Tabla de Contenidos

Against Method - Gregory Chaitin

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AGAINST METHOD TRANSCRIPT

Virginia Chaitin: Well, I don't really know that much about whose idea it was, you know? But it actually is a cemetery for little birds. And I think that they are birds that were peoples' birds, or maybe birds that would sing in peoples' gardens. And they have this little cemetery and the birds are here and, in the entrance there's a saying that says “I'm singing to make my little friends, my departed friends happier”. So it's like... it's a little bird saying that he is singing around here to...

Gregory Chaitin: Boa tarde senhor De Pablo. Tudo bem?

Virginia: ...to um...

Gregory: A lot of poems here.

Virginia: ...to sort of make the other little birds that have departed happier.

Gregory: Anyway, your dad loved this cemetery, right?

Virginia: Yes, yes, and I used to come here, me and my sister, when I was a little girl, so it's kind of a...

Gregory: The family legend is that Virginia was conceived in Paquetá. Her parents came here on their honeymoon, and then continued to come. And very quickly Virginia was born, so that's the family legend.

Virginia Chaitin: Right, it may be true, may be not.

Gregory: But she was created in Paquetá. Virginia: But definitely after I was born, I came here many times, when I was a little girl, until we left Brazil.

Gregory: Yeah, I'd like to tell you about four of my heroes, um... four of the great imaginative minds that I view as creators of digital philosophy. That didn't sound too enthusiastic. It sounded sort of tired and sad.

Virginia: Are you tired and sad? You need some more coffee? Water? Yes, you're looking at the machine... I should have stood there, and smiled.

Gregory: I should be saying this to you, Virginia.

Gregory: Shouldn't have been saying it to the camera, to the...

Virginia: You want to say it all over again?

Gregory: No, no... OK, darling, so did I ever tell you about my childhood heroes, Gödel and Turing?

Virginia: Well, yes, but I would like to listen to all that again.

Gregory: I didn't pay much attention to my teachers, I taught myself, I am completely self taught. You know, that I have my last degree as a high school degree, which I didn't have. I don't have a college degree, I don't have a doctorate, I just have honorary doctorates. So that's because I think you should teach yourself, you know, you shouldn't pay attention to anybody else. And you shouldn't pay attention to what people think is the fashionable questions. You shouldn't pay attention to the funding agencies, with the universities. You go out, you look for the ideas that you think are interesting, the questions that need to be thought about, and just start doing it on your own, and this is how I worked. What I was doing for IBM was practical computer engineering and software engineering. They couldn't care less about my theoretical work, but they let me do it as a part-time activity, so by being at an industrial lab, where I did work that was useful for a commercial company, for new products, I was completely free to work on any research I wanted to, because this was not what they were paying me for. You know, I wasn't a university professor, where there would have been a lot of pressure on me to work on fashionable subjects. I was a sort of a solitary child. And I was always reading, I always had piles of books. In New York, they had a wonderful public library system then, and I would have 20 or 40 books out, read my way through all the books I could get my hands on, including books from the adult section, even though I was a child. Or books from the Columbia University stacks later, that normally only professors had access to, piles of books. And also, I always had projects. I was building things.

Virginia: That sounds like you today as well.

Gregory: Electrical projects, little logical circuits, collecting minerals in Central Park, I had a microscope, had a chemistry set. Originally I wanted to be a physicist or an astronomer. I was very interested in amateur astronomy, but you know, to be a physicist you had to know mathematics, theoretical physics is very mathematical. Then I found, to my surprise, that there are questions in math that are as deep as the question of quantum mechanics or general relativity.

Virginia: It works beautifully, the way we've been doing it OK? So you don't have to ask me to say anything.

