

## KNOW THE PERSON BEHIND THE PAPERS

Today: Christos Papadimitriou

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**We ask all interviewees to share a photo with us. Can you please tell us a little bit more about the photo you shared?**

**Christos:** Yannakakis and me is unusual. We went to the same high school in Athens, studied in the same department in Polytechnio, and we both got our PhDs at Princeton (I was 2 years ahead in all this). He does not always admit it, but I recruited him to TCS during his first PhD year, when he was enamored to Communication Theory. When I succeeded, I remember thinking “I have now done enough for TCS”. Our CVs intersect only by some small fraction, but this fraction contains some interesting work. The picture is from a time in the 1980s when we had begun to look similar, and people at conferences had started to get confused. Then we diverged a bit. Joining him at Columbia five years ago (our office doors are 3 meters apart) was like a dream come true. When we work together, our bandwidth – the depth of our shared intellectual and life experience – is beyond anything that I have known.

The second picture is recent, by my good friend Muli Safra, who is the most talented photographer that I know.

**Can you please tell us something about you that probably most of the readers of your papers don't know?**

**Christos:** My student years in Greece were miserable. The country was under a US-supported fascist dictatorship which lasted roughly throughout my student years, and Polytechnio, my university, was an authoritarian place in a way that was not altogether unrelated. I hated my studies but I was doing okay. Students were trying to resist, but we were getting nowhere, except to jail and abuse. When I graduated I got a job as an engineer, but had to join the army first. My year in khaki was by far the worst of my life. I saw evil in the eye, every day, and I was powerless. My health suffered badly. I decided I had to leave Greece, and graduate school was my only way out. Princeton was one of two schools that admitted me, and they informed me that I was to join their Computer Science group – a category I was completely unaware of. They classified me this way probably because the only phrase in my statement of purpose that they could understand was “IBM 1460”. I ran to Princeton in 1973, two weeks after my discharge from the army. I was not serious about my studies, and I was opening my eyes to New York and the new opportunities around. Then I looked at my first homeworks – in Logic and Automata Theory – and I was hooked. Here is an intellectual endeavor that existed only in my dreams and prayers, and now I can explore it, and on top of it all I seem to be good at it! For a few weeks I was in heaven. Then in November, the students at my former school, the Polytechnio, started a rebellion that was crushed by tanks. People I knew were killed. I was a deserter – in fact, one who had fled behind enemy lines.

Such are the contradictions that defined me. In 1980 I left my job at MIT to teach at the same Polytechnio. For a few years I became a European TCS researcher, and I was on the board of EATCS – I even organized the 1985 ICALP at Nafplio. Those who were there have not forgotten: Don Knuth gave a talk on “Theory and Practice” in the ancient theater of Epidavros, and was introduced in fiery left-wing prose by famed actor Melina Merkouri, then minister of culture. Four decades after the fact, confessions come easy: I had written that speech.

**Is there a paper which influenced you particularly, and which you recommend other community members to read?**

**Christos:** Alan Turing’s two most famous papers – or is this too much of a cliché? I occasionally teach a course on “Classics in CS” where I cover – well, the classics. Besides Turing we go over Gödel, von Neumann’s interim report, Shannon, Danzig and Edmonds, Cook-Levin-Karp, Codd, Dijkstra, etc. Even Euler and his bridges. It is good to remind yourself once in a while that there are times when a researcher – in most cases in their 20s – realizes that there is something terribly wrong with the science around them, and takes time to fix it. But Alan Turing is special to me. A tribute titled “Alan and I” was published in CACM on Turing’s centennial in 2012. It narrates how, all of a sudden, in 1997 I started to write fiction, inspired by Turing. Before that I had written nothing

besides math, and yet after this experience I realized that I will never stop writing stories. My first novel “Turing (a novel about computation),” an oblique homage to Alan Turing, led me to a collaboration that ended up with the graphic novel “Logicomix,” which became a kind of best seller. Then I wrote “Independence,” a story about modern Greece (including the Polytechnio insurrection) narrated by a failed mathematician and backgammon champ named Christos P.

