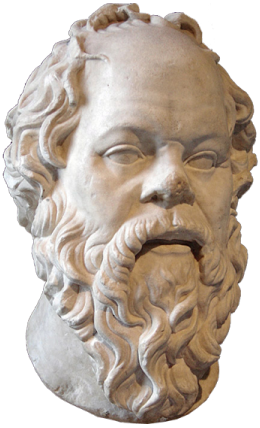
The DPhil Grind



Vitaly Kurin
https://twitter.com/y0b1byte

draft, compiled at August 17, 2025

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Prologue

My journey towards a PhD started back in 2015 when I met Ilya Kostrikov[1] in Aachen during my Master's. He said something like: "Want to do cool stuff? You need to do a PhD!" This encounter changed my life. I started my Master's to learn how to make autonomous cars thinking that you just need to learn some math and programming for that. I had always been fascinated by science, but it had never occurred to me that I could become a part of it. From that point onwards, autonomous cars were postponed[2], I had to get a PhD first. These three mysterious letters became my obsession. I wanted to do cool stuff, after all!

Around the same time, I stumbled upon 'Ph.D Grind, a Ph.D. student memoir', where Philip Guo, now a professor at UCSD, described his journey towards a PhD[3]. I read that hundred pages in one sitting, and it was breathtaking. Of

[1] https://twitter.com/ikostrikov

[2] Sorry, Elon!

[3] The author shut down his website and the openly available pdf some time ago, but you can easily find the text on the internet.

course, the book was full of cautionary tales, but I was so fascinated by the world of academia that I did not take those seriously. And I still do not know if I should have.

'Ph.D Grind' has one major flaw, though. It is too short, and there are no more books like it. However, as Philip Guo said, his book is only a single data point. It is time for me to add one more. Welcome 'DPhil[4] Grind, a DPhil student memoir'!

They say that every DPhil is different. What is so special about mine? And, as a result, what is so special about this book? There are, actually, quite a few things!

- Similarly to the author of 'Ph.D. Grind', I did my DPhil in Computer Science. However, my specialisation is different. I work in machine learning, a rapidly expanding compute-hungry field with hundreds of papers making your research obsolete on a daily basis.

- As a consequence of the above, I interned in four big tech companies[5] during my DPhil, getting experience doing research in industrial labs.

- I did my first undergraduate degree in Economics, which is a bit non-standard for a DPhil in Computer Science.

- I did my DPhil at the University of Oxford, a stunningly

[4]DPhil is a fancy name for the PhD used by the University of Oxford. I will use it instead of a less fancy PhD from now on.

[5]NVIDIA, Facebook AI Research, Microsoft Research, and Google DeepMind.

beautiful town full of traditions. This is a power place for science and as magical as Hogwarts.

- I kept a diary of my experience, writing in it **every day** throughout the four years of my DPhil.

- I am a proud parent of an eight-year old[6], and while my amazing wife did everything possible to make it easier for me, parenting affected my DPhil experience a lot, making it harder and easier at the same time.

- I did my DPhil in 2018-2022, a turbulent time that includes Brexit, the pandemic[7], the death of the Queen, and a full-blown war in the heart of Europe with my country being the aggressor.

- At the beginning of my DPhil, fascinated by the whole new world of science, I really wanted to stay in academia. However, after my rose-coloured glasses were gone, I changed my mind along the way (again) and decided to join the industry.

- The less unique thing about my experience is that I struggled a lot and was on the brink of quitting multiple times. I personally know several people who quit. I

[6]This book was written in 2022.

[7]If you read these pages in the far future, and there has been multiple pandemics since then, I mean the COVID pandemic started in 2020.

want to use this book to increase the awareness of mental health issues among postgraduate students, helping others[8] better understand the students' state of mind.

If, after reading all the above, you still want to keep going, I have a word of warning for you. As a proper old man, I cannot resist the temptation to give highly opinionated advice throughout this book. Remember, this is your DPhil, this is your life. Take all the advice with a grain of salt! Use this book at your own risk!

[8] Parents, friends, professors, university administration, etc.

Pre-Historic Times

In this chapter, I will recount the significant life events that ultimately led me to starting and, also, to successfully finishing my DPhil.

At age five, I started digging a hole in our backyard to get to the Earth's inner core, an early display of my inclination to embark on substantial endeavours without much planning. This is known nowadays as Facebook's motto: 'Move fast and break things', and is a good match with computers that make the cost of an error negligible[1] and feedback immediate[2]. As for the hole, my grandmother told me off for such a mess in the garden and forbade doing anything similarly crazy in the future. Later I found out that someone made more progress on that front with the Kola Superdeep Borehole.

Several years later, another significant encounter with science unfolded when I stumbled upon an article about Fermat's

[1] Unless you are a safety-critical system developer.

[2] Victor Bret has a fantastic talk on the importance of immediate feedback.

Last Theorem in a Soviet math encyclopedia. Determined to solve this problem as I grew older, little did I realize that the theorem had already been proven, and the book I was reading had been written in the 1980s, predating Andrew Wiles' groundbreaking discovery.

My fascination with computers ignited at the age of 11 when my parents promised to purchase one for me if I successfully completed fifth grade with top grades in all subjects. Before this, I had a brief introduction to Quake II during a visit to my mom's office. Coupled with the release of 'The Matrix' in 1999, it was enough motivation for my mediocre grades to jump to straight fives[3] for all subjects.

In anticipation of the day my parents would fulfil their promise, I dedicated myself wholeheartedly. I sought advice from a classmate who owned a PC, meticulously sketching software interfaces in my notepad to prepare for the moment when I would finally have my own computer. Day D finally arrived, and I spent the whole summer of 2002 playing video games.

In 2006, a friend of mine installed Ubuntu on his machine, and I got curious[4]. Trying to impress him with my skills, I found a FreeBSD image and accidentally destroyed all my files. Nobody does backups without losing their data first, right? The sad thing is that I didn't even succeed in installing FreeBSD that day. I surrendered and asked my friend to help

[3] Russian schools have a five-point grading system with five being the highest.

[4] This was a golden era when you could get a disc with the OS image and stickers to your physical post box.

me with Ubuntu the next day. This was the beginning of an amazing journey that bolstered my interest in computers and led me to Arch Linux[5] I am currently writing these lines on.

Nevertheless, when it was time to choose the profession, assertive parents and booming capitalism in Russia in the 1990s somewhat convinced me that I wanted to become an economist. This is how I ended up in the Moscow State Institute of International Relations, a renowned institution known for educating the offspring of Russian statesmen. Luckily for me, I was part of an experimental group studying mathematical modelling for economics, and this group consisted of nerds, gamers and other weirdos that made my undergrad time truly exceptional. The main two things I achieved during my undergrad were getting to learn English[6], and meeting my future wife[7].

I think I was the only person at the university who was using a Linux machine as a daily driver, but I did not think of any possible career related to tech or science. My dream, similar to the ones of my peers, was to get to BCG or McKinsey and become a management consultant. I was not that cool to get to BCG or McKinsey, but I landed an internship at Ernst&Young (EY) at the end of my last year, having a blast

[5] I use Arch Linux, btw.

[6] The university provided amazing possibilities for learning languages. There were two compulsory ones (English and French for me), and you could take as many extras as you want (I studied Chinese).

[7] She randomly sat next to me on the first day, and it was the love at first sight (for me). It took me another year+ to get her interested in me.

at the interviews, when one of the interviewers asked exactly the same question as the previous one. I seized the opportunity and provided a stellar response, ultimately nailing the interview and paving the way for my future career.

I spent the next half a year drawing slides 24/7 and having some kind of existential crisis at the end of my undergrad having no idea about what I wanted to do next. I tried to think of what I liked, and it was math and computers. I decided to do another undergrad to have a more holistic picture of mathematics and went to the Moscow State University to study at the Department of Computational Mathematics and Cybernetics. When I was applying, they told me that they hadn't seen anyone from the Moscow Institute of International Relations before, I thought I made the right call.

This was a moment of personal growth for me as well when I decided to do what I wanted, not what my parents wanted me to do. This resulted in a huge quarrel in the family when I went on to live with my friends and had almost zero contact with my family. But let's not get ahead of ourselves.

My second undergrad time was amazing. I did not care about my grades as much as I did during the first. I was just learning whatever I liked and was discovering an amazing new world for myself. I was not super interested in programming during the first half a year until I learnt that you can pass arguments by value and by reference in Pascal[8]. This was when I got hooked on programming and got determined to find a job as a software engineer.

[8]This sounds a bit quirky, but I remember being amazed by how well everything was thought through.

I remember my first coding interview really well when I was asked to remove the content of an HTML page within `<li>` tags, and I wrote a solution in Pascal, the only language I knew. The interviewer was puzzled but promised to hire me if I came home and rewrote the interview problem solutions in Python. I never went back to that guy, but asked my friend who had a web studio, if they needed any programmers ready to work almost for free while studying and getting more experience in the exchange. Luckily for me[9], he said yes, and this is how I got my first programming job.

My first year, as a software engineer was super intense. I was coding during the day, and studied during the night trying the stuff I learned overnight the next day on the real project. Unfortunately for my health and personal relationships, I pulled a lot of all-nighters and often had other gigs on the side writing Android apps as a freelancer. The pinnacle of my software engineering career was leading a project where we rewrote an old warehouse management system written in FoxPro making it a nice modern web app that was easy to extend, fast enough to work without causing rage in the users, and doing some linear programming under the hood to do allocations. This was challenging, fun, and one of the first experiences that made me appreciate pragmatism: making something work is all that matters. No matter how ingenious your idea seems on paper, the problem is not solved, until you've tried your solution and checked that it works. Also, these couple of years made me appreciate fast iteration on problems that matter.

[9]Thanks Kostya!

Year 2014 was a special year for me and my wife, that summer, our son was born. It was scary, exciting, and exhausting at the same time. I grew up without a father, and I had to learn how to be a good one, no pressure. At the same time, my relationship with my parents recuperated, which was really nice.

At some point in 2014, I realised that in my daily job, I was not using much of the math I had learnt, and loved so much. I decided, that working on autonomous driving would involve some math, and would be interesting and useful at the same time. I applied to some universities in Germany[10], and got accepted to the University of Saarland and RWTH Aachen which had a mutual program with the University of Bonn[11].

I selected RTWH Aachen because I thought that their Computer Vision lab led by Bastian Leibe was the closest I could get to autonomous cars. We moved to Germany with three suitcases, and our new life began.

I had a month before the start of my studies to do all the admin and acclimatize. I decided to get a job in Leibe's lab. Germany has an amazing practice of HiWi, student assistants that get attached to a PhD students and help them out even before doing a master's project with them. I emailed Lucas Beyer, and he invited me to come over.