Gregory: Virginia, would you please comment on that? From your own unique perspective? Please? Mathematics is absolutely fundamental to theoretical physics. But it's not absolutely fundamental to biology. Biology seems to be a very different kind of a subject. And... However I believe that we only understand something, when we can mathematize it. So if... Biologists always say that Darwin's theory of evolution is the fundamental theory of biology and that it's so simple and basic, it's practically obvious - the way they explain it. So if this is the case, there's gotta be a deep clear way to express this in mathematics. I'm a pure mathematician you know. If it [evolution] can't be expressed in mathematics, it's muddy thinking, as far as I'm concerned. Also I don't want mathematics to be left out of biology. So my goal is to define what life is and to prove that it's going to evolve by evolution by natural selection. You see, biology is too messy, too complicated, no.. There are no general rules, right. There are always exceptions, So I'm not going to make a theoretical biology, I'm going to make a toy version, or a metatheory. So I'm dealing with a highly simplified version of biology, I'm trying to extract the basic concepts. So first of all, my organisms have no bodies. That's a tremendous simplification. They only have hereditary material. And it's computer software, it's not DNA. OK, because we don't actually know precisely. DNA looks like a digital algorithmic language, but we don't know it precisely and it's very complicated. So I'm going to instead work with a computer

programming language that I can define myself in. What is the goal of my organisms? Well, what these organisms do is they're computer programs, they're software. And they calculate a number, a whole number. So 33, 999, you know. And the bigger the number, the better the organism. The organism's goal is to name a very, very large number. And this may seem like a trivial problem, but it turns out that there are very concise to name extremely big numbers. This is known as the busy beaver problem. And actually an unlimited amount of mathematical creativity is involved in this. What I'm trying to find is the simplest system in the platonic world of mathematical ideas, that simulates or emulates Darwinian evolution. That's the simplest set-up that leads to evolution by natural selection. So this would be the simplest Pythagorean lifeform. So that's the first step. What I did in metabiology up till now is only been a beginning of a theory. Most people think that mathematics is a sort of a dull topic, and if we're going to make biology mathematical, that means that human beings become less interesting and less rich, they just become sort of dull, machine-like mathematical objects, and... but metabiology doesn't use normal mathematics, it uses what you and I have been calling postmodern mathematics, which really starts with Gödel in 1931 and Turing in 1936. Both of these people are using mathematical methods to do sort of a psychoanalysis of mathematics, and Gödel has shown there can't be a theory of everything for pure math, there is no axiomatic theory for all of math, which sounded bad but really means that math is open and creative, not static and closed. Turing has shown that most things in mathematics cannot be calculated, that there are no general methods for calculating a lot of things. So at the time these were interpreted pessimistically but metabiology interprets it optimistically. It means... This shows that the world of mathematics is not static and closed, and it doesn't provide absolute certainty. The world of mathematics is in statu nascendi, it's open and dynamic, and requires creativity all the time, and so this is a step in the direction of biology from pure mathematics, from the idea of a platonic world of ideas and math that is eternal and static, with the angels singing. I don't know why people want to think that there should be a mechanical procedure for all of mathematical truth or a single theory of everything, an axiomatic theory, a formal theory that gives all of mathematical truth. I mean, it would mean that you would have certainty in pure mathematics, but would also mean that the subject was dead intellectually, that it was finished, it was a closed subject. I think it's much more fascinating that pure math is eternally open, and in evolution, and requires constantly new principles to understand new mathematical phenomenon. These ideas, these remarks of ours, are in general more appreciated when I present them at physics meetings, because physicists know that physics doesn't give certainty. And they, they're sort of annoyed that pure mathematicians feel that they are superior beings, where everything is black or white and you have absolute certainty. So physicists would like it when I would say that mathematics is quasi-empirical. But mathematicians and logicians would vomit, basically. Either they would say that what I was saying was meaningless garbage, or else they would find it um... it's better that it should be meaningless. But if they actually listen to it, it went so against their view of the world. Logicians like to believe that everything is black and white and clear, and the idea that human beings, even in math, will never have the final truth, is deeply upsetting for logicians, but it shouldn't be, because actually I think this is more fun. Otherwise what are future generations going to do? Just study the great works of the past? You know, the normal interpretation of Darwinian evolution, at least in some places, is really pretty awful. It says that organisms want to be well adapted, so this was like, I remember in the 1950s at school, that children had to be well-adapted, they had to be well-socialized, they shouldn't rock the boat, they shouldn't be too creative. They should be good citizens. So this is the goal of evolution, according to one interpretation, that the organisms should be well-adapted to their environment, and once they are well-adapted they can stagnate, and then evolution would stop, and I think that this an erroneous interpretation of Darwinian evolution. There's this wild idea called the Red Queen principle, that you have to keep evolving all the time, even if there is no radical change in the climate or in the geology, which normally people think is what triggers speciation. The animals you eat are constantly evolving, the people who eat you are constantly evolving, and you have to keep constantly evolving too. And the Red Queen principle is one of the theoretical justifications for sexuality, which otherwise is a mystery. If you believe in selfish genes,

