Learning the latent structure of translation
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A thesis is perhaps the most personal and solitary piece of work that a scientist will ever produce. We young researchers must find the courage to venture for the first time alone to the dark corners of knowledge and make a bold step forward where nobody has ever been before, which is outright scary! Luckily, even though in this age-old intellectual rite-of-passage we are the ones who ultimately have to call the shots, we are never truly alone. There is a university, a promotor and a supervisor, there are also committee members and colleagues, friends, relatives and loved ones. There are the people who helped us make it to the starting line and those that are waiting for us after the end of the journey. I feel deeply indebted to all those who, in every possible way, accompanied me in these scientific and personal explorations. In these few lines, I would like to express my utmost gratitude for their help and encouragement.

In the beginning there was hope, aspirations and the great unknown. And God said: ‘Let there be a supervisor’, and there was Khalil Sima’an. I would like to thank Khalil for his continuous support for more than six years now, all the way from supervising my Master thesis to my PhD defence. He would pose the great questions and encourage me to go out and find my own answers. He taught me how to move past the surface and dare to face the deeper facets of scientific problems, however frightening this may be. He made this project possible with his constant encouragement and sincere belief that I could do it, even in my moments of doubt. For all this I am truly indebted to him, but most importantly I thank him for providing the living example of a true scientist.

I was also privileged to have Remko Scha as my promotor. Remko provided exceptional feedback through all the process of writing the thesis. His insightful comments decisively aided in increasing the quality of this work, as well as my own intuitive understanding of the material, and helped to bring everything into context. Throughout my PhD, I enjoyed the purest moments of scientific bliss during the discussions that I held with Remko and Khalil on the chapters of this thesis.
Apart from my promotor and co-promotor, I would like to wholeheartedly thank the other members of my doctoral committee: Pieter Adriaans, Rens Bod, Kevin Knight, Hermann Ney and Andy Way. I thank them for their kind interest in this work and for the valuable time that they spent reading this thesis. I am particularly indebted to Kevin Knight for the enthusiasm he showed for this work and for providing me with his detailed comments. Hermann Ney, unknowingly, played an instrumental role in my choice to join the ranks of Statistical Machine Translation researchers, by delivering a most interesting speech on SMT at the CLIN conference in Amsterdam, back in 2005. His work together with the work of Kevin Knight and his colleagues at the Information Sciences Institute has provided a guiding light for my efforts all this time. The work of Rens Bod and Andy Way on modelling natural language data with fragments has been highly influential for this thesis, while Pieter Adriaans serves as a shining example of the broad-minded scientist that I aspire one day to become.

This thesis and the work behind it decisively benefited by the intellectual air of the Institute of Logic, Language and Computation, which I breathed throughout my PhD studies. Apart from Khalil, Remko and Rens, I was lucky enough to interact with Jelle Zuidema, Stefan Frank, Tejaswini Deoskar, Maxim Khalilov, Gideon Borensztajn, Federico Sangati, Reut Tsarfaty, Gideon Maillette de Buy Wenniger, Sanne Korzec, Paul van Ulsen, Anne Maren Krüse and Lena Kurzen. I would like to particularly thank Tejaswini for our highly interesting collaboration and for giving me the chance to have some hands-on experience with parsing, as well as fellow SMT researchers Maxim and Gideon Maillette de Buy Wenniger for being extremely helpful whenever needed and for our interesting discussions. I would like to further thank Andreas Zollmann, ILLC alumnus and excellent fellow SMT researcher, for his intuitive feedback on work included in this thesis and his kind interest and encouragement. I thank Federico and Gideon Borensztajn for being great friends and for being patient and encouraging during our ping-pong games. I am deeply grateful to Paul van Ulsen for helping me learn how to speak decent Dutch by being patient with me during our long discussions in the language. Our walks in the Dutch countryside uncovered for me a whole new (flat) world of beauty and allowed me to learn so much about the country and its history.

Our ex-director, Leen Torenvliet was kind enough to bare with my continuous complaints due to my insatiable demand for computing power and was instrumental in making sure that our group was provided with the infrastructure we needed; the results in this thesis would have never been reached without it. Our manager during most of my time at the ILLC, Ingrid van Loon, was always there when needed and made sure the PhD project stayed on track during the less easy times. I would like to also thank our administrative staff, Tanja Kassenaar, Karin Gigengack, Marjan Veldhuisen and Peter van Ormond, who always generously provided their support and advice.

Before the ILLC, there were the Netherlands and the University of Amsterdam
and the people who helped me to arrive in this amazing country. First of all, I would like to thank the anonymous employee of the European Space Agency (or perhaps the computer program he was using) for unknowingly initiating the process that brought me in Amsterdam. How this happened exactly will always remain a story worth telling. Then, it was Theo Gevers who gave me a place in the Master of Artificial Intelligence of the University of Amsterdam and Niels Molenaar, Hideko Gieske and the other people at the International Office who made sure, in a most surrealistic way, that I would start a great new life here.

