Talk April 17, 2021

Neil deGrasse Tyson Thinks Science Can Reign Supreme Again

Again

By David Marchese Photograph by Mamadi Doumbouya

Neil deGrasse Tyson is perhaps the country's best-known popularizer of science. The astrophysicist, who is 62, has achieved that status through his ever-expanding body of work in television, podcasting, journalism, social media and books (his latest is the new "Cosmic Queries") and as director of the Hayden Planetarium at the American Museum of Natural History in New York. He has done so at a time when, distressingly, skepticism toward established science has become increasingly widespread. Tyson himself received some scrutiny in 2019 after he was subject to two claims of sexual misconduct, which he subsequently described as misunderstandings. Those claims were investigated by his employers at the museum as well as Fox Broadcasting and National Geographic, which respectively air his series "Cosmos" and "StarTalk"; all three of them decided to continue employing Tyson. "We've lost confidence in our civic entities,"

Tyson says about declining public trust in science. “That’s a strong destabilizing force, and some of that spilled over into the scientific community.”

In your work, you often bring up wanting to inculcate in people a scientific mind-set, which is a way of thinking that would help navigate misinformation. But we don’t always recognize misinformation for what it is. So what questions should people be asking themselves when they encounter material that’s skeptical about mainstream science? Let me first offer a transition from your question: I’ve gotten simultaneously famous and infamous for commenting on Twitter[1] on films and whether they get their science correct.[2] If something lands awkwardly, I ask myself, Could they have done that better or differently? Then later I comment. My defense is, if you are watching a period piece that takes place in the 1950s in L.A., and there’s a 1962 Chevy Bel Air on the road, and the person you see the movie with is a car buff and says, “That car wasn’t made yet,” you say, “That’s pretty good that you noticed that.” Or if you’re watching a Jane Austen period piece: The carriage rolls up, and somebody is wearing a derby instead of a top hat. If you’re a costume designer, you would cry foul. Those

people aren't criticized for making those observations. Because I'm bringing science to that table, people reject it unfairly. Now getting back to your point: What's behind all this? The missing link is curiosity. Without curiosity you're no longer probing for what is true. If someone says, "I saw Bigfoot the other day," there are people who say, "Yeah, that's great!" And people who say, "No, you're full of [expletive]" — both of those responses require no brain work. What is the brain work I would like to see more of? It's: Tell me more. When did you see this? Where did you see it? Did you find other evidence? You start probing. It's the absence of curiosity that concerns me.

But curiosity is also part of what drives people down anti-vaccine rabbit holes or toward conspiracy theories, isn't it? So what I left out is a tandem awareness we must have that would go along with curiosity, and that is self-awareness of bias. I'll give an example: Among religious people who want to change the science curriculum — that's a very small subset, by the way, of religious people[3] — many of them see the universe as perfectly ordered and beautiful. Because they *see* the things that are beautiful. If you look at religious posters that have

quotes, usually from the New Testament, those quotes are on top of beautiful sunsets. They're not on top of the underbelly of a tarantula, which occupies the same world as that sunset. Or ticks sucking blood from its mammalian host. Or —

I get it, I get it. OK. But to brush under the rug the things that don't agree with what you want to be true is the biggest problem we have when we're trying to analyze information.

Neil deGrasse Tyson at the Rose Center at the American Museum of Natural History in New York in 2006. He has been the director of

the Hayden Planetarium since 1996. Suzanne DeChillo/The New York Times

What about the larger cultural perspective? This moment is presenting new political and social challenges to the authority of science, and doing so for a variety of reasons — a lot of them bad faith. Should there be a resulting shift in how scientists advocate for themselves and their work? Big Y-E-S. Here's what I think happened. We lost, as a culture, the concept of authority coming out of the Vietnam War and Watergate, and we stopped going to the moon. This all happened around the same time. Then we find out about the Pentagon Papers — authorities were lying or withholding information. Also, scientists were promising a future of flying cars and monorails down the street, and that didn't happen. There is an absence of delivery on promised goods. So, I saw the slow dismantling of authority as something you should blindly listen to. What that means is you have to teach science differently. You have to say, Here's this body of knowledge that are objective truths established by science. *Then*: Here's this frontier where we're still asking questions. You distinguish between science that's objectively established as true and science on the frontier. Once

you've come up knowing the science and how and why it works *and* understanding what the bleeding edge of science does, you're in a position to pass judgment on science-related news. Now, on top of that, if there's anything we would call a scientific authority, it is the National Academy of Sciences. Most people don't even know that the frickin' thing exists. Why is that? We need better marketing.