sexuality is a bad idea, because you throw away half your genome. You know, people couldn't understand… Then with conventional population generics, people like Dawkins, actually he at one point is frank and admits that sexuality remains a mystery, and it's almost universal. So it was really… I think John Maynard Smith expressed himself a little more clearly as he usually does - he said there has to be something fundamentally wrong with our ideas, because sexuality doesn't make sense. But it's almost universal. So there's something really big we're missing, and that something really big seems to be the Red Queen principle, which is the reason that in the world of biology creativity continues all the time, even when you don't have volcanoes or changes in the climate that force the organisms to change.

Virginia: I think that we should maybe do a break, but then I think that…

Gregory: We're not doing a break, we're continuing. One of the interesting features of this model, that you've just reminded me of Virginia, thanks, thanks a million, is that it involves some uncomputable steps, it involves Turing oracles, a weird idea of Turing's from 1939, as a way to imagine computers that can do things that no real computer can do. You give it an oracle that will answer a question for which there is no algorithmic solution, no computable way to answer. And my model does use oracles actually. Because the reason is, when you make a random change on a program, and remember the program wants to calculate the biggest number it can, it's possible that it doesn't calculate anything, that it just calculates away forever, and this would stop the whole evolutionary game, so you have to eliminate programs from consideration, if they don't actually calculate anything. Also there are mutations which don't give you and your organisms, algorithmic mutations. The basic model in metabiology is an uncomputable model. It cannot be simulated, but you can prove theorems about it. So this is a kind of a theoretical mathematics, and you've pointed out to me, Virginia, that really in a way, the oracle is really where all the creativity is coming from, because the metabiological organisms can do anything that they can calculate, so where can new information come from? It can't be something that you calculate, because the organisms could already do that, so it's coming from a oracle which can answer questions that can't be calculated, it can give you uncomputable things. They're going to be bored by me. Intriguing is what you want to do with this kind of a film. That's more important that conveying accurate, deadly dull information. You want to intrigue people, to maybe try to find out more, or…

Virginia: Are your eyebrows the same as yesterday?

Gregory: Doesn't matter…

Gregory: They're white.

Virginia: No they're not,

Gregory: They're not?

Virginia: There're beaks. This plant actually is very sturdy, it looks very delicate, but it's looking bad because a grasshopper ate it all up.

Gregory: Was that what happened?

Virginia: That is what happened.

Gregory: This plant is doing beautifully. It's amazing how it starts bright red and it gets green.

Gregory: Life on an island paradise.

Virginia: We cannot forget that metabiology is not only about Darwinian evolution, full-stop. It's about how new genes appear. Sometimes Darwinian evolution is only seen as something that explains, yes, it does explain the diversity because there are the random mutations, but it mostly explains how and why life is possible. Or in the sense of how is it that we survive interacting with…

Gregory: A changing environment.

Virginia: A changing environment, and also with our competitors. And it is used a lot to explain that. And less than why it is that there is such an enormous diversity. Where is the focus of understanding…

Gregory: The creativity, the major transitions in evolution.

Virginia: Major transitions, creativity, diversity,

Gregory: Uni-cellular, multi-cellular…

Virginia: …right, you know, so it is basically… And this is what most mathematical efforts are about - like variation of existing genes,

Gregory: Population genetics.

