Transcript for Neil deGrasse Tyson | Astrophysics for People in a Hurry (Episode 617)
Full show notes found here: https://theartofcharm.com/617/

NEIL: If you're going to assert what we don't know is what matters for your wonderment and now you worry that we discover what the wonder is and then somehow it's gone, know there's -- as the area of your knowledge grows, so too does the perimeter of your ignorance.

JORDAN: Welcome to The Art of Charm, I'm Jordan Harbinger. Today, man, today -- super exciting. We're talking with Neil deGrasse Tyson. How do you even introduce somebody of this magnitude, with this amount of gravity? See what I did there? He's one of America's most beloved science personalities, kind of a cross between Mr. Rogers and Carl Sagan. Just an amazing, amazing guy. Super brilliant, one of the major influences on Science Today. Certainly in the zeitgeist of everyone's mind when we're talking about exoplanets and black holes and the solar system and Pluto being a planet. I mean it's not even just that. This is science, this is education, this is how politics relates to science in education. Today we talk about all of these things, finding your calling so young, getting obsessed with astronomy, finding mentors, cognitive bias, focus, science, education, I don't even know where to begin with this one. This is such an interesting episode. So much fun. Everything from dark matter to keeping a child-like curiosity in science. This has just been such a great pleasure so I cannot wait to introduce you here to Doctor Neil deGrasse Tyson.

And, if you're new to the show, we'd love to send you some top episodes and the AoC Toolbox. That's where we study the science of people and discuss concepts like reading body language, having charismatic nonverbal communication, the science of attraction, negotiation techniques, social engineering, networking and influence strategies, persuasion tactics, and everything else we teach here at The Art of Charm. Check that out at theartofcharm.com/toolbox or in the iPhone or Android app at theartofcharm.com/iphone or /android. Also at theartofcharm.com you can find the full show notes for this

and all previous episodes of the show. Whether this is your first or 500th episode of AoC, we're always glad to have you here with us. Now, let's hear from Doctor Neil deGrasse Tyson.
I did like the book. It's a well-written sampler platter of astrophysics. If you've ever heard of exoplanets or black hole stuff and you think, "Yeah that's a space thing," but you know nothing else about it, I thought this was a really good place to start. And like you said, for people in a hurry and you can plough through that thing instead of being really nervous about the wedding you have in five hours, which is what I -- that's what I used it for.

NEIL: Uh-huh.

JORDAN: It's a great way to look at how small you are in the universe. I got married on Saturday, huge significant event in my life. The whole existence of the entire planet of Earth is, in the scheme of the whole universe, not significant really whatsoever. And that was a cool realization to have right before going, "What if I fall? What if I forget this thing or what if I stumble over word?" and whenever you think of that you just go --

NEIL: It benchmarks it all.

JORDAN: It benchmarks it all. People [00:02:54] beings in other galaxies, don't give a rat's ass if you stumble over your word -- wedding vows. It's like watching two amoeba get married or something like that. How do you keep childlike curiosity when you're a scientist and you know a bunch of things and you studied a bunch of things and you're in a planetarium teaching a bunch of things? How do you not let things get in the way?

NEIL: Oh, so no, you don't have to maintain it, you just have to make sure nothing interferes with it, which is different from having to actively maintain something. So, if you have something that's always at risk of evaporating away or fading, then you've got to pump it but I don't have to pump my curiosity. I've had it since childhood. It's the same curiosity you have as a kid but I just have it as an adult. And I think all scientists have it as

adults. It may be the only way you can be a scientist, when everything is curios to you. You say, “Oh, what’s that? Oh, I wonder how that works.” You know, almost distractingly curious. So yeah, it’s there, I just make sure that things don’t get in the way of it.

JORDAN: Sure, I’m curious all the time but I put in the things that I learned about something yesterday and just go and steamroll the learning process with bias.

NEIL: Yeah well bias is an interesting force. You can’t expect to live life without bias but you can live life self-aware of it or self-aware of the risk of it. Often bias -- you don’t even know you’re biased in a moment that you’re being biased. So, you would at least have the self-awareness that you can be biased and then at another time in another mindset, you’ll know to bring someone else into the equation and to assess how effective you were being unbiased if that’s necessary for the thought that you’re having.

JORDAN: Sure like a scientific experiment, the double blind thing, ideally keeps out as much bias as possible.

NEIL: Exactly and so not only that, there’s the -- the fact that someone else does the experiment who might have a different bias from you, but if they get the same result, then it means you’ve transcended the bias.

JORDAN: Right, especially if they’re trying to prove you wrong and they still get your results.

NEIL: Exactly, exactly.

JORDAN: That’s got to be a little disheartening if you’re a scientist and you’re thinking, “I’m going to prove this guy is full of it,” --

NEIL: Right.

JORDAN: -- and you keep doing it, and you're bashing your head against the wall --

NEIL: And you just make the results even better.

JORDAN: Right.

NEIL: Yeah.

JORDAN: You're making it more accurate.

NEIL: One if the problems in science today is there's not much reward for verifying someone else's results.

JORDAN: Sure.

NEIL: So, the person who gets the results first will get the Nobel Prize. The person who verifies it, enabling the rest of us to believe the first result, essentially gets nothing.

JORDAN: Gets fired for not discovering something.

NEIL: We would benefit from a shift in the culture in the peer-reviewed scientific publishing universe but it's still the best thing we've got going in terms of how you would decode what is and is not true in the world.

JORDAN: Thankfully people are still stumbling into correct results, whether or not they want to find them or not, I suppose. People who fund those things might be less crazy about that but the people who are running it at least are doing good -- still doing science.

NEIL: Right, right.

JORDAN: It's still science even if you get the result that you don't want.

NEIL: It's still science, well provided the experiment is properly defined.

JORDAN: Right.

NEIL: Yeah.

JORDAN: Sure.

NEIL: Yeah.

JORDAN: You found your calling really young, when you were really, really young. When I went to school, I was one of those kids who went, “Is there a book full of majors? Because I was told I have to pick one of these,” and I’m flipping through the book and eventually, luckily enough, I made my own concentration out of different subject areas. Very few people do that because it’s a huge pain. But that was dodging a bullet of just deciding on business or something else because it sounds good. Do you find that finding your calling really young is an advantage that has shaped your career path?

NEIL: I took it for granted that I had that interest very young and did not realize how odd that was until college. And just like you said, I’m there in college and half the people are still thumbing the course catalogue. I could have told them, you know, astrophysics is early in the alphabet -- you could go to that.

JORDAN: Yeah.

NEIL: You could hit that pretty early. Only then did I look back and deeply value the fact that I could align my life’s pistons early on so that they’re all firing together. And I guess with emergent electric cars the piston analogy will rapidly --

JORDAN: Right.

NEIL: -- go extinct. So, align my electrical currents --

JORDAN: Right.

NEIL: -- so that every decision I make can be in the service of that mission statement.

JORDAN: You were giving lectures on this stuff when you were what, 15 years old?

NEIL: My first public lecture, yeah.

JORDAN: I mean that's bananas I think --

NEIL: I was 15.

JORDAN: -- most people in their subject area, they give a talk when they're 35 and they go, "Okay I've got to learn how to do this."

NEIL: Oh, it wasn't that I had to learn how to do anything, I was simply talking about what I loved. So, if you love something so deeply and you know a lot about it and someone says, "Tell me about it," are you nervous? No you'll just start talking. So now, it's like, "Tell me about it," except there's 50 people in the room or 100 people in the room. So that didn't make any functional difference to me, sharing it with one individual or a room full of people. The difference was when I gave it to the room full of people, they actually paid me.

JORDAN: Right, you get a check at the end and they clapped instead of [00:08:05]

NEIL: Yeah I was like -- and I did it without expecting that. They were candid and said, "Look this is what we would pay other speakers and," -- I mean the subtext was, "You're only 15. We probably could have gotten away with not paying you at all but we're going to pay you because that's what we pay all our people." It might not have been more than $50 or something, but it felt like an infinite amount of money at the time.

JORDAN: Somebody just gave you enough money to buy pretty much everything you could wrap head around.

NEIL: And all I did was talk about what I loved.

JORDAN: Yeah, not bad.

NEIL: I felt really cheap. Like, no the world should not be configured this way. Did I sweat, did I bleed, did I -- no, it was just an outing. And then I realized that society values knowledge.

JORDAN: Yeah, some parts of it anyway.

NEIL: Some parts.

