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Some Problems Can't Be Solved | Satyan Devadoss

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The Veritas Forum

PART OF A SPECIAL 6-WEEK SERIES | What happens when you try to solve for something that can’t be solved—like what should you do with your life? Can you find joy even when there’s not an answer? In today’s episode, we talk about curiosity and awe with Dr. Satyan Devadoss, a math professor at UC San Diego. Satyan *loves* math, but not because it’s useful, or a good problem-solving tool. In fact, he loves math because it leads to many more UNsolved problems. Most of Satyan’s time as a mathematician is spent on difficult, “wicked” problems, and he says that we can’t—and sometimes shouldn’t—solve everything. Like what you heard? Rate and review us on Apple Podcasts to help more people discover our episodes. And, join the conversation on our Instagram, @veritasforum. You can see our full slate of speakers, learn more about our production team and co-sponsors, and read full show notes at beyondtheforum.org

Transcript

[Music] One of the biggest creative problems you will have to solve in your life is what career you are going to pursue. If you're a college student, you already know this, and you probably think or stress about it regularly. But even if you're older, you probably think about it too, because you'll likely change jobs or even switch careers at some point in your life.

And all of us one day will retire, and suddenly have time on our hands. And we'll probably find ourselves returning to these questions. What do I want to do with my life? How do I want to spend my time? In design thinking terms, figuring out your career isn't a simple problem.

It's a wicked one. Simple problems are problems that have fairly straightforward answers, like how to get from point A to point B, or how to make the best pizza. You may debate these things with your friends, I have friends with very particular opinions on making pizza.

But for the most part, with simple problems, you know the options and can follow the

instructions. Wicked problems, on the other hand, are complex, like ending cancer or ending homelessness, or figuring out what career to pursue. Or even what is the good life and how to live it.

There's no blueprint for these problems. There's lots of trial and error. They take time.

People have been asking and re-asking these questions for generations. My guest today is Sethi Endevidos, a mathematician at the University of San Diego. And you might think, as someone who does math for a living, that he's focused on problems you can solve with formulas.

But he actually spends most of his time on wicked problems. And he says that we can't and sometimes shouldn't solve for everything. So in this episode, we talk about curiosity and awe.

And what happens when you try to solve for something that can't be solved? Like what should I do with my life? Can you find joy in awe in the not knowing? This is Beyond the Forum, a new podcast from the Veritas Forum and PRX that dives into life's biggest questions. For our first season, we're asking, "What is the good life and how can we live it?" And we're talking with some of our favorite thinkers. I'm your host, Bethany Jenkins, and I run the media and content work at the Veritas Forum, a Christian nonprofit that hosts conversations that matter across different worldviews.

Sethi End was born and raised until he was about eight years old in India. His parents were both professors in India, but they didn't have PhDs. So they came to the United States to study and they stayed because his dad got a job.

My dad applied for a job when he finished his PhD and he's like, "Ah, let's just see what happens." I think they offered him in the 80s, like 30 grand, which if you convert to the Indian currency, becomes 900,000 rupees, which is like 30 years of your salary in one year, like if you do the conversion. But at the same time, I live in America and I grew up in Chicago and watching Michael Jordan, you know, and so I'm kind of very much of an Americanized kid in some other sense too. When it came to choosing his own career path in his family, getting a PhD was just assumed.

Most kids in America growing up, the concept of going to fourth grade or not, is not a discussion that happens at the dining table. You're just going to go to fourth grade. Like, that's exactly my family in grad school.

For Sethi End then, the only question was, "What will I get my PhD in?" His favorite college course was aesthetics, the philosophy of art. And he also loved mechanical engineering and playing with gears, pistons, and legos. But he had a problem.

His undergrad major wasn't in aesthetics or mechanical engineering. It was in math. So he decided to get a PhD in math.

But when he got to grad school, he faced an even bigger problem. He suddenly realized he didn't really like math. And the reason I'll tell you why I didn't like math in grad school, Bethany, it was because in grad school, unlike undergrad, all you do is math.

