EDINBURGH NAPIER UNIVERSITY

**SCHOOL OF COMPUTING**

**PROJECT DIARY**

**Student: Calum Hamilton Supervisor: Andreas Steyven**

**Date: 23/01/2020 Last diary date: 06/02/2020**

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**Meeting objectives:**

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| * We are planning to discuss ideas for the dissertation project. I have a vague idea of what I hope to achieve – competitive and cooperative behaviour in simulation/robots * I’m hoping to see an example of a university robot, which I may use in my project * My current project idea is to robot football and transfer learning to the bodies of actual robots. |

**Meeting discussion:**

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| * I was given several other project ideas – including capture the flag. I realised my dissertation focus was too broad and not specific enough. I was looking to train robots, transfer learning, find emergent behaviours and work with both robots and a simulation. * I got the chance to see a robot, however it is unlikely I will use robots for my dissertation going forward after the discussion |

**For Next Time:**

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| * I will go away and further consider my options for my dissertation project. I have narrowed my idea to looking at emergent behaviour between competitive and cooperative agents in a simulation * I will extend the project to robots if I have time, however it is no longer the focus of my project * I have plenty of leads to start researching my dissertation project. I will go away and research my topic further |

**Supervisor’s Comments:**

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| Discussion of project ideas, which need more focus. Identify one or more research questions that you plan to answer. This will help you with the structure of the project. |

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**Meeting: 30/01/2020**

**Meeting objectives:**

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| * We are planning to discuss my IPO this week. I sent a copy of my IPO prior to the meeting to ensure that my supervisor had a copy * I’m also hoping to ask questions about my dissertation planning and keeping a project diary, and about the timelines I should track |

**Meeting discussion:**

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| * We reviewed my IPO document. New/additional wording was discussed for several sections, and several further sections were slated for review over the weekend. Andreas really helped me understand the sections I didn’t fully understand * I was advised to create a project diary as soon as possible, and start planning and tracking my overall project progress |

**For Next Time:**

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| * I will submit my finalised IPO by Thursday (6th February) * I will bring a copy of my IPO to the meeting, marking any final changes made * I will create a plan for tracking my project and bring to the project * I will discuss starting my Literature Review with Andreas |

**Supervisor’s Comments:**

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| The IPO needs a bit more focus in certain sections, but you have a clear idea of what you want your project to be about. I have no doubt at this point that this will be a great project! |

The meeting on 06/02/2020 was cancelled due to unforeseen circumstances. The follow up meeting was on the 13/02/2020, where we met for longer than usual discussing the business for both weeks.



**Meeting: ~~06/02/2020~~ 13/02/2020**

**Meeting objectives:**

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| * After beginning to write my dissertation I’m looking for clarity regarding the literature review write-up, the abstract write-up and the introduction write-up * I’m also looking for feedback on the project plan that I’m keeping, to ensure it is suitable – and also looking to understand how it will shape in the future |

**Meeting discussion:**

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| * I had been too concerned with covering the field, regardless of how relevant the information was to the topic. For fear of missing information, it seems that my original scope was far too broad in the literature review * I’ve been introduced to a new writing style – namely, ask me thrice. The technique relies on you introducing a topic by name, mentioning it again in discussion and concluding with the name – hence the name of the technique. It ensures that one stays on topic when writing * I will go away and track my project diary. Pending review at the end of February * I was trying to be too broad in my approach to the literature review as well, ensuring I didn’t miss information about the implementation. As the literature review is much more abstract, I will create additional sections to fit the relevant content instead of shoe-horning into the literature review * We worked through both documents presented and then generally discussed the approach to the research document |

**For Next Time:**

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| * Continue working on the literature review * Bring along any questions I have about further research |

**Supervisor’s Comments:**

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| Discussed structure of dissertation and the purpose of each chapter and general good writing styles.  You might need to focus certain bits a bit more, but generally, you are on a good track. |

**Meeting: ~~20/02/2020~~ 27/02/2020**

**Meeting objectives:**

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| I’m slightly behind due to illness   * Looking to discuss simulator selection * Looking for further advice regarding the literature review and additional information * Want to understand when to begin my practical work |

**Meeting discussion:**

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| * Advice was given about the structuring of the literature review * We ran over various simulators discussing the pros and cons. We also discussed how I would write my choice of simulator in the literature review |

**For Next Time:**

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| * Start basic implementation within OpenAI Gym environments * Check the gym environment used in the Emergent Behaviours paper * Continue the literature review |

**Supervisor’s Comments:**

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| After a period of being off sick, there might be a bit of catching up to do. But you seem to be focused on the right things now. As discussed, look at other people’s experiments, especially the OpenAI one to see which simulators are being used. If you find an experiment that is very similar to yours, that’s a good thing. You can then use that, if it is good enough, which will automatically give you a baseline to compare your results to.  Keep reading and make sure to take notes from relevant work to inform your literature review and methodology chapter. |

**Meeting: 05/03/2020**

**Meeting objectives:**

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| * To understand better ways to plan and execute my project * Further help regarding dissertation layout * More understanding regarding how to research effectively |

