S02B06 - Entropy Rising

HOST: Welcome back, my interstellarly inclined interlopers! I'm your quantum-superposed relocation specialist, simultaneously approving and denying moving expenses across infinite cosmic neighborhoods. You're tuned into a special bonus episode of "The Multiverse Employee Handbook" - where today we're exploring humanity's cosmic cubicle expansion!

I'm delighted to announce we've arranged a temporary employee exchange program with our cosmic colleagues over at "Entropy Rising." That's right - we're doing a podcast swap with the only show that manages to make the heat death of the universe sound like an exciting career opportunity.

Today, our friends Jacob and Lucas will be discussing interstellar colonization - essentially the corporate equivalent of opening a branch office so remote that the commute requires cryogenic suspension. It's like when Dave from Accounting requested to work remotely from his cabin, except the mountains are in the Alpha Centauri system and the cabin is a habitat dome that hasn't been built yet.

Be sure to follow Entropy Rising - you'll find links in our show description or wherever you get your podcasts. What I particularly appreciate about Jacob and Lucas is their refreshingly optimistic view of the future. While we're busy calculating the quantum probability of your performance review going sideways, they're boldly going where no podcast has gone before - charting a future where humanity actually gets its act together. Their discussions would make Captain Picard proudly adjust his uniform with that signature tug and nod approvingly.

Now, before we dive in, I should warn you that Entropy Rising takes a slightly different approach than we do. They seem remarkably unconcerned about the proper filing procedures for requesting new planetary resources. And their risk assessment protocols for alien encounters contain significantly fewer references to quarterly performance reviews than our standard first contact guidelines.

So prepare for a temporary adjustment to your standard corporate programming as we explore humanity's next giant leap - or as our HR department calls it, "non-local workforce distribution optimization."

Jacob: 0:00
If I tell you, either we can go 20%, the speed of light, this trip is gonna take five generations, and you're gonna be living in these not so great conditions, or, we're only able to go 10%. The speed of light. But you're gonna be in luxury the entire time. Do you care if that means there's gonna be a few extra generations after

you're dead? Not at all. Hello and welcome to Entropy Rising, where we talk about science and futurism. I'm your host, Jacob, and as always, I'm joined with my wonderful co-host Lucas. Lucas. How are you doing today?

Lucas: 0:34
I'm doing fantastic, Jake. How are you?

Jacob: 0:36
I'm doing great. I'm glad to hear that. So today's episode is all about interstellar colonization. Particularly we're gonna be talking about colony ships, not so much setting up the colony and, and what colony worlds are gonna look like. So this is kind of a follow up to, our Interstellar travel episode. Right. Of course, that one focused more on the rocket equation and what goes into actually getting a ship to a new star. Yeah. Uh, whereas this one's gonna be all about how do you get people to that star and what does life look like on these ships?

Lucas: 1:03
Yeah. It's, a little bit more of an in depth dive on what that would be like. Not only for the people designing the ship to get there, but also for the people who will be living on that ship.

Jacob: 1:12
Yeah. Yeah. It's gonna be, I think, a fun one. I'm looking forward to it. I've been looking forward to recording this episode all week actually.

Lucas: 1:18
Yeah. Me as well. I love diving into these topics and getting to learn a little bit about it and then sharing it with our viewers.

Jacob: 1:24
Yeah. So, you know, I think a fair starting point for this episode is gonna be, why would we even want to colonize other star systems? You know, what's gonna drive us to leave our home system and expand into other star systems? It's gonna be a challenging journey and there's gonna be risks involved. You're leaving your entire world behind, essentially. And at least for your home system, there's not a ton to gain. there's almost unlimited resources really in our solar system, or at least there's, more than we could use in a very long time. So. Lucas, I'm curious, what, what are your thoughts on this? Why do you think humans might colonize other stars? Or do you think we actually would?

Lucas: 1:56
That's a great question. I definitely think that we will, and really I feel like it all just stems from an innate thing that separates us as humans. It's a curiosity. Okay. And also a drive to expand. Yeah. Right. We've, we've expanded to every, livable part of

our, globe. We are going to expand out into our solar system and eventually it just makes sense that we will expand even further out to other stars and other planets.

Jacob: 2:22
I completely agree. You said humanity. I think it's, even deeper than that. I think innately, any biological system that goes through natural selection is going to be driven to expand. You know, even if you put bacteria in a culture disc, it's gonna fill every little niche in that. And looking at life on earth, we have filled every single biological niche that exists on this planet. Not we, but, you know, life has. Yeah. So I, I think humans have, that same innate drive buried deep inside of us to a biological level to expand as much as possible and to go out there and to really try to establish new homes, new niches, really.

Lucas: 2:57
Yeah, absolutely.

Jacob: 2:58
But I do think it's worth talking about why we wouldn't expand, because, I mentioned it a little bit earlier, but the idea of expanding to another star system, for resources just doesn't really work out in my mind.

Lucas: 3:11
No, if I'm thinking of why our planet would invest in doing this, would maybe be to claim other territories, but. We would have to understand by now that when you have a colony, especially one that is that far away, you will have no control over that regardless.

Jacob: 3:25
Yeah. No control over it. And even if you did have control over it and they agree to send resources back, it's so energy intensive to try to send any significant amount of resources over interstellar distances that it just doesn't make sense. Unless you are a type two or type three civilization who basically has unlimited energy and they just wanna build a mega structure. That's, literally the only situation I see where you would want to get resources from another star system.

Lucas: 3:50
Yeah. And even then you wouldn't send colony ships there. Yeah. Probably automated drones. Exactly. But. Realistically, I guess there is a resource that we could gain and that would be research or knowledge from a colony.

