Final report
Internship abroad

Personal data and general information on the internship

Subject of studies: Neuroscience

Bachelor/Master/State exam: Master

Time of internship: 04.11.2024-31.01.2025

Place of internship: Lisbon, Portugal

Internship institution: Champalimaud Foundation

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Guidelines:

- The report should have a length of at least **4 DIN A4 pages** (Times New Roman, 12pt, 1.5 line spacing)
- If you want to give names, please do not give the full name of the person. Use only the first name or abbreviations such as "L.".
- When integrating photos, please note that your report requires the consent of the person(s) photographed when published and distributed.
- Please save your report as a word document (max. file size: 8 MB) and upload it to MoveON.
- If you are looking for a little inspiration for your own report or would like to compare your experiences with those of other students, please feel free to have a look at our website.

You may structure your report as follows:

1. Planning and preparation (e.g. application process, finding accommodation, language course)
2. Internship (tasks, typical workday, workload)
3. Social contacts
4. Everyday life and leisure
5. Financing (cost of living, shopping tips)
6. Internship and studies (Were you able to apply what you learned during your studies, How has the internship changed your motivation to study and/or your attitude towards your future profession)
7. Conclusion (were your expectations met, challenges, particularly defining experiences, tips for future interns)

The first steps of my journey to Lisbon started in the summer of 2024 in Munich. As a neuroscience master's student almost finishing my studies this was a time for me more filled with questions than actual answers. While the idea of doing a PhD was already on the horizon, I was not sure what topics I wanted to explore further and more importantly, where I wanted to conduct my PhD. To this end, I had always considered doing an internship abroad. I had been involved in scientific projects in extended capacity as an intern, thesis student and student assistant before. However, all these projects were based in Munich. International conferences and seminars I had attended in New York, Paris and Venice during my master's program had shown me that research environment depends heavily on the culture of the location and the institute, which was why I was eager to experience a different scientific atmosphere.

As for the topic I wanted to explore during my prospective internship, I had become interested in decision-making processes during a previous laboratory rotation at LMU. After studying this from a human perspective, and given my background in biology and animal behavior, I was deeply curious about how animals navigate decisions in their habitat. All animals constantly receive information from the environment which are then processed by their sensory systems and help modulate their "responses", in other words, their behavior. One particular aspect of this is decision confidence or decision commitment. After all, animals can also be more confident or more hesitant about their choices! In a previous conference I had attended in Venice, the main topic was about animal metacognition, in other words, awareness of one's own thoughts or actions. Since confidence also plays into this concept of thinking about one's own thinking, I was very interested in how confidence is computed in an animal's brain in a way that it might reflect on its actions.

Talking about this recent interest with a colleague of mine, he immediately asked me if I had considered the Champalimaud Foundation in Lisbon for an internship. I knew of the Champalimaud Foundation already because of the internationally renowned research focusing on behavioral neuroscience, but I had never thought about completing my internship there. I was beyond thrilled to find the laboratory I worked at, as their scientific focus was completely on decision-making processes! I contacted the principal investigator about internship possibilities, and we had an online meeting soon after discussing my mobility.

Flash forward to November 2024, I was as nervous as I was excited while waiting for my plane to board. Here I was, travelling to a country I had never visited before, whose daily language I did not speak except for a few months I spent on language apps. Would I be able to build a life for myself in a completely new setting? Would I be welcomed in my workplace? Would I make meaningful connections?

It did not take too long until I learned the answers to these questions as my first workday was just around the corner. Approaching the institute, the first thing that stood out to me was the stunning architecture and the location by the riverside of Tagus. My supervisor welcomed me at the entrance and gave me a tour of the laboratory, where he introduced me to the PhD students working in the lab. I was already surprised by the number of people I met, and even more so by their enthusiastic and warm attitude towards the newest member of their research group. After taking care of several onboarding steps I had the first meeting with my supervisor in which my project was introduced.
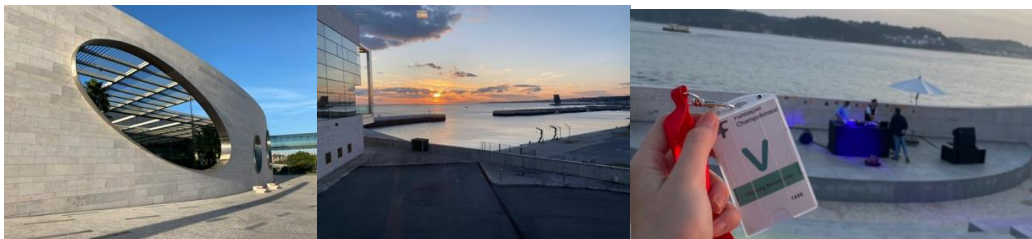
The group uses a setup to study how rats make decisions based on the sounds they hear through small headphones. In each trial, the sound coming from one side of the headphones is louder than the other. The rats choose which side is louder by walking to and poking the port on the left- or right-hand side in the experimental setup. While the readouts of choice (left or right) are directly recorded by the setup, the underlying process during walking to the port is unknown. My project aimed at understanding how animals moved and whether decision commitment or confidence could be inferred from the vigor or other kinematic parameters of movement.