Virginia: Population genetics. How is it that life survives? How is it that life goes on maintaining itself - less than how is it that life goes on creating and recreating itself. It's more about maintenance and less about creating and recreating.

Gregory: More about adaptation to the environment and less about endless creativity.

Virginia: Right.

Gregory: OK, well yeah, you're right, I forgot about that. Another way of looking at what metabiology is - it's an attempt to connect mathematical creativity with biological creativity. And mathematical creativity is essential, as was demonstrated by Gödel in 1931 and Turing in 1936. So I'm using ideas that come from them um, and some other stuff in the cocktail mix, and I'm trying to go from Gödel's incompleteness theorem in a way to Darwin's theory of evolution. So I'm trying… In my toy model biological creativity and innovation is not that different from mathematical creativity and innovation. To speak in more general terms - creativity is something mysterious. It's by definition something we don't know how to do. So how can you analyze it? Well, you cannot analyze it by giving an algorithm for being creative, because at that point it would stop becoming creativity, it would become mechanical. So the definition of creativity is it's always something that we don't know how to do, and it's mysterious, but but you could have a theory of creativity which involves uncomputable elements - Turing oracles for example. It's a theory that doesn't give you a way to simulate creativity, but gives you a way to prove theorems about it, you see? This is the question of how you can make a theory about things that you're not… how you can do things that you're not supposed to be able to do, where there are no general methods for doing, there's no mechanical procedure for doing… So I think, these are all, as I said, first steps in the direction of mathematical theories of creativity, and this is how interdisciplinary research works, right? That you're taking an idea…

Virginia: Hopefully.

Gregory: Hopefully, how it ought to work when it's really fertile.

Virginia: Exactly.

Gregory: Is that you really have these different fields speaking to each other and making suggestions to the other field from the perspective of another field. And then you see whether the suggestion works or not.

Virginia: Or not.

Gregory: Or not. And this enriches one's understanding for awhile, and then you have to come up with a new model, once you've gotten all the new ideas from a given model. I think every model has a limited lifetime, as a fertile theory, at any rate. It may stay in the textbooks, but what's in the textbooks is awful stuff. It's not the frontier of new ideas of research. So um… but, this is how research goes. So what do you think of that, Virginia? Did I sort of hit the main points, or did I miss something important?

Virginia: I think that as a general explanation without too much…

Gregory: The camera is there.

Virginia: Oh, but I'm not talking… Am I talking to the camera?

Gregory: I'm sorry, I should keep my mouth shut.

Virginia: Oh no, no, it's just that I think that as a first definition of metabiology this is very good. Because um… I believe it is important that people first see what motivated metabiology, how it works, and um, what was, what were your goals. Now, from that, from that on, then other people interpreting, oh but this also shows this, that and the other. If you start talking about that from the start, then it becomes too confusing.

Gregory: This tree has just really spectacular flowers. Here's another tree that has very beautiful flowers, I think because spring is over, so there aren't as many flowers as there were before. They're a little wilted but its still very beautiful. The island on its best is just spectacularly colorful - the different trees, the bougainvilleas, which are behind you, there's a very big one with beautiful flowers. It's very inspiring to see all these inventive lifeforms and you wonder how nature created them all. And they're all very beautiful by the way. And so it's a challenge to understand the nature's creativity, nature's inventiveness. Now - that may be Darwin explains it a little bit. Why they're so beautiful is a more subtle question. The notion of beauty, why we find many things in nature beautiful - that's I think a deeper question, I don't really know. Some people would say that nature wants to create beauty, but that's not a position that's very popular at this moment, but then you need to find another explanation, that's what I think, it's quite a challenge. This a good place to see the sunrises. From here, or the moonrise, the full moon rising here, from the side of island is a very beautiful sight. I feel the sensuality of the whole country, the tropical atmosphere, the trees and the plants and the flowers are very lush, and beautiful, and the people are too. And I responded to that. Coming from New York, the first time I was in Rio I was 8 years old, and then I was here at 23. And I really felt very stimulated by the, how do you say, the élan vital that I feel in Brazil. The English colonists, English colonies, the English would send husbands and wives and they would slaughter the natives, so that's the difference between what happened here and Portugal… in Brazil, where there was a lot of inbreeding. And that produces this remarkable variety of people you find here. The Africans who came here were from many different parts of Africa. Some are tall, spectacularly beautiful Africans. And you get some amazing mixtures. When, you know, a beautiful African woman marries a handsome European, the children are unimaginable, they've never existed before. This is biology trying to find new possibilities, new combinations to create something new. This is what Brazil is all about, this is what sex is all about, this is what making love is all about. It's about creating something new, and in the attraction between people from different races in Brazil is very much about creativity, because