Back then, I took the decision to get on a one-way flight and arrive in Amsterdam, without any reassurances that there was even a place for me at the MSc programme, as it was weeks before I finally got formally accepted and courses had already began. I was living out of a suitcase and sleeping on a hostel bed. After checking in my hostel, I took the tram and went, without an appointment, to see Niels. Right there in the middle of my daring leap of faith, I was not sure if I would land on a new adventure or if my trip would end as a big disaster. Niels sat to talk to me, smiled and said ‘well, now that you’re here, let’s just fix everything’. After a couple of days, I had a new apartment and I was following courses. I will always remember these days as a time when I was taught how pure kindness and human interest can transform the most perilous moments into bright new beginnings.

Apart from all these wonderful people that I was lucky enough to encounter during my time at the UvA, I would also like to acknowledge the enduring support and encouragement that I received during this period from my friends and beloved family members. Angelos and Valentini Nastoulis have embraced me with their true friendship for almost two decades now. My discussions with Angelos allow me to feel for a few moments like a philosopher of the old days, when we take time to pause and question everything anew. Valentini’s warmth of heart and encouragement has provided the fuel to move further many a time. Manolis Foundoulakis has been a close friend for a whole decade and he was decisive in convincing me to move toward a researcher’s education and career. His belief in me all this time and our precious time together whenever possible helped to make the life project he inspired a reality. Persa Karanika and Iphigeneia Vrettou remained good friends despite the distance and their kind words and the inspiration they provided whenever we met was really important to me. Georgios Grigoriadis has laid his mark firmly on this thesis by kindly providing his expert skills for the cover design.

One thing that kept me going through all this time was my love of the mountains and nature, which always provided solace when I needed it most. Although my decision to come to the Netherlands meant that I would have to travel a bit further away to come closer to the windy peaks, somehow magically there was always a chance to do so during these years. I would like to thank all the people that I met in these trips, particularly those that accompanied me while walking the Santiago de Compostela path in Spain: Asuncion Revert Garcia, Sara Shel-
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Apart from my friends in Greece, I was also lucky to meet highly interesting people in the Netherlands as well and they have all supported me while performing this work in many different ways. Isaac Esteban was the best study mate during my MSc years and a true inspiration for the time afterwards. Gideon Borensztajn, apart from a colleague and a long-time room-mate, was also a good friend who provided enormous help during the last three years. Tejaswini Deoskar was a further colleague I was fortunate to get to know more and was extremely encouraging when inevitably things got tough, apart from being a great travel mate. As they were located in Groningen which is 200 km away from Amsterdam, I did not manage to see Barbara Plank and Martijn Wieling very often. Still I was always happy to meet them at the most distant places during conferences. Aspasia Beneti, Simon Butterworth, Antoinette Christou, Vanessa Diehr, Nina Godeke, Dimitra Kassari, Sybren van der Kolk, Elisavet and Iliana Kyritsi, Maria Petrovas, Fotis Stringos and Na Yang are just some of the people I was fortunate to have around me during the time I was compiling this work.

Then there is family, and what an amazing one I was blessed to have in this life! Words cannot describe the extent of the support and encouragement I received from my family all this time. First and foremost, I would like to deeply thank my mother, Maria Xydianoy, for her enduring love and her persevering belief in me. Day and night, through the brightest successes and the darkest moments, we were always walking this path together. Everything I am and will be, I owe it to her. My father, Nikos Mylonakis, was instrumental in getting me obsessed with computers and artificial intelligence. Thanks to him, I was lucky to have grown up with a computer at home since the day I was born, a rare coincidence for my generation. Together, we explored and dreamt what these machines could do for us humans and the influence of these days will always endure within me. My sister, Zoi Mylonaki, steadfastly stood beside me throughout all these years and her unceasing encouragement meant the world to me. She is someone I deeply admire and her existence makes this world so much better in many different ways. My brother, Damianos Mylonakis, has provided his love and advice without a break. The person he will be in 12 years is the man I aspire to be today, even though I know I could never reach that far. Antonis Katelouzos and Stamatis Salamouras were also extremely supportive and our interesting discussions supplied ample food for thought. Alexandros, Martha, Anastasia and Kostas Mylonas embraced
me in their family like one of their own and their warm words of encouragement were precious for me. I am also indebted to all my relatives in Crete, Athens and Larisa (and those venturing all over the world) whose love and positive energy also drove this work forward. Above all, I would like to express my gratitude to my grandparents Zoi and Damianos Mylonakis, who passed away recently, for their love and support. Grandma Zoi, the thread of love and appreciation that connects us is stronger than death itself.

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Markos Mylonakis
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