To this end, one must determine the locations and positions of an animal at all times during the experiment. Recently developed tools based on deep learning and machine learning have become a staple in animal neuroscience where one trains an algorithm based on how animals look in videos. These algorithms can then extract the animal object in other videos and track their movements, called pose estimation. This is not restricted to the animal as a whole but also its limbs, joints and other body parts.

My project started with exploring these algorithms and choosing the best one suited for our needs. After deciding on employing SLEAP (Pereira et al. 2022), I labeled scenes from videos where the rat was visible. Later with these labels I was able to train a neural network which, upon refinement and improvement of the dataset, could predict where the animal positioned with 99%

confidence. The next step was to apply this network to more than 100 videos of experimental sessions, which alone took more than one week but was a big success.

After this, my goal was to integrate this movement data with existing trial information. This certainly required me to improve on my coding skills and to learn new ways of data processing, but was less of a hurdle as my colleagues were very helpful and enthusiastic in teaching me how to do this. Once my data was organized neatly I moved on to the final step, which was analyzing everything in a bigger context.

This project was completely out of my comfort zone, since my research experience predominantly revolved around experimental work and had limited computational focus. In this sense, trying out new tools predicted to characterize next decades in neuroscience research as well as learning to analyze them in a broad context helped me gain invaluable insight and expand my skillset for my PhD.

However this was not the only scientific gain I had during my time at Champalimaud: I had the chance to interact with many PhD students who carefully explained their research and let me observe their training sessions as well as surgical procedures. Seeing the protocols outside of my home lab expanded my perspective and helped me compare between different techniques used. I regularly participated in weekly lab meetings where recent publications were discussed and lab members received feedback on their own work, helping me gain insight on the work and management culture. In addition, I attended seminars that included all research groups in the institute, where I had the chance to hear about the developments happening in other fields of neuroscience. One such unforgettable opportunity arose in my second week when I had the chance to listen to a keynote lecture by a researcher whose thought-provoking research I had followed closely for years and even cited on my bachelor's thesis! There were also opportunities I felt I benefitted from tremendously as a scientist: in my first week I presented to my fellow lab members my previous research project and received very useful feedback. Similarly, on my last day I had the chance to talk about my three-month project and what we achieved as results. All of these experiences, along with the strong professional network I built there, helped me grow as a scientist, broaden my horizon and become more secure in my future academic steps, something I will always be grateful for.

But of course, my development and gains were not limited to a professional domain. In these three months I also got to experience Portuguese culture, fell in love with the city and made lasting personal connections. The culture for me was strikingly different after spending several years in Germany, and I visited numerous sights and museums during my time in Lisbon. Most

notably, my daily commute involved walking past the Belem Tower, the Jeronimos Monastery and the Monument of the Discoveries, all iconic structures of Lisbon. During weekends I had the