I don't already remember what we chatted about, but he gave me some version of FizzBuzz and got interested in my

[10] Germany sounded cool since education is almost free there, and it would be nice to live in a different country for a while.

[11] The first year was mostly in Bonn, and we were supposed to move to Aachen in the second year.

x230 laptop that had Arch installed. That won him over, he was an avid Arch user and also used a tiling window manager I was a fan of. I got the job, a machine with a GPU, and a place in the lab. I was hyped!

Surprisingly for me, my master's program allowed students to choose their own curriculum, which was not the case at all for my undergrad. There were some compulsory courses during the first year, but I didn't pay too much attention to them, because I wanted to focus on machine learning. The only non-machine learning course I remember well is 'High-Performance Matrix Computations' taught by Paolo Bientinesi[12]. The lectures were captivating, I loved the topic, and I absolutely loved the book by Golub and Van Loan[13]

Let's get back to machine learning. In my first *Advanced Machine Learning* lecture, I found out, that there was a Deep Learning revolution going on, and people doing classical machine learning were being pissed by a bunch of researchers stacking more and more layers on a weekly basis. I thought it was cool enough for me.

I never thought of this at the time, but there have always been people around me who significantly affected my life trajectory. In Aachen, there were two of them: Ilya Kostrikov and Lucas Beyer, and it was Lucas who introduced me to Ilya. We first met at GCPR 2015 which was conveniently located in RWTH, so, I just had to walk from my lab to another building to attend. I clearly remember that I understood almost noth-

[12] https://yobibyte.github.io/cholesky.html

[13] https://www.google.co.uk/books/edition/Matrix_Computations/ml0a7wPX6OYC?hl=en&gbpv=0.

ing at the talks, and was amazed by people nodding around me, which added to my already strong impostor syndrome.

When I met Ilya at the poster session, having enough common cultural context allowed us to start talking about important stuff straight away: 'What is your plan? What do you want to do in life?' And, as I mentioned in the Prologue, he said: 'Want to do cool stuff? You need to do a PhD'. My life was turned around one more time, and now I had a clear goal in mind: get to a good PhD program.

This made things much harder for me. One of my idiosyncrasies is that I don't usually like following the predefined curriculum. Instead of following recommended literature with DFS, I do BFS with some random combination of books, YouTube videos and Wikipedia abyss. This makes me a better generalist[14], but often I miss some important bits that people consider a must-know. Getting good grades for the Master's required following the curriculum, and I felt like a part of me died, but the final goal was more important to me than being authentic or something like that[15].

Ilya became something like an informal mentor to me: he helped me to grasp some machine learning concepts, sent me papers, gave me advice on how to implement stuff and get more visibility on GitHub, constantly nagged me that I should apply and get a Google internship that would boost my career. All of it was extremely helpful for me, and now I realise how

[14] People who worked with me might have a different opinion here, but come on, this is my book, I'll do what I want.

[15] Big mistake.

lucky I was[16].

The first question I got when I came to work in the lab was 'What is your favourite beer?'. I wasn't quite sure what exactly was happening, but it was nine in the morning, and I was not used to drinking that early[17]. It turned out that every computer in the lab was named after their user's favourite beer and they were making an account for me. I liked that a lot. I also enjoyed having access to a machine with a GPU, though I had never trained a neural network on a GPU before.

My first project was to refactor Lucas's code that was doing head orientation prediction[18] so that it runs on ROS, the Robot Operating System. I had to learn quite a lot of stuff, ROS was quite a shocker, and I don't really want to write about it, but Theano was something even more shockier. I thought people were pulling my leg by saying that I couldn't just simply print out the variable values in Theano. As print statements was my favourite debugging strategy at the time, my productivity decreased by a hundred-fold. But I liked tinkering, and having access to Lucas was amazing as he knew a lot of stuff I didn't.

Another task of mine was to do data labelling, which I hated a lot.[19] There were two things I understood back then. First,

[16] I warned you that I'll give some advice along the way. Here you go. Find someone more experienced and learn from them. It should not necessarily be an official mentor-mentee relationship. Just ask people questions and don't be afraid to look stupid or something.

[17] For completeness, my favourite beer is Kriek.

[18] https://github.com/lucasb-eyer/BiternionNet

[19] To Lucas' credit, he didn't make me do all the data labeling. He

data labelling is hard, and you have to invest your money or time into it to ensure the success of your learning pipeline. It is tedious and time-consuming, and you have to visualise every step of your pipeline to make sure that nothing went wrong along the way, and that your models get what you expect them to. Second, to make the previous one possible, you need to build a convenient infrastructure and use the best tools for the job. Even a simple image viewer program can make a difference[20]. I think this experience taught me important lessons that affect my everyday decisions at work even now.

Apart from the actual skills I developed when working with Lucas, I also got a glimpse of the lives of the lab's PhD students. On the one hand, there was this amazing atmosphere of collaboration, people having fun and enjoying solving interesting challenges. There was an fabulous expectation of incoming changes with Deep Learning eating the computer vision field step by step. However, I could sense some people were stressed, or even depressed, sometimes, they looked desperate crushed by negative reviews or by being stuck for a long period of time. This was also when I read the 'PhD Grind' by Philip Guo which also described how hard a graduate student's life can be. Surprisingly in retrospect, I didn't think of this seriously enough, and none of these sad experiences actually affected my decision to become a graduate student myself.

* * *

equally split it between us two, and I appreciated this a lot.

[20] I will be forever grateful to the creators of Geeqie.

It's not every day that you read a scientific paper and it changes the course of your whole life. The Arxiv version of the DQN paper[21] was one of these rare cases for me.[22] And, of course, it was Ilya who sent me that paper.

This paper had everything: video games, source code that you could download and play with[23], it was easy to understand on a high level and the product was visual. I loved every bit of it.

Ilya trained a Pong agent on the Uni machine, and it looked like magic[24]. It was pretty clear what I was going to work on for my master's thesis.

I came up with the idea of cold-emailing other professors and industry researchers trying to find collaborators outside of my lab. I didn't think of that back then, but I now believe this was a genius idea. Nobody constrains you to work with your Uni professors only, getting out there will expose you to different problems, ideas, and other working styles, and will increase your network. And you might have some fun along the way as well! Most of my emails were not being replied to, but there was one that came back from Sebastian Nowozin, another hero of this book who altered my life trajectory.

Sebastian was at MSR, Cambridge back then, and his website said that he was looking for student collaborators in academia. He probably meant 'PhD student collaborators', but I decided

[21] https://arxiv.org/abs/1312.5602

[22] There is another one like that, but you'll need to read further couple of chapters to learn which paper was that.

[23] Lua was pretty terrible though.

[24] Though it was a rather slow magic.

to ignore this thought and shot him an email. I couldn't find the exact email, but it was something along the lines: *I'm Vitaly. I'm planning to do a PhD in a year, and, to prepare for that, I'd like to do a master's thesis in RL. I have been using Linux for 10 years, and I can code in Python or Java. Could you, please, be my co-supervisor?* To my great surprise and delight, Sebastian replied the next morning (which was mind-blowing given that I sent an email about 2am at night[25]). We had a couple of meetings and devised a plan: I write a website with an Atari emulator[26], collect human trajectories for five games and do imitation learning on top. GAIL paper appeared at that time (https://arxiv.org/abs/1606.03476), and imitation learning was on the rise. Imitation learning look exciting to me and made a lot of sense given my experience with training a Pong agent for a week.

What was even more exciting, according to the plan, I was supposed to spend three months at MSR, Cambridge as a visitor, working on the second part of the project: training models on the collected data. Cambridge had been the place of my dreams after I spent two weeks there back in 2010. Every history of science book I read mentioned it at some point, and it was a place of power for me from this perspective as well[27].

[25] Maybe this was partially because my email got on top of the list? People use this to hack Arxiv submission timings.

[26] No, I didn't write an emulator. There was a good emulator written in JS already, I had to do the scaffolding and attract people on the website to get the data. I had a plan B as well: if nobody wants to play, I'll just spend a week of gaming and get all the data I need.

[27] Now after I've graduated from the other place, I realised that

So, when I got a document from MSR inviting me to come over and spend three months, I felt like Harry Potter who got a letter from Hogwarts.

It was time to get my hands dirty and do some web development. It doesn't sound too sexy, but I love programming, and it was a well-scoped project that I could finish within a reasonable amount of time: it was perfect! Getting users to play on the website was the hardest bit. I had some experience of guerilla marketing from my undergrad, but it was still hard when you are nobody and your social media presence is non-existent. 'Play for science' was a nice perk though, and I had a lot of friends ready to do that[28].

I also had some fun maintaining the server the whole thing was running on. I remember ssh'ing from my phone trying to revive the server while taking a sleeping car to my grandma's house. It was quite stressful since it coincided with me posting stuff on Reddit and I was stressing about losing some super important trajectories[29].

* * *

I am standing at King's Cross and my taxi driver is cramming my son's pram into a front seat on the left. I ask him,

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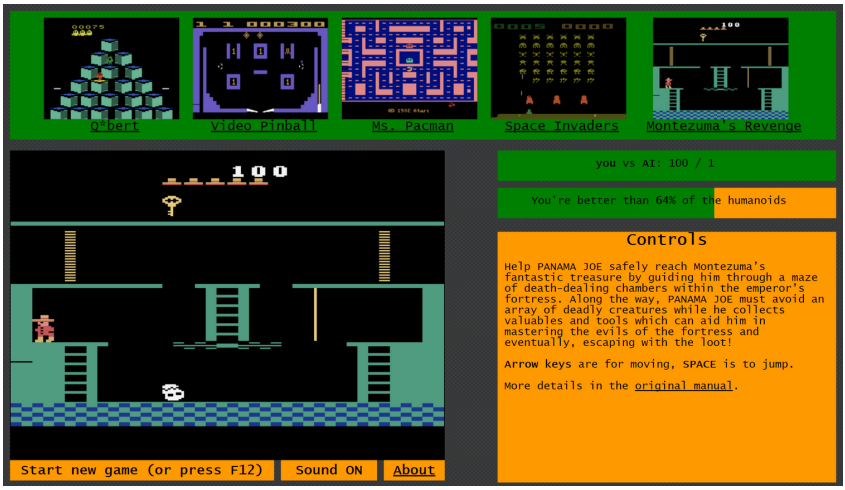
Cambridge is not that cool. JK, Cambridge is amazing.

[28] Huge thanks to Valentin Belonogov who kept beating his Montezuma's Revenge top score and was almost a sole contributor to later stages of that game.

[29] As usual, the importance of the events appears to be higher when you are at that moment. I should have probably stressed less and having more fun, but I couldn't back then.



