The Memorial Column

by

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A Visitor from Buenos Aires in the United States

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Abstract

Reminiscences of a crucial year in Chaitin's life, 1974.

In the first few months of 1974 I traveled from Buenos Aires to New York as a "summer visitor" at the IBM T. J. Watson Research Center in Yorktown Heights. I lived in the White Plains YMCA and commuted to the Watson Center by train and taxi.

It was during this visit that I discovered or invented the halting probability Ω. I remember the exact moment. I had been invited to give a lecture at a university somewhere in the United States—every week it was a different one—and was flying back to New York. At the precise moment that I realized that the halting probability was irreducible or algorithmically random, I was looking out the window and saw an unmistakable sight, the Pentagon in Washington, DC.

The author in 1974 in Terry Fine's office at Cornell University

Due to the usual delays for refereeing and such, the halting probability did not appear in print until the next year, 1975, in my fifth *Journal of the ACM* paper, "A Theory of Program Size Formally Identical to Information Theory."

By the way, the halting probability was originally ω, but the set theorist Robert Solovay, who was visiting the Watson Research Center, suggested to me that Ω might be better because in set theory ω stood for the set of natural numbers $\{0, 1, 2, 3, \ldots\}$.

During this visit to the Watson Research Center I also corrected the proofs of one of my first publications on incompleteness, destined to appear later in the year, an invited paper "Information-Theoretic Computational Complexity" in the *IEEE Transactions on Information Theory*, with an appendix giving the mathematical details, which proofs I was to send to Gödel, as I will tell below.[1]

And I had two very interesting experiences.

The first was that I attended a lecture at the New York Academy of Sciences in Manhattan by a mathematician I admired, Mark Kac. The lecture was on randomness, and Kac's thesis was that randomness was an interesting but slippery notion that resisted precise definition. He concluded his lecture with the following words: "In spite of this, a definition of randomness has been proposed by Kolmogorov and by a young fellow in Argentina, Gregory Chaitin." I stood up and said, "No, I'm here now!" Pandemonium, over which Kac declared, "This was not rehearsed!"

After the talk a gentleman came up to me and said, "I'm Dennis Flanagan, the Editor of *Scientific American*." And he told me the following story about Gödel. At the time Flanagan was living in Princeton, New Jersey, and he had just published a wonderful article, "Gödel's Proof" by Ernest Nagel and James R. Newman (1956), later expanded into a small book that completely obsessed me from the moment it appeared in the New York City public library (at that time I lived in Manhattan). Gödel was not known to the general intellectual public yet—that article and that book were to change that—and few people had seen a photo of Gödel and knew how he looked. However, Flanagan had sent the well-known portrait photographer Arnold Newman to Princeton in order to be able to include an image of Gödel in the article about him in *Scientific American*, resulting in a stark portrait of an angry-to-be-disturbed Gödel sitting in front of a bare blackboard that has been reproduced many times.

So Flanagan knew how Gödel looked. And one hot, humid summer day Flanagan was walking down the street in Princeton, a small town, and saw Gödel approaching. He prepared to introduce himself as the publisher of the article about

[1]However, my best paper on incompleteness was probably "Gödel's Theorem and Information" published in the *International Journal of Theoretical Physics* years later, in 1982, and then reprinted in Tymoczko, *New Directions in the Philosophy of Mathematics*, together with the paper that I sent to Gödel.

Gödel's proof. At that moment, however, a scantily clad beautiful young female student (we used to call them "co-eds" from the word "co-education") passed by, and Gödel stopped dead in his tracks to admire her. As they say in French, "La belle opportunité est perdu!" Flanagan did not dare to interrupt Gödel!

The second amazing experience was that I somehow managed to make a phone call to Gödel's office at the Princeton Institute for Advanced Study (IAS), a cold call as they say in the world of sales, and Gödel himself picked up the phone. "Professor Gödel," I said, "I am extremely fascinated [obsessed would have been more accurate] by your incompleteness theorem, and I have a new proof based on the Berry paradox instead of the Epimenides paradox [the paradox of the liar, 'This statement is false']." He replied, "It doesn't matter which paradox you use!" In fact, he says this in the introduction to his famous 1931 paper, which I was familiar with. So I was prepared, and I immediately answered, "Yes of course, but this suggests to me a new information-theoretic view of incompleteness, which I would very much like to visit you and tell you about." He replied, "Send me a paper of yours on this subject, and I will take a look at it and decide if I give you an appointment." So I sent him the proofs of my as-yet-unpublished 1974 IEEE paper. Then I called him back, and he commented "Very interesting, your complexity measure is an absolute notion [like computability as contrasted with provability, which depends on the axioms]." And he gave me an appointment!