inbreeding is bad for human beings. And it's very good, it's very healthy when people make love to somebody who's different. So because Europeans for example have some health problems that the Indians here don't have, and vice versa. You get mixtures and they can turn out to be winning combinations, healthier than their source. Lately, Virginia, you know it's this idea I have about the brain, that I know nothing about, which is that I don't think most of the stuff going on in the brain is at the cellular level, which is, I think, a fashionable view. I think that most of the computing and the memory actually has to be at the molecular level, sort of at the level of DNA and RNA or at the molecular biology level, where there's a monstrously greater computing and memory capacity than you can have on the neuronal level. And you know, the immune system uses molecular biology intelligently, of course every cell does. But, you know, Von Neumann said he never saw a computer where the logic, which is the computing part, and the memory were the same technology, so why should neurons do both in the human brain? I think that neurons are just the front-end, and all the real heavy duty work is being done in the unconscious, at a much lower level. Although I don't know, my theory doesn't have to explain how the human brain works, I think it's a possible design for a brain. So again, the fact that I worked in computer engineering and math, and I'm not a professional, neuro-, brain scientist, gives me more freedom to criticize the prevailing view and maybe propose an alternative view, which may be wrong, but most fields tend to get stuck in a paradigm, and people work it to death, and…

Virginia: You're exploring an information based view on how the brain could work, and even if it's not 100% what happens, it can provide new insight, and this is what I think is the richness of interdisciplinary research.

Gregory: Absolutely.

Virginia: And even meta-theories, because metabiology is a meta-theory.

Gregory: I remember how angry someone whose speciality is the brain got at me?

Virginia: Yes, I do. I hadn't read hundreds of books on the brain like she did, and the stuff I was saying sounded completely crazy to her.

Virginia: Yes, because it's a totally different approach, it's a different framework…

Gregory: To life.

Virginia: Well, yes, to life.

Gregory: Become an expert in the field, read all the books… And my attitude is: Get quickly, you know, it's sort of slash-and-burn… Quickly get an idea of what's in the field, criticize it to death, propose an alternative view, say maybe people aren't seeing their hands in front of their nose? I don't consider myself a specialist, Virginia, I'm not afraid to go into a field where I know very little and criticize the prevailing dogma and think of maybe alternatives. Which means I have to be comfortable with not knowing, with not being a specialist, but that gives me more freedom, because the people who are specialists are really stuck in all the existing framework, you know. They've been drilled in it, they've exterminated any deviant thoughts that they've had so they could concentrate on the field, that may be good for developing engineering for example, or a field that already you know the basic questions and you just have to study more to work out the details. But when it's really a frontier, where nobody knows what to do, like the brain… The human brain is really largely mysterious, in spite of the hundreds of books published every year on this subject, right? There you really need new ideas. So fashion is evil, and I think that talented people should be against fashion, should be against the ideas of the majority. Fight the system! Or don't… you can't fight it… Just ignore it. Try to find a way