Jacob: 4:03
No, that's fair. It costs very little to send information back, if you can power a transmitter, that's about it. So. Absolutely. I could definitely see some research institutions being interested in throwing some funding that way.

Lucas: 4:14
Yeah, it would most definitely be privately funded.

Jacob: 4:17
I think so. I could see governments maybe funding these for the first couple of colonies. You know, there is a prestige to be had to be the first, so maybe, you might see one or two missions get funded. I. just to say we did it, but I don't think you'll see many because no one cares if you're the fifth to do something. Right?

Lucas: 4:33
Yeah, that does make me think of another point the whole idea of a new life or a fresh start For people who, feel like they can't advance anymore in the lives that they have here on Earth because everything's so saturated. It offers either yourself depending on the type of ship or your family an opportunity to really, come out on top.

Jacob: 4:52
I agree with that. It's very possible we'll reach a point, especially if you have life extension technology. You might have people living hundreds, maybe thousands of years. If you do have that happening, it could be really hard to socially advance, especially if people who are above you aren't dying off. Right. Yeah. There's no opportunity for that. So it's very possible that going to another star system might be an opportunity for advancement. And let's also not forget, religious reasons. Throughout history. That's been a common cause for expansion.

Lucas: 5:17
Yeah. Trying to, find a place where you can practice your religion freely. that has been a huge reason why people have expanded in the past.

Jacob: 5:24
Yeah, I love that The Expanse actually covered that with the, with the Navu. That was their colony ship and it was funded by the Mormons. Mm-hmm. That was a really fun plot point. I really liked that. Which Blade became the behemoth? The warship. So it didn't quite work out for them, but I think, I think it might work out for us better.

Lucas: 5:37
Oh, you know, not everybody succeeds on the first time. They'll try again.

Jacob: 5:41
Just while we're also on this topic, when we're talking about funding it I don't necessarily think these colonies have to be externally funded either. Mm-hmm. You know, we tend to imagine people are gonna be living in orbital habitats. So it

might be the case that one of these habitats decides, we want to go off and explore another solar system. You know, they just need to get the money together to build an engine and maybe shore up some other systems so that they can recycle everything more efficiently. And, anyone who wants to join this journey, there's no reason for them to keep most of their worldly possessions. Right. So it might make sense to get a group of colonists together who want to go and basically crowdsource this thing.

Lucas: 6:14
Yeah. I mean, you definitely could do it. Now to crowdsource a ship of that magnitude or, even a journey of that magnitude, it, uh, definitely wouldn't be cheap. So if you're already living on an O'Neill cylinder and living a life like that, why would you choose to, spend your extra funds on essentially living the same life, but just going somewhere else?

Jacob: 6:35
It's worth pointing out if we're imagining a point in the future where we're building hundreds of thousands to millions to billions of O'Neill cylinders, which is kind of the situation we talk about with a Dyson Swarm, it might actually be fairly cheap to build one of these things. They could be mass produced and it could be a case that if you can get, 10,000 people together, a hundred thousand people together, that you could just scrape together the raw resources, especially if you have a lot of automation. it might get to. Money's not really a factor. You just get some automated drones together. They go maybe get some mining claims from asteroids, get the raw material, build the ship, or, retrofit an existing mass produced O'Neill cylinder and anyone who wants to go can, fund it or whatever.

Lucas: 7:12
That's actually a great point. I didn't really think of that. I was living too much within the next hundred years, not the next couple thousand.

Jacob: 7:17
Yeah. Which I don't think it'll be in the next hundred, maybe hundreds. We'll see the first one. But I think hundreds to maybe thousands. Always tough to say, things tend to grow exponentially and it's hard to predict when that exponential curve will end. Right?

Lucas: 7:30
Yeah. But you talk about how these ships are, going to be made if they're either out of existing O'Neill cylinders or, we make them from scratch to be designed to travel that way. But I definitely think that we should jump into a little bit about how the ship will be designed to be able to support life, for that period of time.

Jacob: 7:47

Yeah, no, absolutely. in my head at least, I tend to imagine these are gonna function. Like O'Neill cylinders. Of course that's gonna change depending on the technology available. but one big distinction between O'Neill cylinders and colony ships, not just the engine of course, is the fact that your recycling systems need to be significantly better for an interstellar voyage. They do need to be for an O'Neill cylinder that might be, surrounded by other cylinders, and they're able to have trade or even top off, their oxygen or their water from the solar system. That's not really an option Right. When you're traveling between the stars or it's harder to do anyways.

Lucas: 8:19
Yeah, that's a really good point. And when I think of that, especially for water mm-hmm. The ship would actually have to operate at a hundred percent recycling efficiency. I mean, we could make water on the ship by fusing, hydrogen and oxygen, but that is a very dangerous and explosive method of creating water. So if we don't recycle at a hundred percent efficiency, we would eventually run out, especially if this strip is going to take several hundred years.

Jacob: 8:45
Um, the efficiency is really just gonna depend on how long the trip is. Right. You know, if you've got a hundred year trip versus a thousand year trip, you might be able to get by with different levels of efficiency. 99.9% efficient could work for a hundred to 200 year trip. But yeah, you're right. If you're going on a multi, thousand year voyage, which I tend to think that's definitely on the extreme side, you would need pushing near a hundred percent efficiency. Yeah. Now, I mean, you said that using hydrogen and oxygen. Is an explosive process. But I mean, realistically, if you're powering one of these ships anyways, you've, you've gotta have a reactor room, right? You need a pretty beefy engine. So you can probably handle that. And I tend to think these would probably be either fusion based engines or some other design. if you have anti-matter, that would be nice too. But then you can do anti-matter catalyze fusion, so you can still make resources if you want to.

