The Science of Foundation with Stephen Webb

[Opening theme music with voiceovers.]

Stephen Webb

"My school didn't have a reputation for progression through to University. The teachers were great, but University seemed like it was unattainable. So I feel personally as if I owe a lot to Asimov and to his writings. Just a personal opinion, I think we're alone and I think it's a chilling thought. But if you do think that way, it does put an extra responsibility on us not to mess up this planet."

[Theme music plays out.]

Joel McKinnon

Welcome back, everyone, to Seldon Crisis for a very special episode and the first featuring a guest since my interview of Nathaniel Goldberg on the Philosophy of Foundation. Today we're going to talk about another pretty important element of this awesome series science. My guest today, Stephen Webb, studied physics at the University of Bristol in England and went on to gain a PhD in Theoretical Physics from the University of Manchester. He is well known for his work on the Fermi Paradox and his Ted Talk exploring the existence of extraterrestrial intelligence has been viewed more than 6 million times.

Joel

Stephen is also a lifelong fan of science fiction. He enjoys science fiction in general and Asimov in particular. He's the proud owner of over 500 of Asimov's books! Few authors can match The Good Doctor's prolific output, but Stephen is soon to submit his tenth book for publication. Hello, Stephen. It's great to have you on the podcast!

Stephen

It's great to talk to you, Joel. It's getting to the end of another hard year, isn't it? A hard year for all of us. So it's nice to wind down and talk about something we both enjoy.

Joel

Yes, indeed. First, I have to inform our listeners that I did a video call earlier with you and you showed me your bookshelf full of Asimov and I thought I was dreaming. It's a great collection and it shows how deep your appreciation is for his work. Can you describe how you came to love science fiction and Asimov in particular?

Stephen

Yeah, I do have a large collection of Asimoviana on display, much to my long suffering wife's dismay, I have to add. It takes up quite a bit of space because I own all of the books on Ed Seiler's canonical list of the Good Doctor's work. Apart from the wall charts, history of biology, history of mathematics, they aren't really books. I guess teachers will have pinned them to classroom walls and then taking them down when they got tattered, so I doubt I'll be able to find them now. But if any of your listeners do have spares they'd like to sell, I'm in the market.

But getting back to your question, I discovered Asimov books in the public library as a kid, and his works have had a huge influence on me. I grew up in a science fictional time. Astronauts on the Apollo program were reaching

for the moon. How science fictional was that? A lot of stuff on TV was science fiction. A lot of movies were science fiction. So the stuff I wanted to read was science fiction. And I remember loving the Danny Dunn books by Ray Brashkin and Jay Williams and the Chris Godfrey books by Hugh Walters. I can't remember the first Asimov book I read, but it was probably one of his non fiction books for children.

My hometown had a great public library back then, and I noticed Asimov's name popping up whenever I visited it. It's a quirky name. I think I originally pronounced it as "Aziminov." And I eventually found his science fiction and fell in love with it; Foundation especially, of course, but also the Robot series. Great short stories like The Last Question, Nightfall, and The Dead Past. Tremendous standalone novels like The End of Eternity and Martin Reese. Lord Reese, our Astronomer Royal, he likes to say that you can learn more from first rate science fiction than you can from third rate science.

And I learned a lot. Yeah, it's a wonderful quote, isn't it? And I learned a lot from Asimov science fiction. And if you liked Asimov, then you tended to like Clark and Heinlein I'm sure that's the case for Joel.

Joel

Yes, indeed. Yes, indeed. Very much.

Stephen

And I did like those authors, too. But there's something about Asimov's voice in particular. I think it is cool and it is rational and it is considered, and it really appealed to me above those other writers. And then I fell in love with all the nonfiction. He poured out the monthly science columns in Fantasy and Science Fiction magazine, the science books, the history books. And I got an education from him. And I'm really grateful for that because my family had no history of higher education. My school didn't have a reputation for progression through to University. The teachers were great, but University seemed like it was unattainable. So I feel personally as if I owe a lot to Asimov and to his writings.

Joel

That's so impressive. I had the same experience when I was... not the same family experience with higher education, but I had this experience where if I had trouble with a subject, I would often wonder, did Asimov write about this? I'd love to hear this from Asimov, because he'd teach it to me well. And I would often find, yes, indeed. And I'd go find the book that he wrote on that subject and read it, and that really helped me. So same thing.

Stephen

Yeah. He had a very cool, logical approach to everything he wrote. It's very often an historical approach, and you got a very thorough understanding and grounding, I think, of pretty much everything, because he wrote on pretty much everything, didn't he? But everything he wrote, I think the Foundation series means the most to me. And it was that a humans only galaxy, that mix of ordinary, everyday people, characters like Onum Barr, which you've described in previous episodes of your podcast, and Arcadia Darell, I presume she'll be coming up. They're living their lives against this backdrop of the vast, distant future, galaxy spanning civilization. And it just resonated with me, and I think it seems to have done with countless other people.

Joel

Yeah. One of the footnotes to your book on the Fermi Paradox, "Where is Everybody?" Says that Asimov created a galaxy without aliens for Foundation as a reaction against being told by his publisher, the great John Campbell, not to write any stories where the aliens win against humans. Is that right?

Stephen

Yeah, I think it wasn't perhaps as explicit as that, but John Campbell had certain views that certainly nowadays we would regard as problematic views to do with race. I think Campbell's attitude was that the plucky human spirit would win out against anything because we're the best, aren't we? And Asimov, I think, thought that was just nonsense. If you come across an alien species that has better technology, the alien species with better technology is going to win out if there's ever any war, any conflict, any battle. So to get rid of that battle or conflict with Campbell, the logical thing was just to remove the possibility of meeting aliens. And so, by probably just default, he ended up with this idea of a humans only galaxy. Yeah.

