

Evelyn Lamb: [00:09](#) Hello and welcome to the Lathisms podcast. I'm Evelyn Lamb. In each episode, we ask a Hispanic or Latinx Mathematician to talk about their journey in Mathematics. Today we're happy to have Jesús De Loera on the show. Welcome.

Jesús De Loera: [00:23](#) Thank you for having me.

Evelyn Lamb: [00:25](#) Can you tell us a little bit about yourself?

Jesús De Loera: [00:28](#) Yes. I am a professor of Mathematics and member of the graduate group in Computer Science at the University of California Davis. I have been here for 20 years as a professor. Before that I was at the University of Minnesota in Minneapolis. I was also at the Geometry Center. I was also a post doc at the ETH in Zurich, this is a Swiss Federal Institute in Zurich as a Computer Science post doc. That's more or less my trajectory. I did my PhD at Cornell University in 1995.

Evelyn Lamb: [01:09](#) What were your early experiences in Mathematics?

Jesús De Loera: [01:13](#) I did my undergraduate degree studies in Mexico. I went to the National University of Mexico. The background that I have is ... in Mexico, public education is much more readily available, financially available than in the United States. Essentially, if you have good grades you can go to college because education is free. I come from a middle class family, my parents never thought of sending me to a private school because the National University ... if you have good grades, you can go there so I went there.

Jesús De Loera: [01:58](#) My earliest experience in Mathematics, I remember, was in high school. I liked Mathematics ever since I was a little kid but I never remember saying, "Oh, wow. This is actually something I can do." Until my last year of high school, I was starting to think what I was gonna study. I considered several options but I was very good at Mathematics. I won a state competition. That's when I ... first time I realized or I became aware of myself that Mathematics is something that I really enjoy and that I was good at it and ... I must have been 18, 17 years old at the time. That's when I decided that I could study Mathematics. My father was extremely angry with me because, you see, in the National University as I told you the education is free. By the grades you have, you can choose your major.

Jesús De Loera: [02:58](#) Obviously, the most famous majors are medicine, law, engineering because you can make a lot of money. Right? So, I decided to choose Mathematics which my father was extremely upset with me. He was really angry because he's, "How can you do that? You're gonna die. You're not gonna get a job. There's nothing to do with Mathematics."

He told me, "You are not gonna do that." I decided, "Well, watch me." That's the earliest experience I have in Mathematics.

Evelyn Lamb: [03:34](#) It sounds like your father didn't encourage you to pursue Mathematics.

Jesús De Loera: [03:37](#) No.

Evelyn Lamb: [03:37](#) But did you have encouragement from other people in your family or professors at the university?

Jesús De Loera: [03:42](#) Well, my mother was extremely supportive. She will fight with my father about it. Even though my father was really ... he never accepted the fact that I was gonna study Mathematics. Sadly, he died without coming to peace with that. Yeah, my mom is somebody that really was important in my life because she really ... essentially, she told me that I had to choose my path in the world, that I had to choose my life and nobody else could do that for me. All she was asking is that I really had a love for my job because that's all ... she thought that way that I was gonna be happy and that money will come later. She was not so worried about the financial. I think she was right. It's true that I think people should be more driven by their passion and their abilities rather than their financial decisions in my opinion.

Evelyn Lamb: [04:44](#) Yeah. What about the professors at the university or teachers that you had in high school?

Jesús De Loera: [04:51](#) Well, in high school ... again, I won this competition and everybody more or less was supportive but I will say, I didn't have ... the undergraduate experience in Mexico is very different from the undergraduate experience in the US in the sense that when you start the university, you already know what you want to do. I don't have to talk about anything else but Mathematics. You have to be decided, of course, you have to be sure. But in some sense, when you go to such an environment, everybody's excited because everybody's doing what they want to do. You see?

Jesús De Loera: [05:35](#) It was a great environment because my colleagues, the other students that were in college with me, they all wanted to do Mathematics. It was a very competitive environment, very high energy. Everybody wanted to learn more, and more, and more. It was a very, how can I say, positive, very enriching, very energetic environment, stimulating, stimulating is a good description.

Jesús De Loera: [06:03](#) I never really, except for the bad experience I had with my father, I never really had that, "The world will say no. What are you gonna do with that?" I was surrounded with

people that were positive about it. Everybody was Physics or Mathematics major, or Statistics major, so everybody wanted to do that type of work.