Lucas: 9:31
Yeah, that, that is definitely true. It's just expending that, especially fuel. Mm-hmm. I mean, I'm not gonna say your most valuable resource, but you need it to get there and you need it to stop. Yeah, that's absolutely true. So, burning that to try and counteract the fact that you're not operating at a high enough efficiency to create those fluids, I feel like the ship is just designed to fail.

Jacob: 9:52
Maybe. I don't know. A common way that I think about slowing these ships down is gonna be something through like a baard Ram Jett. Mm-hmm. I know we mentioned it in our entry, solar travel episode, so I'm not gonna go too deep into it.

And if anyone's curious about the concept, check out that episode. But we talked about how you can use one of these to actually slow down. You put a large magnetic field out to catch interstellar hydrogen. You pull that hydrogen in to, power a fusion reactor to slow down your ship. It doesn't work great for accelerating, but it does work well for decelerating and it also gives you a bunch of hydrogen. So maybe you can use that to top off your. Water reserves or your fuel reserves halfway through the trip once you're ready to start decelerating.

Lucas: 10:25
I mean, that would definitely be perfect because the big issue with hydrogen, especially when you're using it as fuel to slow down, is it's such a small particle that it leaks through metal. Yeah. It leaks through everything.

Jacob: 10:35
Yeah. It's very hard to contain hydrogen.

Lucas: 10:37
So even if you're not burning your fuel you're still losing fuel, especially over a period of hundreds of years. So if we could design something that not only doesn't need extra fuel to stop us or slow us down, but could also provide us with more fuel during the travel, that's definitely a viable option for maintaining, your water as well. Yeah,

Jacob: 10:55
absolutely. I do think it's worth, also talking about this in my head, depending on technology, I imagine there's three different ways you can do colony ships. Mm-hmm. And so basically the way I think about it is option A, this is with basically technology that exists today. Ignoring the engine side of it, you've got no life extension. You've got no way to preserve people either by freezing them or anything like that. Mm-hmm. So if you want to go on a four or 500 year journey, this is gonna be done through a traditional generation ship type situation. Right. Where you have people living their entire lives on the ship breeding up other generations to try to make this whole journey.

Lucas: 11:28
Yeah.

Jacob: 11:29
Option B, the way I see it is maybe you have life extension technology, people are living well into their hundreds. You know, maybe even you've reached a point of near biological immortality where. People don't age, they don't die. And you have a situation where people could make this voyage through their entire life, but you don't yet have the technology to freeze people. Mm-hmm. And then option C is basically all of those together. You have the option to freeze people, you can put

people in cryos stasis, you also have life extension technology. I tend to group those together because if you can repair the cellular damage from freezing somebody, you also pretty much have life extension technology. Yeah. at that point you have the option to have sleeper ships or people who might be awake for the journey for their entire, multi century life, maybe multi millennial life. So those are the three options that I foresee for colony ships.

Lucas: 12:20
Yeah. I would agree with that. Absolutely. I do. Love to think that we will have life extension and we will have perfected, cryo freezing and being able to essentially sleep through the whole ride. Yeah. There. But, I definitely want to focus on, what we can almost do now.

Jacob: 12:38
Yeah. So I, I was thinking maybe we could talk about all three of these options. Absolutely. Yeah. I think first, why don't we start talking about like the generation ship type.

Lucas: 12:45
Okay. So talking about that we already covered, water and fuel, right? But another big thing is food. Yes, of course you need to feed these people. And depending on how many people you have, you're gonna need about a half a kilometer of farming space. You, that's both aeroponic and traditional farming styles to provide meat and, calorie rich vegetables. And fruits like. You'll see a lot of beans, tomatoes, potatoes, things like that.

Jacob: 13:11
What kind of population is that for? Uh,

Lucas: 13:13
500.

Jacob: 13:14
500 people. Mm-hmm. So, I mean, that's a, a surface area. of course you can do that vertically too. So you can divide that up. So if you have an O'Neill cylinder, for example, you don't need half a kilometer of the

Lucas: 13:23
No. Yeah. You don't need just a square ship that has half a kilometer in it, but you just need a half a kilometer of space. So, for the people who don't really know how the O'Neill cylinders are designed, they rotate around themselves essentially to provide like a suitable living area and mimic earth. Now, we could have a farm that's just in one of the rings that's also providing gravity to the ship. That would definitely be viable. But these are also, going to need a lot of water for

maintenance and things like that, and that's just per 500 people. Now, how many people do you think would be on one of these colony ships?

Jacob: 13:52
I think quite a bit. So are you familiar with the concept of Dunbar's number? No. It's essentially the, a number of social relationships, a person can manage and it's around 120. Mm-hmm. Okay. You can know more people than that, but you really can't maintain more relationships so that it's just to be too much. That

Lucas: 14:06
sounds exhausting. Yeah, exactly.

Jacob: 14:09
So there's, uh, a lot of research behind this that basically says a minimum viable population size to keep you socially healthy is about twice Dunbar's number. So about 240 people is enough people to have distinct social groups to allow marrying, to allow people to move through friend groups, to distance themselves from people they don't like. that's essentially the minimum viable number of people you need before society starts to feel a little too cramped. Yeah. Now I think that's a very small number though. Personally when I'm thinking of, colony ships interstellar. Especially where people are awake. I think a population size around 10,000 is pretty reasonable, gives you a lot of genetic diversity and 10 thousand's, a fairly large town, so you're able to have tons of social relationships. You're able to have completely different groups and even specialization in certain categories, and I think that's a good number to aim for

Lucas: 14:57
Yeah, that would be ideal. What would a ship that could maintain 10,000 people, how big would that be?