chance to do excursions outside the city, in which I visited Sintra, filled with natural beauty and hike routes and Cascais, a charming resort town. I participated in concerts, since as a hobby musician, learning about the local music scene was one of the things I was most excited about. I also knew about football being a huge part of the culture in Portugal, so cheering for Benfica, with its truly passionate but enjoyable fanbase in two different games (one even being a Champions League match!) was a fun experience.
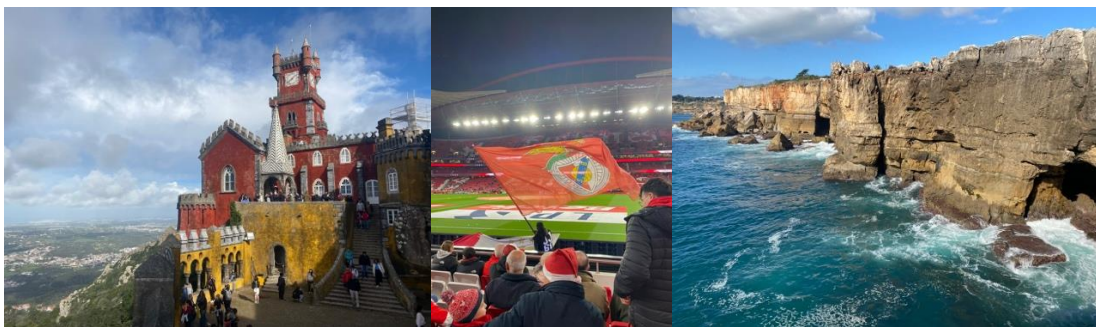
In November I was introduced to the festivity of Magusto at the institute, when roasted chestnuts are consumed in celebration. Since my time there coincided with Christmas, I had the chance to learn about Portuguese traditions, such as Bolo Rei, a traditional festive pastry. During New Year's Eve I visited one of the main squares in Lisbon, enjoying the spectacle of fireworks fired from the river. In my free time I explored the city on my own pace, going for long walks in different neighborhoods, pursuing my favorite hobby, urban photography, and finding cute cafes where I could have a peace of mind away from the chaos of the city center. Lisbon completely gripped me with its historic beauty, abundant tilework, unique architecture and a sense of belonging I felt from the first day I set foot there.
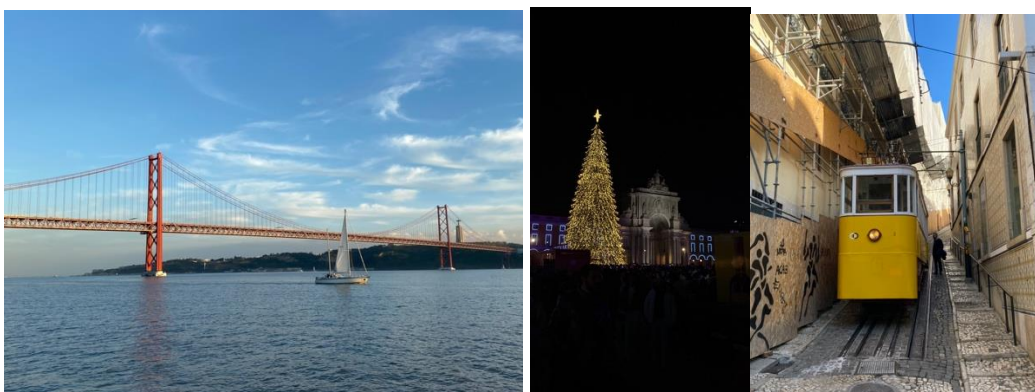
However, it was perhaps one single aspect that made my time in Lisbon so special: the people. Every person I interacted with in my daily life was warm and welcoming, at times making me forget I am thousands of kilometers away from my hometown. My colleagues were careful to include me in events and to help me orient at the institute. Our Christmas dinner as a research group was particularly enjoyable, and we ended up playing board games until 2 a.m.! But for me the most memorable part was shortly before my departure. I had already expressed my sadness for leaving them and leaving Lisbon, but certainly did not expect such a thoughtful farewell! On my last evening, we went out for dinner as a group where I was surprised by a quiz game where the topic was random trivia about me, testing how well my fellow lab members had gotten to know me. I was also gifted a coffee mug with a group picture we had taken at the institute – a gift to remember my scientific family in Lisbon forever. At this touching gesture I realized what wonderful connections I had made, making my departure even more bittersweet. I am looking forward to seeing them again at scientific conferences, summer schools and perhaps even one day, again in Lisbon.

Reflecting on my time in Portugal, I believe I knew even before I left that this experience would change me as a scientist and, more importantly, as a person, but I was not prepared for the extent of it. I got to experience a completely different work culture and had the chance to work at one of the best institutes in Europe for neuroscience. I pursued a project that was perfectly aligned with my interests but also encouraged me to think outside the box and step out of my comfort zone, gaining new and highly relevant skills and making me feel more confident about my goals in pursuing a PhD in cognitive neuroscience. I interacted with many peers and gained new mentors, learning about their approach to science and contributing to their environment with mine. These interactions extended beyond the territory of the lab as I had the chance learn about the Portuguese culture and experienced Lisbon from the local perspective. Although I was not able to become fluent in the language, I was genuinely surprised at how much I could understand it by the end of my stay. But most importantly, I am proud of myself for completing this journey, for daring to follow my dreams to the (literal) edge of a continent and for building a life for myself there. And so I returned: tanked up on Vitamin D and pastel de nata, two finished rolls of analog film in my backpack, equipped with invaluable know-how and a new perspective, refreshed and ready to take on new challenges, knowing that Lisbon will always have a special place in my heart.