to ignore it, and do your thing, and you don't care what other people think. You're just looking for truth. And truth is not political success, it's not professional success. It's the wonderful feeling you get when you can understand a little bit better something that fascinated you, that you didn't understand. Like… Those are the beautiful moments. The pay off really is when you get a new idea and all of a sudden you realize that it explained something that you were interested, you know. It lasts very little. I think Feynman says this somewhere. He's searching all his life for new ideas, he knows a number of fundamental problems like reconciling quantum mechanics to general relativity, and every time he hears of a new idea, or he has a new idea, he asks, can that settle it? And then he says that you have a wonderful week or two, that you, once you get the new idea, you run with it, you develop it, you look at its consequences, that sort of more systematic, you have to have good technique for that. The inspiration, who knows where it comes from. And the problem with all this though, is that you have these few weeks of euphoria where you are developing a new idea, you have a new idea and you're developing its consequences, and what do you do with the rest of your life? Well, the rest of your life is you have love affairs, you have marriages, you travel to different countries, and you're looking for new ideas everywhere, but you can't force yourself to have them. You can just read a lot and not feel that you have to force yourself to be creative like the universities want, and the funding agencies want. They want a steady stream of sausages coming out of the sausage machine. This may be good for routine science, but it's not good for creating a new field, for really… for a paradigm shift will never come from normal science or from an industrial lab, you know. You have to be crazy. Being crazy is a necessary but not sufficient condition. There are a lot of people who are crazy and they're just crazy, they don't create a new field of science. But I think craziness is a prerequisite for being able to produce a paradigm shift. Because to disagree with the way everybody else is thinking about some field, you'd have to be crazy, no sane person would do that, it's risky. And there are some of us who can't help ourselves, though for personal reasons. We are this way, and if we're lucky, you can create a new field, if you're unlucky you're just a crazy person. Right? I think this has something to do with creativity. You should write a book.

Virginia: Me?

Gregory: On creativity or on…

Virginia: Yes, I don't know, maybe…

Gregory: Or maybe a book about our marriage.

Virginia: We could write a book together, eventually.

Gregory: Once I'm gone, you can write a book: “What was it like living with this crazy person”, “What is it like seeing a new field created, metabiology being created in front of you?”

Virginia: I'd rather write it with you.

Gregory: “What is it like seeing a new field created, metabiology being created in front of you?”

Virginia: I'd rather write it with you.

Gregory: Yeah, and maybe Virginia wants to say something about oracles.

Virginia: No, I don't want to say anything. You know, Virginia's very good, I don't know why she doesn't want to talk.

Virginia: No, I'll talk tomorrow at home.

Gregory: It's nicer listening to her than listening to me.

Virginia: Listen Greg, you have a stronger voice, here in the outdoors...

Gregory: Let's go and see Rio in the distance.

Virginia: Let's go. That is the Corcovado which means jorobado in Spanish, it means 'humpback'. And on top of that is the sculpture of Christ the Redeemer, which is the symbol of Rio de Janeiro. And Rio is a very big mix of poverty with wealthy people in a way that you don't have, say, in San Paulo, where the wealthy people are downtown and the poor people are outside. In Rio everything is mixed together. And there is Christ, letting everybody know they are all part of the human race, this wonderful mixture that is Rio de Janeiro. That's the Pico da Tijuca and that's actually the highest point in Rio de Janeiro. And the view from there is spectacular and a group of us would go from the university once a year to the top and recite poetry, at the top of the mountain, and then rip up the poems and toss them into the air. The view on a clear day is spectacular.

Virginia: The education systems, societies, tend to bring children's spontaneity and creativity down, and that did not happen to you.

Gregory: And you're supposed to specialize in an area and spend the rest of your life working on it.

Virginia: For so many reasons you're supposed to have a specific behavior, specific professional interest and you haven't, you haven't gone down that road, so maybe that is why some people may think you are a child, but I don't think so at all.

Gregory: With the years I got more interdisciplinary, not less. More openly interdisciplinary. Got interested in Leibniz, and philosophy, in biology and evolution and artificial intelligence and how the brain works...

Virginia: And I think that the artistic element in your thinking and in your decision making is also very present. Beauty is very important.

