Andrzej Mostowski, 1913-1975

Professor Andrzej Mostowski was born on November 1, 1913 in Lemberg (Austrian Empire), later known as Lwów (Poland) and now Lviv (Ukraine). As a child he moved to Warsaw (and his entire career is connected to this town). Mostowski started his studies of Mathematics at Józef Piłsudski University (later known as Warsaw University) in 1931.

We mention all these facts to indicate complex changes that Poland (and other geolocations in what is known as Eastern Europe) was subjected to during his life.

The Faculty of Mathematics where Mostowski studied provided an excellent roster of individuals that were contributing to widely understood Foundations of Mathematics (including Logic, Set Theory and foundations-related aspects of Topology e.g. Descriptive Set-Theory.) This group of scientists included K. Kuratowski, St. Leśniewski, A. Lindenbaum, J. Łukasiewicz, W. Sierpiński, A. Tarski, and others. Not all these scientists were on the faculty (notably Tarski was not on the faculty) but they collaborated, shared problems and regularly met at seminars. Poland in the 1930ies did not have enough positions in its universities to provide employment to the great talent. Often no positions were available or available in minor schools (viz. Tarski). Moreover, on par with the rest of Europe, during the 1930ies, Polish universities were subjects of violent nationalistic events. This political tumult and violent episodes with deeply divided student bodies and faculty contributed to the worsening political situation. Mostowski graduated in 1936 and soon left for Vienna and Zürich for further studies. The studies were supposed to prepare him for work as "applied mathematician". Apparently the idea that one should really be *applied* scientist is not that new. Anyway, Mostowski was in Vienna when Gödel presented his ideas on constructibility, and thus consistency of the Axiom of Choice, and took classes in Zürich. While Mostowski found the lectures in Zürich fascinating (and the photo of Hermann Weyl was permanently displayed on the wall in Mostowski's office in Warsaw after WWII,) Mostowski devoted his life to Foundations of Mathematics, esp. Set

Theory and Logic, areas that do not promise an immediate applicability.

After coming back from travels, Mostowski presented the doctoral dissertation "On independence of definition of finiteness in a system of logic". This work and subsequent work on the independence of the axiom of choice from the "ordering principle" introduced what is now called "Fraenkel-Mostowski" method of independence proofs. Specifically, one adds to the universe of sets a collection of individuals (sometimes called *urelements*). Then one considers a sub-universe of the universe so obtained, by considering elements that are preserved by a suitable group (we provide only a *very* rough picture.) The resulting class (for a suitably chosen filter of groups) is a model that establishes a desired independence result. Of course it only sounds simple; technical problems need to be properly treated, and this is what Mostowski did. Mostowski's dissertation (formally under the supervision of Kuratowski, but in reality of Tarski) was defended in 1938.

The World War II, especially savage (no better expression comes to mind) in Eastern Europe (see current studies of historians, esp. T. Snyder) had as an immediate result loss of *any* opportunities for mathematicians in German-occupied Poland. Eventually, Mostowski supported family working as an accountant in a bitumic-paper factory.

Even though Nazis, motivated by their racial ideology, attempted to eradicate all education over the elementary-school level, Polish mathematicians (that is those that were not immediately killed), at great risk, created and taught an Underground University; Mostowski was one of the lecturers. At the same time Mostowski worked on his habilitationschrift.

Mostowski collected his war-time results in a "big black notebook". During the WW II he was in prime of his life; those were his late 20ies and early 30ies. But the history intervened again; during the Warsaw uprising of August 1944, Mostowski (like the entire population of Warsaw) was exiled from the city (which was subsequently 95% destroyed). The big black notebook burned with the city. Later on Mostowski would tell us, his students, about the results he got during the war. Some, but not all, were later published. Many important results that were there included his work on what we now call

"Kleene-Mostowski hierarchy" that is arithmetical hierarchy, results on the consequences of the axiom of constructibility on projective hierarchy and many others.

After WWII, Mostowski defended in 1945 his habilitation at Cracow Jagellonian University, again on results related to the Axiom of Choice. He soon returned to Warsaw and for the next 30 years - till his untimely death - was associated with Warsaw University, raising to the position of Professor of Mathematics. Eventually he was also elected a member of Polish Academy of Sciences. In 1948/49, before the stalinist regime cut the scientific connections to the West, Mostowski spent the academic year 1948/49 at the Institute of Advanced Studies at Princeton, NJ. Fortunately, the isolation from the world science was shorter this time; Polish mathematics came back to world science in 1954.

Once established at Warsaw University, Mostowski's regularly contributed to all areas of Foundations of Mathematics. His significant work contributed to Recursion Theory, Undecidability (extending work of Gödel), Model Theory, Set Theory, second-order theories such as Second-Order Arithmetic and theories of classes (Gödel-Bernays and Kelley-Morse), Constructibility, algebraic methods in Foundations of Mathematics and so-called Generalized Quantifiers. This is not a place to sum up his spectacular achievements, so we will mention only Ehrenfeucht-Mostowski theorem on existence of models with indiscernibles, and his introduction and studies of the quantifier "There are infinitely many", Ehrenfeucht-Mostowski theorem is discussed in all handbooks of Model Theory; Generalized Quantifiers form a cornerstone of Abstract Model Theory and have important applications in Computer Science.

Mostowski created an important center of studies of Foundations of Mathematics; his Warsaw seminar not only educated researchers in his native Poland, but also was a magnet for many scientists from all over the world, and especially Europe. Warsaw became a place where logicians of the East and West met and collaborated. During the times of "Cold War" it was a unique place where logicians could, and indeed actually met.

Until his death in 1975, Mostowski lead a large center of foundational research in Warsaw. Among his numerous Ph.D. students were H. Rasiowa, A. Grzegorczyk and A. Ehrenfeucht, well-known math-

ematicians in their own right. Mostowski's Foundations of Mathematics seminar was visited by a veritable *who-is-who* of researchers of the area.

It is hard to overestimate Mostowski's role in the heroic period of Foundations of Mathematics, culminating with the feverish period of research after P.J. Cohen's discovery of forcing. This period, starting in the 1930ies coincided with the activities of Professor Mostowski. He died, age 62, on August 22, 1975, in Vancouver, BC, on his way to London, ONT, Congress of the Section of LMPS of the International Union of History and Philosophy of Sciences.

A meeting devoted to Mostowski's legacy will be held at Warsaw University, October 13-15, 2013. See the conference page at http://mostowski100.mimuw.edu.pl. The meeting is sponsored (among several other organizations) by the EMS.

Organizers of the meeting Mostowski100.