

Danny Breslauer

June 20, 1968 – December 19, 2017



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Zvi Galil

Georgia Tech

Danny and I met at Tel Aviv University in the late 1980s. He was a high school pupil auditing computer science classes at the university and habitually found in the computer room. He soon won a reputation of a ‘whiz kid’ and a gifted programmer.

Danny attended the algorithms course I taught at the time and impressed me with his enthusiasm, ability and flair. Soon we began research on parallel string matching, culminating in a beautiful result – an $O(\log \log n)$ optimal parallel algorithm for string matching. We learned subsequently that Omer Berkman, Baruch Schieber, and Uzi Vishkin had produced similar results for other problems. Our joint work was presented in STOC 1989, and our string matching result appeared in SICOMP 1990. This result is still the best known parallel algorithm for string matching, though the preprocessing portion has been improved.

The string matching result was more than sufficient for a master thesis. There was a minor problem: Danny had yet to earn his high school diploma and B.Sc. degree in order to complete the M.Sc. requirements. He completed all three at about the same time, at the age of 20. By then it was evident that Danny is extraordinarily brilliant and prefers to follow his own way through life, quite different from everybody else. Danny came with me to Columbia to pursue a Ph.D. in the field of stringology. In those years he produced several good results topped by the $\Omega(\log \log n)$ lower bound for parallel string matching, which implied that our algorithm was the best possible in the comparison model. It is still an open problem if one can do better in the case of special alphabets, like an alphabet of constant size. This result led to a STOC article in 1991 and a SICOMP article in 1992. In three years Danny had the basis for a good thesis. Recognizing his abilities, I encouraged him to stay another year and develop it further, but he insisted. Danny received his Ph.D. at the age of 24. There was a small delay since Danny had to pass two of the qualifying exams, usually taken in the first or second year.

In parallel with his academic achievements at Tel Aviv University and Columbia, Danny used his prodigious talents to pursue a career in programming. He enjoyed both the challenge and the remuneration. Following his graduation, Danny held several academic appointments and kept working on research with quite a number of colleagues. He also worked for two or three companies, the last being Google.

We kept in touch throughout the years. When I stepped down as president of Tel Aviv University and briefly returned to research in 2009, we worked together on streaming algorithms for string matching. We tried to understand a certain

FOCS paper, and though we never did, we improved it. The result was a real-time streaming algorithm for string matching that was presented in CPM 2011 and published in ACM Transactions on Algorithms. I clearly recall our stimulating collaboration. We later met in the Bay Area, occasionally dining with a common friend, Cosimo Spera. We last met in Venice in June 2016, at a memorial conference of another common Italian colleague and friend, Alberto Apostolico.

It was with deep sadness I learned of his passing. I recall encountering him as a bright, gentle ‘kid’, his extraordinary gifts as researcher, as a valued colleague, and throughout – his playful sense of humor.

Amihood Amir

Bar Ilan University

I am not of the "Columbia Crowd". In fact I am from the generation of Stringologists that preceded Danny. Thus I only got to know him when he started publishing. Such a friendship is, on the one hand, a happy and partying friendship – of drinking together at conferences, and laughing together at banquets, and thinking together of exciting problems in the halls of workshops. It is indeed a happy and carefree friendship, but it is, by its nature, a somewhat shallow friendship. The knowledge is only skin-deep. Nevertheless, these meetings were enough to recognize Danny's gentle and unique soul. Reading his papers, in addition to the little brain-storming sessions, were enough to appreciate Danny's sharpness and intelligence.

Our friendship deepened in 2010, the year that Danny spent in Haifa. We have in Bar Ilan University, an advanced graduate research seminar in Pattern Matching. This is a seminar where our graduate students prepare topics for discussion and we then discuss possible improvements and advances. We have had many guests from other universities joining this seminar throughout the years, and the seminar indeed produced nice results in the years of its existence. In 2010, both Zvika Galil and Danny attended our seminar. It was a pleasure to have Danny's contributions, and it was an opportunity to get to know him deeper. That seminar was fruitful and led to the Breslauer-Galil paper *Real-Time Streaming String Matching*.

In Judaism, a memorial service involves learning *Torah*. It is preferable to learn things that the departed contributed. This is due to the conviction that as long as a person's deeds and thoughts have an effect – he is not truly gone. This is the reason for the famous song *David Melech Israel Hai veKayam* (David, the king of Israel is alive), and the reason for the Talmudic statement that *Jacob the Patriarch did not die*.

For this reason, the advanced graduate research seminar in Pattern Matching is dedicated this year to Danny's work. The students are preparing and presenting his papers and the discussion will be in understanding the concepts and seeing what new results can be achieved based on Danny's ideas.

This is the Jewish way of immortalizing a person.

תהא נשמתו צרורה בצרור החיים – May his soul be a part of the path of Life.

Shiva Chaudhuri

Intellisys

I first met Danny in graduate school in the late 80's. Since then we had been in regular contact, through all the professional and geographic moves that he and I made in our lives. If I had to describe Danny in one sentence, it would be "He cared about people." His actions demonstrated this over and over again. He made it a point to keep in touch with people and he always did whatever he could to help them. Through the years, we have shared our hopes, frustrations, successes and setbacks with each other. And, of course, many laughs and stories. (I think Danny would smile if he saw my next sentence.) Not all these stories are suitable for public consumption. Enough said.

When I was contemplating a change in jobs around 2000, Danny was the one who made the introductions that led to my employment for the next 17 years. So, in a sense, I owe my professional career over nearly 20 years to Danny! And I am not the only one; I know of at least two others who could make similar statements.

In October 2017, I spoke with Danny and he said he was going on a trip to Japan. I called him in December 2017, and was shocked to hear that he was seriously ill in hospital. Over the next two weeks I spoke with him regularly. Things seemed bad; he said that they did not know what was wrong, and he was not in the best frame of mind. He didn't give me many details about his condition. He asked me to take care of some administrative work for him, which I did. We spoke on Dec 17 and he told me that they were going to undertake a risky operation on Dec 19. I did my best to cheer him up and told him to keep a positive outlook. I told him I would call him on Wed 20, after the operation.

When I called, there was no response. I tried Skype, email and more calls over the next few days, but got no response. It was then that I realized how little I knew about Danny. Other than a phone number and an email address, I didn't know anything. I couldn't think of anyone who might have information about him. I didn't even know which hospital he was at. I took a guess and called up the UCSF hospital and was able to confirm that he was admitted there. However, the staff refused to give me any information regarding his condition or whereabouts, despite calling different departments and speaking to different people, with a sinking feeling in my heart. And I didn't know any more until I received word from the academic community.

It is sad that Danny's life ended so prematurely. But in his short life, Danny experienced and did more than many who live much longer lives do. So, to Danny, you were a great friend and a good person. I will miss you. Rest in peace.

Maxime Crochemore

King's College London

Danny was a very kind colleague and friend. The first time we actually met, if I remember well, was during CPM in Asilomar (1994). Soon we started to discuss and to exchange ideas on common subjects related to text algorithms and so. (We had certainly met before in Padova or Paris but my memory is fading.)

During his talk in Asilomar, the meeting centre suffered a power failure: no light, no overhead projector, etc. The organisers decided to have the talk and maybe several others on the lawn outside the conference room using board, chalk, eraser, as it was common in the old style. The session started with a speech by W. F. Doolittle, a famous biochemist, followed by Danny's talk. Despite more difficult when you had prepared solid slides, Danny accepted to give his talk on the board. It was great, very lively, and the audience was delighted.