Joel

So that makes me wonder what you think about the likelihood of humans eventually filling the entire galaxy, aliens or not, and establishing a galactic empire the way Asimov described it.

Stephen

So I think the first thing to say is Asimov wasn't trying to predict the future. It's not something that science fiction writers need to do in general. They're not in the business of predicting the future. And that's not what he was trying to do in Foundation. He wasn't trying to provide a roadmap for humanity to follow. He was just a young man, surprisingly young man, trying to sell some stories to John Campbell. And Asimov actually tired of writing those Foundation stories really rather quickly. And I think, as you pointed out in an earlier episode, he had to be cajoled by Campbell into continuing to write the stories.

So we shouldn't look upon the books as some sort of prognostication. It's just a story. But it is a really interesting question you raise. So suppose for the moment there aren't any aliens. The question, would humans be

able to create that galaxy spanning empire? And I think to discuss the question sensibly, we have to agree on two things. First, we have to agree to allow a place for imagination when it comes to technology. We have to be imaginative. Scientists are sometimes suspicious of that because the results can sound like fantasy. But the technology of 100 years from now or 1000 years or 10,000 years will be incredibly powerful if we survive.

Just think what's happened in terms of technology in the eight decades or so since Asimov wrote The Psychohistorians. Each of us carry around a device, a mobile phone. I think it's a cell phone, the term in America, isn't it? It's a device that has a functionality Hari Seldon would kill for. The idea; you have a single device in your pocket that can give you directions. It can play music for you. It can serve up your favorite movies to watch or books to read. It can provide you with a camera. It gives instant personalized news, and on and on and on and on.

Back then, that would have seemed much more magical technology than a flying carpet or whatever. So we have to allow for huge technological development over these long time scales. So I think that's the first thing. Second, though, we have to agree that whatever we imagine follows the laws of physics as we currently understand them. We know that our understanding of physics is incomplete, but it is also pretty impressive. It allows us to construct and operate those mobile phones, for example. And if we simply disregard the laws of physics, then it's like playing tennis with the net down.

Anything is allowed. And if anything is allowed, nothing makes any sense. So that constrains what we are allowed to imagine. Well, that second point, to my mind, tends to rule out the sort of civilization; single, galaxy spanning empire described in Foundation. The problem is that the universe contains a local speed limit, the speed of light. You can't transmit information faster than the speed of light. And that's the killer, because although light travels quickly, the galaxy is big. So suppose you have the

Emperor sitting on Transor, which is at the Galactic center, and we are sitting on, say, Anacreon, which let's suppose is close to us here on Earth.

The Emperor sends out a message. I don't know, something like, "how fair my loyal and faithful subjects on the Planet of Anacreon." That question takes 25,000 years to reach Anacreon. Then the local Imperial officer answers, "Things aren't too good, Your Highness." And that answer takes 25,000 years to reach Cleon. The Emperor says, "Would you like me to send reinforcements?" Another 25,000 years? "Yes, please." Another 25,000 years. So it's 100,000 years before the troops even set off. You can't maintain that central control.

Joel

Yeah, I was just thinking about a comment I saw on a YouTube about galactic empires recently. Somebody said, I think that was raised in the YouTube video. And one of the commenters said, but isn't this like the British Empire when they ruled the world? And it would take weeks and weeks, if not months, for communication to go each way, and you would have the same kind of issues, but that's not 50,000 years.

Stephen

I think that's the difference, isn't it? Empires on Earth, whether it was Rome needing to put down a rebellion, say, in the north of England, it would take weeks to get there to quell that rebellion. But weeks as a fraction of the human lifespan is okay. 100,000 years, that's a long, long time in terms of the lifespan of a species, not just individuals, so personally, I don't see how you can maintain that control of a central Trantor if you like, running the business of the galaxy, if you have that...

Joel

I know a way you could do it.

Stephen

Uh huh?

Joel

Hyperspace jumps. Is that even possible? Is there any way you could do that?

Stephen

Yeah, well, that's how Asimov and science fiction writers in general, don't they? That's how they get around the problem - have a hyperspace jump. And I'm told - I don't think it's apocryphal - but at a science fiction convention, a science fiction writer was asked how the hyperspace jump works, and the answer was, "it works very well, thank you." And it does work well for a science fiction story, but that's all. It's a story. And Asimov he was really good at giving these simple names to difficult concepts, not trying to explain the nuts and the boats, just allowing the reader's imagination to take over, make of it whatever they want, and then getting on with the story.

And sometimes he gave science fictional names to everyday items just to give that sheen of strangeness, if you like. So you have men, it's always men, smoking cigars while they talk politics around a conference table, which now seems incredibly old fashioned. Instead of throwing the stubs into an ashtray, which is what they would do, they drop them in a disruptor. And the disruptor, it's just a throwaway word, no nuts or bolts given or needed. And he did that in lots of his novels throughout Foundation. And ultimately, I think hyperspace jump is just that. It's just words, and it enables the plot to move forward.

I can think of two serious suggestions for faster than light travel based on physics as we currently understand it, but just two. So we have two deep fundamental pillars of physics. There's general relativity and quantum

theory. And general relativity is our theory of gravity. It gives us our best understanding of the universe on a large scale. Quantum physics describes the universe on small distance scales. Well, general relativity pictures spacetime as a sort of fabric. And that fabric can be distorted by the presence of mass and energy and movement through that distortion is what we experience as gravity.

