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THE INTERNATIONAL POLITICS OF ALGEBRA

Abby: Take us into the past, Bernd. How long have you been here?

BERND: I came as an exchange graduate student to the States in 1985. At that time, there were two Germanys, and I was from West Germany. A long time ago. I was supposed to be in Seattle for a year and then go back to get a PhD in Germany, but I loved Seattle, and I got stuck here another year, and another year.

One reason I stayed in Seattle, well, the main reason, is that I met the girl of my dreams. I'm glad to say we are still married. After Seattle, I was teaching at Cornell, NYU. I spent a year in Japan, a year in Austria, and then I came to Berkeley in 1995.

My work is very much between what is traditionally considered pure math and applied math. When I came to Berkeley, I was sucked into the pure math culture here. In the meantime, I was given courtesy appointments in computer science and statistics. That means, for these two departments, I don't have to teach, don't have many duties, but I can supervise PhD students, I can vote, and occasionally, I get a free lunch. So that's my situation right now.

So were you always into math?

BERND: You know, I was a good student in high school, but not specifically in math. Many of my colleagues were in special high schools, in places like Moscow, at age 12, studying advanced math and winning international gold medals. I was nothing like that at all.

I was a good student. I liked math, but I liked philosophy—like you—and language. I liked many, many things. After high school, I had to do compulsory military service in Germany. That helped me figure out that mathematics, possibly computer science, was what I wanted to do. I went to the university in Germany, and then I really got into it.

Did you have any mentors?

BERND: Sure. I had one mentor who supervised the master's thesis for me. We were very, very close. He helped me a lot, and we started publishing together. After I went to the States and decided to stay, the relationship turned sour.

He was kind of a father to me, and most parents want to see their children succeed. Some parents don't. They get very anxious or envious. He was that sort. He couldn't let go. I was thinking about leaving mathematics just to avoid this person. So, it was very much an emotional thing, actually, to stay in this field.

At that time, I had no career goal. I got my PhD very quickly—in two years—and my new mentor in Seattle said I should do a post-doc, and he sent me to Minneapolis for one year. So I didn't have a very clear idea of what I was doing.

I had what is more commonly attributed to female mathematicians: an imposter syndrome. I felt like, why did

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I get picked for this postdoc? I got picked for that job. I got invited to this and that, but I'm really not good.

I go to the library, I open a random journal, and I don't understand anything. It's all fragmented. I don't understand anything, and there are all these wonderful scholars out there. They must understand everything. Why did they pick me? They are going to find out, right? Any day now, they are going to find out.

I sort of waited. When will they find out that I'm not so good? After a couple of years, I realized they never found out. They didn't find out, and maybe the other people aren't so amazing either. So they still haven't found out yet, and I'm still here. I didn't really have a great planned out thing. One thing happened after another very quickly.

How was your educational experience different in Europe?

BERND: At that time, and until recently, we had 13 years of high school, and the last two years are very rigorous, analogous to maybe the first two years of college here. Mathematics was taught very rigorously in Europe, and still is to this day, I think. Once you enter university in Europe, you pick your major right away.

Here, there is this idea that universities are ranked. Some colleges are very good, and they are hard to get into. In Germany, once you get a high school degree, unless you want to go into a highly demanding subject like maybe medicine or law, you just go. You pick your favorite university and you show up. You don't have to pass a standardize test or get admitted.

Mathematics never, ever has any entrance requirements, but after year one, half of the students disappear. The selection happens through the subject of study. Everybody sort of gets a chance. Of course, that's a very expensive and wasteful system. You waste a lot of resources and people's time. Now, it's more streamlined and it's moving more in the direction here.

It was a big shock for me when I got a letter from the University of Washington, "Congratulations. You've been accepted." I didn't know what that meant. What do you mean? I was going to go. Why the congratulations?

I try to explain this to my American friends. In Germany, university was a public service, like the post office and the DMV. You don't get to go to the El Cerrito DMV because it's more prestigious than the Oakland DMV. "Congratulations. You've been admitted to the San Francisco DMV!" It's a public service that serves customers who are entitled to its services. That was the perception of public education. To some extent, it's still the case.

Maybe it's a problem that it's free. People here bankrupt themselves to send their kids to college, but as a result of that, they really appreciate it. I get a sense that students are very conscious of the expense.

