that's, I think, very much the dynamic that's driving this as opposed to any actual desire for deep time survival of earth species or human species.

[01:22:49] you know, it's, con artists will be con artists.

[01:22:52] **Tom Murphy:** Yeah. And I'd like to also touch on this idea that well, couldn't earth be, you know, much, have a much smaller human population, but high tech, you know, and the question that I would have is. How do you propose a glide path to that? Because as soon as you have a decline in population, markets fail because growth isn't really happening and services fail, and institutions fail and supply chains fail.

[01:23:22] And I, I actually build as a side thing, I invented an airplane detector as part of my, you know, laser ranging job. So it didn't hit airplanes and it caught on and it's been successful. And so I occasionally build these guys. And after the supply chain disruptions from COVID, it was really hard to build a successful unit.

[01:23:48] a third of the parts that I needed were really just hard to find out of, you know, a list of over a hundred parts and. It really made me work. And that was a

The Great Simplification

baby thing. That was, you know, a hiccup. So I don't know how you maintain the complexity, through the transition, that series

[01:24:09] **Nate Hagens:** that goes beyond the topic and complexity of this.

[01:24:13] But maybe you come back, Tom, and we talk about that because I think with endocrine disrupting chemicals and the demographic changes where two thirds of the countries in the world are below replacement rate, right. on their total fertility, it is an issue and how those things snowball. correct and, fit together, but that's a different topic.

[01:24:34] So, For those listening or watching this who are maybe Don like you were when you were in your twenties, enthused by the idea of space exploration and even going to space themselves listening to this conversation, where would you ask them to point their excitement and passion towards instead, given all of the constraints that you've outlined on that endeavor?

[01:25:04] **DJ White:** I'd say keep the passions, keep the ideals, but grounded in reality. In reality, realize there's some stuff that's simply not gonna happen. And, you know, if you wanna have a fun religion, have a fun religion, there's lots of them to choose from. But if you wanna actually do something real in the world, this is the spaceship we're on.

[01:25:26] Pick a species, there's a bunch of them gonna go extinct. You know, I picked several and I've, kept them from the brink. there are so many things you can do. Also, contact me if you want to, you know, Nate's got a pretty good audience now, but there's not gonna be tens of thousands of you who there, there will be tens of thousands who go, who the hell are these guys to say, we're not going to Mars.

The Great Simplification

[01:25:52] That's gonna happen in the comments probably, I would imagine. Oh, for sure. But, and I'll take it. Send me those too. but, Ask me. There are things too. You can redirect it. You can try and step outside the conversations that suffuse all around you, the people you know and the things that you automatically agree with.

[01:26:13] To step outside that a little bit, see what. See what's in the blind spots. See the really important and profound things that are right there, and that you might wind up being the only earth advocate for the only being with agency over some really important thing. And you can do that. I don't see it happening a lot.

[01:26:35] Humans move as groups and, unfortunately I don't see that happening. I have to say that the, environmental movement has failed by any reasonable measure. I don't even call it. I haven't called myself an environmentalist in a long time. I'm an eco interventionist or whatever you wanna say, because even the word environmentalist implies that it's here for us to use up, it's the human environment.

[01:27:03] Whereas what I started doing was. Ecology movement in which humans are one bit of a big, beautiful, overall balanced thing. So try and build a new ecology, movement and the wonderful level o of expertise and brilliance that people with physics degrees and stuff who wanna go into space. Think about the fact you are already in space and, you know, let's keep us there.

[01:27:30] Let's extend the human story and let's extend the story of the only other non-human minds we will ever meet.

[01:27:37] **Tom Murphy:** Well, I've gone through this journey myself, I would say, in that I started out as space enthusiast and holy bought in. It was exciting and, what I experience now is maybe even more exciting in that I like to think about what could we as humans be on this planet?

The Great Simplification

[01:28:03] I don't buy into the idea that we're just bad news because for most of the time on this planet, we weren't bad news. And that doesn't mean we have to live the way that we lived for that 99% of the time. But there are wise lessons there that we might explore. And so rather than trying to master this earth that we live on, which is a failing prospect anyway, we just don't have the, brains for it.

[01:28:31] Anything that we invent in our brains, we have to suspect, compared to things that are biologically ecologically, evolutionarily. those are far more robust. I mean, we can't, using our brains, you get the best experts in the world and give them, you know, computer resources even, and ask them to design a novel protein that you can't find a template for in life.