So you can imagine maybe punching a hole in the fabric at one point and stitching it together at some other point. And then you'd have a hole through which you might be able to travel, which would take you from one point to another. And I guess that might class as a hyperspace jump. Another option is to have a spacecraft, and you warp space in a particular way just in front of the craft, and you warp it in a particular way just behind the craft, and you can get a ripple in space that can move arbitrarily quickly.

In the spacecraft itself, you wouldn't experience anything different. You still couldn't move faster than light, for example. But the whole system warped space at the front, flat space in the middle, warped space at the back that moves as fast as you want. The trouble is, these suggestions require something called exotic matter, and it's really not clear.

Joel

Dilithium crystals.

Stephen

I'm sorry. I missed that, Joel.

Joel

Dilithium crystals is what they need.

Stephen

Yeah, exactly, it's the dilithium crystals. Again, it's just words. And it's really not clear that those crystals or that exotic matter can exist in our universe. So building that warp drive isn't just a matter of engineering, okay? It's not just imagination. There may be fundamental reasons why you just can't do it. The other option that people sometimes raise is in quantum theory, which allows for something called entanglement. So if you bring two particles close together, then the properties of the particles can become intimately linked or entangled. And if you send one of them away, separate them by as large a distance as you wish.

It turns out that measurements made on the particle here that you kept, they affect what can be measured on the particle over there. And it's as if some instantaneous signal flashes between them and one particle saying, I've just been measured to have this property, so you better make sure you have that property when you get measured. Well, entanglement certainly exists. It's a property of quantum physics. It seems weird, but it doesn't allow you to send a signal. Unfortunately. It's a strange observation about how the world works, and it's not intuitive, and it seems quite strange and spooky, but it doesn't give us a method of sending information faster than light.

So the only glimmer of hope I can see for having this empire where Trantor really can keep an eye on everything, is to accept that general relativity and quantum physics we know don't work well together. So we know that our understanding is incomplete. Maybe if we had a theory of quantum gravity, we might figure out some clever way of making a jump through hyperspace. But as things stand, I think we are just stuck with that slower than light trek to the stars, which I think rules out Foundation as we know and love.

Joel

Yeah, it's a little disappointing, but I wanted to mention in the Apple TV series, I don't know if you've seen that yet, but they have these warp ships that spin up what looks like a black hole from nothing, just using magnets and big rotating rings. I wondered if you've seen that. Does that seem at all plausible as a way to generate a black hole? It seems like that would not be something you could really do, but I would love to know that that was something reasonable.

Stephen

It would be great, and I have seen it, and visually, it looks stunning. So those jump ships, my interpretation of what I saw on screen, they're using that first type of idea that I mentioned, the idea that you can somehow warp space in a way that permits travel. And if you are going to warp space in that way then something like a black hole is probably going to be necessary because the singularity of a black hole where the gravitational force, according to our theories becomes infinite. That seems to be a place where the fabric of spacetime gets punctured.

Maybe we just don't know what goes on there. Now, if you're a science fiction writer or the producer of a science fiction television series and you need some faster than light craft in order to facilitate the plot, then I think the best you can do in terms of known science is to use something like a jump drive. Something like was pictured in Foundation on television. And I'd certainly cut those people some slack if they use that device. And you could argue that in the absence of the theory of quantum gravity it's not unreasonable to say a jump drive might be possible but we really don't know how to build one and I wouldn't put any money on it being possible.

Joel

So we're left with some fraction of the speed of light is the most reasonable expectation. In that case, would there be any way that you could fill the whole galaxy with a civilization of humans?

Stephen

Yeah, I think you can. I think you can. I don't think that speed limit actually rules out spreading out through the galaxy. If we allow our imagination to roam we can think of lots of ways that a civilization could spread throughout the galaxy. So, for example, I can give you an example that's appeared in the scientific literature. You can imagine creating what's called a Dyson Swarm around the sun. So maybe you dismantle Mercury and put lots and lots of little orbiting rocks around the sun and then you have essentially the Sun's entire power output to play with.

That gives you a lot of power. You send out self replicating probes to the nearest stars. They're traveling fast, but nevertheless, at sublight speeds, no physics is being broken and you program them to do the same thing. When they reach that star system, they create a Dyson Swarm, they send out probes, and so on, rinse, repeat. Maybe while they're there, they terraform a planet in the habitable zone for later colonization by biological beings or whatever it is that we evolve into. And the civilization doing that could spread throughout the galaxy really quickly would take an achingly long time on the timescale of individual beings, yes, but it would be very, very quick on a geological timescale or a cosmic timescale. It wouldn't be the empire that we see in Foundation, at least as I understand it because I don't see how you maintain that central power structure. Speed of light doesn't allow that.

Joel

But it might be even more interesting with a lot of differences between the different pockets of humanity here and there.

Stephen

Indeed, we can assume that evolution would still take place in all of these different places and it would actually perhaps be a much more interesting place, but it wouldn't be the galaxy, the Foundation. But I think that then leads to an interesting question. Why don't we see any evidence of that attempt at reaching out into the galaxy? If we think we might be able to do that, and we think we might want to do that, that's a different question. But why don't we see other species trying to do that out in the galaxy?

Joel

Well, from your book, I learned that Fermi asked that question, and back at Los Alamos, he and a bunch of other people were having lunch one day, and he just said, "where is everybody?" out of the blue. And being nuclear physicists and, like really smart guys, nobody looked around to see who he was talking about. They all seemed to understand immediately what he meant, whereas everybody, meaning the aliens... because I guess they must have been thinking about it too.