- Jesús De Loera: [06:26](#) In college, in the National University of Mexico ... the typical name is UNAM because that's the Spanish acronym. UNAM. In UNAM, it's a huge university, there's hundred thousand students in the campus. It's much bigger than any American university, bigger than the biggest. You don't know everybody but you know the Science students are small minority compared to the rest, right? I got to know a lot of the professors, and the professors get to know you ... at least back in those days, it was easier to get to know you. At some point, I remember some professor telling me, "Well, there are fellowships in the Institute of Mathematics to do research for undergraduates."
- Jesús De Loera: [07:18](#) I went there and I got a fellowship. I was awarded a fellowship to do research with a professor. My first mentor was Javier Bracho Carpizo, he was a researcher in the Institute of Mathematics. He taught me a lot of graph theory, topology, and things like that. I wrote my senior thesis on essentially a combination of topology and graph theory. He was my mentor in the first few years. He was tremendously influential.
- Jesús De Loera: [07:56](#) Another person that was very influential to me was Francisco Larion, he was an algebraist. He taught me a lot of Algebra back in those days. Another person is Víctor Neumann, he was essentially the first Mexican Mathematician that did combinatorics. He was the founding father of combinatorics in Mexico. So, very exciting environment for me.
- Evelyn Lamb: [08:24](#) Now as you're further along in your career, I imagine you're on the other side of the mentorship relationship. Can you talk a little bit about the importance of mentorship in your mathematical life?
- Jesús De Loera: [08:36](#) Oh, I'm extremely dedicated to mentorship. I often say to people that I'm proud of my books and my papers, and my theorems. But I'm more proud of all the students I have had. As of today, I have 12 PhD students, and three more are coming up. I have had 50 undergraduate students working with me in research and have written senior thesis with me.
- Jesús De Loera: [09:01](#) I consider myself a very social mathematician. From that point of view, I enjoy very much inviting young people to join me on exploring questions in Mathematics. Mentoring, for me, is a way of doing Mathematics. I'm not that kind of mathematician that goes to his office and closes the door and starts throwing theorems by himself. I

hate that. I really think better talking to people and just saying stupid things, and then getting ideas after you hear something stupid is easier for me. I like to talk when I think. It's something that I ... I don't know why but that's my style and I'm very social, and I reflect that in ... you can see that in my group.

Jesús De Loera: [09:49](#)

For example, I just had a group meeting in the morning where my 12 students; I have two post docs, three graduate students, and many undergraduates are together talking about different types of Mathematics. Everybody's talking, presenting, discussing, asking questions, that's my style. Yeah, mentoring is a way to do Mathematics for me.

Evelyn Lamb: [10:14](#)

Can you tell us about your research?

Jesús De Loera: [10:16](#)

Yes. Okay. So first of all, I am a Discrete mathematician, or combinatorialist, special spaces that have finitely many components or finite many pieces such as graphs. I like to use Geometry. I use a lot of Geometry and study geometric questions that are finite. For example, let me try to give you an example that I like a lot. In Geometry, one of my favorite objects is complex polytopes. Complex polytope is ... you have seen examples, cubes, triangles, squares, pentagons, icosahedron, all these beautiful objects that look like jewels, they are one of my favorite objects because they are finite, they are made of finitely many pieces glued together but they also have a lot of beautiful geometric properties.

Jesús De Loera: [11:25](#)

I study, for example, the graphs of polytopes. That's one of my favorite topics right now. I do Discrete Mathematics but I also do Discrete Applied Mathematics. I'm very interested on applications to optimization, data science, and I try to use Geometry to understand applied questions. For example, clustering data, when you try to do classification of data, a lot of classification processing in data science really can be phrased as geometric questions. I use a lot of that in my research.

Jesús De Loera: [12:05](#)

I'm always motivated by questions in Applied Mathematics that come from a concrete applied subject. But I always translate that into Geometry and often into Discrete Geometry.

Evelyn Lamb: [12:19](#)

That sounds like a field where you'd have a lot of different paths that your students could also pursue.

Jesús De Loera: [12:27](#)

Certainly. That's one of the reasons I like to bring a lot of students to my research because I often have to do applications. For example, in data science right now I have a group of undergraduate students working on a

really exciting project that I think is very easy to explain so I will tell you what it is.