Roughly at the same time, early 90s, Danny worked in Paris (INRIA Institute). It was the time when Laura was a post-doc in my department in a new university that is presently Université Paris-Est. I hardly saw him then, so busy he was with the job and the rest, but later on, when Danny visited the friends he made earlier in Paris area, he would call and we would meet and discuss in a restaurant or a coffee shop in the city, where I always enjoyed his company.

I also remember another example of his kindness. It was during a visit to Gadi (Landau) in Haifa University. Every morning we had the breakfast in my hotel, he would give me a lift to Gadi's department where he was working, and we would start working with the group or only us both when Gadi was busy. The work we started there was continued with others during a meeting in Dagstuhl but I am afraid it won't be completed without the ideas and help of Danny.

The very last time we met was in Venice for the AxA Workshop in honor of Alberto (Apostolico) in 2016. I discovered his disease and could see how hard it was for him to have long discussions and long promenades.

I will always regard Danny as a bright and smart scientist, as a generous and gentle person.



Figure 1: Danny in Piazza San Marco, Venezia, 2016.



Figure 2: Photo of myself in Venezia, shot by Danny, 2016.

Devdatt Dubhashi
Chalmers University of Technology

Aarhus

I loaded my tray and paid the cashier at the canteen of DAIMI, the Computer Science Department at Aarhus University and looked for a place to sit. I noticed instantly a tall blonde person looking straight at me. Danny welcomed me into his friendship from that very first moment I had landed in Aarhus. He was renting a very nice apartment right down the hill from the university on Ny Munkegade whereas the one I rented was an old shabby apartment out on the Ring Road. So Danny just invited me home to dinner. This was my terrific good luck. For one, Danny was a connoisseur of all things Italian, especially food. Then, he was a great one for conversation ranging from science to politics. And we discovered that Indians and Italians share many character traits - we are both opinionated, argumentative and fond of gossip! So many an evening we would be there in his apartment preparing simple but well made food and wine to match. Danny also had a wide social circle, so often we would end up with a large gathering of friends. Among these were the first batch of PhD students in the new BRICS research center that we had been recruited to as postdocs - Lars Arge, Allen Cheng, Thore Husfeld - and other postdocs such as Vladimiro Sassone and Claudio Hermida.

Danny and I were both interested in algorithms but our specific research areas were quite far apart. Danny was a specialist in string algorithms whereas I was into probabilistic analysis of randomized algorithms, especially combinatorial algorithms on graphs. Nevertheless, we shared a passion for the beautiful mathematics of combinatorics. So we ended up teaching a course in the BRICS PhD school and the lecture notes from the course were published as a BRICS report called. *Combinatorics for Computer Scientists*. We just pulled together different fun topics from discrete probability, graph theory and linear algebra. Several years later we kept getting request from people around the world to share those notes! Eventually we also wrote a paper together. It used Ramsey theoretic arguments to transfer lower bound arguments from the simpler comparison tree model to the more complex PRAM model of parallel computation.

New Delhi and New York

After Aarhus I was back in India for a couple of years, at the Indian Institute of Technology (IIT) Delhi while Danny moved to Wall Street. We kept in touch and Danny told me what a different world it was from academia – aggressive power brokering and arm twisting! Danny worked in the Twin Towers but lived in New Jersey. I visited him and stayed in his apartment and I think I even got to see his work place on Wall Street briefly.

A few years later, Danny visited me in India. We arranged a trip to the famous Khajurao temples (which I myself hadn't seen before). The temples were truly fascinating and gave Danny a window into ancient Indian art and culture. It was winter and as happens quite often in those months, the flight back was cancelled. So, on the trip back, he got a real first hand experience of present day India. We first took a bus to the nearest railhead. The bus clattered and shook as if it was going to break up into pieces at any instant. A few hours later we found ourselves queueing up to try and buy train tickets back to Delhi. At the rate the line was progressing, it wasn't clear if we wouldn't miss the train as well. To complete the experience, a cow wandered in and squatted down in the queue right in front of us!

Danny was obviously earning a Wall Street salary several fold what we in academia could only dream of, but on the other hand I could clearly see that he was bored and his sharp mind was desperate to go back to the intellectual challenges from his research life.

Göteborg and California

A few years later, I ended up back in Scandinavia in Göteborg in Sweden, just across the Kattegat waters from Aarhus in Denmark. Just about a year later, an afternoon was shattered by the terrible scenes on TV of planes crashing into the Twin Towers. I felt a lump in my stomach and called Danny immediately. I got only an automatic voice reply - was I hearing a dead man's voice? Fortunately, I later found out, Danny wasn't in the Twin Towers when it happened.

It was inevitable that Danny would leave Wall Street and a few years later, he joined Google in Mountain View. I was visiting the Simon Center at U.C. Berkeley and of course I took the opportunity to visit him in the Googleplex. It turned out that he joined the group led by my Cornell buddy Tushar Chandra whom I was happy to meet again and there were many smart people in or around the group including Yoram Singer. This was promising towards connecting our

research interests once again, as I too had been moving into machine learning (this was before the current craze when *everybody* it seems is into ML!). Finally it seemed, he was in an intellectual milieu that would stimulate his fine brain.

Alas, this was when the troubles with Crohn's disease started. Danny who enjoyed good food now had to severely curtail his diet. He said he was experimenting with some Indian food that worked well for him. He took me to a special tea house in a quaint little suburb of San Francisco.

I visited U.C. Berkeley again in March 2017 – Sweden was setting up collaborative projects with Berkeley and Stanford under an ambitious new investment in autonomous systems research. I met Danny again and it seemed the situation was as before - he had been trying several treatments but nothing solved the problem. Never did it ever cross my mind however, that this could have anything remotely like life threatening consequences. He talked a lot about other places that might be better for him to live - Tokyo was a place he mentioned a lot.

Then came this shocking news out of the blue! Why does it have to happen to the good guys?!

As an Indian, I should believe that we will meet again in some other universe ...

Gabriele Fici
University of Palermo

I met Danny for the first time in Palermo for CPM 2011, at that time I was a PhD student. He proposed me an interesting problem on stringology, namely that of finding an efficient algorithm for computing an unbordered conjugate of a given primitive word in the equal/unequal model. I remember I started to work on this problem with him, Maxime Crochemore and Filippo Mignosi with great enthusiasm. We obtained some results, but we never published anything, since every year we planned to meet again to work on this problem. I met Danny for the last time in Moscow for CPM 2014, where we had great time together discussing about everything but computer science! Below is a photo together during a session of that conference. The sad news of his passing arrived totally unexpected and was a shock for me.



Figure 3: CPM 2014 in Moscow.

Matt Franklin
University of California, Davis

When I started the Ph.D. program in Computer Science at Columbia in 1989, I wanted practical advice from Zvi's senior students. Pino, Raffaele and Kunsoo played that role for me very well. What about Danny? I quickly judged that Danny was in his own category, neither senior nor junior, and of no practical use to me at that moment. He attacked the Ph.D. requirements in typical Danny "style": brilliantly, rapidly, and with little regard for authority.

I enjoyed hanging out with Danny as a Ph.D. student, and our friendship spanned many decades after that. There were a few long stretches of living near each other that made this easier: on the East Coast when he worked in finance in the mid-to-late 1990's, on the West Coast during his Altavista phase, and again on the West Coast for his Google phase.