Stephen

That's right. I mean, Fermi had this reputation of being able to calculate things in his head incredibly quickly. He was a very, very bright guy and a great physicist. And when he and those colleagues were having that conversation about the possibility of extraterrestrial intelligence, I think they knew immediately that he'd asked a profound question. And incidentally, I first came across the notion of the Fermi question, or the Fermi Paradox, as it's often called, in Asimov's science fiction magazine. So that's yet another way that Asimov has influenced me, because I've thought about that question Where is Everybody?

I've thought about it a lot, as have lots of people. And people have come up with many solutions over the years. And for a majority of people, actually, there isn't a problem. They'd point to UFOs or UAPs, as they're often called now, Unidentified Aerial Phenomena. And they'd say that aliens are here right now, but those are just from my vantage point, they're just lights in the sky. It's not evidence for the existence of extraterrestrial intelligence. I think most scientists would say that extraterrestrial intelligence probably exists, but we just haven't detected signs of it yet. And Asimov himself wrote a book, of course he did, called Extraterrestrial Civilizations, and he concluded that there are 530,000 planets in our galaxy, which a technological civilization is now in being.

And personally, I think he got that number wildly wrong. But most astronomers, I think, would agree that there are advanced civilizations out there, possibly thousands of them.

Joel

So where is everybody?

Stephen

Indeed. Indeed. And we could spend hours discussing the various answers that people have given. Maybe the answer is what we've already touched on, which is that the galaxy is just too big, and it turns out that civilizations can't disturb the universe in a way that others can detect. But maybe intelligence is a self limiting phenomenon. Maybe if you're a bright creature with opposable thumbs, maybe that's not a good evolutionary strategy. Maybe we snuff ourselves out through war or environmental destruction or we create some grand technology and then think, "oops," and it's too late.

Joel

We've come uncomfortably close already.

Stephen

We are, aren't we? And that is a worry. Or maybe everyone's listening. Maybe civilizations are too scared of coming to the attention of other civilizations that we think might be more advanced and potentially malevolent. There's lots and lots and lots of possibilities, but there's also the possibility that we're alone. It's just us. Maybe it's difficult for life to start in the first place. Even if life starts, perhaps that transition from simple, unicellular life to more complex life forms is difficult. It took a long, long time here on Earth to make that transition. And even if complex life arises on a planet with the sorts of resources you need for technology and one that has a stable climate that can support evolution over billions of years, would that necessarily lead to beings that are intelligent, technologically sophisticated, interested in making that trip out to the stars personally?

And it is just a personal opinion. I think we're alone, and I think it's a chilling thought. But if you do think that way, it does put an extra responsibility

on us not to mess up this planet, because as you just alluded to a moment ago, we're uncomfortably close, aren't we?

Joel

Yeah. I have a feeling that people's general assumption that there are aliens out there, it seems to be the common idea. And popular science fiction, television and movies and everything kind of supports that and drills that into people. So there's a tendency for them to not see it that way and like, oh yeah, if we screw things up, there's at least life out there that's going to continue. And that's not necessarily the case. This could be the only life. So anyway...

Stephen

Say Joel, I think harking back to what I said right at the start. I think there has been a fascinating interplay between science and science fiction, and I think the science fiction that a lot of us grew up on has influenced what scientists think and how they view the universe. And that in turn feeds back into science fiction. And there is this subtle interplay, and it's gone back actually to H. G. Wells influencing scientists. There's this subtle interplay between science fiction and science, which, again, could probably spend hours talking about. So I'll shut up and let you ask your question.

Joel

No, that's okay. So, anyway, I was just going to say, after all that about the various possibilities, I'm pretty much on your side thinking that we're alone, but having been a fan of Star Trek and everything, I would love for there to be Klingons and Romulans and Vulcans out there. But I kind of come to the conclusion that if there's any life out there, it's likely to be microbial, and we're not going to have those kind of interactions with them. But who knows? I should keep an open mind and not get totally closed off to it.

But anyway, if we want to get something like Foundation and we expand throughout the galaxy eventually, let's just assume that things turn out the way Asimov put it in the story, and we fill the whole galaxy. Given that kind of a context, how plausible do you think psychohistory is, as it's described in the novels?

Stephen

Well, the social science aspect of this isn't something I'm expert in at all. I think it was a struggle of genius by Asimov, by the way, to think about human interactions statistically in the same way that physicists look at molecular interactions statistically. We don't know what an individual molecule might do, but when you have quadrillions of them with certainty what's going to happen, we have the laws of thermodynamics. And thermodynamics actually was an obvious inspiration for Asimov, one of his best ever stories, The Last Question, it's about thermodynamics, and that makes it sound incredibly dull, but it is a profound story about what humanity might become.

And I won't give any spoilers, but if any of your listeners haven't read it, please do read it. But that idea of psychohistory, that there might be equations that govern the activity of humanity on a large scale, it's inspired at least two people to take up economics and use mathematics to try and predict the future and then go on to win the Nobel Prize. So Roger Myerson and Paul Krugman, they both explicitly stated that Foundation was an influence on them. So Asimov clearly struck a chord here. Whether it's possible, though, I don't know. I don't think economists right now understand how people act in the real world.

The mathematics they were using ten, twelve years ago didn't help them understand that financial crash. I'd argue that the models they were using made it worse. So you have economics, you have politics. You can think of psychohistory in terms of politics. Maybe. So, Salvor Hardin, he said

something along the lines of - and I am paraphrasing - I haven't looked up the quotes, but it's something like, I wanted to be a psychohistorian, but we didn't have the facilities, so I went into politics. It's the same thing. But again, if you look at politics over the past few years, certainly in my country and I don't want to talk about your country, but reach your own conclusions.