**Meeting discussion:**

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| * MoSCoW (Must have, Should have, Could have, Won’t have) was given as an effective way of controlling project and checking what should be in, and what should be missed * I was recommended to make multiple Gantt charts to track the progress of my project. Andreas showed me an example of the charts he used to track his PHD dissertation * I need to sure I’m approaching each topic in light of the research question, and linking back where possible |

**For Next Time:**

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| * Write up more of the literature review and research further |

**Supervisor’s Comments:**

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| Good progress. Make sure you stay on track with your schedule and use appropriate tools to monitor your progress and adjust if necessary. |

**Meeting: 20/03/2020**

**Meeting objectives:**

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| * I’m looking for further advice regarding my literature review. I want to ensure what I’m writing is specific enough as I’ve written a lot of background – a lot of which may not be relevant |

**Meeting discussion:**

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| * Some of my literature review sections are far too generic. I need to make them much more specific to the topic * Advice has been given on the structure and the possible need for a Methodology and Approach section |

**For Next Time:**

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| * Need to get some further experience using simulators to understand what’s possible and what I may struggle with * Further work on my literature review – hope to get a lot further for next meeting |

**Supervisor’s Comments:**

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| Good progress. Start your practical work. This way you get your hands dirty and get experience with the simulator and libraries that you can jump right in to implement your algorithm instead of having to battle to idiosyncrasies of the tools. |

**Meeting: 02/04/2020**

**Meeting objectives:**

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| * I’m looking for further advice regarding my methodology. I want to understand how to approach the writeup * I would like further advice on how to read extremely complex papers, detailing full-scale implementations based on highly complex technologies * I’d like to know where I can train my models, to ensure I have enough processing power & can start running models |

**Meeting discussion:**

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| * I’ve been given advice regarding writing up the “what, why and how” of the methodology – It’s also important for me to keep a note of my research approach so I can talk about it in the evaluation too * Need to continue reading through the underlying papers to understand the complex implementations * I was told about the virtual Napier desktop, where I can train models via a bash terminal. I was also advised about free AWS credits and also possible Nvidia/Google options for ML training |

**For Next Time:**

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| * Need to continue reading through the underlying papers to understand the complex implementations * Need to start implementing & getting my hands dirty * Looking for help with some of the maths & knowing how much I need to understand |

**Supervisor’s Comments:**

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After this meeting, I needed to work further on my dissertation. I reached out to Andreas when I was next needing advice.

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**Meeting: ~~07/05/2020~~ ~~14/05/2020~~ 21/05/2020**

**(Moved due to exams & lack of results and then due to illness)**

**Meeting objectives:**

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| * Need to continue reading through the underlying papers to understand the complex implementations * To come along with some implementation work * Looking for help with some of the maths & knowing how much I need to understand |

**Meeting discussion:**

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| * Been advised it’s best to read through the abstracts of the papers if reading many or trying to find relevant papers, to avoid spending too much time on individual irrelevant papers * Been advised to stay away from the maths as much as possible and avoid trying to get bogged down in complex equations * Still have been struggling to get implementation work done. Need to start getting work done. Once I have networks and environments, Andreas will show me how to train on the University system * I have been busy with term exams. I will begin full implementation now that exams are over * I’ve been creating basic networks in gym environments to get a feel for the implementation I’m attempting * Environment has been built for the emergent computing project. Need to start implementing the network |

**For Next Time:**

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| * Come with implementation work * Come with examples of the dissertation to read |

**Supervisor’s Comments:**

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**Meeting: 01/06/2020**

**Meeting objectives:**

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| * I’m changing my project from the emergent behaviour project to the Agent57 project * This is due to the computational requirements, the highly complex nature of the project and the difficulties with getting it working on Linux * I’m looking to run my new project past Andreas and get feedback on approaching my new project |

**Meeting discussion:**

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| * I’ve been told to reach out to the paper’s correspondence email if I have any implementation-related questions at [adriap@google.com](mailto:adriap@google.com) * Andreas recommended I ask for code or at least get recommended the library which they were using to implement the original paper * I need to try and implement the architecture and try and get back to Andreas |

**For Next Time:**

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| * Email Adria with any questions * Come back with an initial implementation * Start writing up my implementation results |

**Supervisor’s Comments:**

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**Meeting: 16/06/2020**

**Meeting objectives:**

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| * Discuss the email with Adria * Get advice on implementing the network |

**Meeting discussion:**

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| * I received this email from Adria      * I seem unable to get my hands on code so I will need to try and implement the architecture and get it working |

**For Next Time:**

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| * Implement the network * Get training started |

**Supervisor’s Comments:**

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**Meeting: 26/06/2020**

**Meeting objectives:**

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| * Discuss the network |

**Meeting discussion:**

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| * I have created the initial network in Sonnet. I now need to get the training set up for it and ensure the network is running * This will involve getting the agent running in Atari environments |

