RÓZSA (ROSA) PÉTER

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Summary

As her adoptive son, I shared a flat with Rózsa Péter for almost a quarter of a century, so I could recount very much about Professor Péter, about "Aunt Rosa" to so many. However, the chronicler will hardly be able to give a full picture, on a few short pages, of the significance in education and scientific progress of her generous activities stemming from love of humanity and of science.

The two dates on her sepulchral monument erected by the Hungarian Academy of Sciences are: 1905–1977.

Rózsa Péter the mathematician

In compliance with her father's wish, Rózsa Péter took up chemistry at the university; soon, however, all her interests became absorbed by mathematics. Among her professors, Lipót Fejér and József Kürschák particularly encouraged her. A fellow-student, László Kalmár, however, had an even greater stimulating influence on her course of life. Her first achievement in mathematics, on perfect numbers, was obtained early in her university years. Perfect numbers are positive integers for which the sum of their proper divisors is equal to the number itself; for instance, 6 and 28 are perfect numbers, because $6=1+2+3$, and $28=1+2+4+7+14$. Rózsa Péter discovered certain properties of odd perfect numbers, although odd perfect numbers are not known. She did not, however, publish her result, because it turned out that someone else had discovered and published it earlier. This news discouraged her. She stopped her research work. She asked herself: Am I worthy of being a mathematician? Later she frequently cited Kalmár's answer which gave her a new start: "It is not you who is worthy of dealing with mathematics, but it is mathematics that is worthy of being dealt with."

An exciting period followed. In those years research related to the foundations of mathematics began to unfold powerfully in the frame of David

Hilbert's proof theory. Within its sphere, a special part of number theoretical functions, the class of so-called recursive functions attained an important role. The recursive mode of defining a function is to define its value at zero and to define a procedure allowing to compute its value at any positive integer knowing the values assigned to previous values. Functions describable in this manner are called recursive functions, and their different classes arise from the categorization of the computing procedure. Rózsa Péter's attention turned to recursive functions, and this field accompanied her whole mathematical research career.

In the simplest type of recursion, called primitive recursion, one refers only to the function value assigned to the place n in defining the value at the place $n+1$. Functions obtained from zero and from the function $n^* = n+1$ by a finite number of substitutions and primitive recursions are called primitive recursive functions. One of Rózsa Péter's first achievements was the demonstration that certain complicated recursions can be expressed by means of primitive recursions.

Rózsa Péter first reported her results at the 1932 Internatial Congress of Mathematics held in Zürich. She obtained her Ph.D. degree at the University of Budapest in 1935. At the 1936 congress of mathematics held in Oslo she read a paper on so-called higher-order recursions. (Such recursions arise by allowing to define functions depending on function variables.) From 1937 on she was member of the editorial board of a distinguished American journal. None the less, she only obtained a permanent teaching post after the end of the war, in 1945, and in 1939 the Fascist laws deprived her even from her temporary teaching job.

It never occurred to Rózsa Péter that her results might be utilized in practice. What happened, however? Her book on recursive functions (Rekursive Funktionen, Akadémiai Kiadó, Budapest 1951) was the second book by a Hungarian author that was published in the Soviet Union (1954), since it was found indispensable in the theory of computers. Rózsa Péter frequently pointed out that those who wish to push pure mathematical research into the background sin against practical utility. To the narrow-minded who only value practical achievements she responded ironically: "Only the fruit of the cucumber plant is of any use. Let us therefore diligently extirpate its roots, its stem, its leaves and flowers occupying so much place."

In the 'sixties, further generalization of recursive functions opened up many new applications, the most important being in the theory of programming languages, mathematical linguistics, translation between formalized languages, logical optimization. The major part of these results are summarized in Rózsa Péter's further book (Rekursive Funktionen in der Komputer-Theorie, Akadémiai Kiadó, Budapest 1976) which appeared six months before her death.

This monograph discusses applications of recursive functions in the theory of programming, with the following major results: it is demonstrated that the class of functions computable with an exactly defined "ideal computer" (the mathematical idealization of real computers) is identical with the class of partial recursive functions. (These functions differ from general recursive functions only insofar as they possibly are not defined for certain values of their variables.) It is confirmed that the stack memory method playing an important part in the theory of translation programs is partially recursive. As the mathematically adequate form of block diagrams (of major importance in preparing computer programs) the concept of computability by graphs is introduced and it is proved that the concept of computability coincides with the concept of partial recursivity. It is demonstrated that recursive processes can—on principle—be eliminated from the program language ALGOL 60, and that the meta-language used to describe this language is primitively recursive. The recursivity of the concepts of two-stage grammatics applied in the definition of the language ALGOL 68 is demonstrated too.