We have politicians can't predict what's going to happen tonight, let alone next week or next month. But on the other hand, you look at the developers of social media platforms, they seem to know exactly how people are going to react. They know exactly what to do to get people to keep on pressing those buttons on their platforms. So I don't know, I'd be interested to know what you think. Joel?

Joel

Well, my take is that people tend these days to dismiss it a little too easily. I suspect the way he describes it, Asimov describes it, it probably wouldn't work exactly that way. But as you say, he doesn't describe things too well. But the basic idea, I think if we had gigantic data sets and we're getting into this big data phase now, but if we had data sets that were quadrillions of people and we could really play with all that information. Maybe we could figure out probabilistic patterns of what was going to happen, and we could assign the possibility of certain events to be very high probability.

Then I think we might be able to make predictions. So it wouldn't be exactly psychohistory, but it might be kind of getting close to it. If we look at the Mule as an example in the book of an example of Seldon's psychohistory failing, I don't think it necessarily was a failure of psychohistory as much as it was just one of those very low probability events that he said, by now there's a 95% chance that you're going to be doing such and such. And that 5% is what happened. The Mule appeared.

Stephen

Yeah, I think that's not unreasonable.

Joel

So anyway, let's switch gears for a minute and talk about something else in Asimov's universe, something very important in Asimov's universe, which he left out of Foundation at first, but eventually brought back in. And that's robots. With his robot books, he postulated that they had positronic brains and three inviolable laws of robotics. And I'll read them off here. The first law is a robot may not harm a human being or through inaction allow a human being to come to harm. And the second is a robot must obey the commands of a human being unless doing so would violate the first law, and the third law is a robot must protect its own existence unless doing so would violate the first or second laws. And later he added a zeroth law which says a robot can break any of the other laws if it's in service of protecting humanity as a whole. So are positronic brains remotely possible? And would it be possible to bake in these three laws?

Stephen

I don't think positronic brains are remotely possible, but this was just another of his phrases like hyperspace jump, where I think Asimov left the reader to fill in the gaps. And if you strip away the nuts and bolts and look at the fundamental idea he was concerned with here, that humans would develop machines that can act for themselves and interact with people, then I think he was really modern in his thinking. As the robots before Asimov in science fiction, they tended to be clunky machines that turned on their creators. And Asimov once said that whenever people invent anything, they invent safeguards.

They invented a sword and then they invented a hilt so your fingers don't go slithering off when you thrust at someone and say with robots, however they manifest themselves physically, whether it's positronic brains or

silicon or whatever will want to bake in some safeguards, what those safeguards should be? Well, that's the really interesting question, isn't it? And the Three Laws make sense, but they are ambiguous. And that was great for Asimov. As he said when he wanted an idea for a new robot story, he just had to look at the Three Laws and look for complications.

So a robot shouldn't harm a man. Well, what is man that thou art mindful of him? If harming one person saves two people from harm, is that okay? Does psychological harm count the same as physical harm? How could a robot understand psychological harm anyway? And isn't engaging with dangerous activities something we need to do occasionally? I think the best robot story that Asimov didn't write was With Folded Hands by Jack Williamson, which is about robots taking those laws really too seriously, and on and on and on. And I don't think we'll see an entity like Daneel Olivah anytime soon.

But you mentioned big data and advances in machine learning. It means we'll see computers that are really, really powerful and able to navigate the world in ways, maybe, that we don't understand. And I think, as a society, what safeguards we need to put in place to handle that technology is something we really, really need to think about. We need philosophers and we need ethicists and computer scientists to think about this. And as a society as a whole, we need to think about it. And we don't have very long, I don't think, to wait. And we should be thinking about it now.

And that's why, in some ways, I would have preferred it if Apple had filmed not Foundation, but Caves of Steel and The Naked Sun instead. It might have helped kickstart that conversation.

Joel

Yeah, I would love to see, with the budget they have, what they did with Solaria, the world of Caves of Steel. But anyway, what's your reaction to the TV show? What's your verdict?

Stephen

Loved the visuals. Certain scenes that were like a Chris Foss painting come to life that was wonderful. My problem with it is I'm just not sure who the series was aimed at. There'll be people like me who think it deviated too much from the book. And I understand why the producers of a TV show might need to do that, and heaven knows, sort of the attitudes to women, for example, in the early books needed to be updated. But for me, and I know for others, something was lost in the translation. I liked the actors, I liked some of the additions to the story.

I thought they were very clever. It wasn't bad, it was just and I was thinking about this last night, and I think one of the reasons I was disappointed was that everyone in the show was all so serious and so portentous. But the story is actually quite light in parts, as it's often quite ironic, and that lightness of touch just didn't come across in the show for me. But for people who haven't read Foundation and are coming to it fresh. I can imagine it being confusing and I can say that with proof because my wife, who isn't a science fiction fan, she really didn't enjoy it.

Joel

Yeah, we're on the same page there. My wife is the same way. But I have to be honest, I'm in the rare group of people who love the books and also loved the show. When it was announced, I remember thinking that it was likely to depart significantly. They were talking about Brother Day, Brother Dawn, Brother Dusk. I don't remember any of these people. What are they talking about? And I thought, okay, so this is not going to be Foundation as I read it. And in a way I was okay with that because I knew Foundation as it was written so well that if they had done it exactly like the story line, it would have been a little too predictable for me.

