

Life and work of Vojtěch Jarník

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In: Břetislav Novák (editor): Life and work of Vojtěch Jarník. (English). Praha: Society of Czech Mathematicians and Physicists, 1999. pp. 95--102.

Persistent URL: <http://dml.cz/dmlcz/402247>

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RECALLING ACADEMICIAN VOJTĚCH JARNÍK

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The present notes recalling my teacher and later an unforgettable older friend are intended to complete the picture of the human profile of a great scholar and a man of pure character and extraordinary qualities.

When writing these lines I did not make any deep research. I am writing about Jarník as I have him in my memory, as I see him before my eyes even today. Many times I include small details; I cannot and will not avoid them even if they are perhaps of subjective character. On the other hand, in the context of recollections we cannot disregard historical events, which were stronger than our will or our desires.

I met Professor Jarník personally at the beginning of October 1932. It was a “one-way” acquaintance: the first lecture on Calculus for first-year students. His name was not unknown to me. As a secondary school pupil I had been an eager reader of *Rozhledy* (Mathematical-Physical Horizons, a journal for secondary school pupils published by the Union of Czechoslovak Mathematicians and Physicists) including the journal’s cover, where I had learnt that a new edition of K. Petr’s book *Integral Calculus* was soon to appear, with an appendix *Introduction to the Theory of Sets* by V. Jarník.

I entered University with a certain lead over some others. My teacher of Mathematics at the secondary school had lent me the well-known textbook by V. Vojtěch, intended for students of technical colleges. I computed many dozens of examples from the book. An idea about what is “exact” and what “less exact” had never occurred to me, the main thing being that everything “added up”. In the present (cliché-ridden) terminology we would say that I had relatively well mastered the “technical aspects of the matter”. Subconsciously, nevertheless, I felt uneasy. Approximately at the same time, as a reward for my success in solving problems from *Rozhledy*, I received among several older mathematical books also M. Kössler’s *Introduction to Differential Calculus*. I somehow did not like it. It contained a lot of such “obvious” things and I found reading it rather tedious.

And, above all, there were too few examples. At the age of seventeen I did not have enough patience to get through it all and to grasp the very substance.

When I started to attend Jarník's lectures, I found in two or three weeks that the situation was not so rosy with my "lead". (However, my knowledge came in very useful for Trkal's Introduction to Theoretical Physics.) Jarník knew exactly what we had learnt at secondary school. Therefore he started with inequalities and the absolute value. (Not, of course, such neck-breaking examples which are now forced into secondary-school subject matter by immature reformers.) His lectures were transparent, delivered in a cultivated language. Jarník did not lecture "slowly", but no rush was ever felt. We felt that everything was well thought out and organized beforehand. I cannot remember whether he did ever consult his notes. In the first seminar he "apologized" several times that he would teach the theory of real numbers only in the second year. His lecture was accompanied with a practical exercise named Elementary Problems of Higher Analysis, which he conducted himself.

The lectures and practical exercises were attended by 15–20 students, who did not miss a single lecture; some 5–10 other students did not attend the lectures so regularly. Jarník was then 35 years old. He was so "tactful" that he tried not to call us to the blackboard to solve problems: mostly we volunteered. He was extremely patient. At the oral examination after the first term I learnt that Jarník knew my name and also how I performed in the seminar of Prof. Bydžovský. In this way I discovered that even the teachers "were gossiping".

Naturally, as young students we used to discuss and judge our professors among us. Each was different, also the differences in age were considerable. Of course we had various "reservations"—naturally we did not take the matter very seriously. Jarník was beyond any criticism. We inherited a certain unwritten respect also from the older students. One detail: Prof. Trkal rushed us (even if with a touch of good nature) to the library, Jarník just delicately recommended it to us. There were teachers who now and then "moralized", that is, blamed us for our drawbacks. For more than forty years that I knew Jarník, I never heard him giving somebody "moral precepts". When he did not like something, he chose to be silent. In this way he behaved even when dealing with us, 19–20 year old students.

