In memory of Boris Trakhtenbrot, Mars Valiev and Michael Dekhtyar

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1 Boris (Boaz) Trakhtenbrot (20.02.1921–19.09.2016)

The scientific history of Boris Abramovich Trakhtenbrot has already been well described in [1,2,4]. So, I would like to focus on some aspects that seem important from the humanistic point of view, touching on other things only very slightly.

Moldova, WW2, Chernovtsy. Boris Abramovich Trakhtenbrot was born in Brichevo village in Northern Bessarabia (now Moldova). In 1940 he started studying mathematics in the Moldavian Pedagogical Institute in Kishinev, then evacuation..., returning back..., then enrolling in the University of Chernovtsy (Ukraine) in 1945 and getting a master's degree in 1947.

This was also a happy time because he married Berta Isaakovna Rabinovich (1921–2013). Later, many of us enjoyed the warm hospitality of this family, particularly of truly remarkable woman Berta Isaakovna, with two sons Mark and Josef and, now, many grandchildren.

Kiev-Moscow 1947–50, PhD degree under direction of prominent Soviet mathematician and logician P. S. Novikov from Moscow. This was a brilliant scientific start with the famous Trakhtenbrot's finite version of Church's Theorem about non-recursive enumerability of first order logic truths on finite models.

Meanwhile, this was also a difficult time for survival of mathematical logic in the USSR due to an absurd semi-official ideological accusations against such greatest logicians and philosophers of the world, actually founders of the subject, as B. Russel ("warmonger") and A. Tarski ("militant bourgeois"). Trakhtenbrot was only a passive witness of such attacks at that time, but soon...

Penza 1950–1960, the Pedagogical Institute. Once, after giving a seminar talk "The method of symbolic calculi in mathematics", Trakhtenbrot was blamed of being "an idealist of Carnap-species"—quite a dangerous accusation in 50-th. Fortunately, Moscow's colleagues P. S. Novikov, A. A. Lyapunov, A. N. Kolmogorov and others were able to defend him. By the way, Trakhtenbrot always priced highly and recalled warmly the deep relationship with Lyapunov, his influence on him and support, particularly in his earlier period of research. In the more quiet 1970s he told me this story even humorously. The very idea of algorithmically undecidable problems was an "ideological crime", because "there could not be anything insoluble for the great Soviet people!" Then, to protect himself in the future, he published an educational article "Algorithms and automatic problem solving" in a "Mathematics in School" journal in 1956. Later it was reworked (1957, 1960, 1974) as a widely popular introductory textbook in the USSR and even abroad "Algorithms and Computational Automata".

Siberian Period 1960–1980 became the last one for Trakhtenbrot in the USSR. He was engaged in research at the Institute of Mathematics of the USSR Academy of Sciences' Siberian Branch (IM SB AS USSR) in the *Department of Theoretical Cybernetics* (through the initiative and guidance of A. A. Lyapunov (1911–1973)) and also lecturing at the Novosibirsk State University in Akademgorodok. In 1967 he and A. Gladky jointly established the Department *Automata Theory and Mathematical Linguistics*. Collectively, in Academgorodok, staff, undergraduate and PhD students related with the Department were in various periods: V. Agafonov, J. Barzdins, N. Belyakin, V. Boyarkin, M. Dekhtyar, A. Dikovsky R. Freivalds, A. Korshunov, J. Hodjaev, M. Kratko, Z. Litvintseva, I. Lomazova, Matveeva, L. Modina, V. Nepomniaschy, L. Orekhovskaya, V. Sazonov, M. Sokolovskiy, A. Vaiser, M. Valiev. The departmental seminar *"Algorithms and Automata"* was visited by many guests: S. Artemov, M. Kanovich, E. Kinber, V. Kotov, L. Levin, L. Lisovik, A. Nepomniaschy, G. Plesnevich, R. Pliuškevičius, A. Slisenko, M. Taitslin, M. Trakhtenbrot, G. Tseitlin—just to mention some of them.

At this highly fruitful period Trakhtenbrot was working on automata theory (publishing two books in co-authorship of one with N. Kobrinsky (1910–1985) and another with J. Barzdins), complexity theory, semantical and logical problems of high level programming languages, etc. See much more in [2,3]. As the result of his teaching and research on complexity theory, he published Lecture Notes "The Complexity of Algorithms and Computations" (1967).

