My Tribute to Dr Haralampos Tsaknakis

When I was in high-school I wanted to become a Computer Scientist, and when I studied to be one (at Univ. of Patras, Computer Engineering and Informatics Department) I did not know what kind of.

I was always a good student (never the best though) and ambitious for a research career in the United States. During the fourth year of my undergrad studies, I selected a course named 'Algorithmic Game Theory'. I heard it was taught by a Professor who was an intelligent, but hard-core theoretic computer scientist, named Prof. Paul Spirakis. My first thought was: "That Should be Fun!" and I attended the first lecture. The very first lecture was given by Prof. Spirakis himself and it was the time that I thought: "That is an MIT-quality lecture", even though I have never been to MIT before (I did a few years later, and I was not wrong). I fell in love with Algorithmic Game Theory and the way that Prof. Spirakis taught it.

In the end of the fourth year, I was sure that Algorithmic Game Theory (AGT) is something I like a lot and Prof. Spirakis was the reason that I finally had an answer to the question: "What type of Computer Scientist would you like to be?" -- "An AGT one!". When we had to select final thesis projects, everybody was telling me to stay away from Prof. Spirakis, because it was too hard to get a good grade, since all his topics are really difficult. So, I didn't! I decided to get the difficult road of Prof. Spirakis' projects. I visited his office and told him I would like to work on a theoretical problem of AGT: finding a good approximation in Bi-Matrix Games. He said "OK", and when the thesis topics were out, he did not include the topic I requested in the list. I went back to his office and waited roughly 2 hours (at a time when we did not have smartphones or laptops), only with a paper in my hands, named: "*An Optimization Approach for Approximate Nash Equilibria", by H. Tsaknakis and P. G. Spirakis.* A paper that I read all night and made notes on it. I entered his office and I told him that I could not see anywhere about the project we agreed on. I am not sure if he took me seriously during the first meeting, but I really wanted that topic. I wanted to crash on this wall called Approximate Nash Equilibrium, try to do research as an undergrad student, and see if I can achieve something or not (for me it was crucial to see if I can get the maximum grade from one of the most demanding supervisors in the University). Prof. Spirakis, looked at me smiling and told me: "I have a friend - we were actually schoolmates- and we work together now on approximate Nash Equilibrium. His name is Babis Tsaknakis and he is based at RACTI at Athens". I looked at the paper I was holding and I got excited.

We arranged a starting meeting at Athens, me, Prof. Paul Spirakis, and Dr. Haralampos Tsaknakis. We met in an office, I think close to the American Embassy. I went by train from Patras, traveled roughly 3-4 hours to reach the place. When I entered the office both of them were there, smoking and talking. We introduced each other and then Dr. Tsaknakis put out a paper and started explaining the theory and the problem setup. I could not understand almost anything. "How the hell could they think of such an algorithm?", I thought. Prof. Spirakis smiled and said something like: "Yeah, exactly." I waved my head and said: "Yes, I get it!" (no I wasn't; it took several nights over the paper to understand what the hell was happening). Dr. Tsaknakis looked at me through his eyeglasses and smoked his cigarette. "Time is over, I need to move to another meeting", Prof. Spirakis said and we stood up. Dr. Tsaknakis, told me: "I want an implementation of that, because I believe that the approximation can be dropped to a smaller number for sure. We have limited time, since

others (Daskalakis-Papadimitriou and Chen-Deng) will find a better approximation soon." (Needless to say that our approximation is still the best since 2008). He continued: "Give me your phone number, so we can go through the algorithm and we can meet once per month here to talk about details." I did give my number. For 6 months, he was calling me every morning at 8am. I was usually working on the project until 4 or 5am, so I was jumping every single day from my bed, with Dr. Tsakanakis saying: "Did I wake you up?" (Yes he did, but I was always answering: "No, no, I was working on the project."). I ended up never turning off my computer because I knew that at 8am, Dr. Tsaknakis will call. This period was the most beautiful, fruitful, intense, and stressful in my undergrad life. Next to Dr. Tsaknakis, I learned how to do research. I was going to Athens and we were working on the problem for hours. He was telling me: "I don't understand: the experiments show that we have a better approximation, but theoretically I cannot see why. Tomorrow we will ask Paul". During our last meeting, we had all the theory and experiments done. We were waiting for Prof. Spirakis outside his office in Athens. Dr. Tsaknakis told me, ten seconds before we entered: "If we manage to convince Paul about the results, then I think our theory stands and we can publish it. If not, then we need to work harder and the bad news is that you need to complete your thesis in a month." I waved and looked at the hand-written papers in my hands. "What a mess!", I thought. "Now, we have to convince Prof. Spirakis. And he will not be convinced." We entered the office and I stood up on the whiteboard: "The main question is: can we find a really difficult bi-matrix game, where our algorithm and the two players can be confused? Maybe a circle in the cost matrices? We tried *this* and *this* and *this*, but yet all approximations were better than your previous theoretical bound. Is there a more difficult bi-matrix game?" Prof. Spirakis looked at us and said: "Not any that I can think of. It is ready for publication. Babi, can you help?" We smiled. I thought that this was a personal victory. We left Prof. Spirakis' office and we shook hands with Dr. Tsaknakis. I was happy.

During the summer, we wrote my first ever academic paper named "*Performance Evaluation of a Descent Algorithm for Bi-matrix Games*", by Haralampos Tsaknakis, Paul G. Spirakis, Dimitrios Kanoulas. Because of that, I got accepted for a PhD at Northeastern Univ. in Boston. There, I met Papadimitriou, I met Daskalakis, and others (just to understand that I cannot compete with them, unless I was returning to Greece to work with Prof. Spirakis again). I decided to quit the research on Algorithmic Game Theory and move to robotics after visiting my next advisor at his office at MIT CSAIL. A couple years later, I emailed Babis (Tsaknakis) to meet in Athens. We met close to Syntagma for a coffee. I told him that I quitted Algorithmic Game Theory research, I changed my advisor, and I was doing robotics. He did not seem to like my decision, but he tried to be excited: "Well done! What problems are you trying to solve?" I am not very sure what I answered, but I remember that I could not really find any of the topics that I was looking at and could be more exciting than the approximate Nash Equilibrium problem.

Last September, I emailed Paul (Spirakis) and Babis (Tsaknakis) about a new paper that talks about our 2008 paper: "*Efforts to improve the results remain not successful in the past 14 years.*" I told them that I want to work again on this problem, and maybe apply it to robotics. Now that I became Professor myself, we can apply for funding and find students capable of taking it to the next level. Paul emailed me back saying that Babis passed away a year and a half ago (I remember emailing him to wish for his nameday and I never got back any answer from him, which was weird, because he was always answering to his emails; I

blamed COVID). I decided to write my undergrad thesis story as my tribute to the great supervisor Babis was. He (along with Paul) helped me understand the research process, made me excited about a computer science topic, defined me as an early-career Computer Scientist, and wrote with me my first ever paper that was published in WINE 2008.

I am very grateful that I met both of them when I was 22 and they defined my academic career path - more than they might have thought of.

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