

Petr Hájek, *1940 – †2016

Petr Hájek studied mathematics at the Faculty of Mathematics and Physics, Charles University, Prague, and graduated in 1962. After graduation he accepted a research position in the Mathematical Institute of the Czech Academy of Sciences (at that time it was part of the Czechoslovak Academy of Sciences). In 1992 he was elected director of the Computer Science Institute of the Czech Academy of Sciences and served two terms. After that he remained in the institute as a leading researcher.

His thesis, written under the supervision of the Czech algebraist Vladimír Kořínek, was about a subject in algebra. He did not continue working in this field and turned to mathematical logic, where he worked all his life. Mathematical logic in Prague was pioneered by Ladislav Rieger, originally a geometer. Rieger died in 1963 and the initiative was taken over by the young mathematician Petr Vopěnka. In the 1960s logic became very popular due to the breakthrough result of Paul Cohen who proved the independence of the Continuum Hypothesis. Motivated by this result, Vopěnka founded a seminar devoted to the study of axiomatic set theory. He attracted a group of young and talented mathematicians (Tomáš Jech, Karel Hrbáček, Karel Příkrý, Antonín Sochor, Petr Štěpánek and more), who later became famous in the field of set theory. One of the participants in the seminar was Petr Hájek. This was the beginning of the successful cooperation of the team Vopěnka–Hájek. They wrote a large number of papers about set theory, both together and separately. Their work culminated with the monograph *The Theory of Semisets*, which appeared in 1972.

After finishing the monograph Vopěnka continued working in set theory, but Hájek turned to another subject. He became interested in the logical foundations of arithmetic. This subject gained popularity due to another breakthrough in logic. It was the seminal result of Jeff Paris and Leo Harrington, who found a mathematical sentence independent of Peano Arithmetic. In 1976 Petr Hájek (together with me) founded a seminar on formal arithmetic. The seminar was soon joined by Jan Krajíček, Vítěslav Švejdar and several other researchers and students. Hájek published a number of papers in this field, but what is perhaps even more important is that he founded a school. Participants of the seminar and their students are still working in arithmetic, though the interest has shifted more to bounded arithmetic and proof complexity; the seminar is still going on in the Mathematical Institute. Hájek's work in arithmetic culminated with another monograph *Metamathematics of First Order Arithmetic*, published in 1991 (to which I contributed by writing a chapter on bounded arithmetic). The book became the standard reference for researchers in formal arithmetic and is often cited.

Since the beginning of his scientific career Petr Hájek was interested in applications of logic in computer science. The first project that he got involved in was

the system called GUHA. He developed GUHA together with Metoděj Chytil, Ivan M. Havel, Tomáš Havránek and other Czech researchers. The system was able to automatically generate hypotheses about the relationship between properties of empirical data.¹ For instance, it was possible to find symptoms that, according to the given data, imply a particular disease. Originally GUHA only used propositional logic; later it was extended with some statistically motivated connectives. The biggest impact of this project was again the creation of a group of scientists that worked on applications of logic in computer science.

As computer science was becoming a major research area, Petr Hájek was following new trends. It was quite natural to turn from GUHA to general expert systems. At this stage he cooperated mostly with Tomáš Havránek. Their work was eventually published in the monograph *Uncertain Information Processing in Expert Systems* written jointly with Radim Jiroušek.

When Havránek suddenly passed away in 1992, Hájek replaced him as the director of the Computer Science Institute. By then he had left arithmetic and fully devoted himself to the study of uncertain information. Fuzzy logic was in full swing, but many theoreticians did not consider it a serious research area. Hájek was among a few logicians who realized that fuzzy logic could be studied as a solid mathematical theory. In his monograph *Metamathematics of Fuzzy Logic* he presented fuzzy logic as a theory of logics based on truth values in the real interval $[0,1]$ and satisfying some basic axioms. This book has become a fundamental reference in this field and is highly cited. But it was not just his publications, he again founded a very successful group in the Institute of Computer Science (with Marta Bílková, Petr Cintula, Zuzana Haniková, Rostislav Horčík and others) that continues his work on nonclassical logics.

This brief survey certainly does not cover all areas of mathematics and computer science in which Petr Hájek made significant contributions. Altogether, he published more than 380 articles and seven monographs. For his work and achievements, he was awarded many prizes including Honorary Professorship at the Technical University, Vienna, the medal of the Czech Academy of Sciences *De scientiae et humanitate optime meritis* and the medal *Za zásluhy* given by the president of the Czech Republic.

Petr Hájek was a very talented and diligent mathematician, and a humble and honest person. He passed away on December 26, 2016. We miss him very much.

Pavel Pudlák, Prague, 1.2.2017

¹The U in the acronym stands for unary predicates.