I always enjoyed teaching undergraduates, but I never quite understood the path that brought them to college. After my own kids went to high school, I realized this whole madness of AP, ACT, SAT, prep, applications, whatever, whatever. High school juniors and their families are so stressed out. Coming from Germany, I just didn't know what was involved.

I think the set-up is very different here. This whole idea here that proofs are scary and we all admire calculus … One problem we have in this country, if I may ramble on a bit, is what I would call a calculus problem. I am on record in my department as the "calculus hater," but that's not true.

I think calculus is a historic accomplishment, 200-300 years ago, to understand how passing to the infinite is a limit process that leads to very powerful consequences, with applications to physics, and engineering, and many things.

It's very important that students learn calculus, but it's at the expense of all other mathematics. In high school, it's this big thing. Smart kids lead up to pre-calculus, a little bit more pre-calc, and then there is calculus. Really smart kids take AP calculus. Really, really smart kids ace the BC calculus test. But then the madness goes on.

These kids go to college and they take a math class. Most students who take a math class in college will take exactly the same calculus class they took in high school—maybe a slightly higher level—but the content is exactly the same. It's the stuff they learned for their AP test.

So they pass it, and if they have to take another math class, it's another calculus class! Multivariable calculus and yet more calculus. And it's to the exclusion of everything else like logic, like probability, statistics, combinatorics, discrete math . . . There are so many interesting things that students could take.

I think the English department and the philosophy department, for example, would never put up with this.

THIS MONOCHROMATIC, MONOLITHIC VIEW THAT THERE IS ONLY ONE PATH. IN MATHEMATICS, FOR SOME REASON, THAT'S BEEN ESTABLISHED. EVERY HIGH SCHOOL PARENT BELIEVES IN IT. ALMOST ALL COLLEGE PROFESSORS BELIEVE IN IT.

I'm not saying we should abolish calculus. I'm saying that it should not be 99% of the offerings for college freshmen and advanced high school students. There should be more choice. That's my line. I think this structure is a little bit different in Germany.

So my daughter is a fashion designer at the California College of the Arts. Her interests are far from math. I remember when she was in 10th or 11th grade and we were talking about what math to take. She is not mathematically inclined, like most arts and design majors, but she's always been a good student. So I said, 'You know Nina, I really like statistics.' The choice was pre-calculus/calculus or statistics.

Nina rolled her eyes, as teenagers do, and she said, 'Dad, don't you know, calculus is for smart kids and statistics is for stupid kids.' So they knew; all the high school kids knew. They have no idea what these subjects mean, but they surely know that whatever they are, calculus is for smart kids and statistics is for dumb kids.

Many people have this idea that they aren't math people, that math is difficult or boring. Whatever. You had a different experience. Why do you think that was?

BERND: I always thought it was fun, but so were other things. I think that's learned, that it's not fun and boring. It's not for everybody. Not everyone is into sports or literature. People have their preferences. Being successful helps. I was scared of sports because I was short and fat. I got a C in physical education. So there is always that. If you get positive feedback, it's a subject you like better.

My kids went to Montessori school in Berkeley. Most kids in that school were, by the usual measures, not good at math. At Montessori school, in elementary school, students will choose their own work. Parents go crazy, because most third graders don't choose memorizing the multiplication table as their favorite subject. So parents freak out.

But what happens every year is that the 100th day of school was a math day. And the kids loved math. They thought it was a fun thing, a cool thing. They were not particularly skilled at routine problems, but they hadn't learned yet that math was something they were supposed to fear.

People often get taught that math is something you do to step to something else. You need a good calculus score to be a pre-med. Med schools use it to weed out the stupid kids from smart kids, right? But at the same time, I have seen college students who were told to major in chemical engineering, or business, to live out their parents' dream, and then they came back to math.

But, of course, you're right. The standard thing is that you go to a party and everyone says they were terrible at math. That's a common reaction, but there are also quite a few people who ask what I study and want to learn more.

They now have these groups every Tuesday, math circles. It came from Eastern Europe, but now it's very popular in Berkeley, San Francisco, and San Jose. Kids and parents who are interested in doing more math—it's a packed Tuesday night. So there is a fairly healthy interest in mathematics. I'm not so pessimistic.

You were into math first, then computer science, statistics, and then biology?

BERND: Computer science was fairly new when I was young. Computer science was this exciting, new thing and math was what I liked. As I said, it took me a lot of pain in the military, to figure this out, that this is what I wanted to do.

