The Chaitin Interview I: Chaitin Chats with Kurt Gödel

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Robert J. Marks:

We talk today with the great mathematician and computer scientist, Gregory Chaitin, on Mind Matters News.

Announcer:

Welcome to Mind Matters News, where artificial and natural intelligence meet head on. Here's your host, Robert J. Marks.

Robert J. Marks:

There are few people who can be credited without any controversy with the founding of a game changing field of mathematics. We are really fortunate today to talk to Gregory Chaitin who has that distinction. Professor Chaitin is a co-founder of the Field of Algorithmic Information Theory that explores the properties of computer programs. Professor Chaitin is the recipient of a handful of honorary doctorates for his landmark work and is a recipient of the prestigious Leibniz Medal. Professor Chaitin, welcome.

Gregory Chaitin:

Great to be with you today.

Robert J. Marks:

Thank you. Algorithmic Information Theory, when people first hear the term, at least at the lay level, their reaction is the field might be pretty dry and boring. But I tell them that Algorithmic Information Theory, if you understand it, is more mind-blowing than any science fiction I've ever read or watched. So I hope in our chats that we can convey some of the mind-blowing results springing out of Algorithmic Information Theory.

Robert J. Marks:

So before diving in, I hope you don't mind if I get a little personal. Your life has changed recently. You have two new children in your life. Juan, and how did I do in the pronunciation? That's a rough name to pronounce.

Gregory Chaitin:

Actually in Spanish it's Juan. John in English, Juan in Spanish and the Portuguese pronunciation is a little different. It's more nasal, it Schwann. Juan Bernardo, who is three. And our little girl is going to be 11 months. Her name is Maria Clara.

Robert J. Marks:

That's wonderful. Now this has been a life change for you, hasn't it?

Gregory Chaitin:

Oh sure. For anybody who has children, it's a life change, isn't it?

Robert J. Marks:

Yes, it is. I think we were sharing an email that I babysit for my grandson. And when I'm finished, I feel successful if I've kept him alive. He gets into all sorts of problems. He likes to pull things down from the shelf on him. He climbs the stairs and I'm afraid to fall down and need intensive care. And it's just one thing after another. So I expect you've experienced similar stuff, right?

Gregory Chaitin:

You bet. Actually, now that I'm a father, it seems like a miracle that children survive.

Robert J. Marks:

Yes. It's amazing. Leonard Euler, if I remember when he lost the sight of one of his eyes, came out with a positive statement, he said, "This is good because I have less to distract me from my mathematics." And I'm sure, but in a much more positive sense, this has distracted you from your intellectual pursuits because it's not a distraction, it's a wonderful addition to life, but have you found that to be the truth?

Gregory Chaitin:

Well, that's a good question. I've worked a lot on mathematics and I've done what I had intended to do. So I welcome this new project.

Robert J. Marks:

New project. I read Virginia's comment in your new book, which we're going to post a link to it on the podcast notes, but she said that your children have completed your marriage's incompleteness problem. I thought that was hilarious. That really cracked me up.

Gregory Chaitin:

That was very clever of her, wasn't it?

Robert J. Marks:

That was very clever. I think that our audience, much of our audience might not get the humor in that. But I think maybe as we go on, we can probably get this.

Gregory Chaitin:

It's a joke for logicians.

Robert J. Marks:

Yes, it is. It was funny. It cracked me up.

Gregory Chaitin:

It's a wonderful experience having children. It's true that both of us are older than normal, my wife and I, in my case substantially older than normal, and my wife not that much. But we wanted very much to have children and it's a gift from God. We manage somehow.

Robert J. Marks:

That's wonderful.

Gregory Chaitin:

As a doctor said in the Middle Ages, I believe he said something like, "I attended the patient and God cured him."

Robert J. Marks:

Exactly.

Gregory Chaitin:

In spite of all our efforts, it might not have worked, but we're very happy to have our two little children.