Jacob: 15:02
Well, you know, the thing is with the, O'Neill cylinder design that we're talking about is you're limited on cross-sectional area. Mm-hmm. Because if you're spinning it, the larger, you try to make the radius, the more forces the ship goes into, but you're not limited at all on how long it is. So, to answer your question, I don't really know how. Big it would need to be Right. Uh,'cause that really is just up to you. And it's also gonna depend on food availability and resource availability. But these O'Neills cylinder, you can design them to have population densities, like New York City, in which case a couple square kilometers could give you, over a million people. Or you can make'em more like small towns, rural areas, in which case you might have a few people per square kilometer. So how big the ship is gonna be is mostly gonna be determined by resources more than livable area. Yeah. Okay. And we don't necessarily need one ship either. You can send a fleet of ships and have, maybe even automated farms that are literally just nothing but

farms.'cause that might have, less constraints to it than a ship that has to kill humans.

Lucas: 15:59
That is a good point as well. And then the farming ships could just have transportation vessels that go back and forth Yeah. And drop off the resources.

Jacob: 16:07
Once, once you've reached your speed, you know, It's pretty easy to transfer between ships and all that. Yeah. I can even imagine having these ships follow and like align so that the ship ahead is already clearing on a path so you don't have to worry about, impacts.

Lucas: 16:19
Yeah, absolutely. that, that is a really cool idea for the ship. And, going back to the original design, just saying that we have one ship and if we are using the O'Neill cylinder concept and just talking about 500 people and what we would need be that's a sample size that I, used for the math on it, we could just copy and paste that. Yeah. And make it. Infinitely long. Yeah. Supposedly.

Jacob: 16:39
And going long is nice because the risk of impact only increases with your cross-sectional area. So if you make your ship wider, there's a higher risk of impact. But making your ship longer, does not increase your risk of impact at all with any type of interstellar debris.

Lucas: 16:53
Right. Because the front of the ship is going to take whatever debris was there to begin with. Exactly. Yeah. Yeah. Alright, awesome. And, um, I guess we'll, we'll get into the social aspects in a little bit, but, those are good to talk about, but, as far as the design for the engines, I know that we were already talking about hydrogen because that's what we have available right now, but we do also have solar sail technology. Yeah. We've talked about that a little bit, where we'd use von Norman probes to set up, beams that would send light rays for essentially. Space highways. Yeah.

Jacob: 17:19
And I mean, if you've got a solar cell from Earth, even if you don't have a way to stop yourself when you get to the other end, you know that at least half the amount of fuel you need, if you can accelerate with a solar cell and then use your engines to slow down, that still saves you a lot of mass. Yeah,

Lucas: 17:32
absolutely.

Jacob: 17:33
But as far as the propulsion technology, I think solar cells make a lot of sense. I think fusion makes a lot of sense. If you have antimatter, that's great. But as far as going deeper into details with those, I would recommend the audience check out our Interstellar travel episode.'cause that's, focuses a lot more on these technologies and how they could function. Yeah.

Lucas: 17:48
Okay. so now we've covered how, a generational ship would look. How do you think a ship where we incorporate just life extension technology would look.

Jacob: 17:56
Yeah, that's definitely gonna change things up. One of the largest issues you're gonna run into with a life extension, especially if you don't have any type of freezing technology is you are going to have population growth that's uncontrollable because every new person isn't replacing a person before them. you either need to have a stricter control of reproduction or you need to have a small enough starting population that even with uncontrolled reproduction, your ship can maintain everyone till the end of the journey. Right. But an upside of having life extension is you have this continuity of society, you are not having as much cultural drift, I think is if you had multiple generations.'cause you've got people alive who've presumably lived on earth.

Lucas: 18:35
That is a massive, benefit. Exactly. Yeah. This, and we'll talk about that in a little bit, but really having that is something that I think could make this the best option.

Jacob: 18:45
I think so too. And you have to think as well, it's probably easier to get colonists or people to sign up for this trip if you have life extension technology. For two reasons. One, if you can live virtually forever, barring any accidents, then the odds of you getting bored with your life on earth or your life in the solar system and wanting to go and take a chance and go to a colony, knowing that if you don't like it, you can take the multiple century trip back is, I think, more appealing to people. And there's probably less social mobility back at your home anyways.'cause you have people living a long time. the top ranks of society to get filled up and people hold those positions for a long time.

Lucas: 19:20
Yeah. because in the first option, you're essentially sacrificing not just you, but many generations Yes. To get the opportunity, but if you have life extension, you're offering yourself opportunity. Yes. Which a lot of people will see is more desirable.

Jacob: 19:32
I think so too. Yeah. And I guess for the third option, when you throw in, any type of preservation, I think the odds of people signing up for these go up even more because now not only can you go to these colonies, but you don't even have to be awake for the trip. that does help solve the population issue because presumably you've got a certain amount of people who are like, I'm bored, I'm just gonna freeze myself until I wake up. So that's a nice plus. Yeah. Or you could potentially even shelf people, you could have a set population number and whenever you approach that, maybe it's a case of whoever's the oldest person has to get frozen first. Or maybe it's a deal you make if you have a kid, you agree that in 50 years you're gonna volunteer to be frozen or any type of situation like that. So it gives you the option to control the population while still allowing people to essentially reproduce at a reasonable rate.