**Is there a paper of your own you like to recommend the readers to study? What is the story behind this paper?**

**Christos:** “A biologically plausible parser” (2022) describes a parser of English that is implemented exclusively by neurons and synapses. It is based on intricate TCS (work with Santosh Vempala), which however is only in the references here. It is the latest step in my quest to understand how the brain works, something I have been thinking about for many years now. Develop a formal, computational understanding of the brain at a level of detail bridging the two extremes: individual neurons and synapses, and cognitive phenomena at the other end. Nothing I have done compares in difficulty or excitement.

**What do you do when you get stuck with a research problem? How do you deal with failures?**

**Christos:** Ours is a good life that runs in a very peculiar pattern: months of frustration, then a moment of elation, and then you must write a technical paper. Repeat. There is a second kind of joy and longing: when you have identified a problem worthy of a research life, but feel completely powerless in front of it. And yet another moment of importance: when you turn your back to the problem, but promise yourself to return in good time, and take a fresh look.

**Is there a nice anecdote from your career you like to share with our readers?**

**Christos:** There is a picture on the web of me playing piano with Don Knuth, clad in regalia. In 2003 the two of us were about to receive honorary doctorates from the University of Macedonia in Thessaloniki, and the music department asked virtuoso Don to play something at the ceremony. To my horror, he responded: “I will play only if Christos agrees to play à quatre mains with me.” I did play rock-and-roll keyboards as a teenager but by then I was very rusty. I spent months practicing the pieces with my daughter, and when the day came I was ready. We practiced with Don in the morning of the ceremony, and he could cover all my inadequacies. That afternoon, after we sat in front of the piano with our heavy academic gowns and started Debussy’s “En évoquer Pan,” I burst out laughing, and Don noticed the problem at about the same time: with our long-sleeved gowns we could never cross hands as required by the piece! There were two hilarious bars of musical chaos before we ended with gusto.

A couple of years later my musical career took a different turn: I played with a rock band called “The Positive Eigenvalues.” Mike Jordan was my drummer, and David Culler my guitarist – not many keyboard players can say this. I also wrote the original songs of the band, and some of them were about TCS – this blogpost contains a couple of examples <http://blog.geomblog.org/2013/10/focs-reception-sing-along.html>

By the way, you may have noticed a pattern in my life’s account: All my closest friends are computer scientists. It’s not that I don’t have a life, it’s that computer scientists are all so amazing!

**Do you have any advice for young researchers? In what should they invest time, what should they avoid?**

**Christos:** If you do not feel an irresistible attraction to your research, you are in the wrong place. Don’t work on a problem just because somebody else could not solve it. No math you learn is useless. Even the hardest problems are likely to crumble eventually, make sure to be there when they do. Create your own problems as often as you can; your advisor is there to advise you, not to dictate problems to you. Read Manuel Blum’s advice to young researchers.

**What are the most important features you look for when searching for graduate students?**

**Christos:** What are you looking for in your new-born child? A huge moment, a life-long relationship is starting, the future is present, words fail you.

**Do you see a main challenge or opportunity for theoretical computer scientists for the near future?**

**Christos:** Modern TCS started around 1970 with the realization – through the papers of Cook and Strassen, to pick only two – that elegant mathematical work can inform computation in a direct and consequential way. In its first quarter century it bloomed: it articulated one of the greatest questions in all of science (“can exhaustive search always be avoided?”), and provided mathematical help for the solution of a few epic engineering problems: compilers, databases, security, chips, networks, more. Then the Internet came, applied CS fields developed home-grown theories and theoreticians, and TCS changed course. It started on its new dual mission: develop even more sophisticated math for the big problems of algorithms and complexity, and use the profound insights into computation we have absorbed over the decades to illuminate other sciences and make progress on their important problems. This is where we are now. With luck, there will be even more exciting progress on both of these research modes and fronts. And the interplay between the two will grow as well.

**How was your research affected by the pandemic? How do you think it will affect us as a community?**

**Christos:** Research happens in the world, and the world changed these two years. We may be wiser, more humble, well versed in zoom, more in touch with the planet's unity. And yet we are also more unequal: if you were rich or poor, powerful or powerless, you are probably more so now. I fear that wealth inequality is a timer of planetary disaster that may be even more ominous than climate.