(laugh)

JORDAN: Looking through the course book, thumbing through trying to find a major, if you're trying to help people save time and work by suggesting that they select astrophysics, I think it might -- that recommendation could be a little bit off. But what do you recommend for people who email, tweet at you? I assume you get this all the time. "What should I do with my life?" That's got to be a tough one.

NEIL: What typically happens is, it's not so blunt as that. It's a more common example, not necessarily in detail but broadly -- is that someone made a career in a subject that their parents wanted them to go into. They took over the family business, the parents are doctors, the became a doctor, the parents didn't become doctors but wanted to become doctors, so they wanted their kids to become doctors, so they're establishing a career based on forces that they did not control. For that category of person, they reach a point where they realized they're not fulfilled because they're not doing what they love.

JORDAN: Sure.

NEIL: And then I get the phone call.

JORDAN: Right.

NEIL: Because they like the science they read about. And typically people have a very different range of mathematical background. So, nonetheless, there's many places and ways you can plug into this moving frontier. Of course if you have math ability, you know, the sky's the limit. But if you don't, there are artists who reach for the universe as their creative muse. There are attorneys who are trying to create a new frontier of space law. Who owns this patch of land on the moon if you get there first? Do you get to homestead it? Who owns the mineral rights to the asteroid that you paid a mission to go visit. And so, I think, almost no matter your mathematical ability, there are places you can plug in that still have tremendous value, provided you love what you do.

JORDAN: I used to be an attorney as well. And in part -- it's funny you should mention math ability. One of the things I triple checked on before going to law school was how much math is involved in this particular course of study and they said, "Oh, virtually none," and I said, "Great, I'm in." Not really the only decision factor you want to look at when choosing your career of course, math ability. But when looking at science and things like that.

NEIL: It matters but there's something that's not widely embraced but should be is he get in a math class and they already have some established interest somewhere else, and they'll recite the following phrase, "I will never need to know this for the rest of my life."

JORDAN: Right.

NEIL: "Why am I slogging over it now?" And I think that's the wrong outlook because that ignores what hoops the brain goes through just to solve a problem. The statement would be true if learning was, "I will learn all the things I need to know to do things I will one day need to do." But, that's really not what learning should be because that ossifies you into whatever was the -- were the hot topics at the time you were in school. A more powerful posture would be having had your brain trained for thought and analysis and processing information. And then,

if there's a new thing you've never seen before, you will just attack it with vigor -- attack it in a good way -- because it's an unsolved problem and you can't get enough unsolved problems.

JORDAN: I feel like that's what happened to you in college as well. It looks like, by your own account, you didn't maybe spend as much time in the research lab as you would have needed to because you had some dance and some rowing and some wrestling --

NEIL: Well, no that would have been in graduate school [00:12:13]

JORDAN: Graduate school.

NEIL: Yeah and undergraduate, my load outside of classwork was not atypical --

JORDAN: I gotcha.

NEIL: -- of others who lived down the hall from me in the dorm. But, graduate school, yeah, I spent a lot of time. I mean how much of my time? Maybe a fourth. In retrospect, I clearly shouldn't have. I should have spent all that time in the lap but I could say at the end of it all that I have a certain enrichment of thought and of creativity that I don't know that I would have obtained any other way. I started writing with fountain pens back then. I just like fountain pens. I like the way they feel, I like good ones, ones that have an interesting nib, where they can leave an interesting line on the page. If you just have a fountain pen that leaves the same line in every direction, just -- might as well use a ballpoint. But look at the flourish and the expressive elements of communication that went on in the era of the handwritten letter. In the era of the handwritten letter and handwritten correspondence in general, the words would be written with the flavor of the meaning you're trying to convey and it would influence the flourish or how big the first letter is or the curlicues underneath it. And so it was a dimension of communicating that went beyond the simple definition of the words you were writing. Now all that went away with the

typewriter because every word now comes out identical on the page.

JORDAN: Same font, same size.

NEIL: Yeah, exactly. And then more of that went away in the era of texting where big words are just abbreviated into letters. See you tomorrow is the letter 'c,' the numeral '2.' Evidence that pure texting is completely inadequate to communicate, is the flux of emojis that have come down --

JORDAN: Right.

NEIL: So instead of writing how you feel, you just put a picture of how you feel. That is, like, the supreme height of illiteracy where you put pictures of --

JORDAN: Hieroglyphics again.

NEIL: Is it Pictionary? I mean what is this? Right, it's back to hieroglyphics again. I use fountain pens as a way to commune with the past. That interested started while I was in graduate school. And so I had some pens and I bought ink and I would practice penmanship. Back in the day you had these big computer pages that came out of the big printers and so it was huge real estate --

JORDAN: Dots you've got to rip off on the sides?

NEIL: Yeah, yeah, yeah, yeah. The perforated holes, yeah.

JORDAN: Yeah, perforated, yeah.

NEIL: Their dots.

JORDAN: Yeah you've got to fold it and then you rip the sides off.

NEIL: Yeah, yeah, yeah. [00:14:51] and so my point of saying this is in my adult life, I have found that, now that I've written books,

people are vastly more appreciative when I sign it with one of my fountain pens because it has interesting form to it that the pen brings to the signature in ways that no Sharpie ever could.

JORDAN: Is that what you've got in your pocket right there?

NEIL: Oh, yeah.

JORDAN: Because all I've got is a Sharpie. All right well then, not going to need this thing.

NEIL: You dare put a Sharpie in front of me?

JORDAN: Fling it over my shoulders and speaking of emoji, I'm feeling pretty smiley face with glasses and buck teeth right now.

NEIL: Oh, uh-huh.

JORDAN: So that's a good sign. It's a good interview. There and smiley face with hearts on it, in the eyes -- instead of eyes. You're career started off -- well, I should tell you before that -- with your doctoral dissertation committee getting dissolved from the University of Texas.

NEIL: Yeah.

JORDAN: That's got to be kind of scary, right? Because, you're in the process of completing this childhood dream, you're -- even before when you were 15 you were giving lectures on this stuff and now they're kind of like, "Hey, you know, sports medicine is a burgeoning area you might want to look at." I mean how did that affect you at that time?

NEIL: Well, I don't think they had any clue of the depth of my interest in the subject -- the depth and breadth. So, to say, "Oh, we're going to dissolve your committee, now what are you going to do?" thinking that I'll just do something else, as though going to graduate school was some lark -- decision made on a lark. So, no I persisted and so I knocked on doors and called people I knew, asked if they would admit me. I'd take whatever tasks

were necessary. So they transferred my graduate program to Columbia University from the University of Texas after the committee was dissolved. And so, there a year delay in there because they wanted me to take the general exam, which is what you take after you finish coursework. But once you know material, I mean, you're becoming an expert in a field and a world's expert in a sub part of that same field so the idea that somehow taking an exam would be arduous, that's a foreign concept. We're academics, this is what we do. Not only that, the idea that I would lose years having put into graduate school, and sort of re jump start that exercise, also sounds a bit harrowing but -- no, because what you do in graduate school, is exactly what you do when you get your PHD and beyond. You just get paid less. It's not, "Oh, now I have to slog through another thesis and another thing," and, it's like, that's what science is -- posing a problem, researching it, writing it up, publishing it. So, it was lost professional standing and it was lost income but it wasn't lost ambition.

JORDAN: Right. Yeah that makes sense. In the close-up version of that story, it probably looks a lot like you fell off the tracks. Obviously now you come back to become a legend in the game which is pretty cool. Not everybody does that but the fact is they can't really remove your interest from that. They can tell you, "Well, you know, we're not going to do this anymore because you're doing too much Latin ballroom," or whatever wrestling or whatever the deal was.

NEIL: Uh-huh. Both, yeah.

JORDAN: Both. But they can't stop you from going through it. In macro picture -- big picture, do you feel like that even was anything more than a hurdle or a speed bump or maybe not even that?

NEIL: It was a huge hurdle because I had to leave Texas and I was living in my parents' basement. My wife, who I met in Texas, got her PHD in mathematical physics from the University of Texas at Austin. She moved with me to New York. By the way, she's from Alaska, so this was huge shift for her. She moved with me

to New York -- this is when we were just still dating. Then, while I was living in my parents' basement, I proposed to her.

JORDAN: Oh, wow.

NEIL: And she said yes. And so, I don't think you can get more pure than that.

JORDAN: No. Especially if she wasn't sure what's going to happen. I mean, was there ever a time when you were thinking, "This might not work out"? Especially if you get that letter, "Hey we're dissolving your dissertation committee."

