STEPHEN WEBB INTERVIEW PART THREE

Hello again, Ars Technica readers. This is the third and final installment of a three-part interview with British astronomer Stephen Webb about Fermi's paradox. Or, the bedeviling question of why we can't discern any signs of intelligent alien life in the cosmos. If you haven't yet heard part one or two, there are links to them on the page where this player's embedded, and I strongly suggest that you go back and listen to those installments before this one.

And with that - back to my conversation with Stephen Webb.

Rob Reid: I'd like to close now on the exciting stuff that's about to happen, because we are going to learn a lot of stuff that is very germane to SETI, and other things, as well. You've actually written books on the instruments that we use to gaze into the universe and the things that are coming up new, you're a profound expert in them. Would you care to go through what's happening with new instruments that are about to come online and help us understand the universe far better than we ever have before?

Stephen Webb: Well, I can, again, encourage your listeners just to keep up with what's coming because we're entering really a golden age for astronomy and cosmology. Because SETI itself, Yuri Milner, a Russian billionaire, he's giving this initiative $100 million over the next 10 years, so we'll have dedicated SETI programs just through Milner's work. In terms of multinational collaborations, we've got the European extremely large telescope going to come online-

Rob Reid: They really worked hard on the name of that, didn't they?

Stephen Webb: They're not the most imaginative people, are they?

Rob Reid: Here, we would have sold the branding rights and named it after Petco or something like that. Tell us briefly what it is, what makes it extremely large relative to other telescopes and what cool stuff it will do.

Stephen Webb: It is going to have a mirror of 39.3 meters diameter, that's absolutely huge, but it's not the only one. The giant Magellan telescope, that's a giant telescope, not extremely large, slightly smaller, that's coming online 2021. 30 Meter Telescope, that's self-explanatory. Slight holdup with that telescope in regards to its positioning, it was going to be in Hawaii, but there's a holdup. Large Synoptic Survey Telescope is coming, so that's going to be a telescope with a huge field of view and it's just going to map the skies every few nights. There's the FAST, the Five hundred meter Aperture Spherical Telescope, just come online, it's a radio telescope, in China, FAST telescope. There's the square kilometer array, another radio telescope going to come online in the next few years. These are all wonderful instruments and in the next year or two, we'll see the Webb Space Telescope, not named after me.

Rob Reid: I was about to say. Nor named after my wife who shares the last name with you and with the telescope.

Stephen Webb: It's a replacement for Hubble, essentially. Hubble had a 2.4 meter mirror, Webb's going to have a 6.5 meter mirror. Some of the questions that we've been discussing and touching on, things like Tabby's Star, things like the habitability of planets, Webb is going to be able to answer some of those questions, we hope, so we're looking for a launch at the end of 2018, maybe 2019, and it's going to be tremendously exciting, there's a lot of astronomy coming.

Rob Reid: Yeah. So, with the Webb telescope, my understanding is, they'll be able to point that thing at some of the exoplanets that have been found with Kepler, that in the habitable zone, and with Kepler, that's as much as we can determine. With the Webb telescope, we'll actually be able to pick up chemical signatures and perhaps above all, we'll be able to start looking at the atmospheres of these planets and determine, among other things, if there's an abundance of oxygen in those atmospheres. It will be immensely suggestive that there is some organic life that is creating that oxygen, correct?

Stephen Webb: That's right. You can imagine that as a planet with a thin layer of atmosphere, just goes in and out of occultation with the star. Webb, the space telescope, will be able to see what chemicals are in that atmosphere. If it's oxygen, if it's O2, then that's very, very interesting because here on Earth, oxygen is produced by life, by photosynthesis, effectively.

Rob Reid: Yeah.

Stephen Webb: If all life on Earth went extinct tomorrow, then eventually all of that oxygen would react and it would disappear from the atmosphere.

Rob Reid: It's unstable enough that it needs to be replenished, basically. It's not so abundant in the universe that we can really imagine a non-organic process that would fill a planet's atmosphere with oxygen. Even if there were one, that oxygen would be unstable enough that without refreshment from some source, and it's hard to imagine a non-organic source, it would be gone relatively quickly. Is that a fair summary?