**For Next Time:**

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| * Implement the rest of the agent * Get training started * Reach out to Andreas when I’m ready to start training on university PCs * Ensure this isn’t too delayed so that I have time to train the complex network |

**Supervisor’s Comments:**

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**Meeting: 19/08/2020**

**Meeting objectives:**

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| * Discuss my progress on the dissertation |

**Meeting discussion:**

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| * The implementation I’m trying to do for Agent57 is too complex, time consuming and not possible for me to re-create in the time available, especially with the additional requirements of university * I need a different dissertation question which I can answer |

**For Next Time:**

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| * Create a new dissertation question that can be answered using the existing knowledge and resources that I’ve gained from trying to answer previous dissertation questions |

**Supervisor’s Comments:**

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**Meeting: 03/09/2020**

**Meeting objectives:**

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| * Looking to confirm that my new dissertation project is appropriate |

**Meeting discussion:**

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| * Need to confirm my new dissertation approach |

**For Next Time:**

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| * Come back to Andreas when I’m ready to start training on university PCs and get advice on how |

**Supervisor’s Comments:**

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**Meeting: 30/10/2020**

**Meeting objectives:**

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| * Looking to discuss the implementation * Want to get advice on finishing the implementation * Looking to find out how to implement the project on the university PCs |

**Meeting discussion:**

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| * Need to confirm my new dissertation approach      * Confirmed the approach using TensorFlow-Agents wasn’t working (even on the Linux portion of the computer). Need to look for a new framework to use for implementing my dissertation models * The Reverb library doesn’t work on non-Linux machines, which is used in all example tutorials for the more complex networks |

**For Next Time:**

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| * Finish my implementation * Get the training running on the PCs * Arrange an interim review for the project with Paul Lapok |

**Supervisor’s Comments:**

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**Interim Review: 13/11/2020**

**Meeting objectives:**

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| * I’m looking to confirm my project with my second marker * I’m looking for feedback on my project |

**Meeting discussion:**

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| * Explain my dissertation, including the problem and purpose * I have a plan of work, but my plan is not up to date and my dissertation project has changed as a result of the work (from emergent behaviour to Agent57 to RL in game environments) * Discuss how I will evaluate my work |

**For Next Time:**

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| * My implementation is on-track for March 31st submission (date of submission) * I need to ensure I have an up-to-date project plan with milestones |

**Supervisor’s Comments:**

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**Meeting: 29/01/2021**

**Meeting objectives:**

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| * Looking to confirm submission date * Looking to update Andreas with current dissertation progress |

**Meeting discussion:**

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| * Confirmed the current state of my dissertation project * Need to find a way of keeping the network implementations consistent and ensuring they perform similarly * Have basic TensorFlow implementation but planning on switching to PyTorch as finding more documentation/ability to implement the networks and keep them consistent |

**For Next Time:**

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| * Need to get training running for my networks. Will reach out to Andreas when I’m ready to start training on university PCs and get advice on how to get the training running for my specific models |

**Supervisor’s Comments:**

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**Meeting: 15/02/2021**

**Meeting objectives:**

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| * Looking to confirm submission date * Looking to update Andreas with current dissertation progress * Implementation has been finished. I now need to begin training the models on the University PCs |

**Meeting discussion:**

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| * I have little Linux experience, so I was looking for advice from Andreas on getting the training started on the university PCs. The University PCs were out due to the blackout we had so I was unable to get the training started. Andreas has advised that he will need to go into the University to restart the machines for them to run |

**For Next Time:**

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| * We will meet in 3 days for Andreas to show me how to get the models training on the University system |

**Supervisor’s Comments:**

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**Meeting: 18/02/2021**

**Meeting objectives:**

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| * To get the network training on the University system |

**Meeting discussion:**

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| * Andreas believes the additional complexity of trying to get the Linux training working on a distributed system isn’t worth it * He has recommended training on the virtual desktop service instead |

**For Next Time:**

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| * Train the models on the virtual desktop system * Get the dissertation written up and send a sample of the dissertation to Andreas to check * Email with additional questions if required * The training I was doing on the D2 machine cut off after the machine force-restarted due to inactivity. I don’t have a way to keep the machines active so I’m looking for another way to train the models. I have emailed Andreas to get a new way of training * Andreas has offered some very helpful suggestions. He has spoken to Felix to reserve a D2 type machine which I can train on.      * I’m looking to have a meeting with Andreas so he can confirm how to connect to the D2 type machine |

**Supervisor’s Comments:**

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**Meeting: 09/03/2021**

**Meeting objectives:**

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| * Trying to connect to the university machine |

**Meeting discussion:**

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| * Tried to connect to the D2 machine through the SSL connection * Tried to connect to the D2 machine through the Virtual Desktop connection * Asked about the length of the literature review * Asked about getting Andreas to read my dissertation so far * Tried to connect to 3 additional D2 machines |

**For Next Time:**

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| * Continue writing dissertation * Wait for email back regarding machine to connect to in D2 * Need to remind Andreas near the end of the week if he hasn’t reviewed my dissertation project |

**Supervisor’s Comments:**

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