Robert J. Marks:

It is. Yeah, it is wonderful. I think it says in Psalm 139 that we are fearfully and wonderfully made. And boy, that certainly is the case, isn't it? Speaking of youth, you did a lot of amazing stuff in your youth. I think you were in the Bronx, New York, is that right?

Gregory Chaitin:

Well, we were living in a Manhattan, a very nice location. Madison Avenue, a block from Central Park.

Robert J. Marks:

Oh my goodness.

Gregory Chaitin:

In the mid '60s, 68th Street, between 68th and 69th on Madison Avenue is a very nice neighborhood still.

Robert J. Marks:

But I think I read, you went to the Bronx High School though.

Gregory Chaitin:

I did go to the Bronx High School of Science, which was a treat. And I was also at the same time, I passed an exam in my first year at the Bronx High School of Science, I learned that there was something called the Science Honors Program at Columbia University, which was weekend activities for very bright students interested in the sciences. And I got in. And one of the privileges I got as a result was they gave me the run of the stacks at Columbia University, which is unbelievable. So for example, I was able to hold volumes of the collected works of Euler in my hands.

Robert J. Marks:

Wow.

Gregory Chaitin:

Normal students, I don't think are allowed to go in the stacks. At that time they weren't. So this was an incredible treat. And another thing that happened was I came up, I was 15, I came up with the idea of program size complexity and defining randomness in an essay question in the exam to get into the Science Honors Program at Columbia University.

Robert J. Marks:

Interesting. I know in your work that you looked at things like relativity, this was in your teens for Pete's sake, and quantum mechanics. And so what led you down the path of computer science and to do the founding of Algorithmic Information Theory?

Gregory Chaitin:

I was always very interested in computers. They were just starting at the Columbia Science Honors Program. They had a course where the kids could get access to computers. So I started programming in an assembly language. I think also in Fortran. There was a course given by a nice professor and they let the kids run programs on big mainframes, which is what we had then. So I was programming in high school, which at that time, it was pretty unusual. Now it's not, I'm sure. So, no, I was reading Scientific American. At first my mother would read it to me. I was reading it very young. For example, I remember vividly a 19, I'm not sure what year it was. Could it be 1958 or 1956 article on Gödel's Proof with a fantastic photograph of Gödel where he looks angrily leaned at the camera with a blackboard behind him.

Robert J. Marks:

Oh yes. And he has that silver streak of hair, I believe.

Gregory Chaitin:

It's possible. And then in '58, I think it was a book called Gödel's Proof came out. This was Nagel and Newman. They had written the article in Scientific American. And I saw that book when it got published. I was 11. I had permission to take out books from the adult section in the New York City Public Library. I had piles of books at home and I was reading, reading, reading, physics, mathematics. It was a nice time to be a kid growing up in Manhattan.

Robert J. Marks:

I guess, especially if you're interested in that sort of stuff. You said you had your hands on some of the original works of Euler.

Gregory Chaitin:

Yeah.

Robert J. Marks:

Do you consider him, I consider him maybe if not the greatest, but certainly the most prolific mathematician in history.

Gregory Chaitin:

Yeah, they may still be publishing his collected works. When I was a kid, they were many, many volumes and they were going to be more. He's my favorite mathematician. As far as I'm concerned, he's the... It's sort of silly to rank people. People talk of Gauss as the, I don't know what they say, the prince of mathematics or something. As far as I'm concerned, it's Euler. If Gauss is the prince, then Euler is the king.

Robert J. Marks:

Euler is the king.

Gregory Chaitin:

His papers are beautiful to read. He gives his whole train of thought and it looks obvious. It looks obvious only while you're reading Euler. Gauss gives very concise papers that are very hard to decipher, but while you're reading Euler, you think, oh, I could have done this, but of course only Euler could have done this.

Robert J. Marks:

I understand when he lost the sight in both of his eyes, he would sit around in St. Petersburg with students and dictate his ideas to them because he wasn't able to see.

Gregory Chaitin:

But his productivity didn't go down.

Robert J. Marks:

His productivity didn't go down. Just an astonishing mind.