NEIL: It's possible but, again, I had a huge fuel tank of energy to pursue these interests. It was not anywhere near empty. It was lower, maybe ¼ full, but a car that has ¼ a tank of gas can actually go faster than a car that has a ½ a tank of gas.

JORDAN: Oh, that's a good point. Hadn't thought about that.

NEIL: Yeah.

JORDAN: Because of the weight factor.

NEIL: The weight factor.

JORDAN: Huh.

NEIL: So, you just have to -- need enough to feed the cylinders and you're good to go.

JORDAN: Well, speaking of fuel, I've read and heard you say this a lot. "We can't make America great again until we make America smart again."

NEIL: Right.

JORDAN: What dat mean?

NEIL: You need to make wise decisions.

JORDAN: Mm-hmm.

NEIL: And I recently wrote in Op-Ed -- it's posted on my Facebook page if anybody cares. It has the same title as that video that got so much distribution just before the science march. It's the same title for both and it's called Science in America. But the Op-Ed gets to flush out, in sort of written detail, what that means. There's a section of the Op-Ed, it's about 1,000 words, where I just go president by president, from Abe Lincoln fast forwarding to the 20th century and just moving forward, and identifying which president was responsible for creating which well-known agency that is responsible for thinking about science. So that would include The National Institutes of Health, The National Academy of Sciences, The Center for Disease Control, The National Science Foundation, NASA, The Environmental Protection Agency, The National Oceanic and Atmospheric Administration -- NOAA. You just track this over the past 140 years and it just bounces back and forth across the aisle.

Truman puts in The National Science Foundation and that becomes law in 1950 although it was proposed a few years earlier and he is democrat. He was of course the vice president to Franklin Roosevelt. Then Eisenhower, a Republican, puts in NASA in 1958. Of course Kennedy, a Democrat, sends us to the moon -- 1970, we have the Environmental Protection Agency put into place by Nixon, a Republican. That same year, NOAA, signed by Nixon, a Republican. In the 1990s, there are major investments in bringing the Internet from an obscure thing that scientists use to a household product and these were investments in the Clinton administration.

So, you just look at this and it's clear that enlightened leadership knows and understands and values what role science and technology can play in our health and our wealth. Especially our wealth but also our security. So to enter an era where people are standing in denial of science, in denial of

what is true, established by science, which is the most reliable path we have every invented between ignorance and truth, is a recipe for the complete dismantling of all that I grew up in here in this country.

JORDAN: It's really terrifying to see this, even -- I'm 37, I'm not that old but I've seen from when I was younger, there was very little dissent on a lot of obvious scientific truths and people were in agreement under that and of course there's criticism. "Well you just didn't hear the dissent," and this, and that, and the other thing. And, "Why would the thinking be better back then in one way but not the other?"

NEIL: Well, so just to be clear, right now people can dissent and have it distributed world-wide via the Internet. Before the Internet, you could dissent but no one would care and no one would print your thoughts. So, maybe there was just as many people who would have dissented if they had the mouthpiece to do so. But of course, they didn't have their mouthpiece to do so. And that's what's critical here. So we now live in an age where you can have an idea that has no foundation in any reality, no foundation in nature, and you can create a website, and I have the same no foundation thought as you have, and I'll search my no foundation thought, and I'll find every other person in the world who thinks exactly the way I do, giving the illusion of affirmation of an idea that in a previous generation would have never seen the light of day. So, in a free country where -- at least we tell ourselves we live in a free country. Freedom of thought and of speech. I actually don't care what you believe. That's why you don't see me chasing people down, knocking on their door. I care, as should everyone, if someone says, "I think the earth is flat." "Okay, let's find a job for you that doesn't depend on the earth being round."

JORDAN: It's funny you should bring that up.

NEIL: Plenty of jobs for you.

JORDAN: Yeah.

NEIL: I'm sure we can find a job. And that way you can think what you want in this free country of ours.

(COMMERCIAL BREAK)

JORDAN: I had Shaq on the show a few weeks ago and he came out on this show and said, "Oh, I was just kidding about that," and it made all these news outlets and things like that. And I thought, "Well, it's funny but it's more dangerous than people think because it's still getting quoted everywhere." And of course when he came on Art of Charm and said. "The earth isn't really flat, I was just joking," I got hundreds of emails from people that went, "Boy you know why he had to say that, right? Because the Freemasons made him do this and now it's all this." Once you put that out there, you can't put the toothpaste back in the tube when you're an influencer. It's impossible.

NEIL: I just don't know why anyone cares what shape Shaq thinks Earth is. I don't know why that's news.

JORDAN: Just because he's Shaq. I'm sure that's why.

NEIL: I mean, well, except that he has a PHD --

JORDAN: Oh, true.

NEIL: -- in business management, so he's Doctor O'Neal. And you would think that if you have a PHD in anything, that you are a learned person in ways more than, sort of, the average other person. It might include being able to figure stuff out and -- but he said he was kidding, so okay, fine. So, I just don't see why people care.

JORDAN: I think people like to laugh at slash with a concept like that.

NEIL: It's new -- if he says something that is false, that can influence some agency he has power over --

JORDAN: Then it’s a problem.

NEIL: -- then it’s a problem. Then you’re building a house of cards. You might get two layers high, looks solid, with the third layer -- that’s all she wrote.

JORDAN: That’s all she wrote.

NEIL: Yeah, yeah, yeah.

JORDAN: Game over.

NEIL: Game over, mm-hmm.

JORDAN: Well we see a lot of really cool science activism and awareness shows like Nova specials, Cosmos, Bill Nye's new show on Netflix which looks really good, I haven’t been able to crack into that yet. And they do a great job of -- so far, of explaining the importance of scientific literacy to the masses, right. Like you mentioned earlier, we live in this era that’s just dominated by the Internet, social media, and a lot of that separates people, creates those little microcosms like you said --

NEIL: Bubbles.

JORDAN: The majority illusion, the bubble that breeds scientific illiteracy. When I watch science shows --

NEIL: It breeds much more than that. It breeds not just science illiteracy, it breeds dogma. So you have a point of view that you are sure is correct and you never see a critique of your thoughts because your search engine never takes you there. And even if you did, you would staunchly defend your thoughts because it’s in a deeply held principle within you. It could be a bit of religious philosophy, political philosophy, cultural philosophy, each of which, if taken strongly, you can create a bubble that’s impervious to criticism. Then you ossify in place.

JORDAN: This is a huge problem especially for maybe younger people that grew up digital natives, if you want to call it that.

NEIL: Yeah so what they've got to do -- so, what we're missing is -- okay now that we have this Internet, and there's such susceptibility to it -- by the way if you hear kids in school talk the teachers say, "Never trust anything you see on the Internet." By the way, that is equally as intellectually lazy as trusting everything you see on the Internet. What we need is not telling people, "Don't trust anything on the Internet," we need in the kindergarten through 12 curriculum, somewhere in there, multiple times taught, how to process information and evaluate the likelihood of it being true. And that has huge value in these modern times and it's just simply not taught.

JORDAN: It's really hard to teach that. Which is one reason.

NEIL: That's why.

JORDAN: It's tough.

NEIL: Yes it's hard but so what?

JORDAN: Well yeah, I agree with you. The point is that it -- yeah it's hard but you've got to figure out how to do it because it's more important than just teaching facts. I think when I watch scientific shows and when other people that I know -- we talk about geeky stuff because we're all on the same page but in a way those shows preach to the choir, right? If I've listened to every other episode of StarTalk and I've watched all of Cosmos, I can talk with certain people about that and the rest of the people go, "I don't know what that is. Anyway the earth is flat and climate change is fake."

NEIL: StarTalk, by design, is intended to grow its audience in every single episode, because the guest is hardly ever a scientist. And so, that person, if they're famous enough, they'll have a fan base that'll chase them wherever they go. So now their fan base follows them to a science based talk show. And in a science

based talk show, they're going to hear their favorite person talking about science and all the ways that the moving frontier of science has touched their lives and their livelihood. The goal for StarTalk is to reach people who don't know that they like science. Or better yet, know that they don't like science.

JORDAN: I think we're on the same page there. This show is about getting people who don't care about learning better critical thinking skills to figure out that these can be really interesting, depending on who the guest is of course.

NEIL: Mm-hmm.

JORDAN: And, so yeah. Maybe I should have science based guests on this show.

