The Final Year Project

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These notes contain my personal advice regarding final year projects. Things, I wish I had told my students in previous years, but had not quite formulated at the time. I hope you find them helpful. They are my personal opinion and *not* in any way official policy; this you can find on the Blackboard page for the module MA3990. My advice can be summarized as follows.

> *What the final year project really is about, is you wrestling with a topic, making sense out of it, doing something with it and, in the end, writing about what you have done.*

Everything that follows is just an elaboration and an interpretation of this statement.

1 Beginning

> The current state of knowledge can be summarized thus:
> In the beginning, there was nothing, which exploded.
>
> —Terry Pratchett, *Lords and Ladies*

What is the point? It is not obvious from reading the requirements guide or the marking descriptors, but underneath it all they aim to measure three things: how deeply have you engaged with the subject, how much thinking has gone into the project and what level of understanding have you achieved? These things are difficult to quantify which is why marking descriptors do not mention them explicitly. They are also near impossible to fake. It is possible to rush the write-up in the last few weeks before the deadline, but it is not possible to rush thinking or understanding. Lack thereof will shine through in the way sentences are constructed in a paragraph, technical terms used in the text and how the introduction is constructed.

Do not lose faith. It will seem overwhelming in the beginning and that is normal. When you start learning a foreign language it seems inconceivable that you will ever be able to converse in it or read a novel written in it. The most important thing in the beginning is to get past being overwhelmed. And the only way to achieve this is by spending time with the project. We are here to guide your effort, to point you in the right direction, but you yourself have to invest the effort to overcome this first barrier.

Meet your supervisor. Regular meetings with your supervisor are the most valuable ressource you can access—make the most of it. Bring the work you have done over the

last week, be it a piece of code, a calculation or a list of sources you have been reading. More importantly, bring with you questions that you want to ask. Meetings are most productive, if there is something to talk about. And do not be afraid to ask questions. A wise man once said: questions don't have to make sense, but answers do.

Keep appointments. Do not cancel meetings, because you think you have not done enough. First, it will put more pressure on you to do enough work to justify a meeting the following week. This can lead to a vicious cycle of ever increasing pressure and ever more cancelled meetings. Second, you may be stuck at a difficulty that seems insurmountable to you but can be easily overcome if the right approach is used. You have to give your supervisor the chance to nudge you in the right direction or to encourage you if you are on the right path and just need to persevere to arrive at the solution. Third, your supervisor may want to tell you things about the bigger picture you were not aware had to be told. In any case, it is better to meet and if there is not much to talk about then the meeting will be short, but it will have taken place.

Take notes. During your weekly meetings, take notes. You will not remember everything that was said, not even the important parts. Just like learning does not happen during a lecture, so proper understanding does not take place during the meeting. Too much is said during the meeting to be remembered, which is why you need to take notes. These notes will then tell you what to work on until the next meeting. The other reason for taking notes is that supervisors do not like to repeat themselves. A lot of useful advice will be given during the meetings, once, and it is up to you to take note of it and follow it or not to.

2 Working

> Now . . . if you trust in yourself . . . and believe in your dreams . . . and follow your star . . . you'll still get beaten by people who spent their time working hard and learning things and weren't so lazy.
>
> —Terry Pratchett, *The Wee Free Men*

Work regularly. The key to success is to do work on the project every week. It is easy to get distracted by other modules or by part-time work and to forget about the project, because it is only due in March. Do not give in to this temptation, because catching up is always difficult. Catching up means not only to start working on the project again, but to do the work that was left undone in the previous weeks. Furthermore, this extra work has to be done without supervision, because meetings with your supervisor continue to take place only once a week.

How much work? A simple calculation will show you how much work you are

expected to do on the project. The project is worth 40 credits or one third of your workload in year 3. A working week has 40 hours, which correspond to do about 13 hours dedicated to the project *each week*. This is one and a half days working full time on the project. If you miss a week, catching up means spending three full days on the project in the following week.

