

My Way

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This paper gives an overview of my life, in particular to my relationship to Optimization and Convex Analysis.

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My parents get married late. My father had been enrolled in the first world war not much later than his own father. They both were put in the fight near Verdun, the hot spot of the war. My father has not been wounded, but he suffered a lot and it took several years for him to recover. My mother was a worker in the silk industry near Lyon. At eleven she was given a year more in school before entering a factory (maybe in view of human laws or because she was bright, I do not know). Later, she took care of her mother who was ill, so that founding a family was out of her thoughts. Her thirst of culture and knowledge was strong during all her life.

My parents did not play with me or my brothers, but offered us strong models. I was lucky to be loved by my teachers, at least till I became a not too obedient teenager. Every field was of interest to me, especially literature, drawing and natural sciences. I had no special interest for mathematics. At 14 I entered a school for becoming a teacher in an elementary school. That was the most attractive profession in my eyes. Moreover, I was given food and a suit. The more I learned, the more I wanted to learn. That led me to join the competitive tracks of “classes préparatoires”. But the competitive character of such studies and the load of traditions and little tricks were rebuking to me. My father died a couple of months before I presented the exams to enter some École Normale Supérieure and the financial situation of my mother with her three children became difficult all of a sudden. The American company for which my father was a worker allowed her a stipend in view of the services made by my father in the factory in which he had been working in Ivry-sur-Seine. Thus, quite often I was starving in the evenings and I pretended that I had too much eaten in the refectory of the school. That was a strong incentive to succeed in the competition. I did it and entered in the Ecole Normale Supérieure de Saint Cloud (nowadays in Lyon). All of a sudden I had no more concern with living means!

I was much grateful that efforts could give such a reward. But independently of that, I was very admiring of the professors I had in the University of Paris. Many of them were members of the Bourbaki group: Henri Cartan, Claude Chevalley, Laurent Schwartz, Jacques Dixmier were lively models for me. As Gustave Choquet, they seem to breeze mathematics and invent the concepts and the results while explaining to us what they meant. That was fascinating and I became addict to mathematics and eager to learn all what I could.

Unhappily, the members of the Écoles Normales Supérieures were supposed to prepare a concours (agrégation) and after three years of freedom I had to face again competition and well established notions. No more advanced courses dealing with lively subjects, no more seminars during one year! I had met my future wife and I had to be serious, even if she was more distant than me with such duties.

Delivered from them, I enjoyed the return to lively mathematics. But this time I had to teach and be responsible for a group of students in Paris university. I was almost as fresh as these students with the subject I was supposed to teach : Lie algebras and Lie groups. Happily, in order to learn about the topic, I had translated into French the book by Hochschild. It was written in a concise way I liked and I seriously checked all the exercices. Marcel Berger, who had been nominated as responsible of my teaching activity, visited my classroom. I was impressed, and I am not sure I gave him the best impression I could give. Nonetheless, some years later we build a friendly relationship, partly because another geometer, André Lichnerowicz, was my research supervisor, partly because the Berger family inherited of a typical house in the heart of Béarn, the area around the little town (Pau) where I had been given a position. I could have chosen Limoges or Toulouse, but I enjoyed the proximity of mountains and the challenge of having everything to build in this department of a new university. In fact, on my arrival it was not even an independent department. The comment by André Lichnerowicz : «Your bed will not be prepared» was lucid, but challenging.

My way in mathematics was not obvious in advance. I liked the mixture between geometry and analysis, but I was not too fond of long formulas with tensors one has to deal with in general relativity, as did André Lichnerowicz with pleasure and expertise. Just on the contrary, I was attracted by what was called “global analysis” in which intrinsic formalism was looked for and beautiful results were obtained by Ralph Abraham, James Eells, David Elworthy, Serge Lang, Richard Palais, Stephen Smale, Tony Tromba and others. Most of these results took place in infinite dimensional differential manifolds. Such a framework was very alluring. not just because it was free of coordinates. It also had the potential to give rise to beautiful new results.

However, such results required long preliminaries out of reach of several young colleagues there I had to take into account. Also, this new university was looking for an adequate insertion in its environment which was dominated with the discovery of gas. Thus I turned to more applied questions. Optimization was a junction point between geometry and applied mathematics. I became familiar with algorithms and constraint qualification conditions. The later were close to geometrical approaches and the former were attractive in view of their efficiencies.

But the new challenge after the breakthrough of Francis Clarke with new subdifferentials was in the nature of the irregularity of the functions and sets we were about to be able to deal with. Thus my new path was taking the opposite direction of the one taken by practioneers for whom all functions could be assumed to be smooth or even analytic. Of course, such a direction was full of pitfalls. But such difficulties reminded me the difficulties one may meet in mountains. The sense of danger was the same. And again a geometric flavour was around, as functions and sets were

playing on the same ground, functions being identified with their epigraphs and sets with their indicator functions (with value 0 on the set and $+\infty$ off the set). In both cases, irregularity was entering the picture, bringing new perspectives foreseen by researchers in analysis such as G. Bouligand, K. Kuratowski and G. Choquet or the founders of modern convex analysis such as J.-J. Moreau, R. T. Rockafellar and others. Relaxing the rigidity of convexity was also alluring and again, there were several ways to do that.

Nowadays I keep interest in such directions and their many applications, from design to optimal control and calculus of variations. I am still seduced by the permanence of old questions or views among the richness of modern developments.

I cannot end this brief account about my work without mentioning the debt I have to my teachers who inspired admiration for the legacy of our predecessors and the chance I had to meet great minds of our time – I give no name fearing oblivions – and the chance to discover many countries with various particularities. This diversity among the unity of human beings is a fact shared by mathematic and music. Everybody can enjoy it.