What else was in the running?

BERND: Well, at some point, I wanted to be a journalist, to tell you the truth. I thought that would be pretty cool. I looked at engineering. My father was a civil engineer. But then math is so much fun. I decided I should spend my life doing it. I had no idea that you could have a job just doing math. Nobody ever told me.

I knew that you could be a high school teacher. That's ok, you know. Or a computer programmer. I thought, ok. Then somebody also told me that you could work for a bank. I am from Frankfurt, which is a banking center in Europe, and so that sounded reasonable.

Ok, I thought. I will worry about a job later. Let me have some fun now and study math first. I had no idea that there was this whole world of academic research, that you could be a math professor. Nobody ever told me.

I was always very interested in concrete problems, probably because my dad was an engineer. I look for problems that tie pure math in with some outside thing. That happened at Cornell with operations research. Here, I got into statistics through a collaboration again. I was the guy who was on the math side taking problems from biology and turning them into interesting math problems.

I met this colleague who is now on the faculty jointly between math and molecular biology. He was doing really cool stuff. I got into biology through him. He explained some of the methods they were using in genomics. The algorithms in genomics were similar to some of the mathematical techniques that I knew.

One thing lead to another, and we led this wonderful seminar and wrote this book called, *Algebraic Statistics for Computational Biology*. We worked very intensely for a period of five years. It's been exciting.

Tell us about computational biology.

BERND: Biology, the study of organisms, takes place on many scales, size-wise. The smallest scale is the genome. Ten years ago, the human genome was sequenced, and that led to an enormous amount of data. We have 20 or 30 thousand genes but the arrangement is very complex.

Algorithms of computational biology refers to algorithms, methods, used to figure out what these things are doing. Reading the book of life, basically.

What part of the book were you reading?

BERND: I was involved in some work on phylogenetics, reconstructing evolutionary trees. Biologists agree that nothing makes much sense in biology except in light of evolution. That's a famous quote. So we have present day species, we have some sequence data, and from that, you reconstruct the tree and information about the tree. Mathematical methods are very, very accurate now. They give much more accurate information than fossil records.

A bio paper I was involved in was about the development of vertebrae in invertebrates. Ok, so here is how life works: In the beginning, there is one cell, and then two cells, and four cells, and so on. The embryo develops. At some point, these cells differentiate. You have liver, and bones, and eyes. In invertebrates, at some point, the vertebrae start to form, and this process is called somitogenesis.

Maybe on day seven in the development of the embryo, a clock turns on. Every two hours, or maybe 90 minutes, a new somite gets formed. A somite is a precursor to a vertebra. We have a certain number, like 15 or something. Every two hours or so, exactly one cell differentiates and makes a new somite that will be your vertabrae.

This goes on for a day and a half, a very regular pattern. Then the clock is off. That's it. The organism develops, and it becomes a vertebrae. The question is, how does the clock work?

Our biology collaborators in Kansas City knew some genes that were part of this mechanism, but they had a lot of hypotheses. What drives the clock? We were part of a team that did some mathematical model to help them figure it out.

It was a tiny contribution, because these are complex problems, but we used math to help these guys look at their data, and these very cool questions led to new math problems that can then inspire us to write more books and papers that future generations with imposter syndromes can't figure out. It works both ways.

What are you working on now?

BERND: I have gotten away from biology a bit. Right now, algebraic algorithms in general. I am the guy here who is interested in solving equations, modeling various things with nonlinear equations and then applying them to problems in statistics and optimization.

So you interviewed Christos Papadimitriou from our neighborhood computer science department. These are super, super smart people. They are just amazing. They have the best students. They are theoretical computer scientists and we are mathematicians.

Since they are theoretical computer scientists, they are less interested in actually computing things. They are interested in analyzing the theory of computing and making statements about the large-scale behavior and the limits. How long would it take to solve a difficult problem, to analyze the so-called complexity? That is extremely deep and interesting and very, very important work.

I'm the guy who likes to compute things. I just take a small instance, ten equations, several variables, and see what I can do.

You said that you are applying equations to optimization problems. What does that mean?

BERND: Optimization is finding the best point. For example, in the olden

Evolutionary Trees

days, you would take an airplane, and occasionally it would be half empty, which is great for the passengers. You can stretch out. Nowadays, you take an airplane and it's always full. That's a result of optimization. The airline hired a lot of optimization experts to help them maximize their profit and minimize their expense.