Stephen Webb: That's right. We need a source that keeps replenishing oxygen, otherwise, you're going to get lots of rust, like on Mars or something. You need a source that replenishes the oxygen in an atmosphere and the obvious one is life.

Rob Reid: Life, yeah.

Stephen Webb: Now, it's not 100% definitive because you could imagine, I guess, of the sources, non-life sources, creating this. I can imagine that if Webb does see oxygen, there's going to be an almighty scientific argument about the significance of

this. If we find it in lots of planets, then we'll be able to start figuring out exactly what it is that's causing it. It's tremendously exciting.

Rob Reid: Yeah. It is, just to reiterate, this is a telescope that's going to be launched probably next year, and not long after it goes up there, it will be in a position to gaze at quite a number of planets that we already know are out there, looking for chemical signatures, above all, oxygen, we could see one of those chemical signatures before today's college freshman graduate.

Stephen Webb: One a personal level, I hope I'm around to see it. I'm hoping it's going to happen soon.

Rob Reid: Let's do hope that. Stephen, you have been incredibly generous with your time and with your hard-earned wisdom about this. I am going to just tell folks, it's probably obvious by now, the wild enthusiasm I have for both editions of your book. What's delightful about it beyond all that we've talked about, is when you get into Fermi's paradox, you expose yourself to so much science, you start wanting ... You need to understand, get at least a very strong layman's understanding of geophysics, you need to get a very strong layman's understanding of what goes on inside an atom, and of so many other things. What's great about your book is it imparts the necessary knowledge to really approach each of these 75 solutions. You really do expose your readers to an incredible breadth of science, and it's also a wonderful book in that you can read it in any sequence that you want. You can just browse from solution to solution to solution, including the fun ones like how long would it take to colonize the galaxy, all the way down to what goes on in a quantum experiment and why that's relevant for these things. It really is a great, robust, broad scientific education that I would recommend to any curious mind.

Stephen Webb: Well, very kind of you to say so, Rob. If I could just wrap up by making a plea, if anyone has any other ideas, please do send them in, and if there's a third edition, perhaps 100 solutions, it might well make an appearance.

Rob Reid: How can people reach you or find you on the web?

Stephen Webb: Happy to give an email address, it would be stephenxwebb@gmail.com.

Rob Reid: Thank you so very kindly. I am sure that for one reason or another we will be in touch again.

Stephen Webb: It's been a pleasure, Rob. Thank you.

OK Ars Technica listeners - just a quick context-setting interjection for you here. The first 8 episodes of my podcast - and this one was number 8 - were loosely connected to a novel that I wrote, which is also called “After On.” They were co-hosted by my friend Tom Merritt, who

some of you probably know from his decades of presenting tech news to the world on CNET, TechTV, Leo Laporte's family of online shows, and now through his very own Daily Tech News Show. At the end of those early episodes, Tom and I would discuss how the day's subject ties to the novel - and Fermi's paradox indeed figures into After On's storyline. We'd also talk about the interview itself, as a freestanding discussion point.

For this serialization on Ars, I've cut out the first part of this wrap-up conversation, so we'll now join it already in progress. There are a still a couple passing mentions of the novel, but they're not spoilers, and you won't get lost in the conversation if you haven't read it.

Tom Merritt: All right, let's finish with your interview with Stephen Webb and specifically, Fermi's paradox, a fascinating question.

Rob Reid: It really is and attempting to answer it turns over so many stones in both science and philosophy, that it's my favorite unanswerable question to ponder.

Tom Merritt: Yet, we know Stephen Webb's answer from your interview is that we're alone. What's your answer to it?

Rob Reid: Well, I've been thinking about this nonstop since this morning when I told you we should both have an answer ready for this episode. Now, if you had asked me during one of the decades that preceded this morning, I would have said that I agreed with Frank Drake, that many intelligent civilizations are out there, only they haven't gotten around to visiting us yet for a diversity of reasons. I only would have said that with about 60% confidence because I devoured that book, Rare Earth, that Stephen and I discussed in the interview, and it makes a very strong case that the Earth may be merely unique in its life bearing potentially, but still, despite being attuned to those arguments, I retained that 60-ish percent confidence that we weren't alone. Because given the immensity of time and space, that life's had to emerge. Presuming we're the galaxy's only intelligence just always seemed, I don't know, pre-Galilean in its narcissism, like saying the universe revolves around the Earth as human used to think.