I mean, I would have appreciated the visuals and everything, but one of the things that I love about Asimov is how he surprises you. He loves writing mysteries and revealing things in very stunning fashion, as we just discovered with the Mule. So they didn't do that. And they have created so many different wrinkles in the story that take it away from what we read. But that sets up a lot of surprises for me and it makes it worth watching as - I don't even really see it as - maybe it shouldn't be called Foundation. Yes, it's not really the story of Foundation.

They're using a lot of the same names and things. But it's an entertaining show for me and I'm kind of just looking at it as an entertaining TV show. And it's been exhilarating at times, especially those last couple of episodes.

Stephen

Last two episodes were easily the standout episodes for me.

Joel

Yeah, I thought it dragged a little bit in the middle, but towards the end there was a lot of setting things up, which is inevitable for a story this big, and if they really are going to go eight years with it, and I hope they succeed because that just gives so much opportunity for creativity. And I love the idea of a story set in this galaxy spanning context. It's wonderful. But let's get back to Foundation as Asimov wrote it for a moment. One of the things that struck me when I read it is how people have normal lifetimes of like eighty or so years.

And I always assume that 20,000 years in the future, if we're not uploaded and post biological and just not even human in the sense we are now. If we're human, we're going to have much longer lifespans. But Asimov decided to make lifespans pretty normal, so I wonder why he did that, if you have any thoughts on that.

Stephen

Yeah, I think it's possible. I think it's probable that biologists and doctors are going to make tremendous strides in the future. For example, those nanobots depicted in the TV shows, I suspect they'll be available within decades and they'll be able to help maintain health and delay aging. We'll have better and better gene therapies and there'll be improvements in medicine that we just haven't even imagined. In terms of the Foundation series, though, Asimov, I think, was using the future to ask questions about the past, about the forces of history, about politics, about how we should live today, and an extended human lifespan would presumably lead to very different social structures, social attitudes and so on.

So I think he was right not to introduce that idea into Foundation because it would have been a very different series of stories. It's the same with various other aspects of Foundation. So I've recently listened to your episodes on the Mule, for example, and you mentioned ayta and Toran

getting married. And in the book it's emphasized that marriage is an archaic institution, few people bother with it. But Asimov doesn't tell us what's replaced it or what institutions are in place for raising children. And he doesn't tell us because it's not relevant to understanding Seldon's plan or the two Foundations or the Empire.

But going back to your question, I think it's also worth saying that increased life expectancy that we've seen in recent years, it isn't down to an increasing lifespan basically because of the introduction of basic public health measures, reduction in infant mortality and so on. So I think increasing the human lifespan rather than life expectancy is a problem that biologists still have to solve. But yeah, I think they probably will solve it, and if they do, it'll bring its own problems. But they're problems that Asimov deliberately, I think, chose to avoid because that's not the story. It wasn't what he was interested in, in that particular series of stories.

Joel

Right, he was studying, he was taking historical events that he knew about in the past as kind of just a thought experiment, placing them in the distant future and having things play out in similar ways.

Stephen

Yeah, I think the idea of a thought experiment is a really good term and you don't want too many variables in any experiment. So I think he was deliberately keeping certain things fixed so that he could tweak others.

Joel

Yeah. Let's depart from Asimov for a moment. Considering the distant history that he created for this story, do you have any other favorites that touch on the same or take place in the same kind of world, you know, colossal context as what Asimov did with Foundation?

Stephen

So books about distant human history? It's a hard question, and if your listeners haven't read it, I can recommend The City and the Stars by Arthur Clark that gives a very different take on the future of humanity. But it's very clever. I don't know if you've read that.

Joel

I believe I have, and I want to take another look at it to see if to make sure I have but I read a lot of Clark in my youth, and so much of it is I don't remember very well.

Stephen

He's another author that I think was interested in sort of large scale questions rather than the smaller scale characterization that lots of science fiction and authors in general...

Joel

And he was interested in humans evolving into something different and things like that.

Stephen

Considering he was trained as a physicist, he had a slightly more spiritual, if you like, outlook, I think, than Asimov, but definitely City in the Stars. I could recommend A Canticle for Leibowitz, Walter Miller that looks at how history repeats itself. I think that's a haunting story.

Joel

I've got to read that.

Stephen

Did you say you hadn't?

Joel

I haven't read that yet.

Stephen

Recommended. And then there are classics. Like the Time Machine, of course. HG. Wells, and Asimov's own End of Eternity, which is a very different novel, but you could argue sets up the world of Foundation.

Joel

Ultimately I have to interrupt you for a second. I just found out that there's a Soviet version of The End of Eternity, a film that's with English subtitles that's available on YouTube, and I've been wanting to watch it, but I have not read the book yet. In fact, I've read all the robots and Foundation books but have not read the Three Empire books. And I want to read The End of Eternity before seeing this movie. And I've heard it's really interesting.

Stephen

It's very clever. It's very different to Foundation and anything like Foundation. It's a time travel novel. But ultimately, as I say, you could argue that it sets up the world that we learn about in Foundation. Won't get any spoilers, but except to say it's well worth reading. I mean, very different in style to Asimov. Hyperion, Dan Simmons. Book of the New Sun, Gene Wolf. Three Body Problem I read that relatively recently by Liu Cixin.

Joel

I heard about that. Yeah.

Stephen

If you're interested in the Fermi Paradox, he provides a quite chilling explanation for it. So Three Body Problem I can heartily recommend. There's lots I could go on for ages, so I'll shut up.