So there are a whole bunch of constraints: the airplane can hold this many people, it uses this much fuel, it has crew. You can think of this as a very large system of equations with many, many, many parameters. Then they have a function they want to maximize, like profit. That's an optimization problem. Find the best point subject to many constraints.

After WWII, this was recognized as an important application. In the past, there was a separate department in universities, operations research, that grew out the military, actually. Nowadays, it's happening both in math and engineering departments.

What applications were you looking at?

BERND: In statistics, maximum likelihood. For example, these dice are loaded, and there are unknown probabilities that one lands on A, C, G, or T, the DNA base pairings. Our goal, as computational biologists and statisticians, is to figure this out from the data. If this were a fair, typical die, each side would be a quarter probability, sum to one. That's an optimization problem.

So this is actually a cartoon of such a problem. [points to the cover of his book, *Algebraic Statistics for Computational Biology*]

Yep, that one picture is pretty deep.

BERND: It was very funny. So my daughter, the fashion design major, helped make the first sketch of this cover. Of course, as a California girl, she drew a girl in blue jeans and a t-shirt, and we sent it off to Cambridge University Press in the UK. They came back with a girl in a pink mini skirt. So that's the British version, the Cambridge UK version.

Yes, it's very mod. So tell us about the math culture. Is this a competitive environment?

BERND: It's interesting. People are driven, and there is some competition, but people are very introverted.

I go to the faculty meetings in the computer science department, and they have a strategic plan. They have it all mapped out, how to compete, how to maximize grant income, and so on.

I COME TO THE MATHEMATICIANS HERE, AND THEY ACT LIKE THEY ARE LOST. THEY ARE SORT OF DEEP IN THOUGHT. SO PEOPLE ARE VERY, VERY INTROVERTED. AND IT'S A CULTURE OF TOLERANCE, ACTUALLY.

Do you know the story of John Nash who won the Nobel Prize, the *A Beautiful Mind* story? So John Nash was schizophrenic. He lost his mind, and he was around the Princeton Math Department for 25 years. He had done great work in the '50s, but he was sort of this crazy guy who hung around the library, and went to tea and to lectures. The thing about mathematicians—they are ok with this.

If this were the business school or law school, he would be out the door in no time at all. They wouldn't put up with it. But mathematicians, we are extremely tolerant.

So there is this culture. It's ok to dress weird. Some people are pedantic about having clean offices or incredibly cluttered up offices. That is a typical feature of mathematicians. They are unstrategic. They are not business-minded at all. They focus on the math.

Another part of the culture—it's a young person's game. There are these math circles and Olympiads. People learn these techniques very, very young, the ones who are ultimately successful. Of course, there are exceptions, but on average, our PhD students are much younger than those in other fields. There is married student housing down in Albany, and there is never a math grad student in there.

We can attract the best math students, sometimes irrespective of the cost of living or what we pay. They are so young and so driven. Many don't even think about earthly things: whether they get a stipend, whether they can afford an apartment.

We have statistics on the third floor, and those grad students are more mature. People who go into PhD programs in statistics, often they've had a job. They realize it's very important. For adults, these things matter. Do you have money for an apartment? Can you afford a car? But in math, it's a young person's game.

You go to the math lounge up here, and you see very excited young people, deep in thought, competitive, but about the subject—not so much like what you would find in the business world. It's a different kind of competitiveness. And very tolerant.

They will put up will all kinds of crazy people.

The other thing about being in a math department is that we teach a lot—undergrads, lower division, large classes. We are among the top departments in terms of teaching, so that is our bread and butter. We often get criticized, 'Oh, professors don't care,' but I think we are doing a really good job, actually. I think most of my colleagues are very serious about their teaching, even if a few are a bit nerdy and don't come across so well.

In other fields, in biology, they teach very little. They are focused on running the lab, getting grants to run the lab. Even engineering. They are very busy being strategic and getting yet more federal defense dollars for their research. Everything gets justified by defense. Of course, we love our research, but in math, we have smaller grants, and we are very focused on the teaching mission, at all levels.

People are so worried about cuts in funding these days.

BERND: Everybody needs funding. Mathematicians need funding just as much as the lab sciences, and people have a wrong idea about that. In the sciences, people have big labs, so they need toys. They need chemicals, they need machinery, they need animals. These things are very expensive. But at the end of the day, the biggest budget item is salaries. That's the same here.

