AN INTERVIEW WITH

Graciano de Oliveira

by **Ana Paula Santana***

Graciano Neves de Oliveira was born on the 7th of May 1938, in Cabanas de Viriato, Portugal. He graduated in Mathematics at the University of Coimbra in 1961, and in 1969 he obtained his doctorate at the University of Coimbra with the thesis *On Stochastic and Double Stochastic Matrices*. Due to his political ideas, he had problems in keeping a job at Portuguese universities, until in 1976 he became a professor at the University of Coimbra. He retired from this university in 2002.

Graciano de Oliveira's main research work is in matrix theory and multilinear algebra, an area in which he published extensively and produced several seminal articles. He supervised 11 Ph. D. students and was the leader of the Coimbra school of matrix theory.

Graciano de Oliveira was President of the Portuguese Mathematical Society from 1986 to 1988 and from 1996 to 2000, and Vice-President of the International Linear Algebra Society from 1993 to 1995. He also served on the Editorial Boards of *Linear Algebra and its Applications* and *Portugaliae Mathematica*.

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A very difficult question. I do not know. I know that I preferred Science to Arts and that I was not good in sports. One or two years before entering the University I was hesitating very much mainly due to lack of information. There was no internet and my parents knew nothing about what a University could offer. However I felt I would like to do research in Science. Something theoretical with no laboratories.

How was your experience as a student at the University of Coimbra?

Good in general. Scientifically it was not so good. The curricula were, in general, very old fashioned. But in order to get a pass with good mark it was necessary to work very hard.

Were you already interested in politics?

No. At that time I did not understand what politics meant. I had always lived under a dictatorship, politics was something we did not discuss. I would say that for many people, politics was something that did not exist. However in the last 2 years or so at the University, I started to open my eyes. The beginning of the colonial war was crucial. I had lived in Angola when I was a child . . .

When you graduated you became a university assistant. I guess that was a very natural thing to do?

Yes. All the good students were recruited as University assistants. Except if they had a negative report from the political police or, in some Departments, if they were female.

Did your interest in Matrix Theory start at that time?

It started in my first year as University assistant. I wanted to study something and I was fascinated by research activities but I did not know how to start. It was Professor Luís Albuquerque who suggested some papers on Matrix Theory to start with. It is an interesting curiosity that Professor Albuquerque is better known as a historian rather than as a mathematician.

But then you were conscripted into the army and went to Mozambique.

That's right. And I spent more than three years in the Army, two of which were spent in Mozambique as a lieutenant. It was a great setback to my academic career and an important contribution to my understanding of politics including colonialism. I did not like being a soldier. But today I think military service should be mandatory even though unpleasant. Without it, the 1974 democratic and anti-colonialist revolution would not have happened as it did.

After the army you returned to the University of Coimbra. But you did not stay long. In 1966 you went to Oxford to study Mathematics, but things did not work out as planned . . .

I returned in August 1966 and in September I went to Oxford. Things did not work out as planned indeed. I learnt some Group Theory and Ring Theory but there was nobody working in what I was interested in. Moreover, at that time, a

I start with three classical questions: When you were a child, did you show a special aptitude for Mathematics? In high school were you a good student in general? Was Maths your favourite subject?

Yes. I remember when I was at high school (Liceu), I mean when I was 11 or 12, I clearly distinguished Mathematics from the other courses. I felt as if what I had to learn was divided into two sets: one containing Mathematics only, the other the rest. In general I was a reasonably good student. But only in the last two years of the Liceu (after opting for Science) and at the University did I start getting very good grades in tests and examinations.

If you were not a mathematician, what do you think you might have been in your professional life?

Ph. D. obtained in another country would not be recognized in Portugal. Therefore it was not worth getting a Ph. D. in Oxford as I would have to get it again in Portugal and without it, it was not possible to continue an academic career. However while I was in Oxford I wrote what, in my opinion, is my best paper. This paper would lead, years later, to the Sá-Thompson interlacing inequalities. My paper was inspired on a paper by Leon Mirsky. He worked in Sheffield, we exchanged a few letters but I never met him. I had written to him when I decided to go to the United Kingdom and I asked him to be my thesis advisor. He said he could not accept because he was too busy. Bad luck for me. But his work had a great influence on me.

In 1969 you obtained your Ph.D. in Coimbra with your work on *Stochastic and double stochastic matrices*. But then you wrote a document criticizing the organization of scientific research in Portugal. This was not very well received at the university.