Rob Reid: Then my interview with Stephen, who is clearly in no way narcissistic and is incredibly sophisticated about these issues, that conversation really challenged my thinking, especially that concept of cultural homogeneity, the idea that, sure, any one alien civilization may choose not to visit or even any dozen civilizations, but to explain the great silence, all existing alien cultures have to unanimously operate under some kind of prime directive that says, "Thou shalt not interfere with primitive civilizations." What are the odds? That's not the only possible policy that a species could adopt and it's not the only moral policy that a species could adopt.

Rob Reid: You could argue that it's morally proper to allow us our independence, but you could also say there's a moral imperative to step in and save us from our primitive, stupid ways. So will 10,000 utterly different alien cultures all

independently come to this conclusion? We can't even get all human cultures to agree to anything that's morally debatable, or all American subcultures, or all New York City subcultures, or even a hundredth of the people in my neighborhood of Chelsea. So, that was the first big challenge my thinking faced in the immediate wake of my interview with Stephen, but my gut sense did hold firm. Maybe I'm just constitutionally incapable of inhabiting an alien-free galaxy as a science fiction writer, but I just can't accept that this vast sweep of time and space would remain lifeless when life sprung up rapidly and spontaneously here on Earth.

Rob Reid: So, after wrestling with all of this, in the unique context of having spent almost three years writing After On, I ultimately borrowed a concept from Super AI theory that to me satisfactorily explains the Fermi's paradox, both logically and on a gut level. It is decisive strategic advantage, that term that was used multiple times in the book by Agent Brock Hogan and others. Just as logic dictates that the first super AI to rise up will establish permanent hegemony over the Earth and never allow a future AI to overthrow it or its way of doing things, because it'll always have a huge and compounding technological lead, I believe the first intelligent civilization to permeate the galaxy will have or will have had the same sort of built-in lead over any upstart civilization that comes along, or came along if it were in the past, later. This will allow it to impose its values on the newbies that arise a million or a billion years hence. Those values will have allowed the first galactic civilization, which to be clear, I think rose up far in the past, to survive its own nuclear adolescence, and its synthetic biology post-adolescence, and its nano tech post-post-adolescence, without destroying itself in war.

Rob Reid: It makes sense that it would have a live and let live philosophy. Therefore, I wouldn't be shocked if that galactic philosophy decreed or decided that primitive species should not be interfered with, visited, abducted, probed, et cetera. If a second, or third, or 10,000th civilization, a more juvenile civilization, a less advanced one, came along with different ideas, they'd basically be told, "No, we're way more ancient than you, therefore, we're way more powerful than you, and we were here first and this is the way we do things in this galaxy."

Rob Reid: So, you wouldn't need thousands of civilizations to all independently decide to leave us and others like us alone, you would just need one civilization deciding that, the first one.

Tom Merritt: Would that civilization happen to have a sincere respect for local laws like, I don't know, copyright laws?

Rob Reid: It might.

Tom Merritt: Because this is reminding me of a book I once read, by an author named Rob Reid, called Year Zero.

Rob Reid: Yeah. It is a state of equilibrium that came to prevail in my last novel, Year Zero. Which may sound like a spoiler, but that's actually laid out in the first three pages, so it's not really a spoiler. Although, I should point out that when I was writing Year Zero, I was not thinking of solving Fermi's paradox, but now that I am, I do believe that something like that, probably without the musical comedy elements, did in fact happen, someone permeated the galaxy first, probably a long, long time ago, and they decided for unknowable reasons to allow folks like us to stay in our incubators. To create our own great art, uncontaminated by more advanced species, to come to our own moral conclusions about life, and they're out there. Given their inevitable level of advancement, they're probably quite aware of us and they've probably been joined by, who knows, maybe 10,000 other civilizations down the eons, each of which was politely informed that you can either get on the train or under the train, this is the way we do things, we don't colonize, we don't interfere. If you don't like it, we'll destroy you with our death rays.