Gregory: Well ideas have to be beautiful. You said it once, Virginia. An aesthetic criteria for truth. It's very truth in pure math, it's very true in everything. And I think that's why we have a house here in Paquetá also. It's a small island, it really seems like Brazil a century ago and it's very beautiful. The views of the mountains, the view of the water, the beaches, the trees, the horses and carriages on the street. Mathematics for me is something sensual and beautiful. As a child, I was sort of confused, and even as a teenager, I sort of confused eroticism and sexuality with mathematics, because the ideas have to be beautiful. There's something erotic and sensual in a beautiful mathematical idea, like in a beautiful woman, beautiful music, a beautiful mountain or... To me, they're all connected, they leak into each other. This is all part of the inspiration. I think one needs to draw on the life-force, on beauty, to create more beauty, to look for more beauty.

Virginia: And this was something we talked about, when we had lunch for the first time. You mentioned...

Gregory: Did we really?

Virginia: Plato's Banquet.

Gregory: I did?

Virginia: Yes you did, yes.

Gregory: We talked about all of this on our first lunch?

Virginia: Well yeah, sort of.

Gregory: Here in Rio, right?

Virginia: Here in Rio, yes. When we met at that meeting on Gödel and physics and cosmology. And I think we talked also about Hindu polytheism and the sensuality of Hindu art, the goddess, the representations of goddesses, for example, that in the West you don't have right? But in a polytheistic Hindu religion you have these lush, erotic sculptures and goddesses and female gods.

Virginia: The relation to the body and to sensuality, how it differs in different conceptual frameworks, different religions, societies. And this is what I think that you picked up at the beach what we feel here in Brazil, is that people are at ease with their bodies, the body is not the place for sin. The body is a place for enjoyment. Enjoyment of being alive.

Gregory:You're part of nature.

Virginia: Exactly, exactly.

Gregory: I felt that, I felt that in Rio, even as an 8 year old I think, and even more when I came back at age of 23 to Rio, and had my first information-theoretic incompleteness theorem. It was in Rio, the week before Carnival actually. Carnival is an amazing experience. Well, sex is all about information. That's what sexuality is about, it's exchanging information. So these things are all connected.

Virginia: Right, yes.

Gregory: So is it awful being married to someone who is trying to be creative?

Virginia: No, I don't think so

Gregory: Well also, you have degrees in philosophy of science, history of science and interdisciplinary thinking, which I'd been doing without knowing what it was, since I was a child, because the definition of randomness comes, mixes ideas from information theory, statistical physics, um computers, logic - and metabiology mixes a whole bunch of fields. And this is what you were thinking about, until you met a person who lives that way.

Virginia: Yes.

Gregory: That's me, right? So this has been grist for your mill, I guess, Gregory: …seeing interdisciplinary creativity in action.

Virginia: It's an interesting coincidence, yes.

Gregory: So that's been a lot of fun…

Virginia: Yeah, it has, it has.

Gregory: …interacting with you. I think that I couldn't have done metabiology… I'm sure I wouldn't have had metabiology without you. I would have stayed in Westchester and done nothing. …ideas, that is also flexible and plastic, that's what is left out of this system, and I guess digital philosophy or digital physics is a step in that direction, but it's not going all the way. In this house, lived a painter, Augusto Pereira da Silva, who was the first administrator of the island of Paquetá. He was born in 1897 and died in 1963, and also here lived Silvio Caldas, some kind of poet or singer of songs,

seresteiro in Brazil. He was born here in 1908 and died in 1998. 90 years. So living on this island seems to be good for your longevity. In Westchester, where we have a house, near the IBM Research Centre, all the houses are required to be roughly the same. Every area has to have a certain size of house, with a certain amount of land. Here it's a complete jumble, it's anarchy. This is called creative anarchy. I love it. You know one of these amazing ecologies...

Virginia: People need a pre-established ontological ground.

Gregory: They need somewhere to stand on.

Virginia: ...to step on.

Gregory: ...secure ground or secure foundation.

Virginia: ...they can deal with unknowability on the epistemic level, but unknowability on the ontological level is really scary...