Lucas: 20:19
That is a really cool concept. Like you essentially, you're signing up. Okay, I have a 50 year. Cruise because if we're talking about the second two options, then presumably we already have robots doing most of this stuff.

Jacob: 20:31
Yeah. Even in the first option, automation is something we're seeing today. So I think if you can launch a colony ship, you can potentially automate most of it.

Lucas: 20:37
That does make sense. But I feel like if we're not freezing people are going need something to do. So you

Jacob: 20:41
don't need automation as much.

Lucas: 20:42
Yes. But on these other ships, it essentially would be like robots running the show. If we had multiple ships, it would be automatic transport between the farming ship and the main ship, which would really just make like a party type of atmosphere and that could be used to attract more people to do it in the first place.

Jacob: 21:00
Yeah. actually, I'm glad you brought that up'cause that ties into a point that I wanted to bring up. We have this idea that whomever is gonna be signing up for these ships are gonna be making a huge sacrifice. Right? They're gonna be living in these squalid conditions and have like a shoebox to live in. And that's not really true, you can actually have these colony ships be very luxurious. And I know I've already brought this point up, but again, we already imagine a future where people

are gonna be living in orbital habitats anyways. Mm-hmm. And we imagine that these orbital habitats are going to be very luxurious. We had a whole episode on O'Neill cylinders and we talked about all the benefits of them, how you can build them to be what you want. You can have a beautiful Mediterranean city and have the climate be like that, or you know, whatever you want. And there's no reason you can't do this for a colony ship either. Just because it's moving and going to a new star doesn't mean that you have to sacrifice on these things. Really the only limiting factor is mass.

Lucas: 21:53
Yeah. I mean, it's nice to think that, oh, there are going to be people out there that will sacrifice. Yeah, right. To go to a new star system. But that's not what a privately funded mission's going to wanna do. It's gonna wanna fill spots. do you do that by making the trip, desirable. which would be, adding in luxury, allowing for people to feel like they have the freedom to do what they want on the ship and, of course offering them, at the destination. Something to look forward to. Yeah.

Jacob: 22:17
Someone might be rightfully thinking, okay, but if you try to add on this luxury, there's a good chance that you're reducing your top speed that the ship can reach because you're adding more mass. If there is a fuel consideration, then adding more mass means that you're gonna reach a total lower top speed means the journey's gonna take longer. But hear me out. Do you care at all if this is gonna be a five generation ship or a 10 generation ship? Either way, you're spending your life on it. Right? So if I tell you, either we can go 20%, the speed of light, this trip is gonna take five generations, and you're gonna be living in these not so great conditions, or, we're only able to go 10%. The speed of light. But you're gonna be in luxury the entire time. Do you care if that means there's gonna be a few extra generations after you're dead? Not at all. Yeah, exactly. So I think it's very reasonable that we're probably gonna aim for a decent level of luxury in these ships. Even at the sacrifice of speed.

Lucas: 23:05
Yeah, absolutely. Really the only person who would benefit from the ship going faster in the terms of just a normal generation ship would be if a government did it. Yeah.'cause they wanted something. At the destination, which we already talked about, that's probably not gonna be the case.

Jacob: 23:20
Or with the exception of if you have life extension technology Yes. At that point, you might be willing to make a sacrifice on luxury if it gets you there a little faster.'cause it's like, do you want 500 years of luxury? or a thousand years of a little bit more luxury? It's like, I might be willing to sacrifice to cut, you know, hundreds of years off the journey. If I have to be awake for it.

Lucas: 23:39
I mean, it, it gets a little crazy to consider when you're talking about hundreds of years. Yeah. like people would want to get there as quickly as possible because even though luxury is luxury and luxury is nice, it's like, man, am I even gonna want the same thing in 300 years? Like Yeah. Like just showing up at this barren planet and then nobody's gonna want to get off the ship. But then again, it doesn't matter'cause after you've been on the ship for 10 years, it'll probably be the same mindset.

Jacob: 24:07
Yeah, exactly. And you know, like I said, just to tying back into this point again and again, we already imagine people are gonna be living their entire lives in orbital habitats and O'Neill cylinders. So Yeah, you're right. Maybe when it does get there, people say, nah, like this, I'm good. Like, why am I gonna wanna leave my nice comfortable ship that's set up to be like earth, to go colonize this barren rock?

Lucas: 24:25
Yeah. And of course it's not even closely comparable, but this already happens in real life, like with cruise ships. Mm-hmm. You'll see, they have statistics posted that about 25% of passengers, even though they go and they travel to these different locations, they never get off the boat.

Jacob: 24:39
That's crazy. Yeah. But I mean, it's, it's set up to be luxurious. So yeah. You might have that situation as well.

Lucas: 24:44
Yeah.

Jacob: 24:44
With that thought in mind though, I do think it's worth thinking about how will the society on the ship be, especially if you have a situation where you can't cry or preserve people, and double, especially if you don't even have a life extension, you know? What is it like to be the second generation on a eight generation colony ship, being born on the ship, knowing you're working your whole life just to get you to a destination that you'll never see?

Lucas: 25:06
That's a great topic to bring up because, I feel like one of the biggest issues is even if we get these 500 or 10,000 people who agree to go on this trip and essentially give up their lives for this opportunity, you're going to have not just yourself dying on this ship, but you're going to have, 3, 5, 10 generations after you that you are committing to also knowing nothing but this ship. so that is a huge

thing to bring up. And then also those, people that originally went, they might have been cut out for it, but the people who were born after might not be. so when we talk about dedicating yourself to this, it brings up a huge ethical problem and is that really worth it?