(laugh)

JORDAN: It's really a good idea to do this and it's mandatory. I think because a lot of people want to lock themselves into a cone of ignorance. But I think a lot of other people just don't realize they're in one.

NEIL: But they wouldn't call it a cone of ignorance.

JORDAN: No of course.

NEIL: They would say, "This is the actual truth and everyone else is -- doesn't know what they're talking about."

JORDAN: Right, "So don't waste your time with all that stuff. We already figured it out already." So, what can we do ourselves, aside from making sure that we're watching or looking at different sources of information? What would you do if someone you cared about -- your next door neighbor kid goes, "Oh, yeah, you know, I heard about all this really completely false, dumb stuff and he thinks it's true," where do you even get people started on that?

NEIL: So what I've seen happen -- there might be something written about something that I wrote or said. If it's critical, in a way that's completely missing the idea or the point, they're enough people out there who will jump into the comment thread, and just sort of take the person to task. "Why would you say that? Because he's never actually said this" "But you're saying he said it." "No, he said instead, this." There are people who are plugged in enough into the whole portfolio that I have that's out there, that they become, sort of, defenders in the comment threads. And so, you should, I think, always be prepared to have that argument with someone who might otherwise just simply go unchallenged. If you let false arguments go unchallenged, they become laws.

JORDAN: Oh, that's interesting. It's true and it can be really tempting to do so, especially when you're talking with somebody who is not only maybe condescending, but just refuses to hear your side of the argument. I guess there's only so much you can do but -- especially when it's a young person, the conversation is always worth having. Just because somebody who has their head up their butt got to them first doesn't mean that they should be doomed to think that way for life.

NEIL: Plus they're more -- they'll be more open to a learning session. School is closer in their memory.

JORDAN: Oh, that's a good point, yeah. I've definitely noticed that.

NEIL: You get older folks, you know --

JORDAN: Yeah.

NEIL: -- on campuses. The word lecture has meaning, right? What does it mean to be lectured? To get a lecture, you go and attend, and you take notes and you paid for it, and you take the test. But, interestingly for me, the word lecture has negative connotations in essentially every other context.

JORDAN: Oh, yeah, of course.

NEIL: “Don’t lecture me.”

JORDAN: Yeah.

NEIL: “Why are you lecturing to me?” That’s bad. Which is odd because, I would say, “Please lecture to me, I want to learn. Keep at it.” Repeating a broken record. Do you know what a broken record is?

JORDAN: I’m very familiar with broken records. I’ve broken many records of parents, just ask. [00:33:24]

NEIL: Oh, okay because a broken record -- the record is not really broken, there’s dust on it --

JORDAN: Oh, it’s just dusty?

NEIL: -- that doesn’t come off and then it skips each time.

JORDAN: You haven’t seen me break a record, NEIL.

NEIL: So a broken record repeats the same groove each time because there’s something in a groove that has it pop over and go back to the same place.

JORDAN: And bounce it back, yeah.

NEIL: And bounce it back. So that’s a -- that colloquially is a broken record, for everyone 30 and under, who might not know that.

JORDAN: Don’t lecture us on broken records.

NEIL: See? See? Somehow we’ve created an educational pipeline where the urge to not be in school is greater than the urge to be in school. Right on down to the last day of school where some -- not everyone -- some take their notes and throw it in the air and say, “No school. Summer is [00:34:06],” or, “I’m graduated.” And when all they ever had to do was learn in their life. So,

something is missing in the educational trajectory. Love of learning and reinstilling a sense of wonder and curiosity. Because if you graduate curious then you spend the rest of your life learning and you learn vastly more in the rest of your life then you would have ever learned in school.

JORDAN: I think it is possible to get back there. Because when I graduated law school I was sick of it. And when I graduated college I was sick of that. When I graduated high school I was definitely sick of that and I learn more now than I ever --

NEIL: So you've got a fatigue factor.

JORDAN: Definitely.

NEIL: Okay, that's interesting.

JORDAN: I definitely do. I didn't even go to the graduation ceremonies of high school, college, or graduate school, because I just could not, for one more day, be around it. And I for years thought, "Oh, man I'm just not cut out for any of this. It's a miracle I made it through here. Good thing I have a job now and I don't have to learn anything ever again in my whole life," but now that I'm a grown up and an adult in different ways, I read more and I learn much more now.

NEIL: And so you've retained curiosity and you will spend so much more time not in school than in school, that to define being in school as the one arc of occasions that you learn, does such a disservice to your life.

JORDAN: Yeah, it's a shame. Action, all around.

NEIL: Well in fact, there are many studies that show the strong correlation between the simple existence of books in your home growing up, compared to other homes that have no books at all. And the kids that come from homes with books do much, much better. Is it because the parents make an environment that is more literate or is it that smart kids come from smart

parents? And if the parents have books they might be smarter than average.

JORDAN: Maybe. Depends on the books, but yeah.

NEIL: The jury may still be out on that but the idea that books can matter, I think that's in motion right now.

JORDAN: When I talk to people about this kind of thing --

NEIL: Mm-hmm.

JORDAN: -- there's a lot of hope involved.

NEIL: You're 37, so what's a younger people to you?

JORDAN: People still in college.

NEIL: College.

JORDAN: Yeah, because I get email -- you know, hundreds and hundreds of emails every day from people who go, "I want a job like yours," you know, "what was your career path?" And I tell them, you know, "Seven years of college learning about something I don't do anymore," and they're like, "Ah, I've got to skip all that." But it becomes very tricky to show people that life after college is one, better in many ways, because you have more freedom over what you can learn and what you can do with the knowledge, and two, that it's actually worth pursuing because when you're in the middle of this funnel, this syphon where you have to learn different things that you're not crazy about and apply them in ways that are often mildly tortuous, it's tough to convince somebody that you're going to want to do some parts of this for the rest of your life and apply them and use them.

NEIL: Yeah, so that's why education has to be not only, "Here's a craft and here's where you're going to apply the craft," it's got to be, "How is your brain wired for thought?" so that when you confront a problem you've never seen before, you will attack the

problem rather than shun it. So much of learning is the preparation of the mind for just those situations. The fact that you have students, in school, thinking that what they're learning has to have some direct application, otherwise it's not useful to them, that's a tragic state of affairs under the educational umbrella if that permeates the system. That would mean everyone would just have to be taught a trade. Then you go out and, you know, lay the bricks, or smelt the steel, or whatever they do in steel. Do they still make steel?

JORDAN: Yeah in China.

NEIL: Yeah, okay. That's the right answer to any question.

JORDAN: Right, yeah. Yes in China is the answer to that.

NEIL: Right yep, they do it in China.

JORDAN: How do you prepare your brain then for that? If you're listening to this right now, or if I'm listening to this right now and I'm thinking, "Yeah I've got to prepare my brain to realize that not everything that I learn has to be applied in some way. It sounds like a great idea. Where do I begin?"

NEIL: No, no, no. It's not that active, it's passive in the sense that I majored in physics in college. Half of my courses were neither science nor math. It was a liberal arts school so I had art, and psychology, and economics, and a little bit of history. And while for me it wasn't as fun learning about that as in my major of choice, nonetheless, there are seeds planted that flesh out all the total kinds of thoughts you could have. You don't know the thoughts that you're not having.

JORDAN: But yeah, that's -- yeah.

NEIL: But does it make sense that the more you know about the more things, the more enriched your thoughts would be?

JORDAN: Sure. So even if they're seemingly unrelated --

NEIL: Correct. And then there are people, especially saying this to scientists, “I don’t want to know too much science because that will take away the wonder and the majesty of the world.” So if we’re both sitting on a rock and there’s --

JORDAN: That’s ridiculous.

NEIL: -- and there’s this sunset, and you look at the sunset for its beauty and the colors, and the warmth, and I look at the sunset and I say that is a star, a glowing ball of incandescent gas, undergoing thermonuclear fusion in its core, you might say, “See you’ve ruined it.” But what they’re missing, is the fact that I also see a beautiful sunset with a curtain of twilight colors. I now have another dimension that I can take in the experience.

JORDAN: Knowing how something works has never ruined anything for me. I don’t understand that perspective at all. I feel like that --

NEIL: Yeah I almost tweeted -- you remember there was the double rainbow guy on YouTube?

JORDAN: Yes. “What does it mean?” That guy.

NEIL: Yeah, yeah. And I said -- I tweeted the link to that and I said, “This is how you behave if you haven’t had physics.”

JORDAN: I wondered what was wrong with that guy.