Joel

Okay. I'll just talk about some of the ones I've read that maybe you haven't read that have really been interesting to me because I've read a lot of the big three; Asimov, Clark and Heinlein when I was younger. But recently I just came across a series of a set of novels all packaged up in one book because they were fairly short novels by Robert Sheckley. And one of them was I had read in my teens and just loved it and still remembered it. It was called Mindswap. The premise is a time in the distant future when people use mind swapping as a vacation strategy and you can just switch minds with somebody on a faraway planet and experience what their life is like.

But anyway, the protagonist switches his mind with somebody on Mars and finds out that that body was already claimed by someone else, and so he has a few hours to vacate it, and that sets up just a hilarious chain of events that very imaginative. And I found that all of the novels in the book were on that same level of just brilliant and causing me to laugh riotously throughout. But a bit more serious writer that I absolutely love is Kim Stanley Robinson, and I've been fortunate to get to know him personally through the Mars Society and met him several times. The Mars trilogy he wrote is still one of my favorite books.

I just absolutely love all three of them, and I love his vision of humanity as it's expanded throughout the solar system. The very first book he wrote was called A Memory of Whiteness. And the solar system is just completely developed out, and every little moonlet has its own little - they have these what they call whitsuns that are kind of an extension of the sun that kind of gets beamed out somehow. Another one of those magical things that isn't explained very well, but it really sets up a beautiful story. And his latest book that I just read is all set here on Earth.

It's called The Ministry for the Future, and I highly recommend it because it addresses this great crisis we're marching towards with climate change.

And it turns out, even though it starts out in horrific fashion with a terrible heat wave that kills a lot of people, it ends up being fairly optimistic, and it pretty much lays out a path we could take to have a somewhat utopian future in another hundred years or so where we've gotten a hold on this. And I think there's not enough of that with things like climate change. It's just kind of assumed that it's a matter of how doomed we are.

Are we doomed in ten years or in fifty years or a hundred years? Either way, we're doomed. And he kind of turns that around and says, no, we could get back on top of this, and it's worth it to do so. I really recommend that to everyone. But I have a personal curiosity about my podcast. When I started it, I had no idea how to get listeners, and I have gotten some amazing listeners like yourself. So I'm really curious how you found it and if you have any favorite episodes from what I've done so far.

Stephen

Okay, before I answer that, I just wanted to say I agree with you, your estimation of Kim Stanley Robinson, terrific writer, and you mentioned lighthearted stories just before that with Robert Sheckley, he can - Kim Stanley Robinson can - do lighthearted as well as the serious stuff. And I can recommend Escape from Kathmandu if you want something to cheer you up.

Joel

I know about his sense of humor. I've definitely run into that many times.

Stephen

But about podcasts so I got into podcast listening only recently. Someone recommended the History of English podcast by Kevin Stroud, and it's about the history of the English language, starting right back with the proto-Indo European language of thousands of years ago.

Joel

That's a real interest of mine, too. So I want to check that one out.

Stephen

I think he's on episode 152 or something and he's still working his way up to Shakespeare. So it's a long, long series, but I heartily recommend it. It's very good. But anyway, I downloaded a podcast player to play that and while I was there, I did a search; Asimov and Foundation and Seldon Crisis came up by chance. My favorite episodes have been involving the Mule, but I have enjoyed all of them, I have to say, Joel, because they've brought the stories back to life for me in a way that the TV show, for example, didn't, so please do continue. And once you've gone through the prequels and the sequels, then there's the robot stories to cover, and End of Eternity and lots of other stuff to keep you busy.

Joel

Yeah, I'm afraid I'm going to disappoint you on that score. I would love to be able to do that, to go through all of the robot stories, because I love the robot stories, absolutely. But I just not sure I want to be in Asimov's head all my life, the rest of my life. Although it sounds like you are. It doesn't sound too terrible, right? But somebody actually on Twitter recently mentioned that they were tempted to do something like what I've done with the robot series. And I said, oh, please do it, because then I don't have to do it and I can do other things.

I actually want to write some of my own stuff. I don't know if you know, I wrote a rock opera a little while back and it's a science fiction myth kind of thing. It's really interesting idea and almost too out there for a lot of the audience. I'm thinking of getting back to it now that I've studied Asimov so well about how you write entertaining stories. I'm thinking about taking another crack at maybe writing a sequel to it or something;

Stephen

Brilliant.

Joel

So hoping to get into that - back to the Fermi Paradox for a minute. I read the first edition of your book because that was what was available at my library and I have to tell them to get the new one because I heard the new edition has seventy-five proposed solutions rather than fifty.

So I'm very curious about those twenty-five that I don't know about, although I have been looking into this through other sources. One of them is an excellent podcast called The End of the World with Josh Clark, and really well done, and he discusses the Fermi Paradox. It's the first episode he does, and then he goes on to talk about all these existential risks for humanity. But in the Fermi Paradox one, he talked about something called the "estivation hypothesis" that seems really kind of wild, but says that eventually aliens, when they get post biological and they set up all their Dyson spheres and everything, they're going to have a serious problem with waste heat, and that their ideal solution would be to set up all the Dyson spheres and Dyson swarms and everything, harvesting all the energy from all the stars, and then go to sleep, essentially, just to wait, to await for a cooler future when the universe cools down a little bit.

Because then the waste heat won't be such a problem. So the problem I see with this is that it kind of assumes that aliens think the way we do and especially when they get post biological. You would think that what drives humanity currently to expand and be constantly seeking new information is that we have a limited time to take it in. So we crave more while we have it, while we can get it. I mean, that's the way I am. I want to see all, everything in the world because there's only one chance to do it.