Rózsa Péter was awarded numerous prizes such as the Kossuth Prize, the State Prize, the Peace Prize etc. She was elected corresponding member of the Hungarian Academy of Sciences in 1973. She retired in 1975.

Rózsa Péter the artist of pedagogy

After graduating, Rózsa Péter taught mathematics for 18 years as temporary teacher—with shorter forced breaks—in lower-type secondary schools. Already during those years she followed the principle: instead of teaching the pupils mathematics, she invited them to discover mathematics jointly, in common activity of the teacher and the pupils. We know from her book entitled "Playing with Infinity": she found out that this joint discovery not only gives permanent experience and solid knowledge to the pupils, but also frequently presents the well-known subject from a new, unexpected and surprising aspect to the experienced teacher. The greatest praise she ever got in all her life was—in her opinion—what an eleven-year old girl wrote in a Hungarian literature composition, that is, for another teacher, not for her, describing a school day: "When we have mathematics in the forenoon, my heart beats more rapidly already at 8 o'clock, not out of fear but out of curiosity." It was during her long years of teaching practice that Rózsa Péter developed the concepts of teaching and propagating mathematical knowledge to the wide public, for which she only got the opportunity after the war. She educated generations to find joy in thinking.

. The book "Playing with Infinity" was born from letters to the outstanding Hungarian writer Marcell Benedek. He complained that he was

unable to understand mathematics and missed it much, because without mathematical knowledge he felt poorer in literary expressivity. Rózsa Péter's book which precisely demonstrates the common features of mathematics with literature and art was fully understandable and acceptable to him.

Since, the book has been translated into 12 languages and found great response. An English schoolgirl wrote: "I thought I should never understand mathematics; after having read this book I became convinced that I always was a mathematician."

Let me cite some opinions on this book.

Géza Hegedűs, writer: "Humanity is divided into two parts: those who understand mathematics and those who do not. The difference between the inhabitants of the Earth and the Mars is hardly greater than that between the two camps. Rózsa Péter, from the camp of equation-believers, now undertook the task to recount the issues of mathematics to those who have not the slightest talent for the fairyland of numbers. How very interesting: she succeeded to solve this seemingly hopeless task, and behold, the blind see!"

Marcell Benedek: "Not only have I understood the book, which is its greetest merit. Let me add: it is charming!"

Milán Füst, poet and writer: "I should never have imagined that the abstraction of abstractions, mathematics could reflect such integrity of a human being. How astronomical is the distance between this book and all that tormented us hitherto in the form of mathematical textbooks!"

Tibor Gallai: "Great requirements are set to the author for writing such a book. It needs the knowledge of the creative scientist, pedagogic skill and literary gift. It is a rare chance that all these requirements will be satisfied by a single person. The author of the book "Playing with Infinity" personifies this exceptional case."

From the exercises of a librarian course: "I should recommend this book for comfort from the first grades of secondary school up to university studies." "This book is inspired not only by competence and love of the profession, but also by passion and poetry, though the subject chosen by the author is more unusual than those of thousands and thousands of poets."

Rózsa Péter participated in the development of modern textbooks of mathematics for secondary schools and taught her students at the Teachers' College and later at the University of Budapest to admire and love the beauty of mathematics. All subjects blossomed out from the analysis of some problem, in her lectures as well as in her books.

She was a true artist in demonstrating the beauty of mathematics. She wrote an article "Mathematics is beautiful", in which she illustrated that mathematics is not just dry two-and-two, but has many features related to art. She considered it a mistake to believe that mathematicians mainly calculate. To find those among her pupils who think as mathematicians, she gave them the

following puzzle: Let us pour wine and water, resp., into two equal glasses to identical heights (not to the top). Let us take one spoonful of wine from the first glass, pour it into the glass with water and mix well. Let us then take a spoonful of this mixture and add it to the wine in the first glass. Thus, some wine will be transported into the water and some water into the wine. Which is more: the wine in the water or the water in the wine?