Interface of my human trajectories collection website.

where is he gonna sit now. He looks at me as if I am crazy, as, obviously, drivers sit on the right here. My UK experience begins.

For the first several days I feel great. MSR has a beautiful office with a grand piano in the main hall, someone is playing Chopin's Ballade No.1 in G minor. This becomes my soundtrack for the next three months. People around are extremely friendly and ready to help. I can speak to anyone and lunch conversations are amazingly absorbing.

But in a couple of days, there comes a problem. My old friend, impostor syndrome, smashes me really hard. Every time someone calls me an expert in Reinforcement Learning asking for advice, I am having a hard time and feeling I am a crook. My ideas do not work out and nothing really works that

well, I am under constant stress. This makes me stay at the office late, sometimes returning home after 10pm. Obviously, this does not lead to any creative breakthrough, and I'm in panic mode. Even now, when I write these lines, my heartbeat goes up and I feel uneasy. I was having a hard time there, mostly because of too high expectations of myself there, which didn't do me any good.

Though it was harsh, there were lots of good moments and opportunities there[30]. I could speak to people whose papers I read before. I made several good friends there and spoke to the interns who were doing their PhDs at the time in research labs across the world. I was learning how to do research in an amazing environment, and failing was a part of it.

Finally, all my conversation with Sebastian was like speaking to a prophet who knows stuff other people don't. Some people are super smart, and some people are the next level after that. Sebastian is one of these people. Every time we met, he said something that blew my mind. Apart from knowing what was happening in the community, Sebastian knew very well what was happening in the industry, he thought a lot about the future of the field, and where everything was going, and I loved it a lot.

* * *

By the end of my time at MSR, I found a job ad on the RL mailing list[31]. The job ad was from a new Oxford startup

[30] I now have Bishop's textbook signed by Chris Bishop.

[31] I feel like a real boomer now. Yes I useed DL and RL mailing lists extensively back in 2017/2018.

called Morpheus Labs which was looking for people doing RL and imitation learning. It was an amazing fit for me! The coolest story about the process there is that I missed my first interview because Google Calendar had messed up the time zone, and I really wanted to get ice cream before the interview. I hardly remember being so angry at myself that much before that. Luckily, they were nice to me and my interview got rescheduled.

At that time, I was also not sure what to do after my Masters. PhD and all the science stuff I wrote above sounded nice, but having an offer with real money sounded too good to refuse. However, I was still on the fence and decided to try getting an offer at the Max Planck Institute in Tuebingen. The process itself was amazing. The organisers made it look like a workshop which was colocated with the MLSS that year. We all listened to each others' research talks, made a lot of new friends, had access to professors during lunch breaks, and had our hotels paid for. It was the best University interview experience I had ever had.

However, I was still not sure what to do. I liked Tuebingen a lot, I liked many people who were doing their PhDs there, and I liked the professors I spoke to[32]. At the same time, living in Oxford for a year sounded really attractive, getting a salary was attractive too, and the stuff I could do in a startup was also something I wanted to do. I decided to give it a shot and move to Oxford for a year and start my PhD after that, at least I thought I would.

[32]Georg Martius is one of the smartest and nicest person I spoke to there.

It was time to hand in my thesis and move to the UK. This was a hectic period full of admin stuff, looking for a flat in Oxford (which is a huge quest on its own), moving a lot of stuff, and visiting MLSS in Madrid in the meantime.

It was the end of September 2017, I was sitting on a pile of stuff in my new flat, looking at raindrops on the window pane. I was totally oblivious to what would happen to me, but I loved my new place. I don't know why I liked it, still really don't know why I like it, but that's the way it works in the UK.

* * *

The end of 2017, and the first half of 2018 were my Oxford honeymoon. I made some friends, the city was incredibly beautiful, and had an aura of scientific history that made me feel great. Living there was also an incredible opportunity to have access to talks and reading groups happening around.[33]

For me, it was also a great time, because my impostor syndrome went away a bit. I did not make any scientific breakthroughs during my time at Morpheus Labs, but it was daily little things that changed my attitude towards myself. People asked me questions I knew the answers to, my Linux experience was immensely useful, and I felt amazing. I felt much better than during my Masters, when the progress was hard to measure, and, the scope was more vague.

[33] It would be much easier with a University card to get access to those, but tailgaiting and friends with access cards was good enough!

Morpheus Labs also gave me incredible startup experience. I think, when I joined the team, there were about five people in there. There was no bureaucracy, all the tech decisions were made really fast, and there was a lot of agency in there. This was fabulous!

I also made good friends in Oxford. Kiko and Joao became 'life trajectory changing' people I mentioned at the beginning of this chapter. I learnt a lot from them on the technical side, and we had fun working together, but, what is more important to me, we became more than colleagues. Looking back, I have been to a bunch of organisations where people just work together, and I did not have a great time there. Morpheus Labs was different, I found support there, and music jamming sessions with Kiko were incredibly valuable to me.

Several months after I had started working at Morpheus Labs[34], I remembered that I still wanted to a PhD, and being in proximity to one of the best universities in the world, I applied to Oxford. To be honest, at first, I applied mostly for a laugh. My impostor syndrome returned, and I did not really believe that with my background, I could get in.

Luckily I was wrong! The letter from Hogwarts arrived in due time, and I was incredibly happy for a bit until I realised that I got the place, but did not get any funding. And this was a lot of money, especially when you live without a salary. There comes the last 'life trajectory changing' person, Wendy, my future DPhil program administrator, who got me the UK level funding and a bursary, which was hugely helpful in my

[34]It was later renamed to Latent Logic, and bought by Waymo afterwards, but I'll stick to the original name.

situation[35]. Of course, it wasn't an ideal scenario, but for me, it looked like a once-in-a-lifetime opportunity that I should take with no questions asked[36]. At that time, to be honest, my plan wasn't that well thought-through, the idea was to get more funding while I get in the University[37], do as many internships as possible[38], and get help from my parents, and personal savings[39].

* * *

Before we move to the outro section of this chapter, I would like to write a couple of paragraphs about a tool that not only sparked my interest in computers but has been propelling my studies and developer experience throughout my whole career: Linux[40]. If you could take one piece of advice from this book, let it be this one: 'Linux is an amazing tool, give it a shot!'

Apart from being more productive when working under Linux[41],

[35] In the UK, there are different tuition fee levels for UK/EU citisens and the others, overseas students. If you are an oversea student, you have to pay three times as much for your tuition.

[36] In retrospect, it is not so obvious if I made the correct decision, but it is hard to know what would have happened otherwise. No complaints here.

[37] Bad idea.

[38] Worked out well for me.

[39] I didn't know that at the time, but my Morpheus Labs option grant would help me a lot really soon.

[40] I'm pretty much on board with GNU/Linux terminology, and I have utmost respect for RMS, but I will use Linux in the text for simplicity.

[41] If you ask me how I connect to an external projector, you are not my friend anymore.

I simply enjoy using it. Every time I'm trying to switch to a MacBook to get a nice screen, long battery life or not being scared of connecting to an external projector, I miss it and get back to Arch with my next laptop. Why do I love it so much? There are many answers to this question. Partly, it is because I have a feeling of being in control of my own machine. It is also somewhat similar to showing a middle finger to organisations who impose control over you buying some of your freedoms with convenience and network effect. I am not ready to fully jump on the free software train, but I am doing my best.

Another reason is the feeling of being involved in a long journey where a whole bunch of amazing people have built tools making them open, free and fun to use. It is like keeping 'Experience' by Prodigy on repeat and being inside of the 'Hackers' movie[42]. This feeling of understanding something really deeply, building stuff based on this understanding, and having fun along the way are what computers are usually associated with for me, and Linux boosts this feeling 100x.

I am usually very nosy about the way other people work, and which tools they use. If you are one of these people too, to conclude, below, I list the tools I find indispensable in my daily work. I am a 'I use Arch, btw' person. It's the best distro with an amazing community and a great wiki. It is also super minimal, and `pacman` is the best package manager. `i3` is the best window manager I have ever used. It is a tiling window manager that is highly configurable, minimal, has no

[42]Yes, it's cheesy, but I love it.

visual effects junk, and, as a result, is blazingly fast.

`tmux` is a terminal multiplexer of my choice. It allows you to keep programs running on a remote server even when your connection breaks. Also gives you the ability to run multiple terminal emulators within the same ssh connection. It's so good, that I also use it locally.

`vim` is my default text editor. I'm not a vim ninja that knows every key combination and every command, nor I can do some sophisticated refactoring that is easily done via modern IDEs. But with vim, I can use the same interface locally and via ssh without any sophisticated setup, it is fast and I can reduce mouse clicking which I really hate. There are some alternatives, e.g. `emacs`, but they are objectively worse. I recently switched to `neovim` and am very happy about it.

I haven't been using `PyCharm` much recently, but this is the best IDE I have ever used. Huge shoutout to the guys who build it.

`ag-silversearcher` is an amazing tool to search for anything in your code. I also use some other common utils like `ssh`, `grep`, `tree` etc.[43]

[43] To be updated...

Year One: Happiness

It is the end of September, 2018. I am sitting at the Examination school hall excited about what lies ahead of me. My DPhil has officially started. I am a part of the AIMS CDT 2018 cohort, a DPhil program which brings UK DPhils closer to their US counterparts, by including the coursework. One great thing about CDT, is that you start with a cohort of ten-fifteen people, and you can have some potential friends for your DPhil and after. It is not only your labmates you can hang out with. For us it means fourteen one-week courses, and two research mini-projects at any lab at the Computer Science of Engineering Science department before you decide on which lab to join. It makes it total four years instead of default three-year research programs, and, what is more crucial for me, thanks to AIMS program administrator Wendy, I got funding there. I received the default Computer Science department offer as well, but I did not get any funding for that one. The joke is on them!

Compeletely useless, felt like a monkey copy-pasting code/math from the slides/solvers documentation.

I was extremely lucky to have met two great people in my

cohort: Panos and Alessandro. We are a bit running ahead of a train, but I think I would have quit my DPhil if it is not for these two. Going through all the courses together and having the same existential questions, i.e. what mini-projects to work on, with whom, and which lab to join, is a tremendous bonding experience, and gives you a lot of material to complain to each other when having lunch.

Everything is a complete chaos.

Before I move on, I should say a couple of words about Wendy. She was absolutely fantastic and helped us in everything, I have never had such an amazing support from university administration before. She fought for our funding, booked us tickets, did everything she could so that we could focus on our studies and research. She is also an amazingly fun person to spend your time with. I am absolutely certain, that without Wendy, AIMS CDT would have been much less successful. If you ever apply to AIMS, speak to her before!