I loved the wide-ranging conversations I would have with Danny. He had a keen sense of humor. The highlights of these conversations would often be an entertaining analysis of the technical and administrative flaws of his latest workplace. Danny brought clear benefits wherever he worked, but he never seemed to find a place that was perfect for his enormous talent and rebellious nature.

Danny was about nine years younger than me. Throughout our years together, he was always more vigorous than me. I knew he had health issues, but they hardly ever showed up. That shifted in the last few years of his life. Then I saw the gap in our vigor shrink, and go the other way. I saw him fight for his health in typical Danny "style", with as little regard for authority as ever. And some core of the Danny I knew was always there, to the very end.

I saw him in the hospital a little less than a week before he died. We spoke for about an hour. He was pragmatic about his condition, but optimistic about his chances (and delighted that his "Obamacare" paid for a top-flight hospital like UCSF).

Travis Gagie
Diego Portales University

I joined the CPM community after Danny had left academia, so I think we first met at CPM '14 in Russia. The conference was held at the Yandex headquarters and Tania Starikovskaya managed to get hold of a few Yandex umbrellas to give away to the participants. I really wanted one (they were a funny shape) but I think they were handed out by lottery or something and I didn't get one. Danny did and, sensing my disappointment, offered me his. Naturally I refused it but he insisted: "Travis, you live in Helsinki, and I live in California – take the umbrella."

Leszek Gašieniec
University of Liverpool

I enrolled on CS PhD programme at Warsaw University in 1991 and one of the first research papers I gave a thorough read was on fast (sublogarithmic) parallel string matching co-authored by Danny and Zvi Galil. They studied the concept of witnesses in fast and work efficient parallel string matching. This concept eventually became the main topic of my PhD thesis devoted to fast and efficient computation of witnesses in various parallel models of computation. At that time we started collaboration with Danny on search in binary strings preprocessed (packed) with so called "Four Russians" method. Our new algorithms enabled more work efficient search for squares and palindromes.

More recently, in a larger group comprising Danny but also Oren Ben-Kiki, Philip Bille, Roberto Grossi, and Oren Weimann, we extended our past results to efficient constant-space and real-time string matching elaborating further on the concept of bit-parallelism in string matching. As a side effect, we also developed a novel algorithm to determine the leftmost (most significant) 1 bit in consecutive non-overlapping blocks of a fixed size. This problem is not known to be reducible to finding the rightmost 1 (easily solved) as no one knows how to reverse bits of a packed word in $O(1)$ time.

I will remember Danny as a good colleague and motivator. I have a strong feeling he lived his life the way he wanted to, and was very open about it. The life with many "out of the box" solutions. At the same time very natural and convincing. Among anecdotes, I remember ESA'94 (Utrecht) when at one of the talks or business meeting a telephone hanged on the wall kept ringing and ringing. Somehow, none of the organisers bothered to answer the phone. Eventually Danny walked a very long distance across the whole room, picked up the phone and quietly fixed the matter. I will also remember his great love for books which he considered as the life-time investment.

The recent news about Danny came as a great shock to all of us. We will be missing him badly.

Raffaele Giancarlo
University of Palermo

Ladies and Gentleman, The First Lady of Song ... Ehm, No!!! Mr Danny Breslauer

I have had the fortune to meet Danny at Columbia. I was about to graduate and he was just starting. We have shared many things since then. The last, only two old friends: a very pleasant dinner in Palermo two years ago, on the way to Venice, for the Workshop for Alberto.

But now, friends and colleagues, although my state of mind after that dinner to the latest news about Danny is not on glamorous notes, what comes next is on the notes of Take the A Train: https://www.youtube.com/watch?v=BJ_4cRG8B1g

One glorious day in the early 90s (January 1992, I suppose), I received a phone call from Danny, that goes more or less like this. Well, honestly, it was a bit more colourful, but the essence is there. He had recently received an American Express Gold Card, with all the privileges that come with it. He was very proud of this possession and liked to share.

D: Hi Raf, I know you like Jazz. Ella Fitzgerald is going to give a concert at Radio City Music Hall in May. I would like to invite you to come with me. It is going to be sold out. But with my Gold Card, I have priority on the tickets.

R: Danny, very kind of you!!! I will be very pleased and honored to be your guest.

D: OK. I will buy the tickets and I will give you yours when they come in the mail.

R: Well, keep them and we meet at Radio City before the show starts.

D: The show starts at 8:00 pm. You go ahead to take your seat because I may be max 5 min late. They will let me in.

R: Danny, it is nearly four months ahead. How can you be so sure you will be late and by that margin?

D: My remedial software project to pass the AI qualifying exam is due on the date of the concert...

R: What does the exam have to do with Ella???

D: The project is easy and I can do it in half an hour. I start planning to work on it a couple of hours before the concert.

R: Danny!!!, Can't you start maybe, well...let's not exaggerate, the day before?

D: Not worth it.

Well, that was the way it was going to be. That was Danny. On the day of the concert, I entered Radio City a few minutes before 8:00 pm and took my seat. As announced, no Danny. Then, the curtain was lifted, standing ovation and Danny materialized. After Ella.

D: Raf, traffic was really bad.

He has a smile of great satisfaction and accomplishment on his face. This is the way I will remember Danny.

Roberto Grossi
University of Pisa

I met Danny for the first time when we were both at the beginning of our PhD studies. It was a nice summer school in Acireale (now Lipari School) with top speakers and PhD students from all over the world. We were sharing the same room and Danny was returning from a trip to the Vulcano island in Sicily: he was worried about the smell and the bad conditions of his shoes due to hard hiking to the volcano site. This was over 25 years ago.

Around that time, I went to visit Zvi Galil's group at Columbia U. in NYC, and Danny helped me a lot to settle up, open a bank account, etc. (That year in Columbia was really great, I found new friends there.) Over the next years I visited Danny when he was in Denmark for a fellowship, and he also spent six months in Pisa. He then went into the industry job market, and I reconnected with him some years ago when he decided to come back to the academia. He went to Haifa in Gadi Landau's group, and I had a pleasant visit also there. Communication was very often in Italian, as Danny was fluent in it. Incredibly, after so many years, when I introduced someone to Danny, he was still mentioning the fact that he was smelling like a volcano when we met.

I have many good memories to tell about Danny, but I am a kind of private person when publicly talking of family and close friends. Thus I prefer to tell just few things about what Danny had to go through these years, reporting what he told me in several occasions. He attempted to get back to academia around 2010, but it was difficult as he had been inactive in research for several years. Also, most positions were for the junior level, which was not fitting his age, and he had no recent teaching experience; moreover, in that period, university jobs were less abundant than before. Still with some rust, he was the brilliant guy in research and we coauthored some papers. Danny was full of great ideas... he was still a quick thinker, even though his ability to write papers was slower than before.

Sad and short story is that he failed to get back to academia and thus returned to the industry, working as a software developer for Google. He clearly did not like this job, and I suspect that the stress was a main cause of his chronic disease. Even sadder story, Danny lost his job at Google: a special external company (appointed by Google) investigated Danny's health, misrepresented the opinion of Danny's doctor, and concluded that there was no job position in Google suitable for his disease. Thus after a while, the insurance company started mobbing Danny to avoid to pay his medical expenses, at the point that they were sending anonymous private detectives to investigate whether Danny was cheating or not (and he was

not).