NEIL: Yeah you think there’s --

JORDAN: Lack of physics class.

NEIL: It’s just one physics class. Optics is part of a physics class. Then he would understand double rainbows, he can -- triple rainbows, if the optics are just right. And each rainbow is significantly dimmer than the previous one. So the multiple rainbows are very hard and so therefore they’re rare. And the rarity is what, in part, accounts for the enthusiasm of the

person who left his recording device on. Because remember he was like, “Oh! Oh, my God!” and he like, started crying practically. And you don’t see him but you hear him. So, you might say, “Well did I take away his wonder by doing this?” I don’t think so because we understand rainbows. You want to wonder? I’ll put you on the frontier. There’s a lot of wondering that needs to happen there. Like what is the nature of dark matter and what is the nature of dark energy and what was around before the Big Bang? And how do you go from inanimate organic molecules to self-replicating life? That’s a transition that remains. And we’ve got top people working on that right now. So, if you’re going to assert what we don’t know is what matters for your wonderment and now you worry that we discover what the worry is and then somehow it’s gone. No, there’s -- As the area of your knowledge grows, so too does the perimeter of your ignorance.

JORDAN: I agree. When I was reading this book it’s -- astrophysics, any sort of science I would imagine, is like the -- you ever go to the Winchester Mystery House?

NEIL: No.

JORDAN: It’s right around here, I know you don’t have time to deal with that. But basically this crazy lady, whose husband invented the rifle, the Winchester rifle -- she built a house and you’ll walk in a room and there will be 20 doors in the room. And you’ll open some of them and there’s a brick wall and you’ll open another one and there’s a big pit.

NEIL: Wait, wait, wait, you’re saying he invented rifling?

JORDAN: He invented the Winchester rifle.

NEIL: Okay.

JORDAN: So all these people died as a result of his invention --

NEIL: Okay.

JORDAN: -- and she was loaded and she thought the ghosts of all the people --

NEIL: Loaded with money?

JORDAN: Loaded with money, yeah. Yes.

NEIL: Not loaded with lead. Right, right.

JORDAN: Yes, it's very different.

NEIL: No, I'm just saying because rifling is a very specific feature of the barrel.

JORDAN: He may have done something with that, in fact, and maybe that's why the Winchester --

NEIL: Spin stabilized projectile.

JORDAN: I think that may be part of it.

NEIL: Greatly enhancing -- I'm not saying he wasn't, I just --

JORDAN: Yeah.

NEIL: If the Winchester rifle was the first to rifle a rifle, then --

JORDAN: Successful invention.

NEIL: Yeah. And in fact, I think it goes unnoticed by many. If you look at the most iconic image of James Bond in a poster, you're looking through this cylinder and he's at the other end. And you see his silhouette and he turns and he shoots. And that cylinder is rifled.

JORDAN: Right.

NEIL: So you're actually looking down the barrel of a gun.

JORDAN: Right, the spiral grooves --

NEIL: Yes.

JORDAN: -- that causes the pressure to spin the bullet and stabilize it. So you may be right. I'm going to have to look that up.

NEIL: No, no, I didn't say any -- there's nothing for me to be right about --

JORDAN: Oh.

NEIL: -- I'm just wondering if what you said is exactly as true as you have said.

JORDAN: It might -- I might have misspoken --

NEIL: Uh-huh.

JORDAN: -- and been totally right on that.

NEIL: But if that was the most deadly rifle ever made, then clearly something was different about it.

JORDAN: Sure.

NEIL: Either the bullet travelled faster or it was spin stabilized in ways previous ones weren't.

JORDAN: And the Civil War didn't hurt. I mean, people were shooting each other all the time with this particular weapon. Anyway, my analogy is completely ruined now. Oh, well.

NEIL: Oh, I'm sorry.

JORDAN: It doesn't matter.

NEIL: Did I derail your entire --

JORDAN: It was going to be magical.

NEIL: So she said what? Was she wealthy?

JORDAN: Basically she says well -- built this house with all kinds of crazy doors that lead -- and they're different shapes. Some of them lead nowhere but the book reminded me of this kind of situation in which, when you get --

NEIL: You mean *Astrophysics for People in a Hurry*?

JORDAN: Correct, yes. Your new book, right here. Which everyone should grab and we'll link to it in the show notes. The things that you're learning, or that I'm learning, that you're teaching in this book -- as soon as you find something in there, dark matter or why planets look like they wobble or the fact that things arrange themselves into spheres, you end up with 20 other doors to go through, 20 different questions about the thing that you just learned. So there's no way --

NEIL: And that's my fault, I apologize.

JORDAN: Well that's the point, right?

NEIL: Yeah, yeah, yeah.

JORDAN: The point is, you read this and you go, "Wait, I'm interested in all of these different subject areas." So losing wonder based on learning something is a complete -- that's a load.

NEIL: Yeah, yeah, it's a statement implicitly admitting that it doesn't fully understand wonder or discovery.

JORDAN: Sure.

NEIL: Now, dare I say that Walt Whitman fell victim to this? There's a poem -- if you write beautifully, is it a poem even if it doesn't rhyme?

JORDAN: I think if you say it's poem or if they say it's a poem after you die then that's how [00:43:43]

NEIL: Yeah so --

JORDAN: It doesn't have to rhyme, yeah.

NEIL: I might be mixing two poems from two different people but there's one called The Learn'd Astronomer and he talks about sitting in a lecture hall listening to the astronomer speak. And all this beauty and wonder of the universe, now gets laced with formulas and math and equations and numbers and his eyes glaze over and he has to get up and walk outside and drink in the beauty of the night once again. Maybe we can find it to read it again today.

JORDAN: Sure.

NEIL: It presumes that there are these mysteries and then we figure out the mysteries and then there are no more mysteries. And it doesn't recognize that when you figure out a mystery, you are now standing in a new place and you're empowered to ask questions that you never even dreamt of before. And so, for someone who is curious, where you have learned to love the questions themselves, this is a very natural trajectory through the world of research.

JORDAN: Do you want to read The Learn'd Astronomer?

NEIL: Oh, do you have it? Shall I read it?

JORDAN: Do it.

NEIL: Okay.

JORDAN: Knock it out.

NEIL: Walt Whitman.

When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer where he lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars.

JORDAN: It is a beautiful poem.

NEIL: It's beautiful.

JORDAN: Too bad he didn't like the mathematical formulas.

(laugh)

NEIL: So the counterpart to this would be, "Oh, sir literate one, why ruin what something looks like by describing it with words, when I can see it fully with my eyes? Your words just get in the way. I'd rather my mind float freely, as I gaze upon something of interest, than have the writer step in between me and it, and interpose his or her own interpretation." If I were to compose a poem, it would have been that --

JORDAN: I feel like --

NEIL: -- in rebuttal to that.

JORDAN: We should write that down. My producer will do that, believe me. Neil deGrasse Tyson's reply to Walt Whitman, in the show notes.

NEIL: But I don't really feel that way. But if I had to offer a rebuttal, it's the kind of rebuttal I've thought about often because I've, many

times, been in a party maybe hosted by highly social liberal arts types, so artists or, you know, English majors, history majors -- people that do a lot of reading and writing. And they're generally really informed about things in ways that none of the rest of us are. And so it's a cocktail party. So I'm there and there's a little scrum of them over in a corner and I try to join in and they're talking about some Shakespeare sonnet. And they say -- apparently it was a well-known one but I had never read it. In fact, at the time, I hadn't read any of Shakespeare's sonnets. And, you feel the pressure that I'm not sharing the literacy that mattered in the corner, okay? And I feel it. After that I went up and dug up some of his sonnets. But, consider the opposite of this. Suppose I had a geek party where everybody is sort of engineering, math, science -- especially physical sciences, and then we're talking about Fermat's math, last theorem or something. So what will happen is you get those same people who threw that other party -- this is a stereotype of what happens, but this has actually happened and I've seen this happen -- overhear the conversation and then they'll say, "Oh, I was never good at math," and then chuckle about that --

JORDAN: Oh, yeah right.

NEIL: -- to themself or to their friends who were also never good -- to chuckle. It's not an embarrassment that they were not good at math, it's a chuckle that they were not good at math. And so what's the counterpart to that? It wouldn't be just me feeling guilty I hadn't read these sonnets, it would be me saying, "Oh, I was never good at nouns and verbs."

JORDAN: It sounds way more ridiculous.