I must confess that as a freshman I actually did not have a clear idea that our teacher was a man who already was a recognized scientist. In 1934 I became a student clerical assistant, thus becoming some sort of member of the staff of the Faculty. It was only then that I saw on Assistant Professor V. Knichal's desk a pretty packet of Jarník's scientific papers, which Knichal was studying. (I am not attempting an evaluation of Jarník's scientific impact in these notes. I did that with other colleagues on another occasion.) At that time I was far from realizing

how much inner moral strength was required for a man with such a scientific superiority over us not to hint at it. It was not only modesty but also a good deal of well trained self-discipline.

Whether or not he was to have a lecture, Jarník was in the Institute about eight o'clock in the morning every day, left for lunch and at half past two was back in the Institute to stay till late evening. Now and then I saw him playing tennis at Albertov with Prof. Dolejšek, Assistant Professor D. Ilkovič and others. Sometimes I saw a small Aero car driven by his wife turn in front of the Institute and take him out to one of the concerts which they regularly attended.

When I entered University, Prof. K. Petr announced a course in number theory. It was intended for higher grades, but I attended it since I was interested in the subject. Petr was then 64 years old. The style of his lectures and seminars was considerably different from Jarník's style. Petr demonstrated everything on examples, sometimes he even used examples to "prove" things. He laid considerable stress on numerical calculations. I liked it. I attended all his lectures and seminars till his retirement (in summer 1938). His lectures on the theory of fields were a synthesis of classical and abstract algebra. I was his last doctoral student (in June 1937).

Nevertheless, with one eye I was always seeking Jarník. (To tell the truth, I also devoured Bydžovský's lectures on algebraic geometry.) Later on, Jarník himself told me several times how he had grown under the influence of Prof. Petr (it was during World War I and hardly a pleasure to sit in great coats in unheated lecture halls).

Which Jarník's lectures did I attend as a graduate student? Čech's book *Point Sets* was in galley proofs. Jarník (and a number of others) read the manuscript and the proofs. In the academic year 1934–1935 (I was in the third year) we had a seminar on the theory of metric spaces, in fact about one hundred pages from the forthcoming book (it appeared in 1936). In the seminars Jarník as a rule lectured himself, but was clearly glad when we asked questions. In the same year I attended a course on the Fourier series (an elementary approach without the Lebesgue integral), which considerably ruffled my ideas concerning the subject. I have to mention that already a year or two before we had been currently solving (with Professor Závaška) the equations of mathematical physics by the so called Fourier method. And to a reader born after 1930 it is necessary to point out that the theory of distributions was to arise only 15 years later.

In the next year Jarník held a seminar on measure theory and integral, following the just published monograph by St. Saks. The thoroughness with which Jarník followed the contemporary literature was best reflected in his seminars and lectures on analytical number theory, into which he inserted methods and results

of papers just published. This included such topics as Waring's problem, diophantine approximations, distribution of primes, geometry of numbers and others. And, which was not negligible, he acquainted us with his own results.

I passed my state examination, received my doctor's degree, and on October 1, 1937 I became Assistant Professor. However, this did not prevent me from attending Jarník's lectures and seminars. So, for example, in the academic year 1937–1938 I attended his lectures on summability of infinite series and new results from the theory of diophantine approximations. (I still keep my notes from all these lectures and seminars as well as those of Závíška's excellent lectures on theoretical physics, and many others.)

From what I said above the reader can form an idea of how broad was Jarník's knowledge of various branches of Mathematics (and he was continually widening it). He had an extensive scientific correspondence with dozens of mathematicians from abroad. In the twenties Jarník stayed twice in Göttingen with Prof. E. Landau for prolonged periods. He regarded him as his second teacher. He knew in detail about all humiliations that this scientist of world-wide reputation had to suffer in the Third Reich. He was deeply touched when in February 1938 he learnt that Landau had died in emigration in the Netherlands at a relatively young age of 61 years.