What would be the mechanism for that? I'll go pie in the sky: a mission to Mars with humans. That would do it. Why do I know that? Because in the 1960s, while we're going to the moon, you didn't need special programs to get people interested in science and engineering. It was writ large in the daily headlines because every mission was more ambitious than the previous mission. *This* went higher, *this* orbited longer, *now* we're docking, *now* we're going to launch the craft that's going to the moon, now we *go* to the moon. And you knew it was fluency in science and technology that was empowering that journey. So a mission to Mars with humans, I could script this: We're going to do this in the year 2035. It's 14 years from now, and we want the crew to be in their upper 20s in age, which means that right now that crew is in middle school. Let us

do another Mercury 7[4] except we're going to find the middle-schoolers who we are going to track, and Teen Beat is going to say, "How were your grades? Are you doing all the right things? Are you studying?" They become models for society without having to take out an ad. They go to Mars! By the way, for this you also need biologists, medical doctors, engineers, astrophysicists, chemists, geologists. You tickle all the STEM fields, and everybody is going to want to be a part of that, and science would reign supreme once again.

As far as communicating with the public, are there ways in which your being so active on Twitter is not helpful to your larger goals? Here's one of my great disappointments: I conducted a Twitter survey, and I asked carefully conceived questions. One of them was, How do you lean politically: Libertarian, liberal, centrist or conservative? The response was only about 10 percent conservative. I was disappointed in that because if half the country votes conservative, that means conservatives are underrepresented in my Twitter feed. And my feed is not politicized. You might want to believe it is. It's just not.

Then what accounts for that disparity? I don't know. I've been trying to figure that out. That's why I read books on conservatism, to get inside the head of why is someone thinking this way. Plus, there are tweets that I won't post because they'd be too controversial even though they are completely fun and true. Here's one, I'll just tell you. I don't know if I'll ever post this. You go to the planet in "Avatar," right? Get a nice shot of them being oppressed by the military unit that got sent there. Then I put up that image and have as a caption, "Blue Lives Matter."

Oh, God. Because all of the Avatarians were blue, right? That would land really weirdly. People would pick fights because social media is very tribalizing even when there's no reason for it to be. I have a list of others that I'm never going to post.

Delete that list. [Laughs] OK. I might publish it in a book one day.

Tyson with William Shatner on “StarTalk” in 2016. National Geographic Channel, via Everett Collection

Here’s something I’ve been curious about: My understanding is that, broadly speaking, physics is the study of very small things — quantum physics, particle physics — and very big things —

astrophysics, relativity theory. Can you explain to me the interrelationship between the two areas? Or what a theory that integrates them looks like? So that question is simultaneously brilliant and —

Stupid? You can say stupid. Missing some stuffing. I'll tell you why it's both. The way you can think about the universe is we have these four forces of nature, and you can ask, over what scales do they manifest? That controls what it is we need to know about the universe on those scales. So if you look at the large-scale universe, all matter is neutral. There's an equal number of positive and negative charges. Planets are not attracted to each other by electrical charges. The electrical charges don't play into that. It's just gravity. Astrophysicists were the first to exploit gravity to understand the large-scale universe. Do you need particle physicists to understand the solar system? No. Because the forces that control the particles are not manifesting on those scales. Now let's look at the small scales. I have matter. How is it held together? With electromagnetic forces. Well, all molecules are held together by electromagnetic forces. The physicists lay the groundwork, the chemist takes it from there. How about the smaller particles? All right, the

universe used to be little. We're expanding, so it's smaller yesterday than it is today. Smaller today than it will be tomorrow. Let's roll the clock back. The universe is getting smaller and smaller and smaller. It's now the size of an atom. If the universe is now the size of the atom, how do we connect the gravity that was controlling it to the laws of physics that control something small? That is a shotgun marriage between Einstein's general theory of relativity, the theory of the large, and quantum physics, the theory of the small. When the large becomes small, something's got to give. Thus were born the string theorists. So you don't have to think about string theory when you're looking at cosmology the way astrophysicists do. But if you want to look at the Big Bang and what was going on before, during and right after, you have to merge the theories of the small with the theories of the large. That's a big frontier. They're each at each other's extremes. And by the way, they don't play in the sandbox together. Relativity requires a completely smooth continuum of space-time, whereas quantum physics has quantized space. They cannot talk to each other on the same mathematical page. So either quantum physics will absorb relativity or relativity will absorb quantum — no one thinks that's going to

happen — or there's a third theory that will then encompass them both: string theory or something else. I think that answers your question.

Tyson depicted in "The Simpsons" in 2017. 20th Century Fox Film Corp., via Everett Collection

I know that in almost every interview, you get asked about aliens. But let me ask you in this way: In Avi Loeb's book about Oumuamua,[5] he makes the argument that the scientific community is too hidebound and skeptical about the possible existence of intelligent extraterrestrial life. Is there something to that? No. There's an entire organization fully within the family of the world's astrophysicists called the Search for Extraterrestrial Intelligence Institute, which has an endowment and faculty who are highly respected, and they give interviews to the media. Avi came to this as a cosmologist basically — I've known him for many years, a brilliant deep-thinking person — then he steps into the world of this search for alien intelligence. He's rightly concerned that maybe this should get more attention, more funding. *Everybody* always wants more funding. The question is what are you going to invoke in order to achieve more funding? The argument that Oumuamua was an alien-directed spacecraft was not convincing to nearly all his colleagues. But it was convincing to him, and he wrote a book, and the public eats it up. I *want* there to be aliens, but I'm not going to assume that because right off the bat there's something I can't explain, that the best explanation is going to *be*

aliens. Now, Avi did a lot of homework before he arrived at his conclusion. But the homework was missing all the homework he could have done but *didn't* do because he didn't know about it.[6]