October 1st, 2018 marks the first entry to my DPhil diary, which I kept until the very last date of my DPhil, when I submitted my thesis. I got this idea after reading the PhD Grind, and planned this very book from the very beginning, and it was hard work! There were days, especially closer to the end of my DPhil, when I hated that diary and could barely make myself write something there, but, luckily, I persevered and never skipped a day! It is a living document to the whole thing, and it is so intimate, that I am afraid someone gets their hands on it, because it will be very awkward. Though I think, I will put a couple of quotes from it as margin notes to spice this book up. Bronstein's 'Geometric Deep Learning' and Knuth's 'Concrete Math' have fabulous margin notes, and

Felt like shit again...

I will continue this amazing tradition.

* * *

One peculiar thing about Oxford is that it is a collegial university. When you join as a student, you join the department and also one of thirty-six colleges. Each college has their grounds, usually hidden behind a high and very old wall, a library, a church, and a canteen, usually called a hall. For undegraduate students, college provides tutors helping them learn the subjects they read from the department.

Some of the people like to show their knowledge and asking questions just to show that they know the answer already.

Each college has a junior common room (JCR), a middle common room (MCR), and a senior common room (SCR). This is an actual room (or two) where anyone of your peers (MCR is for grad students) can go and have a coffee, a game of chess or chat about the latest episode of Love Island. This actually sounds pretty cool as you usually hang out with people like you in the department (or most likely only your lab). In the MCR, you can chat to people from all over the university: a doctor, a historian, or a entomologyst who studies the mating behaviour of dung beatles. This is not only just interesting, but widens your horizon by quite a bit, and makes Oxford experience a bit more magical.

I had my complex analysis course, but I've really forgot almost all of it.

Due to a random encounter on a train, I applied for Magdalen College, which is one of the oldest and richest Oxford colleges. It is so rich that it has an actual deer pack wandering inside its walls. It has punts to use at summertime, lots of space to take a stroll, and a great library that works 24/7. It has a magnificent dining hall that serves as a canteen, but

also organises formal dinners where you are expected to wear a gown and pretend as if you are in the Harry Potter movie. Students usually go to each other colledges for those, and often you also have exchange dinners with other colledges to add a bit of variety. I spent a lot of time at my colledge right after the start[1], but eventually the intensity went down due to my family life, worsening mental state, and, eventually, lockdown, and moving to London.

* * *

Let's chat about the courses. Back then, I looked at all the courses as a distraction from research, but now I actually think they are a brilliant thing. Obviously, it is hard to learn anything within a week, especially if you are new to the topic, but if you treat it as a high-level overview of what is out there with access to all the professors, you can benefit a lot from being at a CDT. So, if you are deciding between a traditional DPhil and a CDT one, I highly recommend doing CDT, especially if it is AIMS.

There was no point in digging deeper since nobody cares and I can't spent more time on it.

Obviously, it is impossible to learn anything during a weekly course. It is more like a shopwindow to peek into to understand what is out there. The courses you are familiar with are just for fun, you go there, you speak to the professors and tutors to satisfy your curiousity, and you move on. The courses you are unfamiliar with, are impenetrable, you will have hard time if you want to take them seriously and learn stuff. Control

[1] I am proud to have been an almost unbeatable MCR foosball player.

Theory course was like that for me. A couple of courses were organised like hackathons: you get a team, you get a task and you are supposed to solve it within a week.

Some of the tutorials were fun. One of them was on wireless security, where we had to collect enough packets to crack a WiFi password. I remember doing that during my first year during undergrad, which seemed like doing top-secret CIA shit back then. I also loved the reinforcement learning tutorials as this is where my research interests were, and I understood the material.

Had a seminar on intellectual property in Oxford, time wasted.

Tutorials led by senior DPhil students are another great opportunity to understand what's going on in other labs and meet cool people. I was lucky to meet Henry Kenlay who started at AIMS one year before me, and was working on graph nets with Xiaowen Dong. We first met at Signal Processing course tutorials, when he recognised `yobibyte`'s profile picture, the head of Socrates'. He was super reserved and humble, but he knew a lot, and I learned a lot from him throughout my DPhil. We did not interact much during our first year, but in the next few chapters I will write more about him.

Regardless the course content, the most important thing for me I took away from these courses was getting friends. We often stayed till late with Alessandro and Panos to finish the home assignments with an optional pub after. We got together on the common grounds of ranting. This would countinue throughout our DPhils: we would often meet together for lunches and walks, and infinitely rant about our lives, supervisors, reviewers etc. I highly suggest you find someone to rant with during your PhD. This has an incredible

Famous hackathon prize.

Almost nothing works regarding to the real robot, and this is a good sign for me to stay from the robotics as far as possible.

healing effect on your soul.

One of the best stories from the first year I have is how we won the robotics course hackathon. Given the fact that we spent more than half of the time charging the batteries and fixing some weird connectivity bugs, this is quite an achievement. Later I found out from my friends doing robotics, that fixing your robot most of the time is the norm. In this hackaton, we got a wheeled robot that had to autonomously avoid some obstacles and reach the goal, turn around, and come back to the starting position. Our obstacle detector was shit, and at the last moment, we simply decided to get a penalty for the obstacle by just driving forward, and then reversing instead of rotating the thing. This happily coincided with the fact that the best team's robot got confused by another guy's

The coursework is over! We won in the competition and this felt surprisingly well given how hard we all sucked.

red jumper and started following him. GG. You can see the famous 3D-printed prize on the picture below.

* * *

Another cool thing about AIMS CDT is that there are multiple similar doctoral programs in the UK, and once a year all the students from these programs meet in one of the host university for a couple of days of talks and drinking games. Year 2019 was Edinburg's turn, and it was amazing.

Sadly, I was not aware of Edinburg's rough weather, and decided to go only with a laptop bag, and without much clothes. Onebagging gave me some bragging rights, but, in general, it was a big mistake! Edinburgh in May is freaking cold and wet, and you get even colder, when you are wet and strong wind is blowing at you. Apart from that, it was one of the highlights of the year. Edinburgh is an incredibly beautiful city. It is multilayered as a perceptron: you might be standing on one street, and have another whole street above you.

I gave a tutorial on Graph Nets there, we wandered around the city, got drunk, went to listen to some music, and had haggis. If you have not tried haggis yet, believe me, it tastes much better than it looks.

People work really hard, some of them stay till late. I wonder if they can keep the same pace afterwards.

* * *

Not everything was rainbow and unicorns. Occasionally, when chatting to people, I heard stories about supervisors who dissapeared for a year and did not respond to any of students' emails, about people stealing each other ideas, about people

suffering from depression and some of them quitting. First, you listen to these stories as to something alien, but gradually, you get soaked with the atmosphere of hopelessness. Sometimes, when you speak to third-year DPhil students, you speak to the hollow bodies who have the thousand-yard stare[2], and they want this to be over as soon as possible.

One moment I remember quite well was when we took a lift down after class with our teaching assistant who was a DPhil student in the neighboring lab. No small talk, he told us that he does not want to do his DPhil anymore, that he wants to quit and become a tennis coach or something. This sounded so weird to me back then, but it all makes sense now.

Lost my book on Functional analysis by Kolmogorov.

When you speak to professors about stuff like that, they admit it can be hard but has to be treated as a rite of passage. I do not think people are entirely honest about what is going on in their lives when they speak to professors, and professors have their own problems, they do not usually ask. Naturally, as a consequence, people drink a lot. Pubs, subsidised college bars and wine at college formals help you forget about the next conference deadline, your impostor syndrome and serve a good facilitator of honest conversations with your peers. Few people think that this does actually hurt, messes up your sleep, physical, and as a result, mental health. I definitely drank more than I would like to admit to everyone, including myself.

* * *

The first year of my DPhil was a big hit on my health.

[2] https://en.wikipedia.org/wiki/Thousand-yard_stare

Lack of sleep, physical exercise, stress and alcohol made it harder for me to do research, but it was hard for me to change anything, and I just simply kept going. Later in my first year, I started running, and this helped a lot. I got a Garmin watch and started a 10k program with 3 or 4 runs a week. It felt amazing, and gave me energy.

Sticking to the routine is another great thing. I remember feeling amazing about myself when I went home for a run after a full day of work, took a shower, and got back to the office to finish and send the ICLR draft.

* * *

If you want to stay in academia, prepare for a financial hit.

I do not know if I mentioned, but from the very beginning, my original plan was to stay in academia after I graduate. I liked the general appeal of science, I liked the freedom, I liked the romanticism of it, or, at least, I loved my naive mental model of science I had from reading "Surely You're Joking, Mr. Feynman!" and watching the Big Bang Theory.

In order to get a position, you need to get some teaching experience, and I, actually, love teaching. So, I decided to start from the very beginning, which was, likely, a mistake. One advice for your first year is not to put too much on your plate from the very beginning, when you are still unsure how busy you will be, and how you will cope under constant pressure. Take it easy, there will be lots of opportunities to take on more responsibility.

As I mentioned, Oxford colleges provide tutoring for their students, and professors have small group sessions helping stu-

dents understand the material better. There are also *collections*, that are internal college exams that are not a part of a official departmental evaluation. I was marking home assignments for Shimon's tutees, and also was marking collections on AI and Machine Learning.

I'm super miserable and not sure if the decision to go for a PhD was a good decision.

While marking was bringing some money, it was tough! First of all, a lot of questions were proofs, and you cannot simply say that that proof was wrong because it did not follow the model answers. There are multiple ways of proving stuff. Second, some people had horrible handwriting, it was extremely hard to follow the argument when you could not even parse the text. Some bloody Oxford geniuses even sent me photos of a whiteboard with only a part of a solution.

Sometimes it was funny, but generally it was hell, and took too much of my time[3]. I remember ordering a Papa John's pizza to Thom's building at 3 in the morning to help me get through the night of marking. I was going back to Castle Mill dorm around 6 am when most of the people were going to work, and it felt awful.

'Felt like shit again' was a common diary entry back then. Luckily, I early realised that marking took too much of my time, and never marked anything after my first year apart from one RL tutorial session I had later in my third year.

* * *

Everything changed when she appeared on my horizon. By her I mean the 'Relational Inductive Biases', another life-

[3] I probably took it much more seriously than I should have.

trajectory-changing paper. This was the first time I understood what Graph Neural Networks were, and why the can be useful. I read the GCN paper before and did not really get it[4]. The 'inductive biases' paper was so visual and clear, I had goosebumps when I was reading it on a train to London. It was amazing!

I know, some people grumble that this paper did not introduce anything new, but I disagree. Its novelty not in the new model or any groundbreaking result, but in the formalism it provided for us to have a mental model of any message passing graph neural network we could possibly think of. It gave me a tool helping me understand all the other papers in the field.

