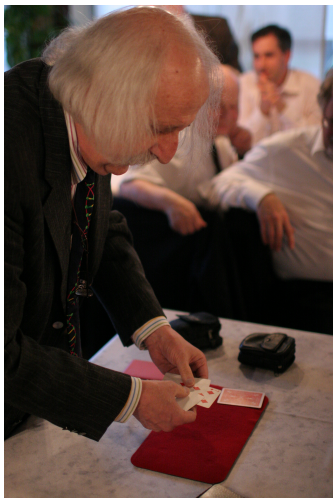
Know the Person behind the Papers

Grzegorz Rozenberg

Bio: *Grzegorz Rozenberg is Professor Emeritus of the Leiden Institute of Advanced Computer Science, Leiden University, The Netherlands and Adjoint Professor of the department of Computer Science, University of Colorado at Boulder, USA. He was EATCS president for 9 years, the editor of the EATCS Bulletin for 23 years, the founding editor-in-chief of the journal Theoretical Computer Science C: Theory of Natural Computing, and a founding editor-in-chief of the International Journal on Natural Computing. Rozenberg is known for his contributions to formal languages and automata theory, concurrency theory, and natural computing. He is sometimes referred to as a guru of natural computing, as he coined the name and defined the scope of this area. He graduated from the Technical University of Warsaw, Poland and obtained his Ph.D. in mathematics from the Institute of Mathematics of the Polish Academy of Science, Warsaw, Poland. Among the prizes he received are: 6 honorary doctorates, the EATCS 2003 award, the first award of the Developments in Formal Languages conference, and in 2017 he was knighted in the Order of the Netherlands Lion.*



We ask all interviewees to share a photo with us. Can you please tell us a little bit more about the photo you shared?

Grzegorz: There are two pictures I would like to share.

(1) I like giving talks on my research. One can accommodate many more subtleties in a lecture than in a paper. Also, it is easier to introduce someone to a research topic through a lecture than through a "dry" technical paper.

It is a popular "wisdom" that the art of giving lectures is very much like the art of conducting an orchestra: a lecturer must be able to synchronize the minds in the audience on the topic of the lecture. The first picture is made by a member of the audience, when I was giving a lecture on reaction systems, currently my favorite research topic. I was really flabbergasted to see this picture, where it looks like I am, indeed, conducting the "audience orchestra".

(2) I am a performing magician specialized in card magic (no apparatus, just my two hands and a pack of playing cards with no distance from the spectators). Although science is rational and magic emotional, there are many similarities between the two. For example, magic teaches you not to accept things on their face value. This principle also plays a crucial role in science. A goal of the highest level magic is to approximate, as closely as possible, something impossible which is also a key inspiration of the highest level science (for example, disproving a long standing conjecture). My magician's business card says "Be Astonished by the Impossible".

I enjoy to perform at science conferences as this gives me a chance to discuss the nature of magic with scientists (in fact, I performed at several ICALPs). The second picture shows me performing at a conference.

Can you please tell us something about you that probably most of the readers of your papers don't know?

Grzegorz: I wrote above that the double helix, formed by the helices of science and magic, underlies a big part of my creative life. This is known through my papers, books, and talks as well as through my magic performances at scientific events. However there is a third helix.

I have studied the paintings and drawings by Hieronymus Bosch for the past 50 years, and am now an acknowledged specialist on Bosch. By chance, I bought a book with reproductions of his paintings and immediately fell in love with his art. The attractiveness of his art for me is the best described by the statement "it is amazing that a single mind could imagine so many things" made by a Spanish monk and historian, José de Sigüenza, in the 16th century. Interestingly, at the top of one of his well-known drawings there is an inscription in Latin which says "For poor is the mind that always uses the ideas of others and invents none of its own". Quite possibly this was the motto of his workshop. Obviously, it should be a leading motto for researchers.

When reflecting on my long life, I feel very fortunate that the structure of my creative life was determined by the triple helix of science, magic, and Bosch.

Through it I got embedded in three wonderful, but very different communities (scientists, magicians, and art historians).

Is there a paper which influenced you particularly, and which you recommend other community members to read?

Grzegorz: My research directions were influenced by a number of papers and books from various areas of science (mathematics, computer science, biology, linguistics, chemistry and electronics). A theoretical computer science paper that had a big influence at the beginning of my research career is "Finite Automata and their Decision Problems" by Michael Rabin and Dana Scott (see [2]). This paper had an enormous influence on the development of automata theory. It is beautifully written and very inspiring (no wonder, as the authors are real giants of theoretical computer science). In fact, I remember that even during the reading of the paper I started to develop my own ideas on multitape automata.

Is there a paper of your own you like to recommend the readers to study? What is the story behind this paper?

Grzegorz: Before I recommend a paper, I would like to mention a concern I have had for many years. I never liked the name "computer science", which somehow suggests that this is a discipline centered around (the use and construction of) specific devices, viz., computers. This view was quite prevalent for a long time during my career. Unfortunately (from my perspective), this point of view is sill quite common. For me computer science is *the* science of information processing and in this way it is a fundamental science for many scientific disciplines. Therefore the European term "informatics" is a much better name.

Natural Computing is a good example of this broad understanding of computer science. It is the research area concerned with human-designed computing inspired by nature as well as with computing taking place in nature (i.e., it investigates, in terms of information processing, phenomena taking place in nature). Although a majority of research in natural computing is centered in computer science, it is genuinely interdisciplinary and it forms a solid bridge between computer science and natural sciences.