- Jesús De Loera: [12:46](#) I have data that is given to you in the form of mathematical books. For example, books having written by mathematicians, Hilbert, and Gauss, and Terry Tao. Imagine you have all the books and papers written by many the mathematicians. Now there's a new mathematician, a mystery mathematician, that wrote another paper or another book, and you like to know who that person is but you don't know the name because it was deleted. How can you write a computer algorithm to guess who this person ... who this mysterious mathematician is?
- Jesús De Loera: [13:24](#) It turns out that this is actually a very beautiful Geometry problem. You are trying to just understand the papers, mathematical papers, are just vectors on a vector space, and you are trying to understand what is the most, the closest group of papers to my new paper, to my mystery paper.
- Jesús De Loera: [13:45](#) If it is closer to Hilbert's, probably likely that that paper was written by Hilbert. If it was written by Terry Tao, maybe it's closer to Terry Tao's cluster. You see? In that sense, data is just Geometry again.
- Evelyn Lamb: [14:01](#) Yeah, that's fun. What are your thoughts on Hispanic heritage month?
- Jesús De Loera: [14:07](#) Okay. I didn't grow up in this country. I moved to this country as an immigrant. I'm proud to be an immigrant but my children are growing up in this country and I can see that there's very few, very, very few children represented in Mathematics competitions, for example, that are of Latino origin yet. This is alarming. This is very, very alarming because in 30 years, the majority of age group that should be doing engineering, that should be doing science, they will be Latinos. They are not gonna be calling their first share of opportunity and their first share of the job responsibilities that they need to be performing. That's gonna damage the economical functioning of the society regardless of what you think about race relationships in this context.
- Jesús De Loera: [15:10](#) Some people don't believe in diversity. If you don't believe in diversity, you should believe in economics. It's an important factor and you cannot expect that a sustainable without inclusion ... diversity is mandated by demographics alone. Those are some thoughts of why we should definitely celebrate and pay attention to these group of people.
- Evelyn Lamb: [15:39](#) Thank you. Anything else you wanna add?

- Jesús De Loera: [15:47](#) Let me just end by saying that one of the big fights that I also have in my mind, sometimes when I talk to specially young people. When I started my career, I had a very pure Mathematics perspective as my training was mostly in Algebra, topology, and then when I came to the US, I slowly realized that computational science is very important too and I realized how computer science algorithms, I became very interested on that.
- Jesús De Loera: [16:20](#) As I grow older and older, I like to think that there's no difference between pure and applied mathematics. A real mathematician should really not care about these differences. Especially not explain differences to young people. There are prejudices in race, there are prejudices in gender. I believe we also have prejudices in the mathematical community about, "Oh, I do Pure Mathematics." Or, "I do Applied Mathematics."
- Jesús De Loera: [16:49](#) This is, I believe, a mistake, a terrible mistake because I think if you really look at beautiful Mathematics, they are everywhere and very Pure Mathematics have applications in very applied situations. This is demonstrated again and again, and again. For example, Number Theory, for many years people thought it was completely useless. Nowadays, we know it's the basis for all cryptographic systems. Similarly, topology, many people say, "Oh, well, the topology is not gonna be good for anything." And then people realize that it's actually related to Game Theory, to find equilibrium in economics or it's also related nowadays to topological data science.
- Jesús De Loera: [17:38](#) This is what I'm talking about, that you cannot, you absolutely cannot stay in one place. You have to look at all the perspective. It opens opportunities for young people and for society to appreciate Mathematics. If we take an open-minded approach, if we stick to this rhetoric that, "Oh, we are only do Applied Mathematics." "I'm only gonna do these kind of Applied Mathematics." Then it's gonna be ultimately very negative for mathematicians of all kinds and for society because then society doesn't know what they can ask from a mathematician.
- Jesús De Loera: [18:18](#) One of my fights everyday to make sure that people stop behaving in a way or another. Of course, people have preferences but I do think that especially young people should not have these kind of biases. They need to be open-minded. After all, they are very young and they still need to learn so much. I still need to learn so much so therefore, they have really responsibility to learn as much as they can about both Pure and Applied Mathematics, or any kind of Mathematics, interesting applications, interesting theorems. It's just a beautiful

landscape and it's all put together, it's even more beautiful.

Evelyn Lamb: [19:02](#) Yeah, it really is. Well, thanks a lot for joining. I enjoyed talking with you.

Jesús De Loera: [19:08](#) Thank you for inviting me to speak to you.

Evelyn Lamb: [19:10](#) Thank you for listening to the Lathisms podcast. It's produced by me, Evelyn Lamb, and made possible by a Tensor SUMMA grant from the Mathematical Association of America. Our music is Volveré by La Floresta.

Evelyn Lamb: [19:27](#) Lathisms is an initiative to celebrate the accomplishments of Hispanic and Latinx mathematicians. It was founded in 2016 by Alexander Diaz-Lopez, Pamela Harris, Alicia Prieto-Langarica, and Gabriel Sosa. You can find more information about the project at Lathisms.org, that's L-A-T-H-I-S-M-S-.O-R-G.

Evelyn Lamb: [19:49](#) Join us next time to hear from another inspiring mathematician.