Danny was trying to settle in Japan, where he was feeling better and liked people (he was learning Japanese). Few weeks before dying, Danny confessed me that he was worried that he had no job and a disappearing health insurance. I had Skype calls with him over the years, and I met him very recently, it was in October 2017. I wish I had not delayed a Skype call with him before the sad news. As it happened with many, it came as a sudden shock to me.

For me he was the smiling and smart tall guy, a very kind person and nice talker. As everybody else he had pros and cons, and the latter ones were OK for me anyway. He called me Robertone because I called him Danone (in Italian the friendly suffix "-one" means "big"). Here are a couple of recent pictures with Danny.



Figure 4: Danny in Venezia.



Figure 5: Danny in Japan.

Concettina Guerra

Georgia Tech

I met Danny many years ago in Padova. Alberto Apostolico was a friend and collaborator of Danny and had invited him to dinner at our place. At the time Danny was a PhD student of Zvi Galil at Columbia. Alberto had told me that Danny was a bright student, adding that Zvi had made the same comment and you had to trust Zvi. But what Alberto did not say and I found out when I met him was that Danny was also a nice, caring and very handsome young person. I never collaborated with him, among other things my research area was not stringology, but over the years I saw him many times both in the US and in Italy. The conversation with him was never boring or conventional, he was certainly a non-conformist guy. Last time I saw him was in Venice in 2016 for the meeting in memory of Alberto. Before then, when he found out that Alberto was sick he visited him in Padova for a couple of days (photos 6, 7). We really appreciated his kindness and thoughtfulness. In Venice we spent time together; he talked about various issues showing an unusual insight. He was all but an ordinary person. This is how I like to remember him, at a dinner table in Venice having a lively conversation with friends and colleagues.



Figure 6: Danny - Padova.



Figure 7: Danny and Alberto Apostolico - Colli Euganei.

Shunsuke Inenaga
Kyushu University

I was stunned by this sudden and sad news.

Danny was my new colleague and friend. I met him for the first time at CPM 2011 in Palermo, but our close relationship started January this year when he contacted me on one of my CPM 2016 papers. Then we started collaboration and had fruitful discussions by e-mails and Skype. Despite his disease, he was still passionate to solve the problems.

He privately visited Japan this year, and I met him with my Japan-based colleagues. We were quite happy to achieve good solutions to the problems, and our first draft was finally up in mid December. I e-mailed Danny to have a look at the draft, but it seemed too late as he did not reply. Then I heard about the passing of Danny... I knew that his disease was serious but never imagined he would have passed away this soon. Very sad and shocking.

Danny was a brilliant scholar and was full of ideas. His deep insights opened new perspectives on the problems. Our paper with Danny will soon be posted to arXiv and will be submitted to a journal.

Danny, Rest In Peace.

Giuseppe F. Italiano
University of Rome Tor Vergata

I met Danny for the first time at Columbia University almost 30 years ago. I was doing my PhD with Zvi Galil and Zvi announced that a talented young guy from Tel Aviv would soon join as a new PhD student. I always trust Zvi, especially when he is talking about research, and of course he was right: Danny's research talent was indeed amazing! During his first years as a PhD student Danny obtained awesome results, solved some long-standing open problems in string matching, and published two papers in STOC along the way. As it is rather common with gifted people, Danny had his own way to do things, which was pretty unconventional, and sometimes hard to understand for several people.

His professional trajectory was rather unconventional too. After doing few years as a postdoc, he could have easily obtained a tenure-track position in a very good university or a permanent job in an industrial research lab. Instead, he decided to leave academia and to go for a Wall Street type of job. After more than a decade in Wall Street, however, he decided to go back to research. I still remember when he called to tell me that he had moved to Haifa, and that he wanted to work with me on some research problem related to suffix trees, where some expertise on data structures would be needed. At that time I was Department Chair, and busy with many administrative duties. On top of that, I had not been working on string algorithms for a very long time. So, I did my best to decline politely Danny's kind invitation. But Danny was very persistent, and he convinced me to start working on suffix trees again. His enthusiasm was contagious, and I was truly impressed by Danny's amazing comeback to research: after such a long time, he had still so many brilliant ideas and deep intuitions. We solved the problem, based entirely on Danny's ideas and intuitions, and the paper got the best paper award at SPIRE. After this quick comeback to research, he went off to industry again and accepted a job at Google. Also professionally, Danny seemed to be in a continuous quest for something, that perhaps he never found.

Danny was a very generous friend. He was always the one to reach out with invitations to do something together or to meet somewhere. Although we have been often living in different countries, we have been always in touch over the years, and shared many ups and downs of our lives. Danny spoke Italian and loved Italy, so he visited me several times, both in Rome and in Sicily, where I usually spend the summer holidays with my family. After he stopped working for Google, he was considering moving and doing research in Japan. But he told me

several times that if moving to Japan would not work out, he would love to move to Italy. Sadly enough, life did not give him the chance.

Danny was an extremely brilliant scientist who could not manage to stay away from research. But as our common friend Mark Kennedy once said, Danny was also a “*mensch*”, namely a good, honest, gentle, noble person, with all the qualities one would hope for in a friend.

Tao Jiang
University of California - Riverside

This is certainly a very sad news just before Xmas! We collaborated on the approximation of shortest superstrings many years ago and I still vividly remember his brilliance in compressing a complex theorem about periodic strings into a few simple formulas. I was unaware of his illness. In fact, he shared with me a new idea about finally cracking the shortest superstring problem just a few years ago, and I was looking forward to hearing more from him! He will always be remembered.

Gregory Kucherov
University Paris-Est Marne-la-Vallee

I was shocked by this news. Let me share some of my memories about Danny. I knew him for a very long time. I don't remember when we met for the first time, somewhen in the mid-90s. He held a post doc position in Saarbrücken at that point. I invited him to apply to INRIA Nancy (where I worked then) what he did, but unfortunately the application was delivered by the post the day after the deadline and was not accepted by the administration. Since then we have been in contact, both professional and personal. I remember I met him once in NYC during the years that he was out of the academia. He didn't look happy, he was clearly missing the academic environment and wanted to return. After his return to Haifa, he ardently resumed the research work and, within a couple of years, wrote several outstanding papers, joint with colleagues. Let me just mention the paper on near real-time suffix tree construction joint with Giuseppe Italiano (best paper award at SPIRE'11, if I remember well) that, in my view, contains the best exposition of (improved) Wiener's suffix tree algorithm.

Without attempting to overview Danny's contributions, let me mention another example of Danny's scientific perspicacity: in his PhD thesis (1992) he made a conjecture about the complexity of computing runs under an unbounded linearly-ordered alphabet. Only 20+ years later this conjecture (still not fully solved) became mature and was studied in a series of recent papers.

Recently, after leaving the academia again, Danny kept attending by himself community events, such as CPM or Dagstuhl seminar, where we continued our discussions. Undoubtedly our community was his "scientific family" to which he was deeply attached. His talent, his warm and open character, his frankness will be always remembered.

Gad M. Landau
University of Haifa

It is hard to believe I am writing about Danny in the past tense. I first met Danny in Tel Aviv, thirty years ago, then in NYC when he was a Ph.D. student and since then we met almost every year. He spent two years with me and Benny in Haifa. I saw him last time in Venice, June 2016.

He was one of the smartest people in our community. His papers are excellent and bring a lot of very deep thoughts and techniques and I am sure that his work will be the base of many future papers.