That's right. In 1969, June or so, the Minister of Education sent out a note asking for suggestions for a reform that was under preparation. I sent in my opinion. The Faculty of Science and Technology did not like it. Thus instead of forwarding it to the Minister of Education they preferred to sack me. In fact I was very critical and my opinion was considered offensive.

Following that you spent several years in Lisbon and Coimbra as a researcher with a grant from the Calouste Gulbenkian Foundation. Then you went to Brazil for a short period. Mathematically speaking that must have been a very interesting time. You published a lot both in national and international journals.

I was unemployed for a while. Then the Gulbenkian Foundation gave me a grant so that I could work at the Centro de Cálculo Científico in Lisbon.

Professor Ruy Luís Gomes (*émigré* in Brazil for political reasons) learnt of my situation and offered me a position in a Brazilian University in Recife. Since I was not happy with computing, I accepted. The idea was to move for good to Brazil with the whole family (I had 4 children the eldest of them being 7 years old). But since I had never been to Brazil, I and my wife thought it would be wiser going alone first to see how things were in Recife. There is another detail which is interesting to explain. Before I was sacked in Coimbra, I had been admitted as candidate to Associate Professor. I should have passed a sort of examination (public discussion of my CV, etc.) in order to be promoted. As a consequence of being sacked this was frozen. I think that was illegal but at that time the law did not prevail, we lived under a dictatorship! I went to Recife in January 1971. In April I received a letter from Coimbra informing me that if I returned, the examination for promotion would be unfrozen. A few months after returning I realized that the information in the letter was a lie. Unemployed again, it was the Gulbenkian Foundation that granted me a scholarship. No University in Portugal wanted me. Professor Sebastião

e Silva tried to bring me to the University of Lisbon but did not manage as this might be considered as disrespect to the University that had sacked me!

Years later, in 1972, what happened in 1969 was falling into oblivion and in September I was employed at the University of Lisbon thanks to Professor Almeida Costa.

It was at that time that you started getting interested in problems in multilinear algebra. Your lectures at the Coimbra Ateneu, 1971-72, are considered the beginning of research in Portugal in that area.

I spent the year 1971/72 in Coimbra. Mainly at home thanks to a grant from the Gulbenkian Foundation.

As far as I can remember I worked mainly in Multilinear Algebra, wrote a monograph and I read many books not related to Mathematics. That was when I met J. Dias da Silva and Marques de Sá. I was not welcome at the University but I wanted to hold some seminars. They took place in the Ateneu de Coimbra. Dias da Silva, Marques de Sá and Alice Inácio attended regularly these seminars. They were still undergraduate students.

J. Dias da Silva and Marques de Sá became the first two of your 11 Ph.D. students. The usual practice at the time was to send university assistants abroad to prepare their Ph.D.'s. How did the decision of supervising your own Ph.D. students arise?

Dias da Silva was the first one to get a Ph. D. under my guidance. At that time practically anyone wishing to get a Ph. D. had to go abroad. I thought this was unacceptable and that our Professors and our Universities should be able to provide guidance to young students. There was very little tradition of research among us. I thought I should try to reverse the situation.

And you did manage to do it! Both of them became national and international recognized experts in their areas of work. You must be very proud of your descendants.

Yes, both of them produced important research work. Marques de Sá received the Householder prize. This was important as it showed that it was possible to produce high quality research that was internationally recognized. Dias da Silva went to the University of Lisbon where he created a school of Multilinear Algebra and Combinatorics.

In 1976, after the April 1974 revolution, you returned to the University of Coimbra. You organized a regular Algebra Seminar and regular visits of foreign mathematicians in the area of Matrix Theory to Coimbra.

That is right, after the 1974 revolution I could return to Coimbra and start regular seminars and we had a large number of foreign visitors. This was, at that time, not very usual. I was so lucky to have a lot of very good collaborators and that their work started to be internationally known.

In the academic year 1978-79 I was a student of yours at the Algebra I and Algebra II courses. Your teaching

assistants were J.F. Queiró and A. Leal Duarte. How I enjoyed those classes! Our exams used to last the whole afternoon! Do you remember that?

I also still remember very well when you were a talented undergraduate student of mine.

Thank you for your compliment!

At that time, shortly after the democratic revolution, many of us thought that students should not be stressed in the examinations for lack of time. And that they should be given an unlimited amount of time in exams. This turned out to be impossible.

At that time a second wave of students of yours was in full bloom: Maria Emília Miranda, Natália Bebiano, A. Leal Duarte, Ion Zaballa, . . . You were in constant activity and I heard your enthusiasm described as infectious . . .

In fact I do not know how my enthusiasm was described!

The constant questioning, love for conversation, for argument, even for provocation are strong features of yours.