NEIL: They would think I was some kind of stupid idiot -- uneducated idiot. The assessment of your person is not symmetric in those two cases.

(COMMERCIAL BREAK)

JORDAN: I am so guilty of that though.

NEIL: Of what?

JORDAN: Oh, I'm, you know, "Oh, this math. Oh, I'm intimidated by this." Even though I can obviously add a receipt together.

NEIL: That's different from saying, "Oh, I was never good at it," and chuckle.

JORDAN: Oh, sure. Yeah I see the difference.

NEIL: That's all I'm saying.

JORDAN: Yeah.

NEIL: There's no shame in not knowing or having struggled. That's not my point.

JORDAN: Right.

NEIL: My point is, somehow thinking that it is -- making light of the fact that you don't know it. These are people who are learned people. And if you are a learned person, you should never make light of anything you don't know. You should run home and learn it. If it arises in front of you, and it was a gap in your knowledge you never even knew was there.

JORDAN: Especially now because you don't have to go to the library and look up seven books on the subject. You can Google thing in the Uber on the way to your next venue. You can get a good synopsis.

NEIL: Now that's a sentence that made no sense 10 years ago.

JORDAN: True.

NEIL: You can Google it in your Uber.

(laugh)

JORDAN: On the way, right. From your smartphone.

NEIL: Yeah smartphone is 10 years old, this year.

JORDAN: Yeah officially.

NEIL: Yeah. Take a picture of the book with your phone as you Google it in your Uber.

JORDAN: And then text it to me. Put it on Snapchat.

NEIL: No we had texting before then.

JORDAN: That's true.

NEIL: It wasn't as fully --

JORDAN: Texting is from the '90s.

NEIL: Yeah, yeah, exactly.

JORDAN: That's right, SMS. Just sending a picture via text though, that came later.

NEIL: Mm-hmm.

JORDAN: That came much later. So what stuff keeps you awake at night, proverbially now? Is it dark matter, dark energy, that kind of stuff? What do you think about?

NEIL: No, I'm a little more obscure than that.

JORDAN: Okay.

NEIL: What keeps me awake is wondering what questions I don't yet know to ask because they would only become available to me, visible to me, after we discover what dark matter and dark energy is.

JORDAN: Oh, man.

NEIL: Because, think about it, the fact that we even know how to ask that question, that's almost half the way there.

JORDAN: Sure, because you know there's something there.

NEIL: There's something there and I can design an experiment, as we're doing now, with face probes and things. But I want to know the question that I can't know yet because it's not available. It's not in reach.

JORDAN: Oh.

NEIL: That's what keeps me awake at night. What is the profound level of ignorance that will manifest after we answer the profound questions we've been smart enough to pose thus far?

JORDAN: Do you think we'll figure that out in -- within our lifetime? The dark matter thing? Or is that just so far --

NEIL: Dark matter, maybe. I'm not sure about dark energy. You know, the over-under on the dark matter is it's going to be likely a particle that one or more -- a family of particles that don't interact with ours. But of course they would have gravity. The problem with dark matter is that, it not only doesn't interact with us in anyway other than by gravity -- in other words it doesn't stick. The experiment's intended to detect it, are hoping that however elusive they are, because they don't interact with us, every now and then, it'll actually interact with one of our molecules.

JORDAN: Glitch in the matrix?

NEIL: A glitch in the matrix. And so it's very hopeful, mind you, but my sense is dark matter not only doesn't interact with ordinary matter, it doesn't much interact with itself. So it can't collapse to become solid objects, even if it's a dark matter solid object. So

we don't see concentrations of dark matter the way you see concentrations of regular matter, because we have the electromagnetic force to hold our molecules together.

JORDAN: And it doesn't even have that.

NEIL: It doesn't even have that. Correct.

JORDAN: Was that --

NEIL: Because if it did have it, it would interact with our particles.

JORDAN: Sure. Right, it would have to. It would have to.

NEIL: Mm-hmm.

JORDAN: Is that what you were showing on -- maybe it was Cosmos. Some of the stuff blurs together. Where you're going down miles underneath and there's this giant vat of something and we're just hoping a neutrino flies through.

NEIL: Oh, yeah that shows the neutrino detector, yeah, yeah.

JORDAN: Okay.

NEIL: And there are reasons why you would have these detectors deep underground. You would shield it against the kinds of things that might masquerade as a signal that you're trying to detect, because the rocks protect you from it but --

JORDAN: How's the cell phone service down there?

NEIL: No they're good repeaters I think. Although I don't know that I've tried my cell phone. These are abandoned salt mines and things so they're kind of already there.

JORDAN: Yeah. I've been in one of those. My parents took me to one when I was a kid, an abandoned salt mine, and if -- it was the coolest thing ever.

NEIL: Mm-hmm.

JORDAN: Still sounds weird saying it out loud, that an abandoned salt mine is the coolest thing ever. They filled it with toxic waste, I remember that.

NEIL: Well it just means -- well, just to get rid of the toxic waste.

JORDAN: Right.

NEIL: Right. So it just means you're curious into adulthood --

JORDAN: Yeah, yeah.

NEIL: -- to say that an abandoned salt mine --

JORDAN: It's still cool.

NEIL: -- is really cool. And of course, do you know how the salt got there?

JORDAN: Ocean water deposits I guess?

NEIL: Yeah, exactly. You evaporate -- generally not an ocean but a -- I mean it could have been but generally it's a body of water that completely evaporated out, leaving behind the -- what was previously dissolved salts. So what that means is, even mined salt is sea salt.

JORDAN: How true. [00:56:44]

NEIL: It's just from lakes long evaporated from millions of years ago. So I think the mined salt community lost an opportunity there.

JORDAN: Right.

NEIL: They might still be able to jump in it. But basically all salt is sea salt.

JORDAN: That's how you get sea salt from Indiana, if your kids find a salt mine, or wherever we were.

NEIL: Exactly.

JORDAN: Yeah. I was climbing a mountain in Israel once -- not climbing like a fancy kind, but walking on a trail in a mountain -- and I remember --

NEIL: That's not climbing a mountain.

JORDAN: I was walking on a high mountain -- on a hill.

NEIL: You were walking on a trail --

JORDAN: Yes.

NEIL: -- that happened to be uphill, yeah okay.

JORDAN: I was probably going downhill.

NEIL: Get that straight.

JORDAN: To be honest I took the bus to the top, probably walked down.

NEIL: Yeah, yeah, yeah.

JORDAN: But --

NEIL: There's a chair lift, yeah. If I keep listening --

JORDAN: So I was driving down this mountain and I put my hound out on the trail and I remember it crumbled and I looked at what had crumbled away and it was a bunch of seashells and little things like that. And I looked down, I don't know, hundreds and hundreds and hundreds of feet, or even more, and there's the ocean. And it was just -- it's such a mind trip to go, "Wow, at some point, that was so high that this was the bottom, and

these are all the things that collected there over hundreds or thousands of years that are still there." [00:57:53]

NEIL: It wasn't so much that the ocean was higher, which can have been the case, but more likely is that you have the geologic rising of the land mass. And now that you mention it, just since you went there, there's an interesting -- take you through a reasoning that then has a fork in the road, I'll tell you about each fork. The fact that there are seashells on mountain tops, had been for centuries invoked by devout Christians -- devout religious monotheistic religious people, as evidence for Noah's flood.

JORDAN: Ah, sure.

NEIL: And of course you wouldn't have to be Christian because that's in the Jewish bible not the Christian bible. So the flood would have brought seashells to high places because the whole world was covered. Okay. That was widely accepted as such and then Leonardo Da Vinci comes along and looks at these seashells and says, "Wait a minute, these seashells are perfectly laid out. It looks like they got fossilized in place, in an orderly way --"

JORDAN: Oh.

NEIL: "-- and if there's a catastrophic, earth-wide flood, nothing gets laid down orderly. You'd expect broken shells, twisted, mixed with all manner of things." And so he used the fact that the shells were orderly, not broken, in their fossilized state, at high altitude to suggest that maybe the land and the seas were at different elevations in Earth's history.

JORDAN: Incredible.

NEIL: And that was in the 1400s.

JORDAN: And everyone went, "That doesn't even make any sense." Or they went, "You ruined it. There goes the wonder." To leave to Da Vinci. Who invited this guy?

NEIL: Uh-huh.