But above all Danny was one of a kind. He always walked in his unique path, he had his own way.

Danny was a good friend with a wonderful smile, and I am so saddened by this loss.

Yoelle Maarek

Amazon

We all know how brilliant Danny was, a true computer scientist, thinking fast and sometimes a bit awkward like most geeks (and for me geek is a compliment), but we should also remember how kind and helpful he was in times of needs.

I met Danny when he arrived to Columbia University to start his PhD with Zvi Galil in the theory group. He was the youngest of all, so it was kind of natural for my husband Frank Smadja, who was already in the PhD program, and me (I had just started at IBM Research in Hawthorne), even if we were only a young couple, to be spending time with him. We felt like he was our young brother or cousin coming to visit from Israel. We saw him quite often in our small one-bedroom apartment on Riverside Drive, listening to him, giving him attention and advice, when he asked.

One memory of him I am the most fond of however is when the relation went the other way around and he took charge. It was in the fall of 1991.

Danny had started an internship at IBM Research in Hawthorne and since I was driving to work from Manhattan every day, he was often car pooling with me, felt like a mom taking him to school. Our car was a ten-year old really rusted but really powerful V8 Camaro, a true muscle car. It was a heavy, hard to drive car but as unsafe as it was, I loved driving it in the long commute to Westchester.

So on this beautiful fall day, Danny was my passenger, and we were heading back to Manhattan after a long day at IBM. Still in Hawthorne, just before entering the Saw Mill Road expressway, I felt the Camaro suddenly swerving. Fortunately, we were not on the expressway yet, so I could easily park on the side of the road. Both of us went out of the car. For Danny, it was kind of a flexibility exercise given how tall he was and how low the Camaro is. It's a car where you lie rather than sit. Both of us checked the car from outside and here it was, a splendid flat tire. It so happens that I was very pregnant with our first son (Uzi who is now 26 and a grad student in CS at the Technion), so I wanted to call AAA road side assistance. Remember however, at the time, there were no cell phones, and I was definitely not ready to walk a mile or so to find a public phone. I really had no idea what to do, and told Danny so. He then smiled at me, a big smile, a proud smile and told me not to worry, he would change the tire. I was stunned! "Danny" I told him "you realize it's a heavy rusted car?" I knew he was a super computer scientist, but he was also a geek, not very much into exercise, since when geeks knew how to change tires? He directly jumped into action, without hesitation. It was not easy, as expected, but he pulled it on his own, dedicated, fully focused as

if he were in front of his monitor. I could only watch and admire.

We were soon on our way back, and he kept smiling all the way back. Danny the kid, had turned into a grown up, I was the little sister and he was the one helping me; obviously he loved the sensation. To be honest, I felt great as well.

Danny you will be missed, you were one of a kind. *Yehi zihra baruh!*

Sabrina Mantaci
University of Palermo

To me, Danny was a friend and not just a colleague. Of course, I used to appreciate him as a very refined scientist, but here I would like to remember him from his human side: a gentleman with great heart and sensibility.

I met him for the first time in my home town, Palermo. I think it was in 1993, where he came to visit Dora and Pino. At that time I had just been admitted to a PhD program while he had already a PhD in computer science and was a promising young researcher.

Since then, I met him again several times, for instance at the Advanced School on Computational Learning and Cryptography held in Vietri sul Mare. In the first photo, we are together in an excursion to Pompei, where we went with a group of students attending the school. There I had for the first time the opportunity to have long conversations with him and to know him better as a person. I think we became friends at that time.

After some time, a sequence of unfortunate personal and professional events took him away from academy. Despite this, thanks to his great passion for scientific research, Danny kept on writing scientific papers, attending conferences and keep in touch with his scientific community.

The last time he came in Palermo, in summer 2016, was the last time that I saw him. He visited Palermo to do some research work with Filippo but he had also some spare time, so we spent much time together and we talked a lot. The second photo was taken at that time, in the panoramic terrace of the small apartment at the beach where he was staying. It was then that he told me about his disease and all the problems connected to it. I understood that it was serious, but in my mind I never always accepted the idea that this disease could be able to deprive us of Danny. I was sure we would meet again, sometimes, somewhere, as usual.

I was completely upset and unready when I heard that Danny had left. I am so sad that we will not be able to spend time together and have those nice and stimulating conversations once again.

I will miss you. Good bye Danny, I hope you're fine, over there!

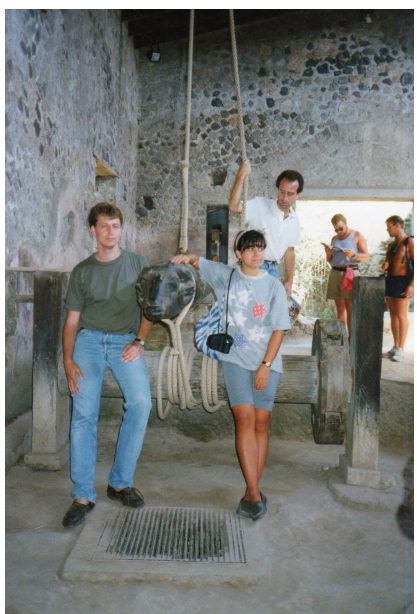


Figure 8: Excursion to Pompei.



Figure 9: Summer 2016 in Palermo.

Oded Margalit

IBM

I met Danny in Tel Aviv University in the 80's. TAURUS computer lab was young and it was interesting to work there, doing many things for the first time. I remember Danny writing a driver for the printer; reading user manuals from cover to cover in days; helping students, much older than him; and proving to the world that there is no limit to the human creativity. I enjoyed working with him and was very sorry to hear about his death. He was a good researcher and a great friend. We've drifted apart in recent years, catching so I had the pleasure of hearing about some of his success only when it was too late. I wish we could have met more...

Filippo Mignosi
Università degli Studi dell'Aquila

Danny was one of my best friends.

I have been seeing him, recently mainly with my family in Palermo for a long time. We had the habit of contacting each other at least once each couple of months. He told me that he was in hospital few days before he left us and I was too late in replying to him.

He was a passionate human being that did not want to show too much his feelings. Maybe this fact, together with his competitive young life, was one of the main causes of his chronic disease. I do not know what was his "short illness" that obliged him to leave us but I am aware that he had still plenty of projects to realize. He was a genius, fast, bright and profound and he had a personal and very human sense of justice that obliged him sometimes not to be particularly wise. And this is an extremely good reason for appreciating him. I believe that the world would be a better place with many more people like Danny, and I am sure that they are there outside and that many more are growing.

While we were talking a couple of months ago, he told me to give a look at his grandfather. I see a good resemblance. His grandfather was a witness at the Eichmann trial (check around mn 6:31) <https://www.youtube.com/watch?v=Mv3bsgLaV9Y>

I and my family will miss him.

I pay my respects to his family.

Mehryar Mohri

Courant Institute of Mathematical Sciences, NYU

I am sad to hear the news about Danny and shocked to hear about his disease, which he never told me anything about despite his many interactions with me.

To me, Danny was a comet: he appeared and disappeared at different moments. He always had that nucleus of interest in algorithms but with a different superficial appearance.