We train people. We have post-docs, graduate students, and we need to pay these people. That is why we need funding. Teaching makes up for it. Grad students get support for teaching. And funding also comes in different currencies. We are very lucky to be in Berkeley. I need less money here than I would somewhere else, because some PhD students and postdocs come on their own money. Berkeley has a very good reputation and is high ranking. It's an attractive place. Just look outside. Location is currency.

I hear that American students are struggling to compete, globally, in math. Do you think that's true?

BERND: But the United States is a diverse society. Go half a mile down to Berkeley High. Berkeley High has 3,500 students. Berkeley is urban America. There is one high school in Berkeley and you find all kinds of kids: kids who can't read and write whose parents are both in jail, and kids who are phenomenal achievers who will end up at Harvard. Society is reflected in that school.

By the very selective nature of how kids go to college, by the time these kids get to a good college, those who make it are well-prepared and extremely motivated. Society is segregated in many parts of the country, and that is reflected in education.

Maybe you can say a bit about your style of doing math.

BERND: FOR MATHEMATICIANS, IN THEIR RESEARCH, THE STANDARD FEELING IS BEING STUCK. PEOPLE PICK PROBLEMS, AND THEN THEY ARE STUCK. BEING STUCK IS THE STANDARD MODE OF BEING.

I think I have a lower tolerance level for being stuck than most of my colleagues. I have multiple problems and most of them are easier. That's why I like to do computer experiments, to get unstuck and try different things.

In math, we are a journal culture. We are very slow. It takes forever for papers to get refereed and accepted. It can take two years, sometimes. Partly, that's because we see ourselves as writing for eternity. In biology, if a paper has been out for two or three years, it's considered outdated. Their journal clubs act very quickly.

In math, we write a book. We read books that are 100 years old, and so we expect that some of the books that are written now will last and still be read and discovered a long time from now.

So there is some trend that engineers and biologist will work on, and then, when all of the hype is over, that is the time for the mathematicians to go in and think about the problem very deeply, slowly, methodically, and get stuck. And then some amazing math comes out. Maybe 10 or 20 years from now, the engineers come back and use the math.

We don't compete with the speedy world around us. We take our time. We go deep into a problem, and hope that eventually we will get unstuck and publish that amazing paper in a prestigious journal.

There is a lot of talk about these journals. There is concern about the corporate side of things, open access, the selection process …

BERND: Yes, that is a big concern in the math community. One company called Elsevier is the bad guy. Everybody loves to hate Elsevier. It's kind of the Starbucks of academic publishing. I think they went too far with overcharging and so on. On the other hand, some of my colleagues have been idealistic in thinking that journals, and the whole process, could be for free.

Math Meets Nature
Nature Flowers

I am an editor on eight journals. I donate my time for free, but actually running a journal … Nothing is free. Even running an online journal, even if just a single person does it. That person will typically be a professor, tenured, whose salary gets paid by a university, whose time is expensive.

Elsevier, yes they are a bully and are overcharging a lot. It's good to have some boycott pressure on them. At the same time, having a process that is professional, and having professional versions of journals and book publishing, whether it's hard-copy or online, it's not something that amateurs can do in the long run. So my view is a little bit in between.

I heard that what is important or ground-breaking work in math may be less controversial than in other subjects.

BERND: Uhh. Not true. In core areas of math, there is some agreement, but even in pure math, there is a lot of taste. It's a human activity. As a result, just now, before the interview with you, I came from a meeting with a job candidate. This semester, we have eight interviews, eight tenure track candidates, and I think we have two slots. They cross all areas of math and they are extremely different.

There is a lot of argument. Everyone on the committee thinks his candidate is the best thing since sliced bread. Maybe you have that in every field. What is important, what is a breakthrough, that gets decided by people.

What do you think makes a good paper?

BERND: What makes a *very* good paper? If it solves a long-standing problem. Mathematics has this rich history, and if someone makes progress on a problem that many people have worked on for a very long time, a 50 year old problem, that is considered a major, important result. Or if somebody is going very deep into a subject and changing everybody's idea about it.

Math is rigorous in that correctness, completeness is absolutely important. You need a proof. Physicists will do some computation, and it's brilliant, but in math, we actually have to prove it. There has to be a formal proof. And that's all agreed upon.