Rob Reid: Perhaps, at some point, if we come to a certain level of advancement, they'll reveal themselves to us and finally pay up for all the pop songs they've been pirating from us.

Tom Merritt: All right.

Rob Reid: Now, Tom-

Tom Merritt: Yes.

Rob Reid: ... how do you answer Fermi's paradox? Where is everybody?

Tom Merritt: The first thing that I thought when I was listening to the interview was that we've got 100 billion stars in the Milky Way, and if there's only 10,000 possible civilizations, not all of them are going to be happening at the same time, not all of them will have the technology to broadcast, some will have moved past broadcast, and many of them just won't have any interest. It should not be surprising that we haven't heard because the distances are vast and it's hard enough to pick up a radio station sometimes, much less broadcast one across the universe. I think what you touched on in the interview about civilizations deciding, "We shouldn't broadcast," is probably fairly likely, as well.

Tom Merritt: However, overall, I think that's only a part of it. I think what explains paradoxes a lot of times, if you look back in history, is that we thought there was one answer, when there are multiples. I think the fact that maybe an Earth, which is in fact kind of a double planet in a habitable zone, with just enough water dumped on it, with whatever process cleared out the asteroid belt for us, is rarer than we're estimating in Drake's equation. So, while there are other civilizations, there may only be one per galaxy, in which case it's much more difficult for them to communicate.

Tom Merritt: I land on the idea that we're not alone, that we'll probably determine, as we learn more, that the ability of life to evolve is rarer than we think, and that intelligent life, therefore, is even rarer and more widespread, making it difficult and possibly impossible for us to detect each other, unless we become incredibly advanced, and I think I'm going to give it a 50/50 chance that we're the first. That one of the reasons we don't see any other evidence of anybody else is that we're leading the pack. It's almost the anthropic principle of, we're the first ones to climb up out of the muck, we're the first ones to survive the asteroid hitting the Earth long enough to develop a civilization and possibly get off the rock, and there will be others behind us, but we will be that civilization who ends up deciding what the rules of civilization in the galaxy might be.

Rob Reid: Got to be someone. By the way, this very exchange of views demonstrates why Fermi's paradox is such a delight, because the superstructure of concepts, of science, of complex definitions, of philosophy, of reasoning, that you need to generate an answer, but also to process an answer. For me to hear and understand your solution, and for your solution to start triggering questions in my mind, and vice versa, this question of Fermi's, this domain of thought that surrounds it, it just gives so abundantly. The deeper you get into it, the more you need to understand about how the universe works, and the deeper you need to think, and that's just a really delightful rabbit hole.

Tom Merritt: It's one of the few examples we have of what the Greeks had as philosophers, before so much was known about anatomy, and physics, and medicine, they got to suspect things because they didn't know.

Rob Reid: Yeah. That is a really powerful analogy, you're dead right. This is what the Greeks encountered when they thought about anything, from thunder on down, that's cool, it's a really, really cool thought. We don't have a lot of those domains left.

Tom Merritt: No, we don't. In fact, one of the others, of the few others, is that anthropic coincidence-

Rob Reid: Yes.

Tom Merritt: ... that you talked about. Do you have your preferred solution to that?

Rob Reid: This is one that fascinates me almost as much as Fermi's paradox. It's less of a rich domain because the solution space is narrower, because if Lee Smolin's numbers are right and if the odds against the various parameters being set just so is in the 10 to the 200 and something power range, I only see three answers. One is a complete cop-out, and that's the one that says, "Holy cow, we're lucky." That's luck on the scale of winning the Powerball lottery 90,000 days in a row and invoking that degree of luck feels like abdicating the question entirely.

Rob Reid: So that leaves two possibilities. One is that someone set the dials deliberately. Now, does that mean it's a bearded God who lives on a mountain and throws lightening bolts down when it's mad? No, it could mean anything. It could point to a simulation because someone setting up a simulation would want it to be interesting, so of course they made a life-bearing universe.