It turned out, there is much more work as I expected (surprise!).

You do not really learn something until you implement it. And I decided to implement GraphNets myself. Back then, the original implementation was in tensorflow, and I decided to give it a go in Pytorch. Pagan (pgn) was born[5]. This was one of the most exciting times I spent in the lab during my first year. I remember coming there really early while the lab was empty, and working for an hour or so before the classes started. My original implementation did not have batching, and it was so slow, it was impossible to use, but I was learning.

Batching graphs seemed so elegant: you assume everything is a single megagraph where single graph components are not connected to each other, and, as a result, the messages do not pass between their nodes, and they are fully independent. I spent many hours[6] profiling the code and trying to understand

All the suffering seems justified now =)

[4]Sorry, Thomas.

[5]https://github.com/yobibyte/pgn

[6]I was not that productive, yes.

why my experiments were so slow. Pytorch-scatter looked like a gift from the gods.

It was not because I was stupid. The topic was rather hard.

I also have a funny story regarding this paper, I broke Google Scholar with my paper notes. If you go to the Google Scholar page of this paper and click on 'all versions'[7], it will list my paper note as one of the versions of this paper. It looks like if you have a pdf online with the title of the paper, it gets parsed as another paper version, and you can do a lot of cool stuff hijacking other people's papers. For instance, you can debunk the paper and have it linked on the original paper's page on Google Scholar.

* * *

Looking at people around, I got this dangerous fixation, that I needed to publish a paper after the first year of my DPhil. Partially, this was also due to my false impression that I knew what I wanted to be doing which turned out to be pure delusion. Anyways, I was trying to do some research on the side while going through courses at the CDT.

I really belive that pressure to publish is one of the reasons we have so many papers that barely work coming from popular labs. If you are a fresh PhD student, you come and see that people around publish ten papers a year. There are two directions you might take from there: you can cherry-pick, oversell, not tune your baselines and do a lot of shady stuff, or you can be a bit more honest and silently suffer when nothing works. I decided to take the latter path.

[7] https://scholar.google.com/scholar?cluster=17278816121299075983

I ended up doing collaborating with other Shimon's students, working a bit on meta-learning with Kyriacos and Luisa. Not sure how helpful I was research-wise, but I was having great time[8]. Thinking about this now, for me this is peak DPhil and research experience. We were getting together at Kiko's place and were brainstorming, coding together, figuring out where the whole thing was going. Part of the great atmosphere for me was that this was not my project, and I was only helping. I had zero pressure to make this work as soon as possible, and could take time to go on a tangent or satisfy my curiosity.

Worked till 3 am.

In general, the best thing about Shimon's lab was that students were collaborating a lot, and usually one worked on their own project using other students' help, and they were expected to help someone else on their project.

* * *

One more project I worked on during my first year was the one that turned out to be the HOOF paper[9]. Supratik has this great idea of tuning policy gradient parameters on the fly, and I was running some experiments there. The most memorable moment of that was when I was doing gradient update into an opposite direction without realising that. Luckily, Supratik quickly noticed that and got it fixed.

In the evening I remembered that Supratik also got shitty results and I suspect the problem is in the shitty weighted importance sampling comparison.

I liked working with Supratik. He was a rare example of a DPhil student who was very chill, and submitted his papers

[8] link

[9] https://arxiv.org/abs/1902.06583

half a day before the deadline and went home while everyone was frantically refreshing the submit page panicking about sending a wrong version. Everyone was doing the last checks often after the submission deadline until the system still allowed that.

He also preferred to do a lot of thinking before actually coding stuff, an incredibly smart thing a lot of the people, including myself, ignore. In retrospect, I think I could have learnt more from him, and if I did, my life for the next couple of years would have been much simpler.

* * *

Worked till 4 am in the morning.

Year one was mostly a year of happiness of my DPhil. Why is it so? Partly, it was less lonely as we hanged around more with Panos and Alessandro, and had common homework to do and common space to stay at. However, there was something else, I allowed myself go on a tangent without any guilt. I could read something, and then fuck around for a week without expecting anything out of it. I was satisfying my curiosity, and it felt great. Unfortunately, I did not take it away as important lesson of the first year, but if I did, my DPhil would have taken a different trajectory.

I read a lot, often too much, my Mendeley inbox was growing exponentially. I tried to keep up with the Arxiv firehose, was going over textbooks found in the college library, and also read old ML/RL papers trying to discover the lost art ready to be resurrected by adding neural nets on top. I was also read way beyond my zone of comfort to get a broader view of the field.

* * *

Our lab's reading group was another amazing experience of my first DPhil year. We meet in Robert Hooke building, and, usually, one person presented a paper going section by section, and we were all trying to make sense out of it together. There was always a plate of fruit and a cake, and discussions were incredibly interesting and stimulating. My paper notes[10] idea was born there.

The atmosphere was usually quite hostile to the paper, this was a room of reviewers#2 dissing a paper. Some people found this was too much, but often criticisms were jusfitifed, we were dissing papers not just for fun. Sometimes, people got inspired to run some experiments, and projects were born after discussions at the reading group. Presenting papers was also great learning experience and good preparation for conference reviewing.

I'm back again to the state when you have no idea what's going on All the previous times it did not end well for me. I think, this is a test for my persistence now. Good luck for me.

This was peak times of Shimon's research group, and partly I chose the lab based on my reading group experience and talking to students there. I heard that people were jealous of pre-COVID Shimon's lab as students there collaborated a lot, there was always something going on and people hanged out together all the time. I know in some of the labs it was totally different, where people did not speak to each other for the whole day and came to the lab only to connect their laptops to external displays and type. I could not imagine myself working in such a lab, but I got an idea how it felt when COVID hit.

[10] link to Notion

* * *

One benefit of a popular University city is that there is always someone interesting who gives a talk and is around to have a coffee with Only during first year, I met with Michael Bronstein, Peter Battaglia, Kyunghyun Cho, Xiaowen Dong and many other professors from Oxford. I also randomly stumbled upon Richard Dawkins on my way to the lab a couple of times, unfortunately I did not have a coffee with him.

Spent about an hour in the morning trying to make a second monitor work with Arch. Succeeded after a fucking hour, almost surrendered.

Obviously, there are some people who are too busy or too arrogant to have a chat with a DPhil student, but most of them are extremely open and happy to discuss ideas, give literature pointers or just have a joke or two. You should use this for your advantage: not to increase amount of friends on Facebook, but just get a better feeling of what is going on in the community, what problems people care about, and what they think is coming next.

Speaking to other DPhil students, especially outside of your area, might also be useful and stimulating. Some problems are general across the communities, and often, you might find an interesting problem to work on with someone who has a ton of useful domain knowledge.

* * *

Every AIMS student got equipment budget, and a part of this budget was spent on shiny Macbooks for us to work on. I decided to give it a shot, but pretty quickly I got fed up with all the animations and interface sluggishness that I started

looking back at Arch[11].

Another guy in my cohort installed Arch on his Macbook, but I was not that adventurous. Luckily, one of the AIMS students got his laptop broken, and Wendy gave him my laptop in exchange for some part of his equipment budget. I had enough budget to buy a Dell XPS13, and set up Arch + i3 there, and could not be happier.

I also brought my desktop I had since my Masters, the desktop had a GTX1070 and several terrabytes of HDD space[12]. I found it extremely helpful to have a GPU that nobody can hog, and which is easy to debug locally, before you start running experiments on the servers. Now I am probably more used to just doing everything via ssh, tmux, and rsync/sshfs, but back then I loved having things local.

* * *

AIMS CDT involves doing two mini-projects during your first year. Usually, this means an opportunity to 'intern' in a Computer Science, Engineering Science or a Stats lab looking for your future DPhil supervisor and getting to know their students better before you join. It is like a trial period for both, your supervisor, and yourself, which is really nice.

In practice, half of my cohort already knew who they want to work with, and mini-projects mostly gave students head start for their research, some additional time in a very short UK

I can be pretty well organised, but as soon as I have some deadline and I am under stress, I do only the stuff related to the deadline and a lot of stuff piles up.

[11] Have I told you? I use Arch, btw.

[12] I am still using this machine as my home server, and run llama.cpp on it!

DPhil project. It was like that for me as well, I went to do my first mini-project with Shimon. I was all over the place trying to find applications of Graph Nets in RL, and multi-agent RL seemed like an obvious use-case.

I got quite excited first, and I liked working with Wendelin Boehmer, Shimon's post doc, who was really open discussing any ideas in front of a whiteboard and watching me pretending to be a centipede thinking about its gaits. Shimon got a great idea of bringing together the brave old and brave new world of coordination graphs, and graph nets. I got extremely excited, as I like connections like this, but the project was going quite slow, and we did not get anywhere within the first couple of months, with me trying to speed up my GraphNets implementation.

My impostor syndrome has started to reappear.

Eventually, I ran out of time before my second mini-project, and Wendelin took over and eventually managed to bring this project to a publishable result, which was pretty cool. I, personally, became less enthusiastic about multi-agent RL after this project, and never touched it again.

Luckily for me, even before I started my DPhil, I got an internship offer from NVIDIA for the summer of 2019. Thanks to Wendy, I managed to arrange it as my second mini-project, as AIMS allowed working in an R&D department of partner companies. I packed a suitcase and boarded the flight to California.

* * *

The weirdest thing that happened to me when I arrived

to California for the first time is a huge deja vu feeling. I had been to that place as a child watching Hollywood movies, and it freaked me out. It was a love at first sight. My trip started on a major chord: the weather was nice, people were relaxed, and the coffee was good. I interned at the Applied Deep Learning Research team, and this was a life-changing experience.

Using Windows is horrible for your mental health, and they want me to use it for development.

NVIDIA was full of life-trajectory changing people, I will write about them here. The first one was Bryan Catanzaro, who was leading the ADLR. I had full freedom to pursue my interests, but it was not the freedom coming out of neglect and lack of planning. I had a choice to start a project Bryan suggested, join any of the existing ones, or start any other. I decided to take on the Boolean SAT solving that ended up being the Graph-Q-SAT paper. Bryan is extremely smart, but is also very kind and caring. Our conversations were insightful, but there was also a human connection part in them.

The second trajectory-changing person was Saad Godil, my direct manager. Saad taught me to be more pragmatic. NVIDIA is a very pragmatic company, and I loved it a lot. Sharp focus, no need in reinventing the wheel and coming up with the ideas which are pompous, but will never work is something that made my experience truly unique. Also, Saad was very senior, but he was very hands on. We pair-programmed, analysed there results together, and he was running experiments on his own. He was not a free-rider on the project which deserves a lot of respect.