JORDAN: What do you think is something that we as humans can see but not really, kind of, comprehend that we're going to discover later as part of this astrophysics -- sort of super complex --

NEIL: No I don't think we understand consciousness yet, and I'll give you some blunt evidence of it. So if you go in a bookstore and ask, "Where are your books on consciousness?" They'll show you the shelves and it's like shelf, after shelf, after shelf and books still being published on that subject. You now say, "Well where are your books on gravity?" Well it's like three books on one side of one shelf. So, evidence that we don't understand something yet, is that people keep publishing books saying that we understand it. When you understand something, the book gets written and then you move onto other topics and you're done. So we have Newton gravity and Einstein gravity, you get that in three or four books. No one is still trying to explain it -- explain it as a mystery to be explained.

JORDAN: Sure, right.

NEIL: They might explain it because, maybe this other method wasn't as successful as -- you have some new educational twist that you would put on it. But then it's as an educational exercise, not someone putting their next idea out as an explanation for it. And by the way, this would be true for almost anything, just look around. If active researchers are still publishing in it, it means we know least about it, typically. So that tells me if we don't fully understand consciousness, yet there are people who fear AI becoming conscious. I don't see one following from the other.

JORDAN: We're afraid it's going to become this thing we don't fully understand yet, because we're afraid of that, maybe.

NEIL: Yeah but, like I said, we don't understand our own Id, in a way to think that just simply having a faster computer, is going to

make an Id in the computer. But, we'll see. I remain fearless of AI. I say bring it on. Just bring it.

JORDAN: Bring it on?

NEIL: Bring it on.

JORDAN: When you start thinking of AI, it starts to answer a lot of questions where people think, "Oh, an alien civilization will never contact us because there's too many stars," and when you start looking at -- well if AI and computers can start to look at things, millions or billions of times faster than we can --

NEIL: Yeah, they'll figure it out.

JORDAN: -- it starts to narrow that --

NEIL: Mm-hmm.

JORDAN: -- that gap quite a bit.

NEIL: Right, right. Right.

JORDAN: I know you've got to go really soon but one last thing that I want to wrap with. July 29th 1958, NASA gets kicked off, it's started. The world is captivated on space travel, we're trying to beat the --

NEIL: Where did you get July 29th? Where'd you get that?

JORDAN: Because I -- because it was written right here. Maybe that's incorrect.

NEIL: Did you get it off the Internet?

JORDAN: I did. I don't trust everything I see on the Internet, though.

NEIL: So, almost in all cases, the actual truth is a little more subtle than the simplified truth that is presented. And that's not a

problem, it's just the reality, okay? So for example, if I say, "What path does Earth take in its orbit around the sun?" What would you tell me?

JORDAN: Ellipses.

NEIL: Okay. Ellipse. So if I drew a perfect circle, and then a -- and sort of an oval, and then like a really skinny oval, and I said, "Pick the orbit that comes closest to Earth's orbit," you might pick the ellipse that is in the middle. However, the perfect circle comes closer to what --

JORDAN: Really?

NEIL: -- Earth's orbit is, than this sort of ovalized ellipse that I had just drawn. Earth's orbit is a three percent ellipse.

JORDAN: [01:02:47]

NEIL: If I draw that on a page, you're not even really going to notice that.

JORDAN: Imperceptible, essentially.

NEIL: Yeah, I mean if you look hard, and you folded to see if the edges match up, yes okay. So you're saying ellipse because you've been taught ellipse. But to say a circle, would not be all that bad. But here's the rub, it's not even an ellipse, because the earth and the moon, orbit their common center of gravity. It's the center of gravity of the earth's moon system that traces the ellipse. But Earth itself, does this loop de loop wobbling with the moon as it goes around the sun. That's the actual path of the earth around the sun, but we just say it's an ellipse because we don't want to talk about the loop de loops.

JORDAN: Sure.

NEIL: Because that's a deeper level of understanding of what's going on. If I ask you what shape is the earth, what would you say?

JORDAN: Sphere.

NEIL: Okay, that comes very close to what we actually are.

JORDAN: At least I got that one right.

NEIL: But if you want to be more precise you would say we're a spheroid, we're wider at the equator than pole to pole. Like a hamburger, right? But then we're not even that, we're slightly wider below the equator than at the equator. So we're pear shaped oblate spheroid.

JORDAN: Provided that the earth isn't flat. Right.

NEIL: Yeah just in case there was any question, right?

JORDAN: Just in case

NEIL: So I'm saying all that as preamble to --

JORDAN: It was July 29th, 1958.

NEIL: Right, so I don't know that date in association with NASA. It could be the date that the legislation was proposed, passed by congress -- there's a different date where it actually became law, where they ratified the -- there's the document that lays out everything that NASA does. That was the one year anniversary -- in the week of the one year anniversary of Sputnik, in October. So, whatever date you found, it will be something that -- I'm not denying it wasn't a useful

JORDAN: Yeah.

NEIL: -- it's not an important date, but generally the date that's quoted is the one in October.

JORDAN: Oh, okay.

NEIL: Yeah.

JORDAN: Well, there's that Internet.

NEIL: And it's easy to remember because it's on the anniversary of Sputnik.

JORDAN: Right.

NEIL: And it's the same week that I was born.

JORDAN: Oh, well that's how I'll remember it from now on.

NEIL: Just saying.

JORDAN: The question, regardless of when NASA was started, was that we're trying to beat the USSR to space or to the moon anyway --

NEIL: Not at the time, just get into space at all.

JORDAN: At all, right. What do we need to do to get people in power to take things like space exploration this seriously again? What do you think we have to do?

NEIL: Well the two easy ways -- one of them is we go to war with China because they want to put military bases on Mars. Oh, I guess we have to go to Mars. And then we go to Mars because it's a military project as was the entire founding of NASA. NASA is a civilian agency but it was triggered by what was viewed as a military show of muscle. Sputnik was not as innocent as we want to think it was because even though it was a radio transmitter that just went bleep, bleep, it was a radio transmitter inserted into a hollowed out intercontinental ballistic missile shell.

JORDAN Oh, I didn't know that.

NEIL: I know, that's why I said --

JORDAN: Looked like a little --

NEIL: It's been cleansed over --

JORDAN: Right.

NEIL: -- over the years. There were laws about who can fly over whose airspace but there were no rules about who could fly over whose space space. How about the space over the air over your country?

JORDAN: Sure.

NEIL: Is there any rule about that? No. And there's Sputnik crossing our country in an intercontinental --

JORDAN: In a missile --

NEIL: In a missile.

JORDAN: -- body.

NEIL: A hollowed out -- they had contemplated doing the experiment with a warhead, a disarmed warhead but they were concerned that that might be viewed as an act of war --

JORDAN: Sure.

NEIL: -- whereas a just simple radio transmitter would not be. So you can still show your might without it being an act of war, by having no weaponry in it but it's the thing that would house the weaponry that does it. Anyone who was alive October 4th, 1957, remembers that like it was yesterday. I don't think in modern times people can fully capture how berserk we went here. Because these are our sworn godless enemies, the communists. And we, you know, we were already kind of didn't like him. This is pre Berlin Wall but, they were -- I mean it was so significant this was that in the mid-1950s we wanted to show that we were

God-fearing and they were Godless, so we added 'God', the word --

JORDAN: To the Pledge of Allegiance.

NEIL: To the Pledge of Allegiance and to the money and to the back wall of the House of Representatives. So -- "In God We Trust," that phrase. And if you look at the Pledge of Allegiance it doesn't really make literary sense read with God in it. Do you know the phrase?

JORDAN: The "In God We Trust?"

NEIL: Yeah. No, no. No, no.

JORDAN: Oh, "One nation, under God, indivisible --" is that what we're talking about?

NEIL: Right, exactly. Okay. So, if you take out, "Under God," it reads, "One nation indivisible." That makes sentence sense.

JORDAN: Yes, yes.

NEIL: Right? "One nation, indivisible," you put, "Under God, indivisible," and it breaks that but you're reminded what that was before this was introduced and so we're doing this in every way to show that we are better, that our system of government is better, that our system of economics is better, that we are in the free world, that they are enslaved to their own country's rules. And if we're better but they then put up a -- something that clearly takes technology -- oh, my gosh, we went ballistic.

JORDAN: No pun intended.

NEIL: No, definitely pun intended. Ballistic, if you only know ballistics through guns, a ballistic projectile is something that moves only under the influence of gravity. And so a bullet after it has left the gun, it also -- there's some aerodynamics in there but it's why -- it doesn't have its own propulsion. So --

JORDAN: Oh, yeah, sure.