Tom Merritt: Thankfully, we live in a simulation that someone wants to win.

Rob Reid: Yes, exactly, or they want their ant farm to do interesting things.

Tom Merritt: Right, right.

Rob Reid: That doesn't necessarily mean it's awesome to be an ant on that farm, it just means the farm will be interesting to the kid who owns it. Anyway, door number two is Lee Smolin's solution, he is a very well-known and well-regarded high energy physicist. His solution is to say that there are so many parallel universes out there that by the sheer weight of numbers, our life-bearing universe is mundanely numerous, despite paradoxically being incredibly rare.

Rob Reid: Now, the problem with the first solution is that it involves invoking a domain, that of the creator, which by definition cannot be accessed or detected by us, because that creator is a huge level up from us, both in levels of reality and in technological prowess. Anything smart enough to create an entire universe or a convincing simulation of one, will surely be smart enough to hide its tracks from knuckleheads like us. Again, it feels like a cop-out, you have to invoke something which by definition can't be detected.

Rob Reid: However, the last remaining alternative is to invoke not one, but 10 to the 500th somethings, which each, by definition, cannot be access or detected, because that's what a parallel universe is, by definition, inaccessible and undetectable, at least with present-day technology, and with any imaginable near or intermediate future technology.

Rob Reid: So, we're stuck, our answer has to stand upon one intellectually offensive thing or 10 to the 500th intellectually offensive things. This is where I go to Occam's razor, the principle that when faced with an intractable problem, the simpler competing theory should be preferred to the more complex one. Though I'm no mathematician, I'm pretty sure one is a smaller number than 10 to the 500th, so I do reserve the right to change my mind as soon as 10 minutes from now, but for now, I feel that we're not the most brilliant entities in the universe and there is a far, far higher power that has a lot to do with us being here, either directly or indirectly.

Rob Reid: How about you? How do you answer this one?

Tom Merritt: Well, I'm going to come down on the other side and not just because you came down on that side, but I actually think that the only reason infinity seems more complex is because our brains like finite things.

Rob Reid: Yep.

Tom Merritt: If you think about it, infinity is the more natural state. Having an end to something is actually impossible to imagine, as well. We prefer, as humans, finite states, but we also always know, "Okay, but what's after that?" It's impossible to conjure an end to something without saying, "Okay, but what's on the other side of the end?" Whether it's space or something else. We think of the universe as infinite in its ability to expand, I think it's perfectly natural that there would be an infinite number of universes, which then makes it simply natural that one of them would have all of the constants in the right place for us to exist.

Rob Reid: That is something that makes mathematical sense. It's definitely something that humanity's two greatest living scientists, Rick and Morty, have explored.

Tom Merritt: Yeah.

Rob Reid: To the great delight of millions.

Tom Merritt: Read your Rick and Morty, people, it's important.

Rob Reid: Yes, by all means.

Rob Reid: Well, these are two very Greco-Roman questions and I'm delighted you came up with that analogy, because people in that era really did approach a lot of scientific questions armed with little more than logic and reasoning. While I certainly wouldn't trade the tools and the fact base that we have today for that, exploring a question on which there's complete scientific uncertainty with nothing more than those raw tools, is a hell of a workout for the brain.

END INTERVIEW ELEMENT OF PART THREE

So Ars Technica listeners - here we conclude the third and final installment of my interview with Stephen Webb. And also, my conversation with Tom Merritt. I do hope you enjoyed it .

If you're curious about the latest episode in main After On podcast feed – this week it's an especially fascinating conversation, which I think will really resonate with Ars Technica readers. It's an interview with a chemist and DNA architect named Floyd Romesberg.

If you have any recollection of your high school biology, you probably know that DNA is written in an alphabet of just four letters. Well, Floyd has added two new entirely artificial letters to that ancient alphabet. The science is amazing, the ramifications could be astounding – and on

top of that, it’s just a great conversation. To hear it, head on over to After-On.com, or search for After On in your favorite podcast software.

And/or - join me here again on Ars next week. When we’ll be serializing another episode from my podcast’s recent archives.