Gregory Chaitin:

It's astonishing because you ask, where did all this creativity come from in other... New mathematics, beautiful new mathematics was just pouring out of his head onto the paper and the publishers couldn't keep up. So his paper... He had a pile of papers that he had and every now and then somebody would take some of them off the top, I think. And he would keep adding more so they weren't published in order that they were done. And when I was reading the collected works of Euler, the Russians had this pile of manuscripts that hadn't all been included in his collected works yet. And they were being cagey. They were going slow.

Robert J. Marks:

You suspect that the works of Euler are still being translated, you believe?

Gregory Chaitin:

I don't know. Well, I was... This was what, 60 years ago? So maybe they finally... No, they were being published in the original language, which Latin I didn't know, but I knew French so I could read his papers in French pretty much like I could read English, but a lot of it was Latin. And then I had to struggle with a dictionary, but one knows the topic. If it was a paper on number theory, I knew some number theory. And so it was an absolute treat. I also had the collected works of Niels Henrik Abel in my hands, a child prodigy who did some beautiful work. But Euler works on every possible topic. And so where does all this new mathematics, where does this creativity come from? It seems to be, have a supernatural source, there seems to be as if, yeah.

Robert J. Marks:

That's great. In fact, that's a topic I want to talk to you about later, whether or not maybe the creativity might be, for example, non-algorithmic, non-computable.

Gregory Chaitin:

Maybe God was talking to him. Cantors thought that. Because it's really hard explain where all those new ideas came from. Ramanujan is another example like that.

Robert J. Marks:

Oh, he was that Indian that knew incredibly intuitive things about number theory, which were just mind blowing.

Gregory Chaitin:

He didn't have a formal education in math. And he said that there was a Hindu goddess. I can't recall her name. He said that she would tell him mathematics while he slept.

Robert J. Marks:

Really?

Gregory Chaitin:

That's the most reasonable explanation I can think of for how he did that or how Euler did that, unless we work out a complete artificial intelligence and it can do what Cantor or Ramanujan did. For now, I think the best explanation is the one that Ramanujan gave.

Robert J. Marks:

Which was a supernatural sort of intervention.

Gregory Chaitin:

Right.

Robert J. Marks:

That's very interesting. You mentioned that you read Gödel's as a young man, the article about his Incompleteness Theorem in Scientific American. I also know that you had a near brush with Gödel, and I've heard the story from you, but I've never seen it published. I wonder if you could share that near meeting with Gödel. That was fascinating I thought.

Gregory Chaitin:

I think it's somewhere, maybe in a paper based on a lecture. Well, the story was, I had been in Argentina for a number of years and IBM sent me to the US. What happened was I was invited to be a summer visitor at the IBM Watson Research Center. And I was living in the YMCA in White Plains. And I'm not sure. This was a long time ago. So anyway, what happened was I had the proofs of one of my first papers on incompleteness. It was from the IEEE Transactions on Information Theory. This was in the early 1970s. And I sent him the proofs. Well, I called him up, and I looked up Gödel's phone number in the telephone book. I called him up. I think he picked up the phone and I said, "Professor Gödel, I have a different approach to proving incompleteness."

Robert J. Marks:

So you cold called him then.

Gregory Chaitin:

Yeah. Out of the blue. Instead of basing it on the paradox of the liar, Epimenides' paradox, my approach is based on the Berry paradox. And Gödel answered, "Well, it doesn't matter which paradox you use." He had said that in his 1931 paper. I was familiar with his paper. So I said, "Of course, but this suggests to me," I don't remember what I said, something like a whole new approach. I don't know. What did I say? Or definition, I say that I would very much like to talk to you about and get your reaction. So he said, "Okay, send me a paper of yours on this topic. I'll take a look at it. And if I like it, maybe I'll give you an appointment to visit." So I sent him the proofs. I had the proofs of that IEEE paper. It was my second IEEE Information for Transactions paper actually. Did it come out in '74?