The great day arrived, and I had already figured out how to take the train from Yorktown Heights into New York City and from there to Princeton, New Jersey, and how long that would take. It was the week before Easter, and that weekend I was supposed to leave NY and fly back to Buenos Aires. There had been a Spring snowstorm, nothing serious, nothing that would stop me from visiting my hero, Kurt Gödel. I was about to leave my office at IBM for the train station, when the phone rang, and a voice, a terrible voice, that of Gödel's secretary, announced that Gödel was very careful about his health and because it had snowed he was not coming into his office that day and therefore my appointment was canceled!

So this is how I spoke to Gödel on the phone twice but never met him. In retrospect, I think this is a much more interesting story than if I had actually met Gödel. It illustrates the surreal quality of interactions with Gödel.

The next week I stopped on my way back to Buenos Aires to present "A Theory of Program Size Formally Identical to Information Theory" at Stanford University.

However, the *annus mirabilis* 1974 was not yet over. Back in Buenos Aires, I was summoned by the head of IBM Argentina, Mr Benito Esmerode. The moment I sat down in Mr Esmerode's office, the phone rang. It was the head of IBM, Thomas J. Watson Jr. "Yes," said Mr Esmerode, "he is here in my office now, and yes, of course we will pay for his trip to the University of Notre Dame!"

What had happened? The IEEE was holding their 1974 International Sym-

posium on Information Theory later that year at Notre Dame University, and the organizers wanted me to present "A Theory of Program Size Formally Identical to Information Theory" in their opening plenary session. But I had told them I couldn't travel to Indiana. So the president of Notre Dame wrote to Thomas J. Watson Jr. and asked for his help. Problem solved.

That was my second trip from Buenos Aires to the United States in 1974. I was transferred from IBM Argentina to the Watson Research Center in 1975, the year that my article on "Randomness and Mathematical Proof" appeared in *Scientific American*[2].

Years later my friend Cristian Calude from the University of Auckland was visiting me at the Watson Research Center, and we decided to make a pilgrimage to Princeton. We found Einstein's former home near the IAS, Gödel's former home in a much poorer part of town, and Gödel's and John von Neumann's graves in the Princeton Cemetery. Einstein is not there. He was cremated and his ashes were scattered at an undisclosed location, as he had wished.

Cris Calude and Greg Chaitin at Gödel's grave in Princeton, New Jersey

Furthermore, as we stood looking at Gödel's home, the couple who were renting it from the current owner came out and invited us in. It turns out that much remained exactly as it had been when Kurt and his wife Adele lived there, in particular the heavy sound-proofing so that Gödel could work undisturbed in his study, and a shrine to the Virgin Mary in the garden, but not Adele's infamous pink flamingo, which Gödel found "charming."

[2]To be followed by "Randomness in Arithmetic" in 1988 and by "The Limits of Reason" in 2006.

Gregory Chaitin is an Argentine-American mathematician living in Rio de Janeiro, and a lifetime honorary professor of the University of Buenos Aires with an honorary doctorate in philosophy from the University of Córdoba, the oldest university in Argentina and one of the oldest in South America. He was formerly at the IBM Watson Research Center in New York, where he was part of a small team that developed the Power processor architecture and its associated software.

On the theoretical side, Chaitin is best known for his discovery of the remarkable Ω number, a concrete example of irreducible complexity in pure mathematics, and which shows that mathematics is infinitely complex. For this he was awarded the Leibniz Medallion by Wolfram Research in 2007. He has also proposed modeling evolution as a random walk in software space ("metabiology").

Among his books are: *Algorithmic Information Theory*; *Conversations with a Mathematician*; *Meta Math!*; and *Proving Darwin*.

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