Research in (both strands of) natural computing constitutes a big part of my research activities. Therefore I would like to recommend the paper "The Many Facets of Natural Computing" by L. Kari and myself (see [1]). Even though the paper was published in 2008 it is still a relevant "nontechnical" introduction to natural computing directed at the general audience of computer scientists. As a follow up, I would like to recommend the "Handbook of Natural Computing", G. Rozenberg, T. Bäck, and J. Kok, editors (see [3]). Just by browsing through it (e.g., through the preface and the table of contents) one can get a sense of the

excitement and relevance of this area as well as the understanding of its enormous importance for the development of computer science.

When (or where) is your most productive working time (or place)?

Grzegorz: I am not well organized in this respect, i.e., I do not have specific times of the day reserved for research. Sometimes it is a whole day when I work on research problems and sometimes it is just plugged into "free slots" during a busy day. My favourite writing places are my home and cafes. I always carry a writing pad with me. In the office I work with my collaborators, students, . . . – for this I need a blackboard (or, nowadays, a whiteboard).

What do you do when you get stuck with a research problem? How do you deal with failures?

Grzegorz: I am always working on a number of research problems in an interleaving fashion, meaning that when I work on a specific problem, my notes on the other problems are set aside. So when I stop working on the given problem (e.g., because I feel that I do not make enough progress on it), the notes on it are set aside and I pick up one of the problems in the waiting line – sometimes it is a problem I set aside a short time ago and sometimes it is a problem from years ago.

I do not accept the negative term "failure" used in the question. It is the process of working on interesting (a subjective term) problems, that makes the life of an active researcher so exciting. Moreover, if you do not succeed in "solving" a problem that you chose to work on, you often learn a lot, produce new interesting notions and/or results, and as a result of this experience start a new research line.

Is there a nice anecdote from your career you like to share with our readers?

Grzegorz: Here is an anecdote I find hilarious, which is well-known among my friends, scientists and magicians. It shows how the perception and appreciation of various professions may be age dependent. One day, when my son, Daniel, was a teenager, I got back home from the office and entered our house. Daniel was then in the hall with his friend, Ferdie. I said "hello", and went to the kitchen. Since the door from the hall was open, I could hear Ferdie asking Daniel about my profession. Daniel answered "he is a university professor" and a moment later he added: "but he is not stupid, he is a very good magician".

Do you have any advice for young researchers? In what should they invest time, what should they avoid?

Grzegorz: Invest your time and energy in following your scientific curiosity and passion *but* avoid to be "chained" to one specific line of research. Try to get some insight into various research areas (e.g., by reading tutorials or following

schools). This may lead to working on different sorts of research issues, which is also good for your intellectual development.

What are the most important features you look for when searching for graduate students?

Grzegorz: Clearly, there must be a "proof" (the master thesis, study grades, presentations) that they are intellectually qualified. But then, I always look for signs of curiosity, passion, and motivation which will allow them to be successful in getting good results and happy with working on them.

Do you see a main challenge or opportunity for theoretical computer scientists for the near future?

Grzegorz: Computer science is evolving towards *the* science of information processing and is accepted as such by many scientific disciplines. As an example of this acceptance I can quote the famous biologist Sydney Brenner, Nobel prize winner, who stated that "biology is essentially (very low energy) physics with computation". For many disciplines computer science provides not only instruments but also a way of thinking. Therefore, the science part of computer science will become a foundational science for many areas of science.

I am convinced that one of the Grand Challenges of computer science is to understand the world around us in terms of information processing. Working on this challenge is a huge opportunity as it also enriches the scope of research problems for theoretical computer science. For example, theoretical computer scientists are already making essential contributions to the fundamental understanding of self-assembly, a central phenomenon of nanoscience.

What kind of opportunities should EATCS offer to researchers, and especially to young researchers?

Grzegorz: In the spirit of my reflections above, I would like to suggest that EATCS gets involved in organizing "broad perspective schools" which would cover, in a tutorial fashion, currently interesting developments in various areas of computer science. By attending such schools, young researchers will get an opportunity to broaden their vision of theoretical computer science and (hopefully) get actively involved in new research directions.

What can be the role of EATCS in solving the challenges of our society?

Grzegorz: In the context of theoretical computer science, our research advances contribute to the foundations of understanding nature, science, and new technologies, all of which will impact lives of people around the world.

The role of EATCS should be extending the scope of theoretical computer science and promoting interdisciplinary research. Extending the scope of research

widens our opportunities to make a progress in a multitude of issues important for our society. The scope of these opportunities is certainly broadened by promoting interdisciplinary research.

Please complete the following sentences?

- *My favorite movie is* ... "Blow-up" by Michelangelo Antonioni.
- *Being a researcher* ... is a wonderful way of living.
- *My first research discovery* ... was in category theory.
- Clever juggling of research, teaching, and administration and a feeling of success/satisfaction in at least one of those areas ... *is key to being a happy academic.*

References

[1] Lila Kari, Grzegorz Rozenberg. The many facets of natural computing. Commun. ACM 51 (2008) 72–83. doi: 10.1145/1400181.1400200

[2] Michael O. Rabin, Dana S. Scott. Finite Automata and Their Decision Problems. IBM J. Res. Dev. 3 (1959) 114–125.

[3] Grzegorz Rozenberg, Thomas Bäck, Joost N. Kok. Handbook of Natural Computing. (4 volumes) Springer 2012. doi: 10.1007/978-3-540-92910-9