Are they? Do you think I have these features? It makes me happy that you think that way.

Amongst your many papers, do you have a favorite one?

I think my best papers are the three papers on *Matrices with Prescribed Characteristic Polynomial and a Prescribed Submatrix*. Another one I like is a joint paper with Dias da Silva on *Conditions for Equality of Decomposable Symmetric Tensors*.

The famous Marcus-Oliveira conjecture — on the determinant of the sum of two normal matrices — keeps eluding those who work on it. It is amazing that a problem so easy to state seems to be so hard to prove.

About 35 years ago (I do not remember the exact date) I suspected that the determinant of the sum of two normal matrices with given eigenvalues should lie in a very simple region defined using those eigenvalues. As far as I can remember, I had this idea when I was reading a paper by M. Fiedler. I was unable to prove it in spite of all my efforts. So I publicized it as a conjecture. This triggered a number of papers with partial results. When I was in Macau, Emília Miranda sent me a paper by Marvin Marcus where this conjecture was stated. Marcus in fact was the first one to put forward this conjecture. Now it seems that some authors call it Marcus-Oliveira conjecture. To my knowledge it remains unsolved. It is frequent that simple statements lead to very hard proofs.

From 1989 to 1992 you were at the University of Macau. How was that experience?

In Macau I had a very happy time. It was a good chance to know many countries in the Far East where I had never gone. I could meet people and make friends from many nationalities. The cuisine in Macau was excellent. And I had the opportunity to deliver many talks on Mathematics in China and to establish mathematical connections. I organized the first Mathematical Olympiads in Macau as well as the first international participation. This gave me a great pleasure.

I have very good recollections of my experience in Macau.

Throughout your adult life you never stayed long in one place. Do you not like to get too used to people and places? Why are you so restless?

Do you think I am restless? In fact in my adolescence my parents lived in several places including Angola. I was used to moving about . . .

The Portuguese Mathematical Society, SPM, has been one of your great passions. You were president of SPM twice, and held several other posts through the years.

I always thought that the Portuguese Mathematical Society could play an important role in the development of mathematical activity. I was President twice and Secretary General once (later on, Secretary General was changed to President). Recently the Portuguese Mathematical Society honored me with the title of Honorary Member. I am very happy with that.

What, in your opinion, should be done to improve Maths literacy in our country?

What impresses me most is the beauty (and the mysteries) of Mathematics, not so much its applications. These come in second place. This is my point of view, I believe many people do not think this way. Nowadays my point of view is not very popular. However I think that in making propaganda of Mathematics, the beauty aspects should be emphasized. Many colleagues are already making efforts to popularize Mathematics among the youngsters. The Portuguese Mathematical Society has made, and will make I believe, an important contribution.

In 2003 you retired, and although you kept teaching, you stopped your scientific research. Was that a decision on your part, or it just happened?

I retired from Coimbra in 2002. This was my decision. Stopping research was not my decision, it took place due to the ageing process. And because Mathematics is a very difficult subject that needs deep concentration. After 2002, I taught in a private University and read Mathematics and published 2 or 3 papers. They were expository papers on subjects that I liked very much: noncommutative fields and p-adic fields. I did not have any original idea. I did this for pleasure only. I dislike the prevailing opinion of putting too much pressure on researchers to publish numberless papers. A result of this is that a high percentage of papers are trash, something close to pollution. This never happened in the past. It is difficult to write deep papers, they may need years to be thought out of the box. The pleasure of learning and of doing research is diminishing because of this.

Mathematicians tend to be very narrow minded in the sense that they specialize too much. This is imposed upon them by the urge to publish. If they learn too much Mathematics they are left behind. Acquiring a broad knowledge implies fewer papers . . . but what counts is how many . . .

Going back to your question on improving Mathematics literacy, I think students should not be told that understanding Mathematics is not a demanding job. The main reason is that it is not true and I see no virtue in telling lies. Understanding Mathematics needs many hours of work and concentration. Today there is an obsession for meaningless rankings. This is negative and hinders deep thought. In many cases instead of a linear ranking I think that a partially ordered set would be more appropriate. For example in the worldwide ranking of Universities: it is not difficult to find two Universities where it is unrealistic to say that one is better than the other. However a ranking shows that A is a little above B. Does it mean anything? No, with a very high probability. But what matters is that there are many people believing (or pretending!) that A is above B. There are practical consequences . . .

Since Mathematics is very difficult and beyond my skills at this age, I keep reading other things. There are many other interesting subjects to explore . . . .

Thank you for your words. It was a pleasure to have this talk with you.