Jacob: 25:45
Yeah. So, I have some thoughts on this. For one though, I don't think it's as bad as people make it out to be. We already talked about how these ships probably aren't, as bad as people tend to imagine, they're probably not these squalid, horrid conditions. Mm-hmm. Pretty reasonable comfort of living. Yeah. And also, how many people are born in a small town in a middle of a rural area, who have to grow up there and stay there, maybe take over their parents' farm or whatever, is, is it really that much more different? And also, you know, when we're thinking about, ah, these people might be born on the ship and resent their parents and resent everything and. And what refuse to participate in society. I mean, there's already people who are annoyed at how society is, I don't like going to work every day. Most people don't. But you still do it and you still participate in society. For what, like what's the grand ambition of society in the world?

Lucas: 26:32
Yeah. That is an excellent point as well because why we think that it would be an ethical problem now is because we have the illusion of choice to get on the ship or not. Yeah. Right. Where, when people are born into that, they're probably going to be more accepting. They're going to learn in their early days in like schooling that they're doing a great thing, that they're, contributing to the society of the ship and they'll know nothing but the ship. And there will still be opportunities for them, of course, they'll be able to go into different jobs and all of them will have this aspect of purpose, so I agree with you on the fact that it probably won't matter to the people who live on the ship. It'll matter more to, the people making that ethical decision to be able to launch the ship. Now, I agree with that. We're getting rid of that choice.

Jacob: 27:17
I think it's more ethically questionable from a distance. I think most people born on these ships are just going to, it's all they've ever known. They're gonna accept it, they're gonna live with it. And I mean, is that ethical from an outside standpoint? That's a fair question, but I don't know. I feel like as long as the quality of life on the ship is good, and, as long as there is enough people to give you a good society, at least 10,000. How many people born in a town that size spend their whole life there anyways. Yeah. A good

Lucas: 27:39
chunk. Yeah. And I mean it, if you wanna move, you could go, a couple miles down the ship and relocate to a different type of climate. Yeah.

Jacob: 27:46
That's built onto one of these O'Neill cylinders. Exactly. Or, if you launch, dozens of these together, maybe even hundreds of them together, if you're not happy, you can just move to another cylinder. And you might have cylinders that have a variety of different climates and, you might have some that are modeled more like cities, some that are modeled to be more like a rural area. Mm-hmm. So, at that point, if you're launching, between 10 and a hundred of these ships together, that can also put around 10,000 people and you have the option to move between'em. I think the ethical issue kind of dissolves there. Is that any worse than being born on earth at that point?

Lucas: 28:17
Yeah. That's definitely a good thing to think about especially to like grandparents where they could be like, oh, my kid moved to ship C 21 and they never visit anymore. Yeah. You know, so, it'll be a new type of society especially, but I think that people will acclimate assuming that we give them, ample comfort and living space to do so.

Jacob: 28:38
I fully agree. And, tying back to this point again, but you might already have people spending their whole lives on O'Neill cylinders at this point anyways, and that just dilutes the ethical argument even more because what's the difference between spending your whole life and one orbiting our son versus one that's in route to another son? Right. Yeah. So,

Lucas: 28:54
yeah. But talking about some of the things that would pose a, real issue from a social aspect. The first one is going to be. As society evolves, it will evolve around their environment. So we'll have changes in language going back to the expanse, like the people who lived in the belt, They formed an entirely different type of language and lingo. And that will continue to evolve until we really won't be able to communicate with Earth. Right?

Jacob: 29:21
I don't know if it'd go that far. That's gonna depend on a lot of different things, presumably you still have contact with Earth there will be cultural drift and there will be linguistic drift. Absolutely. But I think because you have an open channel of communication with Earth, it'll be very easy to keep tabs on that changing and have people who are trained to learn that new language and that language can only evolve. At the speed of, generations, which means people on Earth also have time to learn it and adapt with it over time as well.

Lucas: 29:45

Yeah, that is very true. Like you said, we would have specific people trained mm-hmm. To a language, but the actual language that everybody else speaks on the ship, I feel like would be vastly different.

Jacob: 29:55
Yeah. Or you could have people on earth trained to speak the common language of the ship that way. You don't,

Lucas: 29:59
you Yeah. I, I guess you could do that as well. And I mean,

Jacob: 30:01
realistically you don't need that much back and forth communication with earth. Maybe a few trained people to transmit science and stuff like that, but it's not like, oh no, the regular person on the colony ship can't speak earth language, whatever. Will they do with a

Lucas: 30:16
you you are absolutely right. I don't

Jacob: 30:18
speak middle English. That's gonna be a real challenge one day.

Lucas: 30:22
Really, I'm just thinking from the standard, of course, still like just giving something back to your starting system, but that, that could very well not be the case now where it could become an issue. Is these people are going to be living on this ship and they're not going to know a lot of things to do when they get to the planet that they're supposed to be colonizing, for example, metal smelting or tilling a field or building a home, right? A lot of these people, they're not going to really know how to do that because the ship will provide them with all of those things already.

Jacob: 30:53
I don't know. I think it depends on how are these ships set up to farm in the first place, right? Do you have a large rotating cylinder that has open fields where people can teal and farm. Uh, maybe you do, maybe you don't. It's not the best use of space, but it is possible you would have that en route. Or alternatively, maybe you don't have that. Maybe all the farming is done through automated farms or you know, some more advanced techniques like hydroponics and all that, in which case you would probably still use that technique once you get to the new colony Anyways.