A hundred percent of your time is math. In an undergrad, you were taking a class on philosophy, taking a class on economics. When I went to grad school, it was really disgusting.

You were like, "Oh my gosh, all you guys do is math." And it wasn't until after grad school that he actually fell in love with math. Not because of the math, but because of the unsolvable questions that feel like a melding between math and philosophy. I've come to realize that it's not really math that motivates me.

It's a sense of discovery. And math was a tool to discover things. Even today, I struggle with whether I'm really a mathematician.

Most of my colleagues who know me really well also wonder, "Do I know any math? Like, how did this... is it just like smoke and mirrors?" But here's what they know. It's good looking smoke and mirrors. They said, "Whatever he's doing, it seems pretty cool." And they're kind of... they're kind of still struggling with it.

I'm kind of the real thing or not. And in all honesty, Bethany, I... I don't know whether I love math or not. From the outside, though, it seems to me that Sethian does love math, at least more than most of us.

When we hosted a Veritas Forum with him in February 2011, here's how he spoke about the universe and how math can help us understand it. What do I think of this? I think it is absolutely beautiful. Oh, my goodness.

It's gorgeous. You know, this idea of taking a particle and looking at all possible ways that can go from A to B, now generalizing it to all possible universes, oh, my, well, that is gorgeous, right? So in our conversation, I wanted to understand what he meant by not knowing if he loved math. And he told me that the reason he struggles with this question is because of how math is typically taught.

First, I think it's that math is taught as a useful subject. And I think that's dangerous. And the second thing is math is taught as a set of detailed tools.

To Sethian, the notion of usefulness is the main problem with how we frame studying math. The real fun is in the puzzles themselves. The number one thing that teachers get asked, you know, you even know this from stories and comic books is, "Will I need to know algebra when I'm 30?" Right? Like, you know, when will I need to do this thing? And the answer is absolutely idiotic.

Like, well, check, you know, maybe you need to balance your checkbook. Or when you're

checking out, I have never used algebra in my life. I've never used it.

I don't use trig. I don't use algebra. I don't use calculus.

I mean, I teach it. I use it in terms of making money, like, thank you for paying my salary, but like, never use it as a day-to-day thing. I do whatever video.

So you take out your phone or your calculator and you subtract things. He says to him, "Math is more like music or poetry or art." The whole point of math is to give useless, joyous things. Nobody says, "You know what? Let's put in some Coltrane because it's really useful tonight." You don't listen to Beyonce because it's useful.

You listen because it's you are faced with glory. You go and they go, "Oh my gosh, what are you listening to?" And you go, "That's what I want to taste." The moment you say math is useful, you have shot any point of redeeming that thing. Just like saying music is useful or going to an art museum is useful.

None of those things are useful. They're amazing. They're what makes us human.

Coltrane, Beyonce, I had to remind myself that Sethian was comparing how he feels about them to how he feels about math. I'd never heard anyone talk about math like he was. So I dug a little deeper.

I wanted to understand what it was about math that Sethian really loved. What real math research is is asking the right questions. I think solving the problem is not exciting to me.

I know it's a weird thing to say, but students solve problems all the time. Like, in fact, Ed Berger, one of my jurisprance from probably the most brilliant math communicator in the world that I know of, he always says, "Why is it that in math we always call it problems?" And in every other discipline, you call it fun things. "Hey, let's do a project.

Let's do a composition." Right now, there are infinitely many unsolved questions. And every time I solve one, I've created 10 more unsolved questions. And the unsolved questions that Sethian loves, the ones that get him out of bed every day, they're about boxes.

Think about the last box you got in the mail. So you want to flatten the box. And instead of just stepping on it, kind of crudely, you want to take your exacto knife and cut along the edges.