Danny came to visit our lab near Paris during the time I was finishing my Ph.D. thesis and later serving as an assistant professor for a year. At the time, his girl-friend Laura was also in our lab. We talked about automata algorithms and discussed the use of suffix-tree algorithms as part of a minimization algorithm. Our technical discussions were moving fast. Later, I moved to NY to work at Bell Labs. He called me to say that he had decided to publish that. I lost track of him for many years although his girl-friend at the time (Laura) was in touch via email.

Later, he was a candidate to join the department I was heading at AT&T Bell labs. He seemed to be very motivated, though I felt he had changed quite a bit and had spent a lot of time in the industry. He did not seem to be the same person. We made him a good offer, but in the end he did not take it because the salary was below what he was getting in Wall Street and because he had better offers from Cisco. I was disappointed to see how much financial aspects were counting for him while in the past he seemed to be more devoted to research. He appeared both sad and physically diminished.

A few years later, he attended the Dagstuhl I co-organized and I was happy to see that he appeared more joyful and much more active research-wise. We got to interact a lot but again he disappeared. Later, he joined Google, but I never understood why he did not try to be in the Research organization and I could not figure out what he was up to.

On G. Paradise and Nir Peleg

Veterans of the Computer Science Lab, Tel Aviv University

Several people here mentioned Danny's computer science, yet we fondly recall him as a master technologist. We met Danny at the computer science lab of Tel Aviv university when he was fifteen. His experimental spirit was not always productive (read: sometimes destructive) and strived for focus. Opportunity came along with the lab's new VAX computer: we had to support Unix on our own, and asked Danny to study the new VAX C compiler so he can fix occasional bugs as they show up.

Alas, that compiler was not broken enough to keep Danny busy. Eager to practice new skills, he found a seriously-broken C compiler for the tiny Motorola 6809 microprocessor, fixed it, borrowed some home-brew hardware from the psychology department (who used that chip for laboratory control) and tested his fixes. Embedded systems in 1983 were coded in assembly language; developing them in C seemed like a pipe dream so nobody took Danny's little diversion seriously until, one day, a real problem came along.

The new VAX computer was way overloaded: it would occasionally cease sending data to our only line-printer and then resume. Such start-stop cycles would literally break the printer's gears, resulting in costly repair calls (and students missing their class deadlines) every other week. Could a small buffer between the VAX and printer deliver data smoothly in real-time? Could Danny do it?

Within a few weeks, Danny:

1. put together a small-yet-elegant run-time environment for the microprocessor, so one could develop and test C code,
2. implemented a start-up sequence to be invoked after processor reset,
3. came up with minimalistic code (prioritized polling loop) to handle parallel tasks,
4. designed and implemented a circular buffer for smooth, non-stop data delivery,
5. decoded hardware error indications from the printer (paper out, power fault, ...),
6. added a loudspeaker with ear-splitting alarm on those errors,
7. avoided any other kind of user interface (which turned out to be very smart – see below),
8. connected his contraption between VAX and printer, and tested it,

9. devised a translator from musical notation to C (long before MIDI became popular), and
10. coded different tunes to play on various printer malfunctions.

The resulting box had just one large, friendly red button. As students came to collect print jobs, they'd press it to eject their last page (essentially resetting the processor to execute its startup sequence, re-establish communication with the VAX and send a form-feed command to the printer). Loud musical complaints would prompt lab staff to quickly fix printer issues, if there were any.

A dozen years after, the late Thomas Ungar of the computer science lab asked if we have any use for Danny's print controller. "Works flawlessly like new, but we just retired that old line printer" he said. Not bad for a fifteen-years-old's first attempt at system engineering on an underpowered microcontroller with two kilobytes of RAM.

Danny faced much more challenging technology throughout his career on Wall street, AltaVista and Google. If heaven indeed exists, he must be re-architecting its systems right now.

Kunsoo Park
Seoul National University

Danny came to Columbia about three years later than I. He was a tall and handsome guy, and he was much younger than other PhD students. From the start, his research result was impressive. He obtained an $O(\log \log n)$ time algorithm for parallel string matching and published it in a premier theory conference STOC.

Our PhD advisor Zvi Galil organized Theory Day workshops every semester and his students did some preparations for the workshops such as sending leaflets by mail and arranging the workshop room. One day all his students except Danny were working for a Theory Day workshop, putting leaflets into envelopes and attaching address labels to envelopes (I think Zvi was there also). Danny showed up late, chatted a little bit, and went away. It was a culture shock to me! That time Korea was a Confucian society, where if your teacher tells you to do something, then you have to do it without excuse. (These days Korea is much like Western societies.)

After one summer vacation Danny came back with a wonderful result, $\Omega(\log \log n)$ lower bound for parallel string matching. I couldn't understand it in my first reading; I was able to understand it after a careful reading. He was a prodigy! He published it again in STOC.

Twenty years after I graduated from Columbia I met Danny at a conference held in London. I was startled; his face looked older than his age. He told me about his health problems. Nonetheless, he was again active in research. He visited Korea a couple of times. The last occasion with Danny was about several months ago. He talked to me over Skype about the possibility of staying in Japan (he said for a health reason) and we talked about several Japanese stringologists to contact.

Ely Porat
Bar Ilan University

It is indeed very sad.

I met Danny about a year ago in Palo Alto. He took me to drink beer, and told me little bit about the project he had done in Google which was related to Google play.

He told me that his project increase the revenue by 40 million dollars (I think per month), and that he is doing a real impact. However it looked to me that he had more fun and utilized his skills in the academia.

Frank Smadja

Toluna

I met Danny when he started his PhD at Columbia, I was then on my last stretch trying to finish mine and buckle things up to move on to the next stage in my life after a 5 year bout with grad studies. Danny arrived at the CS department of Columbia University well announced and expected. He was supposed to be the next star, a bit like a first round pick for the NBA and join Zvi Galil's already super strong all-star team that included many of friends like Pino Italiano or Raffaele Giancarlo.

When I first met him, I was at the same time disappointed and pleasantly surprised. The 19-year-old bright kid, did not look anything special, he was just a regular 19-year-old kid. We rapidly engaged in a conversation and, as time went by, I started to know and appreciate him. His sense of humor and his truly outstanding intelligence, the awkward silences followed by quick funny remarks made him a different, charming and interesting person.

On a professional level, not being in the same domain as Danny, I had heard he was as star in computer science theory, what I did not expect was how talented he was in coding, a true hacker. Danny was a real computer geek. His knowledge of C, Linux was amazing; I learned a lot from him and he was always answering my questions with a lot of insight and patience. I felt like the dumb brother learning from his younger smarter and more talented young brother. However, since we left for Israel with my wife and our baby son, we kind of lost touch, only exchanging email from time to time.

It was only when he came to do research at the University of Haifa in Israel in 2016 that we truly reconnected. We had changed quite a bit and so had Danny. However, as soon as I started speaking to him, I realized that, in fact, he had not changed a bit. He still had the same light in his eyes, the same sense of humor and the same energy. We picked up our discussion where we had left it some 20 years before; the topics ranging from Korean food, to beaches in Sardinia, Google's world domination, the best pizza in New York, machine learning algorithms, and more. It was going to be the last time we met unfortunately.

I wish I could continue the discussion with him, we still have so many topics to cover.

May he rest in peace, *zichrono livraha*.

Cosimo Spera

BeeBell

I will always cherish our friendship, even now that you are gone.