According to Rózsa Péter it is not decisive for mathematical thinking to find the correct answer (the trap into which many fall is that they believe that a whole spoonful of wine has passed into the water, while only a mixture, that is, not a whole spoonful of water has passed into the wine); what is decisive is that the following explanation should be accepted as satisfactory: exactly the same amount of wine is transported into the water as water into the wine. Let us consider the wine glass in the initial and final stages, independently of what had happened inbetween: the liquid stands at the same height, since one spoonful was taken out and one spoonful was replaced. Some wine was lost to the glass (this wine is now in the glass with water) and some water was gained. If loss were more or less than gain, the liquid level would be higher or lower at the final stage than at the initial stage. Since the level has not changed, the loss—the wine that passed into the water—must be identical with the gain, with the water that passed into the wine.

Those whose mind is less mathematically oriented will not be satisfied with this logically plain explanation: they will begin to calculate. But mathematicians are characterized by clear thinking, not by calculation; they are capable of perceiving the essence of matters and disregarding what has no significance.

Rózsa Péter was interested in literature and films: she regularly wrote film reviews and translated poems. Her translation of Rilke's "Autumn day" is—in the opinion of Marcell Benedek—the best among all known translations. She emphasized that culture is one and indivisible. Mathematical linguistics are, for instance, a common domain of what is frequently termed "the two cultures". She illustrated the mathematical statement that different models may satisfy the same axioms by an analogy in poetry, by citing the poem Epilogue by János Arany, one of the greatest Hungarian poets:

Whenever
Some whippersnapper
Bespattered me with mud,
I never did dispute
I stood aside
And off the mud I wiped.

The same was expressed by another Hungarian poet, Frigyes Karinthy in his more vehement style:

I'll rest. Amen.
I'd rather have the vermin eat me
Than eat them.

What was Rózsa Péter like?

She passionately loved life and all its joys. She hated all self-importance and pompousness. Gaiety always ruled in her environment, she liked to joke, nobody appreciated intelligent humour more than she.

She was said to be subjective. Well, the following story was accepted by her, too, as authentic. She loved to play, for instance, the game "Twenty questions". While others usually start with the question: A person? A thing? Rózsa Péter's first question was: Do I like it? If the answer was "No", she did not continue the game. Anyhow: she loved truth above all. She could not and did not want to make compromises in any question and demanded the same from others.

She was said to be aggressive. True: she would fight to the very last, if some injustice was committed to somebody or to some good cause. However, she respected personality and despised servility.

She did much refereeing officially and unofficially too, with much greater devotion than usual. If she found mistakes to correct, she was able to find modifications which preserved all slightest emotional elements of the author.

She passionately loved her friends and was always ready to support them generously. She was similarly passionately attached to her students. She followed their life and career with great concern. There hardly ever was another head of department who distributed posts to her students with such circumspection as she did. She thought of everything: vacancies were talked over with the students having maps, bus and train time-tables at hand.

In the last stage of her life she was concerned with the reform of secondary school teaching of mathematics. She felt this to be the most important among all her activities, it being the fundament of mathematical life. If it is on a good path at present in Hungary, it is greatly due to her strong will, to her devotion and knowledge.

She loved to eat and to do the cooking; she prepared dinners for her guests with great solicitude, the preparations took several days. She shared the menus of all cooking tournaments with her friends; she was particularly interested in specialities. She once read in a newspaper that a particular kind of noodles is being served in a restaurant in Vác, a town at a distance of 30 km from Budapest. She took the trouble to take a train for Vác. However, when she arrived, the restaurant was closed for renovation. Rózsa Péter was not the person to put up with fiascos. She hunted up the cook who prepared the famous noodles and returned with the recipe.

Her thoroughness was exemplary. I remember sitting in the corner of the headmaster's room in a secondary school together with the director of a television series "Tête-à-tête with scientists" when the episode with Rózsa Péter was shot. The film director never said a single word: he immediately recognized

that it should be left to Professor Péter, who in fact arranged everything admirably, although she never directed a film earlier.

Rózsa Péter never accepted compromises. I guess that she will be remembered for a long time at the technical department of the publisher of Playing with Infinity. What happened was that she had complained to me several time of the covers of the successive editions of Playing with Infinity: she did not like any of them. She told me once what she had in mind. Since I have some feeling for painting, I immediately made a sketch that we took to the publisher. The technical department then redesigned it to fit the printing procedure they wanted to apply. However, we were not satisfied with it. The publisher regarded the matter as settled, but did not reckon with the insistence of Professor Péter. She spent half a day at the publisher's, argued, fulminated and thundered, but did not give in. Finally she squeezed out the solution: our sketch was reproduced using a photographic process. The sixth edition of Rózsa Péter's book which appeared after her death was covered with our design that triggered off the battle.

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