But what constitutes an important result, that is up to debate. That is part of the culture. Just because it's correct, new, difficult, and proven, that's not good enough. Suppose somebody comes along and multiplies two integers, long numbers that nobody has ever multiplied before.

Even if it took a month to do it, we would not consider it an interesting thing. This is a joke, but some mathematics is like this. That would be seen as a routine thing, an exercise. So the word "deep" has a very positive connotation in mathematics. There has to be depth to the work.

The process of hiring sounds interesting. How is it different in math?

BERND: So yeah. In this department, we have a hiring committee that does the selection and presents the candidates to the faculty. What is particular about mathematics is that we almost never hire by specialty.

If you go into Biology or English, there will be a search for a candidate in a certain area. The ads are very specific. They will say, 'We need a candidate right now in comparative literature of the 18th century Irish experience,' or we need someone who does genomics of a certain kind. Or there is some breakthrough in physics, so you need some person doing material science, dah, dah, dah.

In my department, we never do this. We always have an ad that says, 'We are hiring the best mathematician in any area.' Then applications come in and the committee fights it out. In these other departments, the fight is ahead of them. What is the subject? What is the important thing right now?

In math, we are a big enterprise with a lot of diversity, but we have this idea that we want the best person. We have this idea that wonderful people will do the right thing in the long run, irrespective of what area they happen to be in right now. As a result of that, the fights and discussion about the area take place after the applicants are in.

We have eight candidates and they represent vastly different areas. So then there is discussion about the quality of the candidate and the suitability, but also about the area. Do we really need another person in this field? That happens after the fact, and it's quite different from other departments.

Do you enjoy being part of the hiring process?

BERND: I think I am kind of a sucker for this. I was the chair of the hiring committee for two years. In the fall, I will be on sabbatical, so I am off all the committees. But I am sort of drawn to it. I find the process very interesting. But I also find myself, at every single vote, in the minority, even as the committee chair.

I think that every single candidate that I proposed was never interviewed. I am involved. I am very outspoken.

I have my views, but when it comes to the vote, I am on the minority side. I've learned to accept it, and keeping at it long enough, once in a while, I succeed too.

So how is math political to you?

BERND: Henry Kissinger once said that the fiercest politics are university politics because there is so little at stake. Some of that is true. We fight over these appointments. We fight over this and that. At the end of the day, it's a minor thing. It doesn't really matter to the outside world.

Of course, math is also political in the outside world. The NSA affair is a good example. The National Security Agency is the world's largest employer of mathematicians. Berkeley is a historically Lefty place but also the top producer of PhDs in mathematics. 80-90% of our PhD students are US citizens. That is very different from engineering.

As a result of that, the friendly federal US government likes to hire our students because they are strong mathematicians *and* US citizens. When I was in Germany, people surely didn't like hearing about the NSA and my former students working for them. So we *are* connected to the real world.

Do you feel like an American?

BERND: I think so. It's been so long. I came when I was 23 and now I am 51. I've been here more than half of my life, and eventually I became a US citizen. This is my home. Of course, identity is a funny thing.

So here is a story from a couple of years ago. My wife, the girl from Seattle, is Korean. One night, we had some debate in the family. I was in the minority there also. My kids said, "Oh Dad, white guys don't get it." And I look at them, and they looked pale to me. But they had this identity that they were Asian. That evening, they decided they are all Asian, and I am the white guy, and white guys don't get it.

So identity is a funny thing. Especially with my children, I see this shifting sometimes—when they feel American, when they feel Asian, or white.

Walking around on campus I see a lot of Asian/Asian American students.

BERND: The majority. The composition of the University of California is changing. When I came here, 15-20 years ago, I think the number was 92% of the undergrads were California residents. Of course, among California residents, the ones who make it to the good UC schools are very significantly ethnically Asian but from California. These are second, third generation families.

Now, the latest I heard, the number is 77 % in-state and 23 % out of state. We see lots of Asian Californians and students from Asia, particularly China, especially in the math department. They tend to cluster in majors like math.

It's interesting how students segregate themselves. I taught this freshman class in the fall. One time I said, "Why don't you guys form a study group or two. I will just have a coffee and come back." I came back and there were about 20 kids and 100% separation. Eleven were ethnically Asian, and nine were not. They self-segregated by race, completely.

Another thing that I noticed is that the economically disadvantaged kids are often the white kids. The sort of Orange County Asians tend to do very well. Their parents will make sure they are fully funded, but some of the Caucasian kids struggle to finance their own tuition. Maybe that is anecdotal evidence from last fall.