[01:28:57] So you can't copy what has been evolved. A novel protein to do some novel task, like, I don't know, bring an aluminum atom in through the cell membrane or some task, you know, forget it. We don't have the capability of doing even that. That's just one protein out of tens of thousands in a living organism that interact with each other.

[01:29:19] The proteins. To form a, you know, complex dense, and those proteins in those organisms interact with millions of other species and all of their funny little quirks, and it's all been vetted to work together. That's far beyond anything that we can invent. And so let's get excited about how do we live within that amazing community of life.

[01:29:44] Look into things like animism belief systems that might better to living in as part of a world. There's a lot of awe and excitement and just, amazingness out there to, be really enthusiastic about. And so I would say drop the skyscrapers on Mars, stupidity and think about. Where we can't possibly create an ecology.

[01:30:17] We've got an ecology here, and it's incredible, and we're lucky to be a part of it. So that's where I would try to find some excitement.

The Great Simplification

[01:30:24] **Nate Hagens:** My friends, this has been eyeopening and, informative, and rewarding actually, for me. thank you both for your, continued vigilance about, highlighting reality, and dispelling fantasy because I think that is, one of the baby steps towards better futures than the default.

[01:30:53] Don, I'm gonna give you the closing word. my old friend and co-writer of, three books. What, closing thoughts do you have for the viewers of this episode?

[01:31:05] **DJ White:** Well, remember, but in addition to that, It's important and it's something that we don't talk about enough. But, I'll just say I've stood in the surf with my arms around a young humpback whale, which was unfortunately dying and in contact with it heard.

[01:31:23] Its, its, young cries in singing with quite complex. Did my best to do it, back, give it comfort as, and, you know, and, not to get into it, but I, found that to be a profound thing. This thing, it, it had not been born that long before. It already had a larger brain in mine. It was going to die, and it was a cosmic moment.

[01:31:48] But here's the thing, if those noises we detected, say coming from, we thought that those noises were on Europa. There would be a trillion dollar project. let's build an Orion nuclear rocket to get us to Europa and see what this thing has to say. But instead, our history has been, we've turned these things into corset stays and dog food and oil for, inter intercontinental ballistic missiles.

[01:32:19] And they're mostly gone now. At least a lot of species are mostly gone now. it's, there's so much all that we hope to find in space is here. Still a lot of it. And, you know, maybe people, maybe is so far gone now. You can't be, friends with a dolphin for a long time like it was. Maybe you don't get to hug a whale, but that's not necessary.

The Great Simplification

[01:32:42] it's just open your mind to the blind spots that are out there. Find something that you personally think is sacred and save that sacred thing. And you can do it. You don't have to be, I'm not particularly smart. I barely gradu. I was in slow classes when I was in grade school. I barely graduated high school.

[01:33:05] You don't need to be particularly smart. You just need to be usefully different and you need to have a sense of something sacred and not just that everybody else is sacred, but is sacred to you and your inner self. You don't even need to tell anybody else what it is, but have a sacred thing that has meaning to you that when you get to be my age, you can look back and go, well, you know, that was quite a life and I didn't blow it.

[01:33:29] You know? I actually tried to do something that has meaning, had meaning for me.

[01:33:34] **Tom Murphy:** Yeah. Even before Don mentioned giving comfort and talking to this young whale who's dying, I'd already thought, you know, if I wanted to give any advice, I would say talk to animals. I mean. Go outside and plants and, find them and, appreciate what's genius about each one.

[01:33:53] Each one can do something that you can't do, knows something that you don't know, lots of things that you don't know. Find that genius. Be inspired and open up to talk to them as equals. And I think that's a, can hugely heal this kind of human supremacy that we've, assumed upon ourselves and just be a part of it.

[01:34:17] Not separate from it, not above it, but within it.

[01:34:20] **DJ White:** Amen.

The Great Simplification

[01:34:22] **Nate Hagens:** Thank you both. I really appreciate you both and, It's great to be on this traveling spaceship, this blue-green Earth at the same time, as both of you to be continued, my friends.

[01:34:38] **Tom Murphy:** If you'd like to learn more about this episode,

[01:34:41] **Nate Hagens:** please visit [The Great Simplification dot com](http://TheGreatSimplification.com) for references and show notes.

[01:34:46] From there, you can also join our Hilo community and subscribe to our Substack newsletter. This show is hosted by me, Nate Hagens, edited by No Troublemakers Media and produced by Misty Stint and Lizzie Sirianni. Our production team also includes Leslie Ba Lutz Brady Hayan, Julia Maxwell, Gabriela Slayman, and Grace Brun.

[01:35:10] Thank you for listening, and we'll see you on the next episode.