Lucas: 31:21
yeah,

Jacob: 31:21
that is a

Lucas: 31:22
good point. You could just set up facilities Yeah. Where you use aeroponic or hydroponic farming

Jacob: 31:27
and, it's not like the information on how to do it won't be preserved and the people can't figure it out when they get there too. Especially on a colony ship, you have a way to generate food to sustain that population anyways. Yeah. So you have all the time in the world to figure out farming and you only need to figure out farming to grow your population. You have a farm on your colony ship anyways, that can sustain your population at the size that it is. Currently. Mm-hmm.

Lucas: 31:48
You do bring up great points there. Really, when I came into this, in the beginning, I was thinking of how all the bad stuff could be there. Yeah. But really you'll have most of that figured out. Yeah. And you'll have these people that have acclimated to it, almost like a, a utopian version instead of a dystopian Yeah. Hopefully. Right. Being on the ship. Right. Not to

Jacob: 32:05
say it can't be dystopian. I mean, you have, of

Lucas: 32:06
course. I mean, we could have a ship that's run poorly and people do live in squalor. Yeah. And but more realistically, like you're saying, most of these ships, when they are designed, to get people to go on them, it's going to be a more lavish lifestyle.

Jacob: 32:18
Yeah. Well, I was also gonna say, you can have things happen on the way, for example, maybe you have a, a tyrannical leader, show up and, you have social collapse or something, so things can't happen.

Lucas: 32:26
Oh yeah. I mean that, that's another great point. Government.

Jacob: 32:29
Yeah.

Lucas: 32:29

Right? Like how is the ship going to operate? Because once they leave, what law are they going to abide by? Especially if it's a ship that's pulled from all different parts of the globe. What government does that ship start as and where will it end? Does it just like a common law type of thing. Like, don't kill people, don't steal things. be kind to your fellow person and will make this work. But people will crave leadership and other people will crave power.

Jacob: 32:53
I feel like you'll just set up a government before the ship ever leaves. You'll probably have a charter that outlines all of the laws that will be ab obeyed on this ship and how the government works and all of that. That'll be set up before the ship ever launches.

Lucas: 33:04
But will it maintain three generations down the line? I mean,

Jacob: 33:07
People crave stability. So I think for the most part, if you have a charter set up on your ship, most people are gonna obey that just because that's what they do anyways.

Lucas: 33:16
Yeah. The reason why it's fascinating to me is, I recently just watched the Fallout series. Yeah. And I kind of think of it as like a, a vault. Oh, yeah, yeah, right. Sort of a weird, dystopian vibe to it, to where it's like everybody's like, happy. But there, there could be weird stuff going on in the background or. some kind of, tyranny or something like that. but realistically, you are right. It's not gonna matter'cause where are you gonna go?

Jacob: 33:38
Yeah.

Lucas: 33:38
But, it's definitely an interesting idea to touch on with how that would evolve.

Jacob: 33:42
Yeah, it is fair. I, I genuinely think though, that you would probably set up some type of charter, some type of legal system well before the ship even left. And for the most part, I think people would follow it. Again, just tying into what I said, I think people crave stability. I think most people aren't gonna go for the anarchy route just because they're on a ship the same way you don't have small towns in the United States succeeding just because they have a smaller population. Right. that is true. There is of course, a risk that maybe you'll have a tyrant for a leader that crops up and you can have social collapse. It's not saying that can't happen,

but I don't know. Just have to roll the dice. That's something that happened. Yeah, absolutely. That's something that can happen here on earth though. that is true. It's happened before,

Lucas: 34:16
but it's, it's again that illusion of choice type of thing. Yeah. If you don't like. What's happening? There are other spots in the country where you can go, but realistically, most people don't have the resources nor the ability to do that anyways. But we feel better about the situation that we're in because we feel like we could change it if we needed to.

Jacob: 34:34
There is also a point of bringing out, you can't leave this, right? So especially if you only have one ship and you do have, a dictator crop up, there's no one outside to stop him. Yeah. You know, at least on earth you have different countries and if you get too crazy, presumably someone's gonna declare war with you and take you outta power, you know, on a ship, you don't have any external forces. So there is a risk of that too.

Lucas: 34:53
Yeah. And, that makes me think about also if this is like a fleet. You could have different governments on different ships. Absolutely. Yeah. And what if they disagree?

Jacob: 35:00
Yeah.

Lucas: 35:01
Right. They're like, I don't wanna go to the planet with that guy anymore. Set course to a different star. I'm outta here. Yeah. Maybe

Jacob: 35:08
you could, or maybe you say, you know, whenever we land, we're colonizing the furthest continent away from you.

Lucas: 35:13
Yeah. It's like, you don't get to come on our half of the planet. Yeah. Back up. and then we think about, people who of course are still going to break the law even though maybe not as much as they would here on earth, because it'll all be very equal. To the people that are living on these ships, right. you're going to be in luxury regardless. So if we're thinking about people breaking the law, because some people they will just have devious intention from the beginning. They will murder or arsonist would be a huge problem. How do you deal with these people? Do you have arsonists?

Jacob: 35:44
Why are arsonists particularly gonna be a problem? Well, because if the ship catches on fire, that's bad. Yeah. Yeah. Okay. You're fair enough. Not that it's gonna breed arsonists, it's just that it's a particularly heinous crime in a closed system. That's completely fair. to answer your question, I think you'll have gels, you'll have penal systems, or maybe you depends on the technology. Maybe you can just like. Brainwash people. I dunno. Okay. But I think you would have a legal system just like you would have on earth. I mean, 10,000 people. Uh, you're gonna have jails, I think probably

Lucas: 36:09
right now. Would we put that on a, on a separate ship we keep it on the same one.