And you could cut along every edge of the box, you know, like a cube, for example. You could cut all the edges and you could get six squares. But what if you just want to cut enough so it flattens it? Can you imagine Bethany taking a box and cutting some of the edges so that the box lays flat and still connected, you know, so you don't break it into several pieces and don't waste your cuts? And if you think about it for a second, it'll

actually look like a cross.

So if I give you a cube, you can cut so that, oh, that's perfect. It's one connected piece. I haven't cut it too much and I haven't cut it too little.

It still flattens it. Now we could throw it in the recycling, you know, elegantly rather than waste up volume and stuff. Now, what if somebody gives you another weird box, not a cube, but some other weird, maybe like it has 30 sides, right? Or some like, you know, weird shape with weird angles and structures.

Is it possible for you to cut along the edges so you can unfold it and lay it flat? So the flaps kind of don't overlap themselves, you know, kind of like lays flat on the floor. That is a 500 year old unsolved problem. No one knows how to solve it.

And to me, that is what gives me the rush, right? It's the fact that now I'm at the edge of knowledge. And this is what Sethian does with his students. He doesn't just work with them to solve math problems.

He works with them to discover math problems too. It turns out for a cube, there are 11 different ways you can unfold it flat. And we showed that no matter how you cut any dimensional cube in any different way, it'll always work out for you.

It's really cool. It's not the 3D problem. We kind of tweaked it to just restricting it to cubes, but we went to higher dimensions.

And to me, that is the most useless, idiotic, purposeless, seven dimensional box and folding in the 60 who cares. In one sense, it might have a use because somebody might take those techniques and apply it to this 500 year old problem in somehow. But most likely people don't.

But man, does that give you a rush, right? Like you have now not only stood at the edge of knowledge, but pushed it forward a little bit, right? You've kind of, and more brought along others to share this joint with you. The more Sethian talked about math, the more math seemed to me like any other discipline. Let's take for example something that I'm familiar with because I went to law school.

The law. Sure, there are some cut and dry settled laws. When these go to court, the issue is usually just whether they apply or whether someone violated them.

These are simple legal questions, and most of them get decided in lower courts. But then there are also wicked legal problems too. The kinds of questions that get debated for decades and work their way up to the Supreme Court, they're unsettled laws, and they raise novel legal questions.

You might think of some areas of e-commerce law or laws about space. For some

lawyers, these big questions drive them bonkers because they'd rather deal with settled law. But for other lawyers, especially law professors, they want to explore these legal problems precisely because they're unsettled.

And the same holds true for the law as it does for math. The bigger the question, and the more widely applicable it is, the more interesting it is to explore. And just like Sethian said about math, it's not just solving the problem that's interesting, it's discovering the problem too.

And something else Sethian said about math surprised me. He said, "At the edge of math research and discovery, people often use words or even pictures more than they use equations." We can't come up with a formula to prove we can't have a formula. That sounds idiotic.

We just need to write words. If you look at any of my math research, if you look at most math research papers, they're just paragraphs. So people writing like, "Okay, look at the first picture.

Do you see what I'm talking about? We're just one human, communicating to another human, to convince them that the first human is right." And that's it. So if you can use formulas, great. If you can use pictures, great.

This was fascinating to me, because in a way Sethian's math research combines the two subjects he studied in college, aesthetics and math. But this was also curious to me because it isn't how most people experience math. In fact, at the forum, he talked about a dualism between art and math.

You know, I sit on planes, I give conference, I go to talks, I'm sitting there and I'm talking to somebody else, "What do you do?" "Oh, I'm a math professor." "Oh, I'm sorry." That's the first things you hear. They apologize for their sins. "I'm sorry, Father.

Forgive me. For I liked geometry, but algebra stumbled." You know? And you have the, you know, you're like, "Listen to the confessions everywhere you go." And the greatest confessions are those ones, you know, I'm an artist. You know, those things don't make any sense to me.