In the beginning, read widely. You are given a topic that is both open-ended and has fuzzy boundaries. Read what you can find about your topic. You will not understand all of it, sometimes you will not understand any of it. Do not be disheartened by it, because every now and then you will understand something. The more you read, the more you will understand the context of your project topic and what you do will make more sense to you.

Read and take notes. Taking notes is the difference between reading for pleasure and reading to study something. As a start, keep a list of sources you have read or merely looked at. This list will be invaluable when you will sit down to write the introdutory chapter of you write-up. This list will also allow you to revisit sources, that seemed incomprehensible at first, at a later time. Few things are more frustrating than trying to find a book or website, that you looked at three months ago, and that would be really useful right now, but you just do not remember how you found it.

Not all sources are made equal. Nowadays we can use Google to find answers to most questions, but the answers we find are not all equally good or equally trustworthy. The internet is very convenient and for technical questions Wikipedia is usually reliable, but do not forget the library. Browse the shelves of the library, leaf through books and read their introductions and tables of contents. Well-written books are still unrivalled in their ability to provide overview and perspective for a topic.

Jumping the first hurdle. Your first deadline is the submission of the project background and draft plan. Its purpose is threefold: first, for you to get feedback on your progress and to see how you are doing; second, for us to see whether you understand what your chosen topic is about and what you have to do to successfully complete it; and third, for you to get feedback on technical writing and to be able to gauge how much work writing the final write-up will be. Invest effort in the background plan—not because it is assessed for it is worth only one tenth of the total mark, but because it is an opportunity to get feedback and to improve your writing skills.

3 Writing

> Ankh–Morpork people considered that spelling was sort of an optional extra. They believed in it in the same way they believed in punctuation; it didn't matter where you put it, so long as it was there.
>
> —Terry Pratchett, *The Truth*

Writing takes time. Do not underestimate the time it takes to write a 40–50 page long report. Writing is a process that consists of writing the first draft, reading it, revising it, reading it again and then revising it again. Every carefully-written text should go through at least three rounds of revision. Do not expect to write more than 3–4 pages in one day: that is a good writing day, and these pages will still need to be revised. Budget at least one month for writing the final write-up and don't forget that creating figures always takes more time than planned, so start early.

Form follows function. You will have to decide how your project write-up will look. The motto guiding your decisions should be the same embraced by designers and engineers everywhere: form follows function. The function, or purpose, of the project report is to be read. Like a non-fiction book or lecture notes, it will be read for the information contained therein; novels and poetry, on the other hand, are read for pleasure. Your goal is to make this information as accessible as possible. The formatting and the page layout are to be judged against this purpose. Good layout clarifies the structure of a text while bad layout obfuscates it.

Layout is hard. Creating a good layout from scratch is a difficult task and requires experience, so I would dissuade you from attempting it on your own. In this case my advice would be to find a project, a thesis or a report, whose design you like and to copy its elements: font size and family, page margins, spacing between paragraphs, formatting of headings, etc. A good starting point for a layout is a LaTeX template for a final year project[1] Even if you do not intend to use LaTeX for your project you can reuse the layout and formatting by recreating it in Word.

Use LaTeX. My other piece of advice would be to use LaTeX. This is my personal opinion, not endorsed by the department. LaTeX removes questions of layout and allows you to concentrate on content. If you are using a good template—many are available online—you can be assured that your project will look good. Among other things LaTeX helps with cross references, citations and the bibliography as well.

Proofreading. Proofreading your own work is hard. First, our mind is inclined to read what we intended to write and not what is actually written on the page. Second, we are lazy and we do not want to critisise our own work, because, if we do, we will

[1] One such template can be found at https://github.com/martinsbruveris/thesis-template, but there are many others.

have to spend time improving it. While it is natural to have these instincts, we have to overcome them. Our readers will not read the words in our minds but those on the page and they will expect complete sentences and correct spelling. There are a couple of tips that will help you proofread your own writing.