Jacob: 36:13
I don't know. Uh, it's probably gonna depend on the setup. I mean, if you have multiple ships, maybe one is like a, a penal ship. If you've got, maybe not, I don't know. It's just gonna fully depend on your fleet setup. And, if you're a sci-fi writer, you can do it either way. You can have each ship have their own, you can have a penal ship. maybe you just have an airlock. Yeah. just kill everyone who's a problem. It's just,

Lucas: 36:31
well, yeah, no, it, it's sentenced to life in prison, but then you just put'em in the airlock or, and send them out into space.

Jacob: 36:37
There might be harsher consequences though, on closed systems like this. Especially if you're threatening the ship, it's hard for one person to destroy the world, but, uh, when you're on a closed ship, one act of sabotage really could, destroy the whole ship. Or, you know, at least make it impossible to complete the mission. So it, there might be strong incentives not to do that. And I think, you know what I mean by strong incentives?

Lucas: 36:54
Yes. I definitely think that is something that should be in place. Because like I said, I feel like petty crimes, like theft and things like that aren't really gonna be a thing.'cause why are you stealing? You have the same thing that that guy has.

Jacob: 37:05
I don't know. Maybe, maybe not. I think petty crimes will always exist. my case for this is that. A lot of people commit petty crimes just for the thrill of it.

Lucas: 37:12

Ah, that is, that is a good point.

Jacob: 37:13
I mean, there's people who shoplift not because they need the thing. Right. So petty crime, I think is just a human condition that's always gonna happen no matter what. Even if you have resource abundance, I think people are gonna do petty crimes or get drunk in a fight. That type of stuff. I think you'll probably just deal with like you would deal with on earth. When you get to like capital offenses, that gets a little more tricky. I could definitely see a culture on these ships forming of every single person is a resource sink and they need to contribute to be allowed to stay alive on this ship. Yeah. So it might be the case that life in prison isn't a thing because why are we gonna feed you and clothe you in a limited world if you have done this horrible thing? So capital punishment might be more common. So that, that's a good one.

Lucas: 37:51
Yeah, that is definitely a good point. The last big topic that I wanted to touch on was, reproduction We've talked about that a little bit, already, but would we have a regulated reproduction law, for people? Because overpopulation on one of these ships could be catastrophic.

Jacob: 38:05
I think that is going to depend wildly on what technologies are available and how you set up your ship or fleet. I know I talked about it earlier, but if you've got life extension technology, maybe you start off with a small enough population and you overbuild your ship mm-hmm. So that people can breed freely and the population size, will be reaching capacity as you're reaching your planet. Or, it might be a legal situation. We've definitely seen, on earth, China famously had the one child policy limiting reproduction, but didn't necessarily go well. But it's not hard to imagine having policies like that on a colony ship that has limited availability.

Lucas: 38:38
Yeah. It's just, reproduction is one of those things that I find to be such, an interesting topic because limiting that could be incredibly detrimental to some people's, mental health.

Jacob: 38:47
yeah. You'll have to find a way around it. It does get trickier with life extension, especially if you don't have unlimited capacity on your ship, like I said, it might be a case that to have a kid, either you volunteer to be put in cryos stasis or you put a limit on your own life, maybe that's the sacrifice you have to make. There's a lot of different situations that can happen. Have you read the, silo book series at all? No. there's a TV show on it now on Apple tv. It's really good. It's also a closed ecosystem, and they run into the same issue of reproduction, in the show. every

woman is given a birth control pill, once they hit, the age of, I think 13 is what the book says. Mm-hmm. And that is only removed if you win a, lottery to have a kid. It's basically a compulsory birth control, little dystopian, but that is also an option. I don't think this is a spoiler, it doesn't come up in the show. But the book does cover a character who's mom's birth control fails.'cause there is a failure rate for these and she doesn't report it. She decides to have the kid anyways. And it's revealed in the, the book, the price you pay on that is your own life. Once your kid reaches, a certain age, they kill you.

Lucas: 39:45
I see. I guess no, no matter how you swing it, it'll always be a little. bizarre. Yeah.

Jacob: 39:50
there is the option too of oversize your ship for the generation so they can grow anyways. If you start with a population of, a thousand and you have a 500 year journey, just design your ship to handle that and let people do whatever they want.

Lucas: 40:00
that would be the best option in my mind. Yeah, I think so. Yeah. Absolutely.

Jacob: 40:03
But yeah, just to say there's a lot of different options and you can really go about it and either dystopian ways, utopian ways or utilitarian ways, bunch of different ways you can slice that.

Lucas: 40:11
Yeah. I mean, it's just fun to think about, you know, all the different ways that it could go.

Jacob: 40:14
Absolutely. Well, Lucas, I think that's all I really have to say about this topic. How about you?

Lucas: 40:18
Yeah, that's all that I really got. I really enjoyed talking about it.

Jacob: 40:21
Yeah, this was a really fun one. This is one of our longer wrap episodes. I think we could've gone even longer. We'll have to definitely do a follow up.

Lucas: 40:27
Yeah, definitely. But people did say that they wanted longer episodes. Oh.

Jacob: 40:30

Hopefully they like this one. thank you so much for listening. Please follow us on threads if you wanna follow along with the show and keep up with the latest things that we're talking about. Also, if you wanna support the show, you can support us on Patreon. It helps a ton. It'll help us grow and expand the show and increase the production quality.

Lucas: 40:46
Yeah. Thank you everybody so much see you next time.