And they're really, you know, forgiving in this dualism that has existed, what used to be da Vinci, where art and math and science blend it in together because of the enlightenment era, the renaissance has been cut into pieces. Enlightenment science prized empirical thinking and rational thought as primary sources of knowledge. And today, we're still living in the wake of the enlightenment.

For example, at the Veritas Forum, we frequently host conversations on the idea of scientism, which is an excessive belief in the power of scientific knowledge and techniques. It takes all knowledge, even art or history or religion, and tries to tackle it

with the scientific method. Science played a card that trumped them all, and it allowed them to crush their voices, that only the scientific voice is heard.

If you talk to somebody in the world today and say, "I have a historical truth," or "I have a social truth," or "I have a linguistic truth," those things don't mean anything to people nowadays. But if you say, "I have a scientific truth," then all of a sudden, that feels like that's truth with the capital T. Right? Oh my gosh, he's a scientist, or she speaks in a way that really is truth. When we do this, when we try to force wicked problems into a box for simple problems, it's not going to work.

Not everything can be reduced to a solvable math formula. You need other disciplines with their own modes of thinking. The whole point of mathematics, in many sense, is to find structure and patterns and to find measurability.

As you move down the spectrum, biology deals with measurability in a little bit more complicated system. Actually, a far more complicated system than mathematics. But then you deal with history, and then you have tools that are very crude compared to a scientific tool.

But yet they're really powerful in the historical sense, because you're introducing complexity. You're introducing time at a different level than a biological system would introduce it to. And then you have the issues of the humanities, and you have the issues of linguistic study.

Gosh, the notion of measurability becomes idiotic sometimes, right? Because you're talking about what it means to be human. And he thinks the reason we're tempted to simplify complex, nuanced problems is because we're impatient. Think about that career question.

What do I want to do with my life? It feels so big at age 20. But even people in their 40s or 50s, most of them, they'll say they still don't know either. And yet they're okay.

They have families, jobs, friends. We have lost the notion of learning to sit in something, and we want this quick hit. And this is again self-propagating because the reason we are like this is because we have paid homage to technology, which gives us quicker and quicker hits.

And we are training ourselves to lose the notion of waiting. And so to me, that's the biggest push about complexity that I find in the world today, is the notion of time. And one consequence of rushing to solutions, of treating wicked problems as if they are simple ones, is that we lose the tension and the dialogue between the sciences and the humanities.

And when that happens, the results can be disastrous. I reminded Sethian of the scene from the original Jurassic Park. I don't know if you remember this line from Ian Malcolm,

where he says, "Your scientists were so preoccupied with whether or not they could.

They didn't stop to think if they should." Exactly. I've never not thought of that question. Exactly correct.

That's exactly correct. I'll tell you the problem with the scientific power that you're using here. It didn't require any discipline to attain it.

You know, you read what others had done, and you took the next step. You didn't earn the knowledge for yourselves, so you don't take any responsibility for it. You stood on the shoulders of geniuses to accomplish something as fast as you could, and before you even knew it had, you patented it and packaged it and slapped it on a plastic lunchbox.

And now you're selling it. You want to sell it? Well... I don't think you're giving us our due credit. Our scientists have done things which nobody's ever done before.

Yeah, yeah, but your scientists were so preoccupied with whether or not they could. They didn't stop to think if they should. The big problem with all of this is the fact that the checks and balances that have existed throughout the world, which is that the sciences and mathematics and technology have always been held in check with the arts and the humanities.

Those and arts and the humanities always tell us, "Hey, listen, should you be doing that?" Scientists don't ask the question, "Should you?" We ask the question, "Can you? Could you do that?" Like, we just say, "Can I mix these two things together?" And I have every right to do so unless somebody else tells me otherwise. And those and the sciences have always been in check with those and the humanities and the arts by saying, "Listen, these artists are telling us something about the dangers of certain things." Hi, all. I'm Carly Auschleman, the assistant producer of Beyond the Forum.