It was the summer of 1990 in Acireale, Italy the first time I met Danny. We both attended for two weeks a summer school in Computer Science. Danny was the youngest of the attendees and probably the smartest. I was an Operation Research assistant professor and took the summer school as an opportunity to enrich my knowledge, so I was skipping most of the mandatory homework. Danny was a PhD candidate in Computer Science at Columbia under the supervision of Zvi Galil and always managed to finish his assignments before anybody else. So in the afternoon after class, the two of us were hanging out by the pool or having convinced one of the receptionist to borrow her car to go to the local beach. We barely talked about our research, our conversations span from politics to girls and were never boring. A strong bond between us started that summer and it kept growing during the years to come.

It was December 8th 2017 last time I saw Danny. Twenty-seven years of friendship had passed by, several of them spent in the same location: the Bay Area. Danny had just returned to the Bay Area in 2012 to take a position at Google, after he had rejected an offer from them in 1999, that would have made him a multimillionaire. Danny and I managed to see each other at least few times per month generally during the weekends. Routinely either we played tennis at Google campus on Sunday and then went to brunch in Mountain View at his favorite Indian restaurant or biked on Canada road from San Mateo to Woodside and back and hang out for lunch and coffee around his place.

On December 4th 2017, after his return from his last trip to Tokyo, Danny called me and asked me to stop by his place to help to jump start his car. I went there and both realized neither of us had jump cables, so instead we went to lunch and postponed the operation for the next day. That night Danny texted me and reminded me to be at his San Mateo condo by 9:30am. I left my house in San Francisco at 9:00am. This time with the jump cable in my car. On my way there, I called multiple times but had no answer. I thought he might had gone to Yoga class at a nearby gym, so I thought to go directly to his house. Since he had been diagnosed with Crohn's disease he had started to go to Yoga – I always joked with him that he was going to Yoga to pick up girls there – Once there I rang his door bell for more than one hour as well as to call his cell but had no answer. I started to worry and called the police for a "welfare call". The police showed up at 12:00pm and we knocked at his door. To my surprise Danny – who had just woke up –

opened the door. He had overslept. We argued on why I had called the police and my answer to him was: "that is what a friend will do. Make sure you are OK".

Four days later, I stop by his home to have lunch and speak about what he had to do next year and the option to move for some time to come and stay with me in San Francisco while he figured out if moving to Tokyo would have been the right thing to do. In the next days, he was going to see his doctors at UCSF and I was flying to Europe for work. I was giving a lecture at my Alma Mater, the University of Siena, for the 50th year anniversary of the School of Economics.

During that week we talked several times, as the doctor required him to check in at the hospital and he was giving me daily updates on his health via text messages. Our last call on Dec 18th was short. I had just landed in Vienna and called him to check on his health and to ask him to spend Christmas with me and my family. He told me he was feeling weak and that the doctor had just walked in and could not talk. I texted him: "Hang in there Danny". The next day he was gone.

Danny was for me and few others a real friend. The guy who is always there for you when you need. He had a good sense of humor and loved to travel the world. He spoke fluently few languages and had learnt Japanese in less than one year. He was bright and talented and more important he loved to live.

Even when he was close to death, he found the way to send me a message of friendship. He told his sister Iris that he wanted me to have his favorite chair, that now is in my living room in his honor.

Danny, my friend, you are gone too earlier but you certainly left a strong mark in the lives of the many people who love you and cherish your friendship.

Amiram Yehudai
Tel Aviv University

I ran into On Paradise in the center of Tel Aviv one Saturday night in January, and he told me about Danny's passing. Needless to say, I was shocked. To me Danny is still the shy, tall teenager that I met in Tel Aviv University sometime in the early-80s. For several years I was the CS Faculty member supervising the CS lab, and Danny was introduced to me by the system people as a new recruit. The Lab was run by a bunch of young kids, some of them undergraduate students, some even younger. I seem to remember someone telling me that Danny is a very skillful Unix guru. I think they said he could port Unix onto a coffee machine. Once you overcame Danny's shyness, you could sense what a gentle sweet person he was.

I think I lost touch with Danny when he went to Columbia for his PhD studies. I kept hearing about his achievements, and then I think I saw him after he got the fellowship to do his Post Doc in several European labs. If I remember correctly, he was supposed to spend 6 months in each of 3 different places. This seems to be very suitable for Danny, who has matured, and was very open to different cultures. Again, years have passed until I met him a couple of time when he was in Haifa. He was still soft spoken, sweet, and with a unique sense of humor. Still, in my mind, he will always be remembered as a tall sweet teenage kid. He will be missed by anyone who met him.

Bülent Yener
Rensselaer Polytechnic Institute

I met Danny in early 90s when he joined the CS Department as a PhD Student. Although I was not officially Zvi's student, all my friends were his students including Danny. It felt like a big family and Danny was the youngest member. He carried himself tall, marching to his own drummer but always gently and always with a big heart.

Danny inspired me. Many years passed after graduating from Columbia that we were not in close contact; but about a year ago we started to message each other again. We were hoping to get together in NYC in December.... Danny will be always in our memories.

Xiangdong Yu
Independent Financial Engineering Consultant

In a sense Danny had finished the thesis before even entering the graduate program. Although I did not work in his area, in a couple of occasions, I got opportunities to get clarification from him on the settings and significance of his and others' results, such as exact vs approximate string matching, fixed vs general alphabet, preprocessing vs none, and so on.

Danny is also a guru in computer programming. Every programmer knows basic operators and control statements, but a guru knows the peculiarities of specific data types, system conventions, and special coding patterns. This was especially true before IT becomes a hot career, and before tech doc and forums are widely available on the web. A considerable amount of deep diving must have happened to figure out those oddities. One day, Danny passed by my office, without even talking to me, (probably he had a quick peek at my screen), he immediately pointed out that I must have been struggling in a coding project. "How do you know?" I was naturally puzzled coz I did not tell anybody that the code did not work even after I spent hours on it. "Doesn't matter how, just try unsigned int". I followed his hint to add "unsigned" before "int" in a line, and was amazed to see that simple trick did the magic! I would not have any clue to think that way due to limited knowledge and documents about it. Latter Danny told me this was not the first time he rescued people in coding, similar things happened when he was in Israel.

As a theory guy, I was new to the computer system in the department. Danny helped me to learn the system configurations and shell scripting. Latter, he was quite happy to see that I was able to create a couple of logon utilities with shell scripting to remind of things to do etc, and offered suggestions for improvement.

Danny came to Columbia in the same year as I did. He is a lovely boy, quite tall, with clear eyes and soft voice. From a fairly closed China at that time, I needed to learn many new stuff in life when coming to America. Danny helped me to get through this phase. For example, he told me the difference between rotary and touch tone phone plans, and whether it's worth it to pay a monthly surcharge for the tone dialing. He cautioned me to be careful in price when buying a phone set in NYC. With his advice, I was able to buy a phone for \$25 when the listed price was \$45. He congratulated me for saving almost half. (After being in NYC longer, I realized prices in the Fifth Ave are routinely exaggerated).

In a conversation in school Danny told me he was once seriously sick before coming to Columbia. I did not expect the health issues would bother him for his

life, yet he could still stay so productive. It is such a sad fact that such a nice smart young man just left so early.

Moti Yung

Snapchat

I met Danny when he started his PhD at Columbia. I was already a visitor and an adjunct prof. there, but was still part of Zvi Galil's group. The first impression was that he is very smart, very quick, and knows what he is doing. Then, I heard many good things about him from my Tel Aviv University connections. Besides being smart, he had a great sense of humor, affinity to other cultures and languages (besides the languages we shared), and a good sense of being friendly and social. Since then, for about three decades I was lucky to continue be his friend.