In the years 1933–1938 Prague was a transit haven for a number of emigrés from the scientific and artistic circles not only from Germany but also from Poland and the Baltic states. Among them there were also several mathematicians. One of them I remember very well, but there must have been more of them who approached Jarník asking for advice. Twenty or thirty years later I was approached at various international conferences by people (whom I knew only by name) who nostalgically recollected Prague and Jarník.

Already the beginning of 1938 promised nothing good. The official propaganda was doing its best to calm down the people, but we all know how it all ended in Munich.

After Munich the life of the Faculty was getting into motion only hesitatingly and with difficulties. Both the teachers and the students were becoming nervous. Everybody felt that this was hardly the end of the trouble. I had my own problems. Jarník suggested that he would write to Harald Bohr in Copenhagen if he could not find a position for me somewhere. An answer came by return of mail. Bohr wrote he would do his best, but unfortunately there were too many similar cases. All the same, he would write to Veblen in Paris, whom he supposed to have more relevant information. Later I had some correspondence with Veblen, and instead of doing Mathematics I was learning English intensively.

In mid-February 1939 I received a letter from the Ministry of Education and Culture in Prague, informing me that in accordance with the Government Decree No. 382/1938 (from December 23, 1938) I was placed at the disposal of the Slovak authorities as from March 1, 1939. Then I received a letter from Bratislava summoning me to start teaching at the Slovak Technological College at Turčanský Sv. Martin. Actually, however, I left Prague only the last day of March.

Thus I was still in Prague during the days of March 14 and 15, and I remember them quite vividly. On March 14 Prague was under snow. We were sitting with Associate Professor V. Knichal in the room of Prof. Kössler, catching the latest news from the radio. Kössler said: "Let us not disturb Jarník. He is burning his correspondence. I have already done it." This event left a strong impression on me. There was a moment later in my life when I did the same.

When I returned to Slovakia, I kept up written contacts with Prague mathematicians for some time. After the closing of the Prague institutions of higher education by the Nazis I confined myself, for safety reasons, to two or three Christmas cards sent to Prof. Petr.

The war ended. When I was returning in late May 1945 from the camp of liberated prisoners in Jena and the buses of Red Cross disembarked us in Prague, my steps led me to my unforgettable friend Prof. F. Vyčichlo. It was just a coincidence that on the same day there was some meeting in the Great Hall at Albertov. Vyčichlo took me with him. I met many friends there. With his typical calmness, Jarník told me the following wise words: "Forget about everything, get down to Mathematics again". He was right.

After the Liberation Jarník, as recognized scientist, was overburdened with numerous offices. I used to be rather frequently in Prague; I know about his manysided activities, but I am not going to write about that since there are still enough witnesses who were in everyday contact with him. It would really be worth analysing his efforts for a reform of higher education.

Just in passing: Jarník was an excellent stylist. This ability of his is reflected not only in his textbooks but also in dozens of various documents as well as in his private correspondence.

I will proceed to another chapter of his life, in my capacity as an eye-witness, observer, and to some extent collaborator.

It was in late 1951 that Jarník was appointed member of a (not too numerous) Governmental Committee for the foundation of the Czechoslovak Academy of Sciences. One of the members of the Committee was also my close friend D. Ilkovič. Now and then he confidentially informed me about the proceedings. He always emphasized the extremely positive part played by Jarník with that deliberate and sober approach of his.

After the foundation of the Academy (on November 17, 1952) Jarník was not only among its first regular members, but in the years 1952–1955 he also was Chairman of the section for Mathematics and Physics. The main task then was to set up and shape research institutions, sometimes rather remote from his own interests. Jarník did his work honestly, consistently, and tried to solve the problems so to say with mathematical rigour. He was always seen with a briefcase full of documents; he considered all the pros and contras, tried to penetrate deeply into the problems of various fields of science. His conscience did not allow him to make decisions or put forward proposals unless he was deeply convinced that the solution was relatively optimal.