Unfortunately, this period finished in 1980 as Trakhtenbrot emigrated to Israel. Actually, rather dramatical events preceded this decision. Although this story did not touch me personally, I felt myself this as a kind of highly unpleasant quasi-scientific politics from which Trakhtenbrot and some colleagues, e.g. Michael Dekhtyar, were suffering. Also, Trakhtenbrot was deprived of the management of his Department in 1977. In the new edition of the Soviet Mathematical Encyclopedia Trakhtenbrot's participation was stopped. It is awful when the situation, starting seemingly from quite harmless, even reasonable scientific discussions on formalizations of new intuitions (around the problem of 'perebor' —the problem of eliminating 'brute force search') developed to confrontation on various levels [6,7].

After Trakhtenbrot's emigration to Israel in 1980 some of our colleagues Dektyar, Valiev and, later, Agafonov, Lomazova and me eventually moved to the European part of USSR. Others, already working in different places, stayed in Novosibirsk. M. Trakhtenbrot emigrated to Israel at some later time than his father. The entire life for those who moved has changed. Dikovsky and Modina had already relocated to Kalinin (nowadays, Tver) in 1978. At the same time we were always connected to each other and some of us cooperated scientifically in various ways, e.g. participating in joint projects.

Israel, 1981, Professor of Computer Science at Tel Aviv University. Trakhtenbrot's emigration at that political time could really mean that we never meet again. This was at least a very strange and really painful game of fate. However, the history of the Soviet Union had been changing so dramatically and

rapidly that Trakhtenbrot came back to the USSR for a conference in 1989. This was like a miracle! We could not even dream of it! Since then, he visited Russia again and invited many of his colleagues to attend conferences in Israel...

It is unrealistic to present all scientific achievements of Boris Trakhtenbrot here and his invaluable role in Computer Science both in the Soviet Union and in the World. For example, see the description of his world-wide role as a 'Pillar of Computer Science' e.g. in [1,4]. The Friedrich Schiller University in Jena bestowed a degree of doctor *honoris causa* on Trakhtenbrot in October 1997. He was also honoured with the prestigious *EATCS annual Distinguished Achievements Award of 2011* [5] "to acknowledge extensive and widely recognized contributions to theoretical computer science over a life long scientific career".

Boris Abramovich had a happy life in spite of all problems and created his own school—*the Trakhtenbrot's School* with a great scientific and moral atmosphere. He passed away at the age of 95 surrounded by his loving family.

2 Mars Kotdusovich Valiev (01.01.1942–31.01.2018)

Mars was born in Adaevo village, Tatarstan, Russia—the place where the family survived during the WW2 in hardship and poverty while his father was fighting in the frontline. He eagerly started study at school at 6 (very unusual in that time), and graduated in the village Poisevo with a silver medal. Quite young, at 16, he became a student of mathematics at Kazan State University.

On the last, fifth year of study, he (with a few best students) was seconded to practice at the Novosibirsk State University. Mars happily used this chance to become a PhD student under direction of Trakhtenbrot, and then he got a junior research position in the Institute of Mathematics SB AS USSR. His PhD Thesis was: "On Complexity of Word Problem for Finitely Presented Groups" (1969). This subject mostly prevailed in his works till 1978. Then his interests were extended widely and radically and can be described briefly as application of mathematical logic to programming and database theory, computational complexity, multi-agent systems and distributed computing. From 90-th he did his research in a close and fruitful cooperation with Dekhtyar and Dikovsky.

After emigration of Trakhtenbrot, Mars moved to Moscow where he worked in various places: 1982—Moscow Institute of Electronic Engineering, 1984—Institute of System Analysis of RAS (formerly ВНИИСИ). Scientifically most important were 1994—M.V. Keldysh's Institute of Applied Mathematics of RAS (Senior Researcher at Department of Information Modeling and Control Systems) and 2005—Russian State University for the Humanities (known as РГГУ or RGGU; Associate Professor, reading the courses of lectures on "Programming", "Mathematical Linguistics" and "Mathematical Logic").

Mars was highly talented and fruitful scientist. He is the author of at least 68 publications. See also his 'Research Gate' [10]. Very responsive and friendly he was always ready to help his young colleagues. How many times did Mars give me useful tips for improving the style of my first articles! He actually became a heart and soul of the team and the person who always remembered about everybody living here-and-there. Usually it was Mars who informed us about everything important what happened to anyone in the team. I remember he was

worried not getting contact with Miroslav Kratko in the Summer of 2017. Mars died of a heart attack at the age of 76—so painful loss.