Did not even go for a run. Played Diablo III all night long. Was a bit depressed about state of the project.

I was writing about my impostor syndrome experience at MSR and how stressed I was all the time. With NVIDIA, it

was different. There were a lot of extremely intelligent people around, but I had more confidence in myself that time, and I quickly got a first version of Graph-Q-SAT implemented, and this was encouraging. It was stressful at times, especially closer to the end as I wanted to finish the full paper before my departure, and it was quite tight. Sometimes things did not work, but that was a part of the experience and surprisingly to myself, I was able to come through it all right. I put in a couple of all-nighters, but in general I did not work extremely crazy hours, running helped, and when I was feeling exhausted, I gave myself some rest. Mental-health wise it was good, I was very happy at NVIDIA.

Nothing works again, but I feel less like I care and try not to give a fuck.

It was also great at the human level. I got close with Rafael, another researcher at my team who was a professional musician before he did PhD in computer science. We went surfing to Santa Cruz, we rented a car and went to Tahoe with his girlfriend, my family and Sungwon, another intern. I think this helped me a lot to get through the first year of my DPhil, and I do not think I ever got as close with people during my internships at other places later. However, probably, COVID is partly to blame.

Every time I compare salaries, I want to be as far from universities, as possible.

September approached quickly. I submitted the Graph-Q-SAT paper to ICLR[13], wrote a blog post[14], packed my suitcase, and boarded a plane to Heathrow.

* * *

[13] https://arxiv.org/abs/1909.11830
[14] https://yobibyte.github.io/nvidia_postmortem.html

I want to finish this chapter with the paragraph that is most hard to write. I feel incredibly guilty for putting my family life on pause and spending way less time with my wife and my son than I should have. Luckily, I decided that the weekend is always work-free, and this helped a bit. However, nothing justifies so many late hours and all-nighters, spending time at MCR instead of with family, and cranky mood because of stress and lack of sleep. This is probably the main thing I regret from these four years, and I am lucky enough to have an amazing wife who came through this with me and decided to stay on my side.

I taught my son how to swim! I feel like I'm a better father than a machine learner. I should work for a kindergarten, I believe.

Now when the narrative became more grim, we are ready to go to the Year Two chapter, welcome to the year of frustration.

Year Two: Frustration

So, I was back in Oxford, and my number one goal was to select a research problem. I had no idea what to work on, nothing seemed exciting enough to keep me busy in the long term.

During the application process, I wrote a research proposal on memory models for RL, and the topic sounded quite exciting, but I could not find a first stepping stone to develop the research direction. I liked some papers on the topic, but I could not get all the pieces of the puzzle form a holistic picture. Luckily, Shimon did not make me stick to the original proposal[1]

I liked working on SAT solvers but was not excited by SAT solvers that much to keep working on them for the next three

[1] In general, at least in the CS department in Oxford, the application research proposal is treated as an exercise, and nobody makes you follow your original, often very naive, plan. This makes a lot of sense to me, and I'm glad it does for the University as well.

years. For me it was an interesting application of RL, not the end goal.

The first couple of months after California were happy times. I came to the lab and read a lot of stuff, was having daily walks in the University parks thinking about directions to take.

I decided to stick to graphs, they were fascinating, and I felt they made a lot of sense from a practical view point, my SAT solvers experiense was a good confirmation of that fact. I also liked RL, I had to figure out how to combine them.

I came up with the idea of *incompatible environments*, environments whose state and action spaces were different dimension-wise, i.e. one environment has a five-dimensional action space, another one is seven-dimensional. I didn't care about dimensions per se, for me it was a way to frame my obsession with graphs. It was close enough to the existing research but was still nover and generally useful[2]. It opened possibilities for multitask learning with interesting environments, e.g. environments with graph-based state and action spaces. SAT solvers were a specific case of incopatible environments; even more, they were self-incopatible, every state had a different number of dimensions and valid actions.

It was important for me to have a coherent story for my thesis, but you can always come up with one post hoc. It was also the case for my thesis, the ordering of the chapters for me is not chronological at all: the SAT solvers work comes last as

[2]In retrospect, it was probably a mistake to focus on technique rather than the end problem. This made my life much harder in the future, even though being excited about something motivated me for some time.

a practical application of the whole thing, and the last project of my DPhil comes first as the motivation of the whole thesis.

* * *

While graphs seem to be a natural choice for multi-agent RL that was my lab's specialty, I wanted to get away from it. I did a couple of projects with multi-agent RL during my first year, and I did not enjoy them, even though I liked hanging out with people doing that research.

I started digging deeper into the NerveNet paper[3], one of the first to have used Graph Nets with RL. I wanted to understand it better and see what worked and what does not.

This was one of the most hair-pulling times of my PhD where I had zero progress for multiple months in a row. I did not even know where I was going, I was just fucking around with the codebase trying to get any insight about anything. I spent an embarrassing amount of time trying to get to the results reported in the paper, trying to find any signal in failing experiments.

This time was good for me getting more and more intuition working with Graph Nets and RL, but publication-wise, its payoff was next to zero. The largest insight I got was that if you increase the batch size, everything becomes a ton better, not something that your reviewer #2 would appreciate.

Around this time, together with Max Igl, I started supervising Charlie Blake, a master's student who got interested in Graph Nets and RL. I believe I was a better supervisor

[3] https://www.cs.toronto.edu/~tingwuwang/nervenet.html

than a DPhil student, as I carefully scoped a master's project based on my NerveNet experience. I clearly understood that a master's project should be exteremely narrowly scoped, as the time is limited, and you cannot often predict the success of your experiments.

I enjoyed a lot collaborating with Charlie, he was independent and super smart, but he also worked hard. Deservedly, this project ended in a NeurIPS paper[4], but back in 2020 we had no idea, and I sometimes even felt that I had made a mistake by not doing that project myself instead of doing random adjacent stuff at a time.

* * *

That year prepared another blow, while I was working on the NerveNet improvements, this[5] paper got published. Now I believe I overreacted, but back then it felt like I had been scooped, and had to start all over again. The field was getting more crowded and I wanted a way out of it.

The way out came when I was running around with my son at a children's playground. I got curious about what happens if we remove the graph structure from the equation. In NerveNet, each robot is represented as a graph of limbs and the connections between those. The physical structure of a robot defines the graph's connectivity, and the features are sensors data of corresponding limbs. I wanted to mess up the structure, e.g., change it to a star or a fully connected graph?

[4] https://arxiv.org/abs/2103.01009
[5] https://wenlong.page/modular-rl/

I ran some first experiments, and it turned out that the structure did not matter. While shocking on its own, this directly pointed at transformers, that can be thought of as graph nets operating on fully connected graphs. I remembered Shimon had asked whether I tried transformers for my stuff already, and it clicked. I knew what to do.

Even though Shimon thought I should not pivot to transformers not to lose my previous findings, I thought he was wrong, and decided to not listen to him. I implemented an initial approximation of the future "My Body is a Cage" paper within a week or so. This felt amazing, it finally felt like progress.

I was very cautious, and decided to implement the whole thing in small bite-sized chunks. First, I took the vanilla transformer from the official Pytorch tutorials, and made a toy regression task for it: predict a sine wave. After this was done, it was trivial to use the model as a policy in the RL setting, and this was done pretty quickly too (modulo a couple of pesky bugs). After that, the rest was still tedious, but more mechanistic. Slowly, we were getting closer to a paper which I will write about in the next chapter.

I think I have a depression. I can't focus on anything, I don't have enough motivation and I don't even know what to do next.

* * *

Some time after I got back, I noticed that it was much harder for me to focus. I have not been diagnosed, but now I think I have some degree of ADHD. At least, I got most of the symptoms listed on the NHS ADHD page[6].

[6] https://www.nhs.uk/conditions/adhd-adults/

Back then, ADHD was less discussed, and I did not pay much attention to my physical state. I just kept going. I remember it was very hard for me to keep doing one task for more than a couple of minutes. I could read a paper, then go walk and make coffee, came back, start setting up a dev environment on my desktop, open up Wikipedia, scroll through a couple of pages, and then get back to reading. It was horrible, and, obviously, I was not very productive this way.

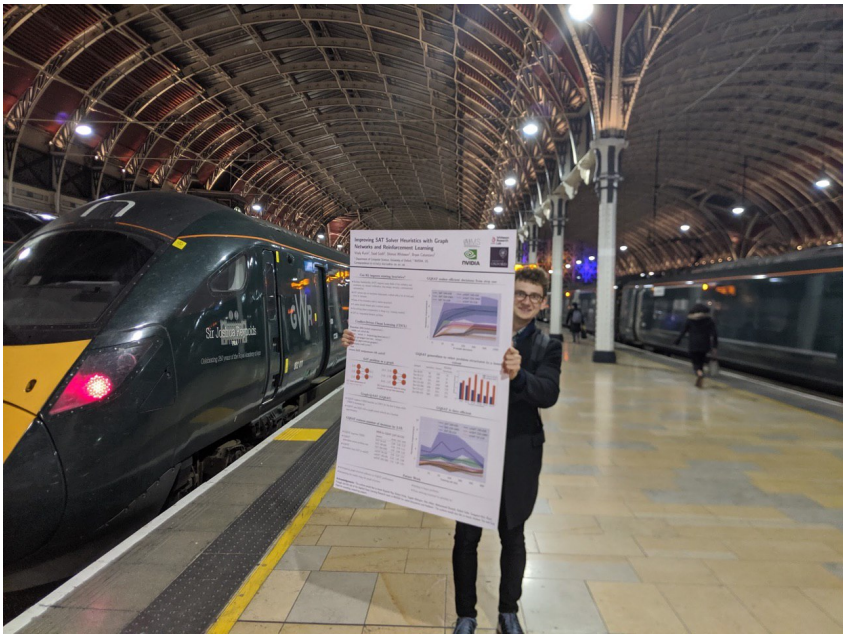
For some reason, I never asked a question on what was going on and how to improve my state of mind. I thought this was a natural consequence of stress, lack of sleep, and bad eating and drinking habits. One thing that helped was running. I was running almost every day in the University Parks before lunch, and it was amazing. Getting registered in London Landmarks Half Marathon added some motivation, and it also helped to clear my head.

* * *

At the end of October, Facebook had a recruiting event in London, and I went there. It was really nice: the food was great[7], there were a lot of familiar faces, and there was a poster session for PhD students. We had sent our posters before, and Facebook printed them out on some plasticky surface, which looked really cool.

I went there to present Graph-Q-SAT and this was a blast, I finally found some confirmation that the research I had done

[7]Facebook really knew how to win the grad students over!