And if you were going to be around for a billion years, you might have a very different attitude about that. So that seems like i I'm curious what you think about that hypothesis and any others that I don't know about in the new book.

Stephen

So this is a really fast moving field. So the second edition of where is everybody? With 75 Solutions that was published in 2015, and the Estivation Hypothesis, which is an idea of Anders Sandberg and some of his colleagues at Oxford, it was out in preprint just as I was finalizing the book. So I mentioned the hypothesis, but pretty much only in passing. There is actually some debate about whether the physics of that idea stacks up, whether it's worth storing your energy for when the universe cools so that you can do more efficient computing. It's not 100% clear that that proposal works, but it does at least demonstrate that people are still thinking about this problem.

You mentioned post biological beings. I covered that. It's very difficult, as you point out, to know anything about what might happen after the so called singularity, if a singularity happens. This idea that we create robot brains that are more intelligent than us, that go on to invent intelligences, that are more intelligent than themselves and they go on and so on, you get this exponential runaway increasing intelligence. What happens after that singularity, who knows? But going back to more mundane approaches. One of the ideas I covered in the second edition is the notion that advanced civilizations, if they wanted to transmit their Encyclopedia Galactica, as Asimov called it, they'd find it energetically favorable to write it down, actually encode it physically in a small volume, and then send billions of copies of their Encyclopedia Galactica out into space.

They'd shield it to guard against cosmic rays and other degradations and then they'd send it out by probe sort of message in a bottle. And a couple

of years ago, we saw something that fit the bill. It's called Oumuamua, and it's the first visitor from interstellar space to visit the solar system. And when people first saw it, they immediately thought of Rendezvous with Rama. Now, I think Oumuamua was a natural object. There's some debate about exactly what it was, maybe a fragment of nitrogen, ice, but it does show it's worth looking for these things, these proposals.

And I think one of the really important questions in science is the role that biology plays in the universe. What sort of universe do we live in? Is Earth the only planet in the galaxy that gave rise to life? Is primitive life common but complex life rare? Or are there other intelligences out there? And if there are, have they become this sort of post biological species in some way? And the really interesting thing for me is that we will soon have some incredible new observatories that will help us in that search to finding answers. So we've got the James Webb Space Telescope - it's going to be launched soon. We've got the Vera Rubin Observatory. These are really exciting times in science.

Joel

I'm just praying the James Webb gets out there and gets set up right and they get it going and next summer. So we're going to fingers crossed.

Stephen

Everything crossed.

Joel

Yeah. Okay, before I ask my last question - no Asimovian pun intended - I swear. I just want to say that if Oumuamua was a message in a bottle, it's a crying shame we weren't ready to intercept it. In just another few decades maybe we would have had a way to intercept it and figure out what it was. So I hope that wasn't like a once in a million years kind of opportunity we just missed by just barely. So anyway, the last question. What are you working on now?

Stephen

Right now? So I'm finalizing a project, lockdown project, when I started at the start of lockdown, and it's a bit of a departure for me. It's a book called "Around the World in 80 Ways," and it's essentially a collection of eighty world maps that illustrate some topic of interest. Well, a topic I found interesting, anyway, and one that I could find data about to create the map. So it's a set of maps along with one or two page commentary. So that's been fun. And I had another lockdown project that I put on hold, and it's an exploration of the year 1956, what happened in the real world along with what happened in science fiction.

Because this was, I think, my opinion, one of the best years in the history of science fiction. So we had Asimov and Heinlein and Clark all producing great work. The science fiction magazines were still strong. There were some terrific movies; Forbidden Planet - my favorite, Invasion of the Body Snatchers, others. So I thought it would be fun to explore that time, which, looking back, seems an entirely different world. And I'd put the idea on hold. But listening to your podcast has reawakened that urge to look at some classic science fiction. So that's going to be the next project for me.

Joel

That sounds like a great project. Well, the maps one looks really interesting to me, too, because I love maps, so I'll be taking a look at both of those. And now, I know you have nine other books you've written, so I assume some of those are not for general audience. Is that right?

Stephen

My first one probably not. That was an astronomy textbook on the cosmological distance ladder, basically about distance determination in astronomy. But other than that, I think most people would be able to get something from some of those books.

Joel

Great. I'm going to be looking that up and seeing what else you've got, because I've really enjoyed reading the first edition of Where Is Everybody? I really like your writing style, very clear, and I guess you've inherited some of that from your favorite author.

Stephen

Well, I've tried. It's a hard act to follow, isn't it?

Joel

Yeah, it sure is. Yeah. I'm hoping that I don't write too much like Asimov after reading so much of them lately, but I think I have some faith that I'm not going to get anywhere close to him, so I'll have my own style. But anyway, I think we're out of time, and it's been a blast having you on the podcast, and I wish you well in all your future projects and in everything you do. Thank you very much for offering your perspective on Foundation and Asimov, as well as the amazing concepts that he and other writers have presented.

And that's going to be all, I think.

Stephen

It's been fun, Joel. I really enjoyed it. And thank you for having me on your podcast.

Joel

All right, well, to all our listeners out there, we still have one more special episode coming before we get into Season Three - Season Three of Seldon Crisis. Next up is another guest episode - two in a row with a different perspective on Foundation. I'll be speaking with TCA Achintya, a historian who studies the British Empire and happens to be another huge fan of Asimov and Foundation. We'll be getting into some of his insights into the story and its genesis in Asimov's passion for history. Happy holidays to everybody, and see you soon for "History and Foundation," here on Seldon Crisis!

[Closing theme music]