A lot of what we've talked about really goes to questions of authority. Do you feel as if your own authority was affected by the claims of sexual misconduct made against you a couple of years ago? [7] I don't think of myself as a source of authority. Let me give an example: The husband of someone whom I was working with was certain that we've never landed on the moon. He gave me this long explanation and said he had so much respect for me that "if you tell me we landed on the moon, then I'll believe it." I said, "No, this is not about authority. It's about your curiosity. It's about your understanding why something is or is not true. It has nothing to do with me declaring it and then you believing it." Then I said, "What would convince you that we landed on the moon?" "Pictures of the landing sites." I said, "Here's a website, and you can see photos." He came back the next day and said, "I saw those pictures, but then I looked and NASA was a sponsor of the website, and that means that if they wanted to keep this a fake —" And I said, "You asked me what would

convince you, and I gave you that evidence, and you're still not convinced. So we are done. It means you are not prepared to be convinced." I never think of what I say or present as authority. My ideal encounter with a person — as me in the educator role — is I teach them how to think about a problem. It's never been about authority. There are people who want to think when I post things it's from pundit status because most people with my level of following are pundits. My postings aren't that. They're to get you to think. So I don't think about authority — ever.

What about from a perspective of curiosity? Did you learn anything about gender dynamics or power imbalances as a result of those accusations? I think the #MeToo movement should have been something we engaged as a society decades ago. I don't think there's anything new about the #MeToo movement that people didn't already know was going on forever. It's not new; it's a matter of when it hit, and social media became a fertile ground for the formation of movements of any kind because finally people get to have a say — not just the media

speaking for people. So I don't know what surprises they held for people. It's not a new thing. It's an old thing that finally got its due.

But I was trying to ask what you, not the culture, had learned. Did that experience open any self-reflection or new understanding about either your own behaviors or thinking regarding gender dynamics? I'm trying to get some introspection. There was the full movement that I think brought a lot of people's attention that hadn't thought about it, hadn't cared about it. I've been very aware of all this for decades. My father is a sociologist.[8] My mother is a gerontologist.[9] They cared a lot about the human condition and access to opportunity. So I had a very good baptism in this and what it means when one group is oppressed or they don't have access to opportunity. I saw that being a Black person growing up. You see how people treat you and how that's different from how they treat others in terms of their expectation for you or opportunities that they think you should or shouldn't have. So I've had a deep lens my whole life.

Tyson in an episode of “Cosmos: A Spacetime Odyssey” (2014). Fox Image Collection, via Getty Images

We mentioned cognitive bias earlier. Do you have any hunches about your own? The fact that scientists are human like everybody means that there is a susceptibility to bias. The difference is the scientist is supposed to have good self-awareness of that bias so that they can check for it. You ask yourself, Do I have an urge for this experiment to come out one way or another? We are trained to invoke, as far as we can see, analysis of bias. So science may be the most honest enterprise humans have ever constructed. So about myself: I always try to check to see if I have bias. You know how to reduce bias? You don't invest emotions. It's just information. So again, my own bias — let me just think. Here's a bias. I think anybody — unless there's brain damage — can learn anything. That's not scientifically demonstrated: I'm operating on the assumption that if any human has learned it, then any other human can learn it. It's sort of a noble bias, right? It's consistent with how I want the world to be. As an educator that's a bias I carry, and I'm self-aware.

Might there be ways of thinking or skills that the next generation of science-popularizers have or need that don't come as naturally to you? Let me back up

for a moment and look at Carl Sagan. He stepped in places where no one had stepped before. He was criticized early on for appearing, for example, on Johnny Carson's show. That's entertainment! That is not science! Then people realized, Oh, my gosh, the public embraces what we do as scientists. Now no one would object to such a thing. I was on Jon Stewart's and Stephen Colbert's shows a lot when they were on Comedy Central. What I chose to do was understand — what is their comedic angle on me? How many seconds will they allow me to speak before they come in with a quip? I would look at Jon Stewart interviewing. He can dance circles around you, and he'll interrupt you and then you stumble. I said, I'm going to try to not let that happen to me. So I timed the average number of seconds he let you speak before he comes in with a quip. It's between six and nine seconds — which is a long time, by the way. So I said, let me parcel my information so that when he does come in it's a natural pause, then we can laugh, and I continue and nothing gets discombobulated. That's what *I* was doing that previously was unnecessary because Johnny Carson wasn't interrupting Carl Sagan every six seconds. What's happening *now* is there are so many ways of reaching people: YouTube and Instagram and

Twitch. This Instagram Live interview I did was hosted by someone named AstroAthens. This is a woman who is one of a dozen or more people who are half my age or less who love science and have chosen to take their enthusiasm to the internet. Take a look at what they're posting. There's no way I can do that. I don't even have the facility with those platforms. And when all the rest of those folks are firmly on the landscape, I want to slowly exit backdoor and have no one even notice that I'm missing.

This interview has been edited and condensed for clarity from two conversations.