Pure excitement here...

was making sense. A lot of people were asking about neural nets being unreliable, and I felt great to rip the benefit of hybrid methods. The whole algorithm was complete: no matter what, the result will always be 100% correct. Unfortunately, this did not excite me enough to dig deeper. I regret I didn't pull those threads more back in 2019. I didn't want to get stuck with SAT solvers, and I was not open-minded enough to generalse hybrid methods to other settings.

The cherry on top was the poster session prize. I got the first prize and received an Oculus Quest for it. This felt surreal

and was a relief in the midst of anxiety and uncertainty during the ICLR submission cycle. I was so excited that I took the whole A0 thing with me and kept it until I graduated, when I ripped it apart with a knife.

* * *

December 2019 brought some disapointment with the rejection of my SAT solvers work at NVIDIA. I had paper rejections before, but I still felt devastated because I believed the paper was at least as good as the previous papers published at the same top-tier conferences.

Some of the reviews were fair, some were just bullcrap. The main two lines of criticism were: "iteration time improvement is not the wallclock time improvement", and, "your SAT problems are toy-problems, show me the scale".

We were aware of both, but unfortunately, I did not use time between the submission and the rebuttal phase well and did not do my best to address those questions before we got the reviews[8]. Realising this made it even more devastating. Scaling the work to large SAT problems was hard outside NVIDIA, and I am not sure I wanted to continue that route.

There is not much to say about this. Now I think this submission cycle was a valuable lesson, but back then I was obviously pissed, miserable, and stressed. I should have been less

[8] I see more and more people are doing that now, and this highly increases your chances to get your paper in. The work on the paper does not end with the submission, you have a couple of months to massively improve it. You can often predict many of the requests you get unless your reviewers are nuts.

defensive at the rebuttal, and should have given the reviewers more new plots showing what they asked for. I got those plots eventually, but for the next submission cycle. Read on to learn what this ended up in!

* * *

End of the year had also some great news for me: the HOOF paper got accepted [9]. Supratik (the first author) could not make it, and I was supposed to present a poster there, I was hyped! NeurIPS 2019 was a pinnacle of my second DPhil year[10]. I had never been to a big conference before, and it sounded like a lot of fun. If you have never been to a big conference yet, I'll try to describe how it looks like.

There are, basically several threads going on. First, there are talks. Some of the talks are given by big shots and they are more positional. The other type of talks are mostly advertising for the posters: 'This is what I have done, come to poster A42, ask me questions'. Another thread is poster sessions, I loved them a lot. Imagine a huge hangar with posters standing in a row. Everyone is shouting and it's very hard to hear anything, but you have a great chance to meet paper authors, find some interesting stuff and have fun telling people they put a minus sign in the wrong place (especially when they didn't). Finally, there are company booths, which is a place you can get enough t-shirts and socks until the end of your studies and also get invites to company parties.

[9] https://arxiv.org/abs/1902.06583

[10] I measure years from October and ending in September.

Delivering a poster was a hugely positive experience for me. People seem to be genuinely interested in your research, and, sometimes, the questions they ask give you ideas on future work. Or sometimes you just have a nice chat. I was so hyped, I wanted to present a poster on the next day, there were plenty of free spots, but I was too shy to do that. Later, some folks showed that you can literally put up anything on a wall and give a presentation about it.

It's not like this anymore, but company parties were on the rise back then. Basically, if you get an invite, the company brings the researchers to some fancy restaurant or an even more extravagant place (I've been to an aquarium, I heard even of a strip club), they serve you food and alcohol and give an opportunity to take selfies with superstars like Yann Lecun. They usually do this for potential candidates, and this is a part of their hiring process. While this sounds like fun, you actually get a huge fatigue by the end of the week and do not want to hear anything about new papers anymore.

The end of the conference is usually workshops, where people present rough and unpolished research, and this is generally the most interesting part of the conference.

Personally for me, the conferences are great for meeting new people and old colleagues. You just go there to have fun and socialise with extremely interesting people in a new and unusual setting: new city, new places, new food and music.

In addition to all the great time I was having there, there have been a bunch of great news for me there. Latent Logic (the company I had worked for before my DPhil) got acquired by Waymo, and my options brought me some money to fund

my DPhil time. This was amazing news as DPhil bursaries in the UK are tiny, and you are mostly broke all of the time. The prices are high, the rent is even higher, and I also had a family. Thanks to Latent Logic and Shimon, things got a bit easier for us.

Finally, I got two internship offers there, one came from FAIR to work with Tim Rocktaeschel, and another one from Microsoft Research, Cambridge, to work with Ryota Tomioka and Andrew Fitzgibbon. Some of the internship interviews took place during NeurIPS, which was quite an unusual experience. Apparently, there were some rooms given to the companies to conduct interviews, and I love having in-person interviews. Luckily, my interviewers liked the experience too, and I got in.

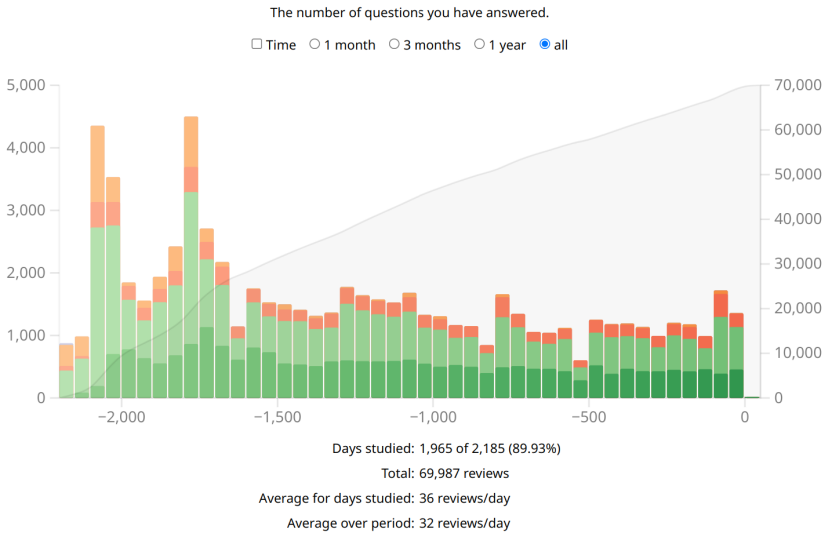
My interview was a bit weird. The guy seemed to be not very interested and vaped all the time.

I was having a blast and accepted both planning to do them in a row at the beginning of the next year. Shimon didn't object, and I am grateful to him for that, I had heard that some of the supervisors were not keen even to give one internship during their DPhils. Andrew and Ryota were extremely flexible and allowed me to postpone the internship until 2020, which was really helpful as I wanted to have some time in between the internship to have some time in the lab.

* * *

During DPhil, I discovered a tool that gave me superpowers: Anki. Anki is a flashcard spaced repetition program. You put anything there, and it sets up the schedule for when to show you the cards based on how well you respond. If you are doing

Occasionally I have thoughts that I will never graduate and this scares me.



My Anki review stats.

well on a question, it will show it to you much later, otherwise, you can get it the next week, or even the next day.

This improved my abilities to memorise stuff significantly. After I started using Anki, I stopped opening Wikipedia every time I needed to recall a linear algebra term or some other factoid. Things just got stuck in my head. I was putting all kinds of stuff there: formulas from textbooks, some proofs, concepts I wanted to memorize. Some of the extensions allow you to add a mask on an image and show them one by one. For instance, you occlude parts of a formula and try to recall them one by one. There are lots of good resources on Anki, you can

find some the links on my homepage[11]. I highly recommend to check it out, but be careful, do not add thousands of cards on your first day or you will regret it. Anki can become a chore, but if you do it twenty-thirty minutes every day, you will see the effect almost immediately.

* * *

The second DPhil year had something else up its sleeve: a pandemic. The things were unfolding rapidly, and there have been only a couple of weeks between me discussing it while having fish and chips at Alessandro's college for lunch, and the lockdown with all the labs shut down and us working from home. We were not allowed to go outside without a reason. We could exercise once a day and shopping should be reduced to necessities only. It felt surreal in the moment, and with every day, it was becoming worse and worse.

COVID hit us hard for multiple reasons, having schools be remote is another one. For both me and Alisa, my wife, school time was when we could focus on work without any distractions. Being confined to a couple of rooms with a five-year old made it almost impossible to do uninterrupted work. We decided to take shifts with Alisa: everyone works for six hours with the first shift starting at seven in the morning. The one who does not work cooked, took care of our son and tried to make it easier for the other to work. With reduced working hours, we decided to work without weekends. I am still not sure whether this was a mistake or not. Back then it was a

For a moment I felt like I was making progress.

[11] https://yobibyte.github.io/productive_grad_school.html

question of survival, with seven days of six hours a week, we got a full-working week. However, it was very exhausting, it was an endless groundhog day with no light at the end of the tunnel. Time pressure helped to focus, but doing creative work under those conditions was hard. Frustration began creeping in and grew steadily each day. This quote from my diary describes my psychological state really well:

> `Today I had the best ten minutes of my life. I got an email saying that a reviewer at ICLR raised the score of the paper from weak reject to weak accept. I got soooooo excited. And then I realised that this was not for the paper I wrote, but the paper I reviewed.`

Gladly, we had the Port Meadow next to our place, and we spent a lot of time going on a hike there looking for rabbits, flying kites and playing football. We tried everything: skateboarding, roller scating, playing the piano in the common room, playing chess, jumping on a pogo stick and a lot of other stuff. While this sounds like fun and having a routine made it less chaotic, doing this seven days a week without any weekends was gruelling. This routine and being alienated from the rest of the lab definitely contributed to my state of mind. This is where I started doubting my graduation prospects.

* * *

Another reason doing DPhil during the pandemic sucked was isolation. While I could not run away from terrifying

thoughts about failing, I managed to numb them down by hanging out with friends. Hanging out with Panos and Alessandro was sometimes about getting drunk and discussing the latest rumours, another time it could have been a serious conversation about understanding something really deep. It was a mix of mental support and intellectual stimulation with a fancy atmosphere of a beautiful town with such a rich history.

Luckily, Henry Kenlay was living nearby, and we started doing weekly walks, this was like a breath of fresh air. Henry was working in Graph Nets with Xiaowen Dong, which related to my research, and we had a lot of things to chat about. I also liked him as a person, and found him to be very honest and blunt, the qualities I appreciate. He did not try to pretend to know something when he did not, and he did not try to make an impression.

Another friend I found was Oleh Stupak, who was doing a DPhil at the Economics department and started a year before. Having a lot of common cultural context, it was easy for us to get along, and he was the most positive DPhil student I have ever met. It was not also naive optimism that was just to reassure you, it was a stoic reception of anything that comes your way.