Gregory Chaitin:

Okay. So I sent him the proofs, hadn't been published yet and I called him up and he said, I think I remember he said, "Very interesting. Your notion of complexity is an absolute notion." Now this was a distinction he made between the idea of what you can compute is absolute. It doesn't depend on the axioms, whereas what you can prove does. So he had taken a look at it and immediately perceived a crucial aspect of the definition of complexity that I was proposing. And he gave me an appointment. This is when I was visiting the Watson Center. So I did some research to figure out. I was without a car. I would take the train into New York City. From New York City I would take the train out to, I don't know, Princeton Junction or something. I would get there. Nothing could stop me, right?

Robert J. Marks:

Yes.

Gregory Chaitin:

I was all set for the great day and it snowed. And this was the week before Easter. So that's unusual, a spring snowstorm, but nothing was going to stop me from, it wasn't a big snow storm. Nothing was going to stop me from visiting my hero. So there I am in my office at the IBM Watson Center about to leave. I figured out how much time I needed. About to leave and unfortunately, very unfortunately the phone rang. It was Gödel's secretary saying Gödel is very careful with his health. And because it's snowed, he's not coming in to his office today. And therefore your appointment is canceled.

Gregory Chaitin:

So that was a surreal experience. And there was no way to reschedule because I was going to leave just in a few days, heading back to Argentina, to Buenos Aires. But actually this surreal story actually fits better Gödel and his legend, because for example, when Gödel died, they found lots of answers typed up to letters he received, but were never sent. They were never mailed. So there was a surreal quality to Gödel and to communicating with Gödel.

Robert J. Marks:

He was a quirky guy and a germaphobe if I recall correctly.

Gregory Chaitin:

Yeah. He was from what at the time was the Austro-Hungarian Empire. And he didn't accept being made a member of the Austrian Academy of Sciences. He never went back to Europe, never visited Europe. He turned down, they offered him to be a member of the Austrian Academy of Sciences. So he's an interesting guy. One of the books I like about Gödel is in French, it's called *Les demons de Gödel: Logique et folie*. So that means “Gödel's Demons: Logic and Madness.” And this was by a gentleman in France

who actually went through the Gödel archive at Princeton. Half the book was also devoted to Emil Post, a forgotten genius.

Robert J. Marks:

Oh yes. Emil Post. Yes. One of the things that I'm familiar with that Gödel did that wasn't published until after his death was its ontological proof of the existence of God, based on the Anselm's argument. So I guess there were a lot of things of that sort.

Gregory Chaitin:

He was definitely a theist. He was living in the Middle Ages sort of. There's a wonderful story that Rebecca Goldstein published, The Princeton Institute for Advanced Study would occasionally have fancy dinners, basically for people who might contribute additional funding to the Institute or provide political support. And at these dinners, they would ask their stars to be present to impress the potential donors and other members of the Institute. So Gödel was at such a dinner. You had to go, it wasn't optional. He probably wouldn't have wanted to be there. He was at such a dinner sitting next to a young astrophysicist. And the astrophysicist was very proud of some discovery he had made, an observational discovery and he spent a lot of time explaining it to Gödel. And finally he stopped, expecting Gödel to express admiration for the story he told. Instead of which Gödel replied, "I don't believe in empirical science. I only believe in a priori truths." That's an answer from the Middle Ages. I priori truths are necessary truths that don't depend on. So maybe he didn't believe in evolution either, I'm not sure.

Robert J. Marks:

Well, he didn't. There's a famous quote that he said evolution is, I forget the analogy, but it was basically that a printing factory explode and result in a book or something like that. So he was not a big believer in evolution either.

Gregory Chaitin:

So he was a very interesting person. Interesting mind, very powerful.

Robert J. Marks:

Very interesting. Well, Professor Chaitin, thank you very much for spending this time with us and giving a little background. I think subsequently we're going to get more into the weeds about your specific work. So we've been talking to Professor Gregory Chaitin, a co-founder of the field of Algorithmic Information Theory. And so until next time, be of good cheer.

Announcer:

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