Gian-Carlo Rota

1 Rearing and Education

Gian-Carlo Rota was part of a prominent family. His father, Giovanni, was a civil engineer. The family library counted more than 5000 books. Rosetta Rota, Giovanni's sister, was a mathematician who worked in Rome. She was married to Ennio Flaiano, a novelist and a screenwriter for Federico Fellini.

At the end of World War II, the Rota family decided to leave Italy and emigrated to Quito[1]. In Ecuador, Gian-Carlo completed high school at the American school of Quito. At the same time he also studied German.

In 1950 Rota enrolled in Princeton University. His teachers included Alonzo Church (the logician well known to any self-respecting computer scientist[2]), Emil Artin (algebra), Solomon Lefschetz (topology), and William Feller, author of a best-selling book on probability and Rota's advisor for his master's thesis.

While at Princeton, Rota studied philosophy with John Rawls, became familiar with so-called *continental philosophy*, and encountered the writings of Husserl and Heidegger.

Shortly thereafter, Rota earned his Ph.D. in mathematics at Yale University. His thesis advisor was Jacob Schwartz. It is worth noting that another of Schwartz's Ph.D. students was Marvin Minski, one of the fathers of artificial intelligence[3].

2 A Beautiful Career... or two?

After a few temporary appointments (NYU, MIT, and Harvard), Rota joined the faculty of MIT in 1959, and in 1961 he became an American citizen.

This important step in Rota's life is the setting for an anecdote that merits sharing here. While filling in one of the several forms to request citizenship, he was asked whether he had one or two names: Was his first name Gian, and the middle name Carlo? Or what?

[1] Speaking of Quito, the eldest of the Organizers recalls having been told by Rota himself that there, among other things, he learned how to *trasnochar*.

[2] In his book *Indiscrete Thoughts*, Rota describes Church as a "big panda".

[3] Specifically, it has been reported that the term "artificial Intelligence" made its first printed appearance in Minski's thesis: a bulky 1000 pages that Schwartz candidly admitted having read "some" of.

Rota then explained that he had only one name, Giancarlo, spelled however as two words. This variation was inadmissible for bureaucratic reasons. For a moment or two, the official was at a loss, but then suddenly he (or she) came up with the solution and said: "A hyphen will do".

This unusual spelling caught Rota's fancy and he decided to keep it. That is why we are here today to remember our beloved

Gian-Carlo.

The great mathematicians he met at MIT included Norbert Wiener, the founder of cybernetics, and Garrett Birkhoff, the father of lattice theory. At about the same time Gian-Carlo also became acquainted with a young mathematician, John Nash, who would later win the Nobel Prize in economics. (Too bad there is no such prize in mathematics!) Rota and Nash used to run into each other in the math department Common Room and at parties (somewhere there is a picture of Gian-Carlo dressed up as Zorro).

Had one the need to set a birthdate for modern combinatorics, one likely choice would probably be 1964[4] when Rota published the first of a series of seminal papers, bearing the name "On the foundation of combinatorial theory". The opening paper, "The Theory of Möbius Function", largely widens the results obtained in 1831 by Augustus Möbius in his work on number theory.

In 1966 Rota began work as a consultant to the Los Alamos Scientific Laboratory where he enjoyed the friendship of Stan Ulam (whom he nicknamed Uncle Sam) and of Nick Metropolis. In 1971 he became Senior Fellow at Los Alamos and in 1992 he was awarded the Medal for Distinguished Service by the National Security Agency.

Despite his successful career as a mathematician, Rota continued his philosophical research, and in 1972 he became the first (and, so far, the only) MIT Professor of Mathematics and Natural Philosophy. He was also a member of the American Academy of Arts and Sciences, the Heidegger Circle and the Husserl Circle. One of Rota's great satisfactions was being invited to teach philosophy at Catholic University of America.

Among the honors Rota received, let us mention the four degrees *honoris causa* from the Universities of Strasbourg (1984), of L'Aquila (1990), of Bologna (1996) and from Brooklyn Polytechnic University (1997). Rota received the Steele Prize from the American Mathematical Society in 1988. The prize citation singles out the 1964 paper "On the Foundations of Combinatorial Theory" as

[4]Incidentally, in that very same year, IBM released the System /360, the first computer to implement the idea of "family of computers".

... the single paper most responsible for the revolution that incorporated combinatorics into the mainstream of modern mathematics.

3 A Few Remarks on Combinatorics

• We start with a statement by Richard K. Guy: *Combinatorists owe much to Gian-Carlo Rota, already a "respectable" mathematician when he interested himself in combinatorics and embarked on his gallant crusade to unify the subject which almost everyone regarded as being at best a bag of clever isolated tricks; to reverse the tide of abstraction in mathematics; to return to the concreteness of a century ago. ... Rota observes that combinatorics is providing the essential continuing link between mathematics and the sciences: biology (structure of large molecules), linguistics (context-free languages, automata theory), physics (statistical mechanics, phase-transition problems, elementary particles).*

• Next, one must not overlook the important parallel contributions of the *mitteleuropäische* school of combinatorics that goes from Alfréd Rény to Paul Erdös.

• Then we supply the very definition of combinatorics in the the words of Gian-Carlo Rota himself: *"Combinatorics is putting different-colored marbles in different-colored boxes, seeing how many ways you can divide them. I could rephrase it in Wall Street terms, but it's really just about marbles and boxes, putting things in sets."*

• Finally, we maintain that combinatorics is the mathematical language of computer science. If you design a nuclear plant or the world's tallest skyscraper, the answers to your questions will be quantities that vary continuously: What should the diameter of a pipe be?; How thick concrete do we need here?; and so on. On the other hand, if you are the project leader of a huge database or the designer of a digital network protocol, the answers to your questions – How many transactions of a given kind should we expect? How many bits should we use for protecting an electronic signature? – would be discrete in nature. Indeed, combinatorics accounts for a substantial portion of discrete mathematics.