NEIL: Yeah if a bullet had its own little rockets on it, it wouldn't be ballistics.

JORDAN: Did not know that.

NEIL: Yeah.

JORDAN: Oh, that's a good point.

NEIL: Yeah, yeah. In fact I wrote an essay long ago called Going Ballistic which was all about the arc of weaponry. But anyhow, you -- so --

JORDAN: Method one, go to war with China.

NEIL: Yeah, yeah. That would -- oh, no, so another way -- so I joke about this, you go to China, you say, "Could you please -- " go to the head of China, you say, "Could you please leak a memo that says you want to military bases on Mars?" Just leak one, it doesn't have to be true. Just leak a memo, then we're on Mars in 10 months.

JORDAN: Yeah, Elon, get back to work buddy.

NEIL: We're on Mars in 10 months. So, of course, I presume, most if not all people don't want this to happen as the consequence of a military engagement. I'm simply being frank and saying, that's how we went to the moon.

JORDAN: That's how we light a fire under our butts --

NEIL: Correct.

JORDAN: -- to get to Mars.

NEIL: That's how and why we went to the moon even though we've cleansed that memory as well. You go to the Kennedy Space Center in Florida, there's a bust of JFK and there's a whole granite wall behind him. And chiseled into the granite, is his famous line from his speech, "I'm, --" you know, "I pledge," or whatever it is, "that we will put a man on the moon and return him safely to the earth." You know I can hear his voice as I read those words and it's stirring. What they left out, and there's plenty of room on this granite wall to have included it, of that same speech he says the following, "If the event of recent weeks," -- this is almost verbatim. I'm probably paraphrasing a little because this speech he gave 6 weeks after Yuri Gagarin had come out of orbit. We didn't yet have a spacecraft that wouldn't explode, much less a spacecraft worthy of putting a human being in it. It would still be the next year before John Glenn would fly, after many failed experiments with our rockets. So, in that same speech, a few paragraphs earlier he says, "If the events of recent weeks," -- wouldn't utter the man's name, Yuri Gagarin. "If the events of recent weeks are any indication of the impact of this adventure of the minds of men everywhere, then we need to show the world the path of freedom over the path of tyranny." It was a battle cry against communism.

JORDAN: Oh, man.

NEIL: Once you say that, nothing else matters in the speech. We can cherry pick it and put it on granite and say to ourselves that we were explorers and discoverers and we're Americans and -- but that's not the reality of how that stuff went down. And when you feel threatened, money flows like rivers. But I would say -- and I wrote this in a whole other book, not this current one -- that there's another way to do it, and one of the great drivers of investment is economics. The promise of economic return. So, if you can construct our exploration of space, as something that ultimately pumps the economy, then it would be trivial to justify doing so. And when I say pumping the economy, I'm not talking about spin-offs or any of the traditional -- they will be, but that's not what I'm talking about. I'm talking about a

cultural shift, a firmware upgrade in our mind, body, and soul, related to how we value exploration, innovation, and discovery.

When you go into space, in a big way, you have to invent stuff. Patents get awarded, records are set, headlines are written, and it reaches us in all of our social fabric, especially in the K-12 pipeline. In the 1960s, you didn't need special programs to get people interested in science or to attract teachers to become science teachers. We knew tomorrow was getting invented by science and technology. In spite of all the other problems we had in the '60s, Civil Rights Movement, and the Cold War, Hot War, assassinations, campus unrest, we were going to the moon and that's shaped our visions. That's how you get TV shows like The Jetsons. Even at that level, children's cartoons, we were thinking about what science and technology will bring for the future. And this is why I made the point in that video -- Science in America Video.

When I grew up, nobody was standing in denial of whether something was scientifically true. Not at high levels of power. Even if you were there, you were not in power. That's my only point. If you were hidden and you thought Earth was flat, and that medicine would kill you rather than make you better, and everything else anti-scientific, you're not in power of anything so I didn't -- it didn't really matter. Economically, we go into space, it could be transformative on our civilization. Certainly on the American culture and possibly the entire civilization. Unless you have some other, more potent way to do it, I'm all ears.

JORDAN: Yeah, well. Hopefully in the near future we'll see a resurgence in this.

NEIL: You began by saying, "We sleep on our backs and we look up and wonder about the night sky." Space exploration, I think there's a little piece of that in everyone, just because we've all gone out into the darkness of the night and looked up and wondered.

JORDAN: I'm super happy that we got to do this. I'm super, super, there are educators like you and I know I'm not alone in that so thank you so much for coming out today.

NEIL: Okay, excellent. Thanks for having me and snatching me from mid-afternoon because I'm giving a talk tonight.

JORDAN: Wow that was great. Went a little bit long, not that I'm complaining. Doing an episode with Doctor Tyson, in person. He was really cool. Even after the show, he hung out with my parents because I had my parents here because I just got married, no big deal. And we were talking about Sputnik earlier in the episode and he walks in and, you know, he's already talked to my parents before the show. And my parents, they're in their 70s and he goes, "Sputnik, now wasn't that some ****?" That's how he started a conversation with my parents and with the producer Matt in the control room there.

Super charismatic off camera, even more charismatic than he is on camera. Love that guy. So, great big thank you to Doctor Neil deGrasse Tyson. The book title is Astrophysics for People in a Hurry. That'll be linked up in the show notes for this episode. That, of course, is loaded with even more science. I highly recommend you read it, even if you're in a hurry, it's designed for you. And if you enjoyed this one, don't forget to thank Doctor Tyson on Twitter. We'll have that linked in the show notes as well. Tweet me your number one takeaway from Neil deGrasse Tyson. I am @theartofcharm on Twitter.

And remember if you're looking for the show notes, you should be able to tap your phone screen, unless you're using Spotify, but hey that's not my fault, Daniel Eck(sp), here's looking at you. Boot camp and Art of Charm live program details theartofcharm.com/bootcamp. Join thousands of other guys who've been through the program who will become your network for life. Meet up when traveling, couchsurfing, get jobs through the network, form lifelong friendships. It is by far and away my favorite part of running AoC. Although, interviewing superstars like Neil deGrasse Tyson are a close second, I've got

to say. To see people become part of the AoC family and the growth they experience over the next months and years, nothing short of amazing. Again, theartofcharm.com/bootcamp for details on that. We do sell out a few months in advance so get in touch, get the info, even if you think it's a long way off.

Oh, also, big thank you to producer Jason's brother Greg and all the folks over at The Proton Center, which is where I got some of these science-based questions. There were so many questions in this episode that I didn't even get to, that we have reams of stuff for the next time Neil deGrasse Tyson comes on Art of Charm, that nobody has asked him anywhere that I could find. So I'm stoked. I'm already excited for the next one. And by the way, if you're military or intelligence agency affiliated, if you're interested in our live programs, going back to that, check out elitehumandynamics.com, elitehumandynamics.com for more information on programs we have that are designated especially for you.

I also want to encourage you to join us in our AoC challenge at theartofcharm.com/challenge or if you're in the states you can text the word 'charmed,' C-H-A-R-M-E-D to 33444. The challenge is about improving your networking and connection skills and inspiring those around you to develop a personal and professional relationship with you. It's free, a lot of people don't seem to realize that. It's not the same thing as the boot camp, I don't know why I have to explain this but look, I realize you're listening while driving or something. A lot of people seem to not know that it's free. It also is unisex, that's the whole idea. It's a fun way to start the ball rolling and get some forward momentum on all this.

And, we'll email you our fundamentals Toolbox that I mentioned earlier on the show which includes some great practical stuff, ready to apply, right out of the box on reading body language, having charismatic nonverbal communication, the science of attraction, negotiation techniques, networking and influence strategies, persuasion tactics, and everything else we teach here at The Art of Charm. It will make you a better

networker, it'll make you a better connector, and like this episode, it will make you a better thinker. That's theartofcharm.com/challenge or text the word 'charmed,' in the US to 33444. For full show notes for this and all previous episodes, head on over to theartofcharm.com/podcast.

This episode of AoC was produced by Jason DeFillippo. Jason Sanderson is our audio engineer and editor. Show notes on the website are by Robert Fogarty. Theme music by Little People. Transcriptions by TranscriptionOutsourcing.net. I'm your host Jordan Harbinger. Go ahead, tell your friends, because the greatest compliment you can give us is a referral to someone else, either in person or shared on the Web. Word of mouth is everything. So, share the show with your friends and your enemies. Stay charming and leave everything and everyone better than you found them.