Oleh was working hard, but sometimes he could just stop working for a day or two because he did not feel like that. Our main entertainment with Oleh was to go to a big Tesco at St Giles after 10PM, buy some beer and finish it off in the Castle Mill common area. While his research topic was far from mine, we found some common things to chat about, and even wanted to do a collab at some point, but unfortunately it

Fuck you, reviewers. Fuck you the whole field, where you can change the reward function and consider it to be a different task.

went nowhere. Economics of networks is an interesting topic, and I think we could do a lot of interesting stuff with Graph Neural Nets in there.

* * *

It's been fucking three days and they haven't responded yet.

After ICLR rejected my Graph-Q-SAT paper, we sent it to ICML, and it was a disaster, a joke, even. We got some unjustified criticism from one of the reviewers, and after the rebuttal, that reviewer mentioned that they were more favourable to accept, but forgot to update their score. The meta-reviewer wrote a meta-review quoting the original criticism that we successfully rebutted, probably reading the reviews with his ass. We got the paper rejected, and Shimon's letter to the organizers was left unanswered. I do not review for ICML anymore.

I am tired of academia. Fuck all of this, I'm super unhappy.

I got really depressed, it felt like constantly fighting the windmills. This was the first time when I realised I did not want to stay in academia if I ever graduate. The whole conference publishing experience was not worth it for me: trying to convince some random guy on the internet to actually read your paper? Sometimes, the reviews were insightful and make your paper better, as they were supposed to be, but most of the time it was just gatekeeping power play which I really hated. We decided to give it another last shot at next NeurIPS, expect a cool story ahead!

* * *

NeurIPS 2019 was amazing, the calendar year ended with a major chord, I took some time off at the end of the year and

spent a week skiing with my family in Slovenia, I was happy.

The year ended with a Christmas miracle, when my son realised that he had forgotten to write a letter to Santa on the Christmas eve, and decided to do it on the spot. We were in a remote hotel in Slovenia, and there was nowhere we could buy any present, not even speaking of a particular Lego set he asked for. I could not believe my eyes when I saw this particular set at Duty Free in Zurich, where we had a layover. We successfully acquired the desired box, and my wife rushed first to our dorm to hide it under the Christmas tree. My son was ecstatic as clearly some magic had happened, even though, several months later, he asked me whether Santa exists while we were biking to school. I had no other options but surrender and admit the truth.

I went to a birthday party with Iurii. About 20 children were present and this was hell!

* * *

Second year was when I started feeling alone on my DPhil journey. Shimon gave his students full autonomy, and it was liberating, however, this was brutal during first couple of years. You are on your own, and you have to find your direction on your own from day one.

I do not like when people tell me what to do, and Shimon was perfect from this perspective. But even I felt neglected and would love more help during my first year. I should have probably asked for that, but it never occured to me. Shimon's attitude was: 'This is your DPhil. You can use me as a resource, but it is up to you when you graduate, what you do and how fast you want to go there.' Occasionally, I saw

him helping out people who were stuck, but I don't think he considered me to be stuck or something.

Before I started, I was imagining myself taking a daily stroll with my DPhil advisor, discussing potential research avenues that would lead to a breakthrough. Another acceptable setting would be getting drunk with your supervisor in a nearby pub arguing about whether to include the discounting coefficient to the definition of the Markov Decision Process or not. The reality was different, more alienating, and desolate. It was like going alone to a forest at night taking only a pocket flashlight with a half dead battery in it.

Shimon scheduled a meeting with me! WTF! Is it a good sign or a bad sign?

Half of the problem were my unrealistic expectations about an idealised version of movie-like DPhil experience. Even realising this did not help the growing frustration that distracted me from work, and made doing research harder than it could have been.

* * *

Oxford has two major milestones on your way to a DPhil: transfer and confirmation, coming roughly after a year and two after your start date. If you are at AIMS, these dates move one year to the future. I was expected to submit my transfer of status report by the end of my year two. Usually, people expect you to write the literature review on the topic of your future dissertation, and give some broad directions on what are you going to do the next two years. When the report is done, you have to defend it, and the experience varies from a nice chat about the weather, to a pointless conversations

about semantics and you failing the exam. If you fail, you have another attempt, and if it does not work out for you, you will be transferred to the Master's program for it not to look like a total failure.

I was not too worried about my transfer of status as I already had a publication, and I was reading a lot of papers, so, writing the literature review as enjoyable. However, I wanted this to be a part of my dissertation already, not to spend time on it in the future, and I was trying to come up with a common theme for all of my research, and write it up as if it is already done.

I think it was very helpful to me, and I am glad I took the transfer of status seriously. Writing was never easy for me, and writing was one of the skills I improved greatly during my DPhil. Shimon is a good writer[12], and patiently corrected what I sent to him. By the way, I don't mean grammar or orphography, I mean the general attitude towards writing. Shimon was playing the role of the laziest and annoying reviewer to weed out all imperfections and vague parts, to avoid embarassing situations during real reviews, and increase my chances to get accepted. While I had a feeling, that I was somewhat abandoned by him when it came to the research itself, when it came to writing, Shimon was always there, editing drafts up until the last minute of the submission deadline. I am greatful to him for that.

I sleep enough, I eat enough, I do not drink. But I feel like shit and I do not know how to fix this.

* * *

[12]IIRC, he majored in Computer Science, and minored in English Literature or smth.

Getting your first-author publication is like first sex. Everyone is putting a lot of importance to it, everyone is talking about it, everybody is anxious, and most of the people get there eventually. Old-timers brag about it, friends become foes, and the longer you go without, the more nervous you become. It was finally time for me to get there.

Here is my diary entry for that day:

```
NeurIPS results are in less than 24 hrs.  Anxious.

We are in!!!!  I got my first first-author paper at
        a top-tier conference.  Super hyped!

My PhD does not look like a failure anymore given
    this and also given a pretty good shape of my
                second paper.
```

It's hard to put on paper what I felt, but it felt really great. I remember walking with Oleh (a friend and a neighbour at Castle Mill) to the big Tesco at St.Giles, buying a bottle of shampagne and drinking it in front of Block A at Castle Mill. This was probably the first time since the start, when I did not have any feeling of urgency. I became so cocky that I didn't work at all the next day.

Talking is important, but eventually you shut up and do stuff.

This also felt great because of my successful rebuttal, I felt like I have defeated the last boss of an extremely hard computer game. The reviewer said that the problems we were solving at Graph-Q-SAT were toyish, and this was true, they were probably a SAT solver expert. But this was an ML conference, and you cannot expect solving industrial-grade stuff straight out of the gate, Graph-Q-SAT was a mere exploration.

I wrote something along the lines "If we could solve problems the industry cares about, we would have gone to a different conference. This is an ML one, there are existing works published at top-tier ML conferences, having an impact on the field." Realising that you have the real agency to change the reviewer's opinion was a powerful realisation, all the previous attempts felt like fighting windmills to me.

The feeling of urgency I described above was the main problem I should have fought during my DPhil. It poised my life considerably and added a lot of unnecessary stress. It did not let me relax. While DPhils are very short in the UK, you should take your time and not rush. I wish somebody had said this to me at the start. Maybe someone did, but I didn't listen.

* * *

I never enjoyed doing research alone. The best part of research for me was to walk with people around University parks and chat about ideas. The peak lab experience was when people gathered around a whiteboard and doodled stuff. Reading groups were amazing, nothing was safe, papers got disassembled and dissed.

Programming was different. I enjoyed working on it alone, building stuff late at night when most of the city was asleep. Or maybe I just enjoyed day-to-day programming more. You have some idea of what you want to build, you write a couple of tests, you implement stuff, the tests pass, you are happy. Programming was a recluse from overstressed DPhil life, pro-

Spent about an hour fixing my printer before realising that it was not connected to my laptop. FML.

gramming was more down to earth for me. Realising this was not too helpful though, I constantly thought that research was not for me and that I had made a mistake by starting a DPhil. This was one of the factors I considered when thinking about dropping out.

* * *

There was something about research that I really liked though, and research had it more than programming for me[13]. When you read or discuss something, you build your own picture of the world. There is high chance that this picture of the world is similar to what other people in the field have. And then, sometimes, you hear something that contradicts your own picture of the world (and most likely everyone's else). You pay attention, you dig deeper, and you realise that people are wrong about something. You write a paper about it if it is useful and helps to solve some problem or advance our understanding of something. I love this way. This way is about understanding, not building something out of shit and sticks and grinding until it works.

This was quite a scary feeling since I am in that field for a couple of years and start hating it already.

I enjoyed this kind of research life, and I never cared about beating the benchmarks. My field though, was obsessed by benchmarks as well as cherry picking the results to show that your ad hoc method is by a millimeter higher on the performance plot compared to the baseline. I also heard stories about top world lab people encouraging their PhD students not to tune the baselines as this is a waste of time. Knowing

[13] I love debugging for this very reason too.

this added to the general frustration coming from continuous research failures. My research experience often started with an idea to build upon some work, trying to replicate the results to use as a baseline, and realising that the method does not actually work. Moreover, you cannot just publish the work saying that the others cherry picked. You have to be ten times as thorough if you want to write a paper like that. This feels unfair, undermines trust in science, and just sucks. If you ever published a paper like this, fuck you!

* * *

My family life went downhill. I lived with a constant feeling of guilt: not spending enough time with my wife and son, not giving them enough attention, asking too much of my wife, who managed most of the childcare and housework while also doing her Master's. I was always tired and sleep-deprived. Even when I was with them, I often felt like a zombie—physically present, mentally gone.

At the same time, I felt held back at work. I couldn't put in the same hours as others around me, staying late invoked guilt. I still had some responsibilities, and I did not want my relationships to get totally wrecked. I wanted my son to have good memories of his early years, and I wanted to be in those memories. I grew up without a father. I didn't want him to grow up without one too, or with someone who was just a ghost in the background.

Social life was complicated too. Going out with friends meant skipping the little time I had with my family. I tried

mixing the two groups, and sometimes it worked: we assembled furniture at Alessandro's place, we went to a couple of events in my college together, Castle Mill had a lot of people around. But it didn't always go well. You don't take a four-year-old to a pub at 8 p.m., and a night out with your wife isn't the same as going to a loud MCR to play some foosball.

Totally destroyed by amount of work.

In some strange way, I think that guilt is what kept me from burning out completely. Like Walter Sobchak, I never rolled on Shabbos. Weekends were sacred. Saturdays and Sundays were for family. I never really rested during the week, but those two days kept me sane.

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We are done with year two, the year of frustration, let's move on to the next one, the year of misery.

Year Three: Misery

TBD

Year Four: Reassessment

TBD

Epilogue

TBD