- *Take a break.* Leave at least half an hour, better a day, between writing and proofreading. Let your mind forget what you wrote so that you can approach your text with a fresh perspective.
- *Print it out.* It helps to proofread your own work with a pencil on paper rather than on screen. Maybe it is the change of scenery or the more permanent nature of paper that tricks the brain into paying attention to the words as they are written. In any case the effect is significant and worth the cost of ink and paper.
- *Read it out loud.* You may not want to do this in the library but reading your text out loud helps your brain switch from writing into listening mode. It also helps you hear the rhythm of your sentences. Sentences that are too long and complicated may look fine on the page but become tangled in the mouth when read out loud.
- *Read it line by line.* Another trick to help you focus on the sentence in front of you is to cover up the remainder of the page with a piece of paper, thus forcing the eye to look at one line and one line only. A related trick to help with spelling mistakes is to read the text word by word *backwards*.
- *Know your mistakes* or as the Greeks said, know thyself. We all have mistakes that we like to make. The important thing is to know what they are so we can look out for them. This is one reason we mark the background submission and read one chapter of your project. The suggestions and corrections we make there you can then apply to the rest of your project.

4 Presenting

> As they say in Discworld, we are trying to unravel the Mighty Infinite using a language which was designed to tell one another where the fresh fruit was.
>
> —Terry Pratchett

Tell a story. A presentation is like a story: it has a beginning, a middle and an end. Unlike a dictionary, it is not a mere collection of facts. Start by setting the scene: What area of mathematics does the project live in? What was the question you set out to answer? What should we expect to learn from you during this talk? Then tell the plot,

explain the mathematical tools you use, show some technical details, show some of the results you arrived at. Finally wrap it up. Explain the importance of your results and tell us what you have learned from your project. If you can do this in 10 minutes, it will be a good talk.

Use slides wisely. The presentation is about the words you say, not about the words that are written on the slides. Giving a talk does not mean explaining what is written on a deck of slides. Slides are there to support the words you are speaking not the other way around. Use slides to show figures and mathematical equations; both are hard to describe with words only. Use them to aide the audience's memory; show them the structure of what you are talking about, but remember that 'talk' comes from 'talking' and not 'projecting text onto a screen'.

Practice your talk. Who has not heard the proverb: practice makes perfect. I cannot sufficiently stress how important it is to practice your talk at least once in front of a live audience. Stuffed animals on the sofa are not enough. Why a live audience? Because it takes away the 'pause' button. You cannot pause to compose your thoughts or to look at the slides one more time, because you are being watched. You cannot 'rewind' and attempt to explain the last slide one more time. You need to stand and present as if it counts and only if you can do that are you ready for the real audience.

Everyone is nervous. Being nervous before a talk is normal. You are about to stand in front of an audience, you will be the center of their attention and your performance will be judged. The key is to control anxiety. Preparation helps, because it reduces the space of uncertainty in your head that anxiety needs to thrive. Nervousness, in small doses, is helpful, because it sharpens your senses and increases your concentration. It is a survival instinct, so make use of it. Two points to keep in mind: it may not seem so in the moment, but most audiences, certainly the one at your project presentation, are sympathetic, they want you to succeed; second, anxiety will recede as soon as you start talking. Anxiety will also subside with experience, although I doubt that it will ever dissapear completely.

Attend to details. A good talk can be easily undermined if you do not pay attention to details. Know what are your hands doing. The talk is no time to stroke your beard or play with your hair. Maintain eye contact with the audience. You should know what is written on the slides and there is no need to look at them during the talk. Have a stopwatch on the desk in front of you. You should always know how much time is left. Getting details right will become easier with practice and experience but for it to happen you have to start paying attention now.

> 'It's not how you finish that matters,' said Buddy. 'It's how you get there.'
>
> —Terry Pratchett, *Soul Music*