At the plenary meetings of the section he listened to everybody's opinions with unbelievable patience. No wonder the meetings often lasted 7–8 hours. I admit that I often became nervous. And I was not the only one. However, one look at the quiet and tolerant more than 70 years old Academician B. Bydžovský was enough to calm me down. The least tolerant was Academician E. Čech. He was in a sense the true counterpart of Jarník. He tended to take things easy. He was of explosive character, preferred fast decisions, and had no problems to change his mind when he became convinced of his error. He easily quarrelled with people only to make it up with them immediately after.

Briefly: there was a period when I did not entirely understand Jarník. However, I learned to understand him perfectly some ten years later when—not on my own initiative—I ended up in a situation analogous to that in which he had been before.

Passing years reduced the difference of age. Later Jarník told me frankly how happy he had been when he was relieved of his office as Chairman of the section. Of course, it was clear that Jarník had never sought offices, awards, and public recognition. He was always pulled back to Mathematics and never stopped working.

Unfortunately, his offices and duties did not reduce considerably even after 1955. The only thing he succeeded in avoiding were the problems of elementary mathematical education. Nonetheless, deep in my heart I was convinced that it was he who—as an outstanding pedagogue—understood these problems better than many others. However, I never said it aloud. Why seek unnecessary conflicts?

Jarník frequently received foreign invitations, but he went abroad relatively rarely. At the International Congress of Mathematicians in Amsterdam he was head of the delegation of the Czechoslovak Academy of Sciences, including V. Knichal, M. Katětov and myself. Jarník never lost sight of us. As a conscious citizen of Czechoslovakia he wished us to represent our country with all dignity. Among ourselves we grumbled a little, but submitted without a word. Later we recalled it

with good humour. And Jarník had a good sense of humour, even if he sometimes kept a reserved face.

In the conclusion of my (certainly inhomogeneous and incomplete) recollections I would like to touch a certain group of problems which were extraordinarily time-consuming, while their results cannot be found in any list of scientific papers. The members of the younger generation of researchers and scientists often believe that the prognoses of development of science are an invention of the recent years. However, the truth is quite different.

By its decision from February 22, 1957 the Government entrusted the Academy with the task of preparing the plan of development of the individual fields of science for 10–15 years (approximately till 1975), including economical and personal data, taking account also of the new computing technique which had just made its appearance on the horizon but whose impact was still difficult to estimate. Such a plan required a leader with a clear view of all Mathematics and with extreme objectivity. The “most obvious” choice was, again, Jarník.

When the problems encountered were of real social importance, Jarník was not able to decline (even if he was already 60 years old).

Jarník did not try to make his task easier. At that time there existed various analyses of prominent mathematicians from abroad on the future of Mathematics and the possibilities of new applications. Jarník thoroughly followed all this, studied demographic prospects of Czechoslovak society and chose a small number of collaborators whom he could trust. In March 1959 he submitted to the Presidium of the Czechoslovak Academy of Sciences an analysis of the state and prospects of research work in Mathematics in Czechoslovakia till 1975. The material was topical and sober, even if it later turned out that in the data supplied the central authorities overestimated the economical possibilities of the country. Why do I recollect this matter in such detail?

Jarník’s material (under changed conditions) served as a basis for other similar documents. (For example, documents prepared by the Scientific Board for Mathematics in 1963 on the development up to 1970, or the material of the same Board elaborated in 1967 on the perspectives up to 1980.)

Jarník retired in the summer of 1968. During the years 1965–70 I used to be frequently in Prague, often for several days. Whenever schedule permitted, I missed no opportunity to have a talk with him, to ask him for his opinion. It always was a pleasant event for me. Now that I myself am well over seventy, I still can see before my eyes a man with deep humane feelings, a man of pure character, such as I have rarely met in my life.