I always enjoyed technical discussions with him about his findings and about his deep understanding of algorithms on strings. Also, he was always doing things faster than others, so his research results during his PhD studies came very fast (and were published in top conferences). He was a very impressive algorithms researcher.

Then, when he worked in industry, I followed his success and in discussions about his work I realized (without him explicitly telling me what he does) that he is very good in systems understanding, and is able to design and deploy systems after understanding the problem in depth, analyzing what are the resources needed, and then deliver. Being a young brilliant performer in industry is great and Danny was over achiever in this work. However, being a strong achiever in an environment like in some industries also offend the less smart people around, and from the stories I understood that he was also affected by the latter! (I did not expect Danny to go by the "office politics" and understood what was going on). But, what I understood is his great talent to analyze, design, and deliver practical systems of high complexity that industry needs.

Then for a while he came back to research, and of course got some new results and ideas, but he was, by then, a big off the community, and has a publication gap in his resume, so it is hard to get a job in academia in such situation. Though, I am quite sure he could have become a great researcher in academia, had someone looked beyond the resume and given him a job (he did a post-doc like job, and was happy about it).

As we kept relationships over the years he visited me at Google NY before joining Google, and finally Google was lucky to have him in California. I knew due to the above, that he would be a very strong performer at Google (combining algorithmic knowledge, systems deep understanding, problem solving skills, and programming at the level of Danny is really rare!).

He joined Google California, and we met during my visits to the west coast

numerous times, and I had a chance to follow exactly what he did. I can only say that his achievements were truly exceptional and he achieved in his main project results that were much much better than other uses of the same technology: in fact his achievements were strongly highlighted within the organization he worked at. Even in a strong environment like Google with many top people, he managed to get unique achievements; since he had no patience to "office issues" he had his personal observations about things that he did not like (being an idealist in a real-world environment is an issue!). For sure, he was appreciated, but, for sure, he was also perhaps perceived as a threat or at least as unconventional!

Over the years, I knew Danny has health problems that bother him. In fact, I was always amazed how he managed to be so friendly and socially involved, in spite of his difficulties. Unfortunately, he left work while at Google on disability as the illness became more serious. The insurance company was not able to assess his situation well, and, according to Danny, they did not trust that he is seriously ill (which created some problem, especially that the bureaucracy involved was bothering him). I was already outside Google, but we kept in contact; I was trying to advice him what can be done in a relatively tough situation. Also over time, he was open that his situation is getting worse, while he was trying to keep his hopes to recover and possibly live in Japan for a while.

We were talking by phone, Skype, and so on, and then in December I went on vacation, and heard the very sad news about Danny's passing by email while in the Far East. In spite of him reporting on his health getting worse, this mail was a big shock for me!

I will always remember him as a friend, as a brilliant smart scientist, a very strong and resourceful industry research and development guy, a true achiever with no patience to nonsense! Also, as someone who besides professional qualities of the first rate, was also a very sensitive, kind, pleasant and friendly guy with unique sense of humor! I will miss him and I am sure everyone who knew him will miss him as well.

My deepest condolences to his family!

Condolences

I am shocked and so saddened.

Rosemary Addarich

It is indeed a deep blow. Danny was a gentle soul.

Amihood Amir

Sorry to hear the sad news on Danny.

David A. Bader

This is really sad. I had the luck to see him a few months ago, where he told me his struggle with his disease, how the health insurance company stalked him and how Google did not help at all. Although clearly he was not completely well, he was trying to be happy and I am really sorry that a brilliant colleague ends this way and so soon.

Ricardo Baeza-Yates

Dear Zvi, thank you for sharing this news. We are so sorry to hear the sad news about Danny. He was a great person and great friend. Danny will be thoroughly missed.

Ashutosh Dutta

I saw him in the hospital on Thursday of last week. We spoke for about an hour. He was pragmatic about his condition, but optimistic about his chances (and delighted that his "Obamacare" paid for a top-flight hospital like UCSF). He was weakened, but still quite clearly Danny as I knew him. Very sad he didn't make it.

Matt Franklin

Very very sad.

Raffaele Giancarlo

Sadness in my deep heart for our friend, I am confused and shocked.

Roberto Grossi

Very sad. I was a great friend of Alberto and myself.

Concettina Guerra

Terrible news. I personally will miss him dearly in future meetings. My heart goes out to his family.

Danny Hermelin

This is so sad, zvi! Very very sorry.

Julia Hirschberg

So young. So sorry. That's like losing family.

Ayanna Howard

Really shocking.

Giuseppe F. Italiano

So sorry, Zvi. Especially, one of your children.

Alan Katz

Oi vavoi. He's always been so young. Very sad.

Klara Kedem

Dear Friends,

A note from Iris, Danny Breslauer's sister:

It is with great sadness that I inform you of the passing of my beloved brother Danny Breslauer. Danny passed away this morning, Tuesday Dec 19th, at UCSF medical center after a short illness. In recent years he found joy in Yoga, studying Japanese and taking long walks. Danny was a gifted scholar and a brilliant

researcher. He was an incredibly caring person, a wonderful uncle and a loyal friend. But more than all these, he was my brother. I loved him dearly and will miss him always. Danny's funeral will be held on Monday, December 25, at Holon Cemetery, Israel, departing from the main gate at 11am.

VERY SAD.

Gadi

Gad M. Landau

Sorry to hear.

Richard Lipton

Unfortunately I heard the news. He was a wonderful person and a great colleague.

Fabrizio Luccio

I was contacted about this about an hour ago from Pino Italiano. Most sad and shocking. He was very-very young and a great person.

Milena Mihail

Very sad. Several months ago he talked to me over Skype about the possibility of staying in Japan (he said for a health reason) and we talked about several Japanese stringologists to contact.

Kunsoo Park

I am sorry to hear about Danny. So much of my earlier research intertwined with his and I have been citing his papers countless number of times.

Teresa Przytycka

My condolences. I've heard you speak fondly of Danny several times – I even think I saw a submission by both of you early on in your GT days. Very sad to hear the news.

Dana Randall

This is indeed very sad news for us all in the CPM community. Danny, Rest In Peace.

Cenk Sahinalp

I had spoke with him on Monday and planned to see him this week. I am traveling in Europe. I am in a state of shock.

Cosimo Spera

That is horrible....so sad. I cannot believe it. So young...so talented. I am so sad for you and of course Danny's family.

Salvatore Stolfo

This is very, very sad news. I still have a vivid recollection of his talk in Asilomar (?) CPM he was brilliantly presenting open-air, on the lawn. And recently, we made a weak attempt to work together but the conjecture was too difficult for us that time. Too soon, so sad.

Esko Ukkonen



Figure 10: Danny in Venice on 24 June 2016, during Alberto's memorial seminar.

I just heard the terrible news about Danny. I did not know he was ill and I'm so sorry to hear this. I remember him as being a real sweetheart. My condolences.

Renate Valencia

I'm very sorry Zvika. My condolences to us all.

Bülent Yener

Danny went to Columbia the same year as I, and helped me a lot in various items. I feel so sad.

Xiangdong Yu

I knew from talking to him that he is quite sick, but this is shocking.

Moti Yung

I'm sorry for your loss, Zvi. I've had several friends pass away around age 50, and it is shocking and profoundly sad.

Ellen Zegura