If you're loving the podcast so far, we want to invite you to continue these important conversations on our Instagram account at Veritas Forum. Follow us throughout our podcast season to access behind-the-scenes content, exciting giveaways, and conversations with other podcast listeners, like you. Thanks for tuning in and enjoy the rest of the show.

By the end of my conversation with Sethian, my mind was racing with wicked, complex problems. Why is there something rather than nothing? What does it mean to be human? What really is the good life and can we live it? What am I doing with my life? In my mind also turned to God. I started thinking about how often we treat God like we treat math, teaching him primarily as something useful or thinking of him as a simple problem to be solved with a formula or an equation.

But there's this scene in the book of Ezekiel, where Ezekiel shares his vision of a throne, and he's at a loss for words, because what he sees he has never seen before. So he uses

language of resemblance, phrases like "the likeness of a throne" or "the appearance of sapphire" or "the likeness of the appearance of a man." And you'd think that the closer he gets to the throne-like thing, the more sure his vision becomes, but the opposite happens. The closer he gets, the more he realizes how otherworldly everything is.

I think of this scene whenever I hear people talking about how sure they are of God and who he is. But if he exists, and I think he does, he's most definitely not a simple problem. And he's also not something that's merely useful.

At the forum, Sethian gave a big vision of God and his creation. At this very moment, where God not causing all that is to exist, there would be nothing at all. It's not that there is a person who needs to start something to say, "This is creation." The fact that we're here, this is creation.

The existence is what creation means. The fact that God is sustaining everything that's happening now. One thing has changed since Ezekiel had his vision, and that is that God came in human form in Jesus.

This is what Christianity teaches, that in Jesus, the incomprehensible became comprehensible. The unapproachable became approachable. The otherworldly came to this world.

You might be wondering why I included an episode on math in a series on the Good Life. It's a good question. And the answer is because we modern people so often see the world through math and reason and science.

But there is a reality that these modes of thinking cannot calculate. And far from that being a bad thing, it's a wonderful thing, because it means that the world is complex and beautiful. You may not be a Christian like I am, but you and I probably share a common struggle.

We often stress about figuring out the complex, wicked problems in our lives. Yet there's research that says finding wonder and awe in your life is good for you. Research tells us that when we feel small in the world, like if we stand on the edge of the Grand Canyon and we stop thinking about ourselves but instead take in something magnificent, we actually feel more plentiful and our life satisfaction increases.

We're even more generous and we get the sense that we have more available time. I know that today is probably full of lists of small and big things. Do homework, pay the bills, get gas, catch up on email, apply for a job.

But don't miss the opportunity to pause and ask yourself, where and when can I pursue awe and wonder today? Maybe you go into nature or maybe you listen to a beautiful piece of music or maybe you try something outside your comfort zone. Or maybe today you ask more questions, bring more curiosity to the table, ask questions that you don't

already know the answer to and perhaps even wonder about the big questions. Why is there something rather than nothing? Why are you here? What is the good life and are you living it?

[music] Next week we have our final episode of the season.

It's with Mira's Lawful, a professor at Yale who teaches one of Yale's most popular courses, a life worth living. You won't want to miss it.

[music] Hi again, this is Assistant Producer Carly Echelin.

To close, we at Beyond the Forum want to take time to say thanks to all the folks who helped us get this episode together. Our first thanks goes to our guest, Sethian Devados. We loved your expansive and ingenious metaphors and your fresh takes on the role of math in our daily lives.

Thank you so much for joining us. We also want to thank our amazing production team at PRX. That's Jocelyn Gonzalez, Genevieve Sponseler, Morgan Flannery and Jason Saldana.

And thanks to our great colleagues at the Veritas Forum for being our biggest fans and a fantastic team to work with. And of course, we want to thank the John Templeton Foundation and all of our donors for their generous support of our conversation. And a final thanks goes out to our launch team and co-sponsors.

It's so great to have your help and support as we produce these shows. That's all for this episode. Thanks for listening to Beyond the Forum.

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