3 Michael Iosifovich Dekhtyar (18.11.1946–17.03.2018)

Michael was born in Zhitomir (Ukraine) were he finished high school with the golden medal. During his school years he was also the winner of the Ukrainian Republican Mathematical Olympiad. Quite independently, both he and his future wife Rika simultaneously enrolled to the Novosibirsk State University in 1964. Besides studying, they worked in the line of the Komsomol on organizing mathematical "circles" (math clubs) in schools of Academgorodok. This way... they fell in love and married in 1969 in the last year of their studies. They were a very happy family with son Alexander (and now with two grandsons).

As an undegraduate student, Michael quite early became a permanent and successful participant of the Trakhtenbrot's seminar. During this period he made his first research work on 'perebor'. That was the time when the very concept had only a very intuitive level, and required some first mathematical approaches. Trakhtenbrot wrote in [2], page 24: "...the inevitability of *perebor* could be explained in terms of computational complexity of the reduction process. The conjecture was proved by M. I. Dekhtyar in his Master's Thesis (1969)... one can say that his construction implicitly provided the proof of the relativised version of the P $\neq$ NP conjecture" thereby anticipating one of the results by Backer, Gill and Soloway (1975). This work eventually resulted in his PhD Thesis: "On the Complexity of Relativised Computations", Moscow State University (1977).

However, before enrolling to postgraduate study, Michael had to serve two years 1969–1971 in the Soviet Army as a lieutenant in the city of Semipalatinsk.

After Trakhtenbrot's emigration the Dekhtyars moved in Tver where Michael was eager to reunite and work with Dikovsky. But it turned out to be impossible right away, and Michael began to work on software projects (against his mathematical interests) in: (1982–1987)—Tver Special Design Office of Control Systems (Chief Designer), then (1987–1991) Tver NPO the Centre of Program Systems (Leading Researcher). At last, the official activity of Michael became coinciding with his research interests: (1991–2015) The Department of Informatics of Tver State University (Associate Professor and then Professor since 2010). Michael received Doctor of Science Degree in mathematics in 2009 with the dissertation "Semantics and the complexity analysis of algorithmic problems of dynamic systems and languages using logic programming".

Overall, Michael was one of the outstanding computer scientists in Russia with wide range of research interests: Complexity of Computations and Algorithms, Kolmogorov's Complexity, Data Bases (active, deductive, probabilistic and temporal), Artificial Intelligence, Logic Programming, Intellectual Program Agents and Multiagent Systems, Bioinformatics, Computational Linguistics. He has 109 publications including 7 tutorial books. His two successful PhD students are S. Dudakov (2000) and B. Karlov (2012). See more in [8,9]. Being an exceptional mathematician Michael could explain complicated concepts very clearly even to non-specialists. He was a charismatic person who radiated kindness, generosity and calm confidence.

In 2017 Michael and Rika moved to USA to join the family of their son Alexander Dekhtyar, Professor at the Dept. of Computer Science at California Polytechnic State University. So, he has followed his father's scientific footsteps.

Michael died after a long illness at the age of 71.

Recalling meetings with Mars and Michael in Tver. Regular meetings of old friends and colleagues where usually held in the hospitable house of Michael and Rika Dekhtyar in Tver. These were long and interesting discussions on various topics connected not only to research news. Once in 2013 Mars, Michael and I were watching a dramatic TV discussion featuring a reform of Russian Academy of Sciences. An extreme anxiety and emotions overpowered us. Then Alexandr Dikovsky from Nantes in France (who was already critically ill) joined us by the Skype and our hot and intense conversation continued... The last meetings were especially touching and emotional.

Boris Trakhtenbrot, Mars Valiev and Michael Dekhtyar are greatly missed. No doubts, all of us who knew them, are devastated and heartbroken by the loss of our friends and colleagues. Now, we have no opportunity to find ourselves in their circle again, "to warm up by the fire of their hearts", to restore those wonderful feelings when we began our scientific life and friendship together in that amazing atmosphere of our spiritual unity. They will remain in our hearts and memories forever, together with other colleagues and friends who also left us: V. A. Agafonov (1940–1997), B. I. Trakhtenbrot (1921–2013), M. A. Taitslin (1936–2013), A. Ja. Dikovsky (1945–2014), N. V. Belyakin (1936–2016), R. V. Freivalds, (1942–2016) L. S. Modina (1945–2017), and just in the most recent months—M. I. Kratko (1936–2018) and A. V. Gladky (1928–2018).

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