My Research History

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My earliest mathematical discovery I can recall, was discovering the concept of similarity and its numerical consequences when I was ten years old. I don't have any other mathematical memory of early age except dreaming of becoming a mathematician during my middle school under the influence of Bell's 'Men of Mathematics'. Bell engaged me in understanding many different aspects of a mathematician's personal life.

In high-school, I had the privilege of becoming my father's student. He was my first serious mathematics teacher. When I was fourteen, I started to learn basic Algebra and Analysis from Hoffman's, Herstein's and Rudin's textbooks. This was when our schools in Tehran were closed for almost one year as a consequence of the war between Iran and Iraq. I recall that we slept in the basement and almost every night could hear explosions of Iraqi bombs in the neighborhood. I was fifteen when I marginally failed to be chosen for Iranian mathematics olympiad team. I became eighth and only six were chosen for the 1989 olympiad in Germany. I was the youngest participant.

I became interested in solving problems from 'American Mathematical Monthly' when I was sixteen. I was attending physics olympiad camp in Beheshti university in Tehran at the time and I had access to the mathematics library. I became familiar with basic algebraic topology through Croom's, by my younger friend Reza Chaman-Ara who is a mature geometer now. I also became interested in algebraic geometry through Kendig's. We were also taught very basic physics in our olympiad classes. Its charm soon hooked me. Fortunately, I was not chosen as a team member of physics olympiad national team either. Otherwise, I could have ended up becoming a physicist!

My sweetest mathematical memory from high-school was when I was asked to help a friend of my father to prepare a few page journal 'Young Mathematicians' which was supposed to be distributed among mathematically strong high-school students. I was so proud when they distributed the next issue, while I was attending the national high-school mathematics competition. This time, I was marginally chosen for the Iranian 1990 IMO team after a close friend's withdrawal. In China, I didn't do well. I obtained a silver medal marginally! On the other hand, since I did my job very well regarding the journal, next issue was left to myself completely. I even asked a few friends for expository papers to be included. This was my first publication.

I was determined to study mathematics in university. I joined Sharif university's mathematics department in 1990 at the age of seventeen. This was where some of our classes during mathematics olympiad camp were held. I got to know one of the deepest mathematicians I ever knew: Siavash Shahshahani. I was not the best in mathematics department. I was joined by my lifelong friend Ali Rajaei who was absolutely the best student in my generation in Iran. We studied real and complex dynamical systems; differential and algebraic topology; differential, complex, algebraic and arithmetic geometry; geometric group theory; and Arakelov theory. Because of my hard working friend, I got to know many important leading papers in these research subjects. Papers which my teachers would not dare to introduce to such a young and immature student.

Our first and only joint work was a short paper using Gromov's quasi-convexity to prove some well-know results in combinatorial group theory. Later, our friend Randjbar-Motlagh extended these results to hyperbolic groups. Gromov showed interest in his results. I do not know if he ever heard of our paper. But in place of that, Bass wrote us a letter of recommendation for the graduate school. The paper was not well-written anyway. So, Shahshahani generously wrote it for us. But we were lazy and never published it. On the side, I became interested in Falting's 'Calculus on Arithmetic Surfaces'. This time, I absorbed Ali's attension, and we attended several national and international conferences on arithmetic geometry in Tehran, Isphehan, Trieste, Bonn. We got to know many world famous researchers in arithmetic geometry. They even were so generous to invite us to give lectures on Faltings' paper in Nankai institute in Tianjin while we were undergraduate students.

I joined mathematics department of Princeton university in 1993 at the age of twenty. I was accompanied by Ali. Wiles accepted Ali as his student and was even so generous to accept to be my advisor. I used to attend many seminars in various different subjects. As a result, I was never successful to concentrate on my research problem. Wiles asked me to work on the function field contributions of his proof. I was too proud and high spirited that I tried the higher dimensional case of Siegel modular forms. For four years, I had absolutely no success except for a few ideas which looked nice. During my fifth year, Wiles asked me to change my problem and I went back to his original suggestion. I got results in a few weeks, but it took about one month to fill some gaps in the arguments. I could have used his advice much more, had I worked on his original suggestion from the beginning. He never complained, but I guess I have bothered him a lot. At this high expense, I got to know how modest and forgiving he was not to even mention a word. In my thesis, I obtained congruences between Drinfeld modular forms, which was the first result in this direction, in the function field case.

When I graduated in 1998, I refused the one year research job in France which was proposed to me by Wiles. This job was offered by Tilouine now a friend of mine in Paris. I rushed back to Sharif university as if my children were in danger and I was the only one who could save them. I felt I was very welcome, but it took many years to realize that I had enemies too. The support of my former teachers Tabesh, Shahshahani, Mahmoodian and many others helped me to survive. I started

to teach almost everything I knew to Sharif undergraduates. I am proud that I was very successful and I had many brilliant students. Many ended up becoming mathematicians much better than me. Research-wise, for a couple of years, I was engaged in the problem of obtaining congruences between Siegel modular forms. This time I got some partial results.

In 2000, I noticed that the high-school background of my students is very weak. So, I got engaged in administrative work in ministry of education and I did research in mathematics education. Shahshahani warned me that I may loose grounds in my research. But I was in love with my children. I spent three years writing research papers and books in mathematics education. We developed the first Iranian curriculum for mathematics K-12. I gathered almost twenty mathematicians and teachers working beside me. These were my most productive years in terms of mathematics education. I wrote seven original papers and coauthored ten books some of which are nationwide high-school textbooks as of today. I tried also to do research in Arakelov theory, formulating an Arakelov intersection on Drinfeld modular curves using the Bruhat-Tits tree. I could not develop my ideas because of my concentration in mathematics education. But when I left ministry of education to join the 'Young Scholar's Club' in 2001 as the leader of the Iranian mathematics olympiad team, and I began to integrate my maturity as a mathematics educator in my mathematical research, I realized that I have won a great deal. Mathematics education had given me the gift of maturity in mathematics in such a capacity, not accessible to me otherwise for many years.

In summer of 2002, I attended in Abel's conference in Norway and I realized so much I have missed during my five years of isolation in Iran. In my country, all the travel funds goes for elder mathematicians who have secured their job. Therefore, I left Iran and my job in Sharif for a year, visiting Tata institute in Bombay, and institute des hautes etudes scientifique in Paris. Of course, I paid for my own travel expenses. This was when I had two important breakthroughs in my research. Upon return to Tehran in summer of 2004, I published my first paper on Ihara type results in higher dimensions and got back my job in Sharif. In summer of 2005, I visited Abdus Salam international center for theoretical physics and mathematics in Trieste and institute des hautes etudes scientifique in Paris, when I set my mind on my long term research program. Being a mathematics educator, I have chosen my research problems in mathematics very carefully, with an eye on how they effect my mathematical personality and skills of thinking.

Today, I am proud to be a successful teacher who has sent many good students to the best graduate schools in the world; a successful researcher who has contributed a few new concepts to his research field; and a successful educator who has developed the first Iranian national curriculum for K-12 with the aid of many colleagues; and a successful author of many mathematics books in Persian to be used by my children to develop their mathematical mind. I am thankful to God to achieve as much at the age of thirty two.