Unfortunately, we see very, very few African American and Latino kids, especially in California. Very few. Very, very few. That's a real shame.

Some people have strong views about how far to promote diversity.

BERND: I think we should do better. The university rides this fine line. Before the application deadline, we are under strong pressure to diversify the pool of candidates, to go out of our way to encourage racial minorities and female candidates to apply, but the minute the application deadline closes, it's illegal, by state law, to do any kind of discrimination.

So when I was the hiring chair, we went out of our way encouraging people to apply. But it's a struggle to actually get people to apply, because people self-select. They feel like they don't have a chance, it's not the right fit. The self-selection is amazing. We try to counteract that, but it's very difficult.

I think it would be better to have a more pro-affirmative action stance after the application process. What good is it to diversify the pool over a very long period of time if the resulting appointments don't make progress in this direction?

Would I want to be admitted because I am female? It would be hard to feel good about that.

BERND: I understand that and I am sympathetic. I discuss this a lot with my students. I have had a lot of female students, and now I have the first ever real Latino. This is actually really interesting. Let me digress for a moment. Latino is a big deal.

There is so much cheating going on. There are many universities who will hire somebody who grew up in Latin America. These are people with a wealthy background from Argentina or Columbia. They got a PhD at Harvard or somewhere, and the minute they get a tenure track job, some administrator checks a box, and quota fulfilled. They are completely missing the point, because it never, ever reaches the disadvantaged.

It's the same with African Americans, actually. There is a small number of black mathematicians in American math departments, and the majority are wealthy Jamaicans who were trained in the UK.

Then they come here, and just because their skin happens to be black, quota fulfilled. That is a bit of a scam. That really misses the point of bringing in a broader pool of the population.

Anyway, so now I have this student, Jose. He is a graduate student. He grew up in … I was going to say "some god forsaken place." He grew up in Texas, ok? [Laughing] His family, some of them were migrant farm workers.

In high school, Jose was amazing in math. He makes it to college at the University of Texas in Austin and then gets into a PhD program. A lot of these kids have a hard time, but he succeeds.

Jose came here as a PhD student. He's a great guy, but he did not write very well. He could not write coherent, clear English. So I had him coached by an Asian American student from Yale. In math, a PhD thesis is about writing, and Jose had never been taught to be good at writing. It's much better now.

But the number of obstacles is phenomenal, and the system is abused by bringing in foreigners from well-to-do backgrounds who, by some racial fluke, get the box checked and get declared a racial minority after the fact. It's not a good system.

So you said you would not feel comfortable being selected or admitted based on gender. I say, don't worry about it too much, because in every selection process, there is bias: where you are from, what kind of math you study, who your advisor was.

RACE OR GENDER IS JUST ONE MORE FACTOR, AND IF IT WORKS TO YOUR ADVANTAGE, GREAT. THERE ARE SO MANY OTHER FACTORS. IT IS NEVER FAIR. IT IS NEVER COMPLETELY FAIR.

If the university looks at your case, because they want to diversify the faculty… Great. Go for it. That is my opinion. Of course, you have to be qualified for whatever you are picked for, but generally, a lot of people are qualified and the committee picks a few.

Usually, people who win top prizes are wonderful, qualified, and deserve the prize. But there are always people deserving of a top appointment or prize, and for one reason or another, from this pool of deserving people, the committee picks one. If one of the contributing factors is broadening the pool, that's ok.

When you are picking someone, is it all about the math or do social skills factor in too?

BERND: That's another one. Let me tell you about my minority votes. Hiring is really about the research, the results and the depth, but if someone is a complete social disaster, we will not hire them.

In my opinion, social skills matter more in the long run than people are willing to admit. There is a top group of mathematicians, a very small group, for which it doesn't matter. There are always these charming stories of people who prove amazing theorems, but for most people in the profession, I think social skills matter. A lot.

You have to do editorial work, interact with students, a wide range of people. I can see a positive correlation between people being successful in the long run and being able to interact with others. Unfortunately, hiring committees disregard this in mathematics.

It's the same with teaching. There is this idea that amazing researchers are terrible, unwilling teachers, and I think it's not true. I think there is a positive correlation between being a good teacher and a good researcher.

There are always frustrations, but by and large, it's a lot of fun. We always have our math to get back to and discuss with our students. And then we are happy again. *