How to finish a graduate programme and have a successful thesis defence

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Disclaimer

- Based on UK tradition
- Also informed by experience in several other countries
  - But theses are generally consistent the world over
  - Nature of defence sometimes changes
- Informed by PhD but also applicable to MSc
- Also applicable to research in general
  - writing papers
  - giving conference presentations
- Based on experience of
  - supervising 35 PhDs
  - examining 30 PhDs

Thanks

King's College London:

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- Steve Munroe, PhD
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- Jorge Gonzalez Palacios, PhD
- Maira Rodrigues, PhD
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- Nathan Griffiths, PhD
- Sorabain Wolfheart de Lioncourt, PhD
- Alexander Poylisher, PhD
- Simon Miles, PhD

- *Toby Walsh, How to Write a Thesis (for slides)!*

Examiner

- Examined around 30 PhD dissertations

- University of Bath, UK
- University of Edinburgh, UK
- Imperial College London, UK,
- University of Liverpool, UK
- Manchester Metropolitan University, UK
- Oxford Brookes University, Oxford, UK
- Queen Mary and Westfield College, London, UK
- Sheffield Hallam University, UK
- University of Southampton, UK
- University College London, UK
- University of Warwick, UK

- University of Melbourne, Australia
- Royal Melbourne Institute of Technology, Australia
- Czech Technical University, Czech Republic
- University of Oulu, Finland
- National University of Ireland, Galway, Ireland
- University College Dublin, Ireland
- Alma Mater Studiorum: Universita degli studi di Bologna, Italy
- University of Technology, Mauritius
- Maastricht University, Netherlands
- Vrije Universiteit Amsterdam, Netherlands
- Universiteit Utrecht, Netherlands
- University of Pretoria, South Africa
- Universitat Autonoma de Barcelona, Spain
- Universitat Politecnica de Catalunya, Spain
- Universidad Rey Juan Carlos, Spain

Overview

Pre-submission
Preparation
Participation

Pre-submission

Writing up

Good News and Bad News

- You only have to write ONE thesis

- With a PhD, you can add "Dr" to your name

- Good for upgrades on planes

- Writing a thesis is hard, painful work
  - Some people never manage to write one
    - 99% perspiration, 1% inspiration
  - You've already done the fun part (the research)
  - It's unlike any other document
  - Thesis writing is not a marketable skill

Why write a thesis?

- Entry to academic career

- In the process, you will learn
    - How to research
    - How to write

- It will introduce your research to a wider audience

- It will make you famous: Unlikely

- It will radically change science: Unlikely

- It will advance our knowledge: Just a little

- Main benefit is in teaching you to do research

What a thesis isn't!

- What I did in the lab over the last 2-5 years
  - I first read the background material
  - I then implemented an algorithm
  - I ran some experiments
- *A thesis is a logical reconstruction*
  - *Not a historical narrative*
- A brain dump of everything you've done
  - You get to leave out the dead-ends
  - But you have to fill in any obvious gaps!
- *A thesis is a logical reconstruction*
  - *With a single coherent message*

What is a thesis?

- Demonstration of an understanding of the state of the art
- Critical appreciation of existing work
- A novel contribution
- Evaluated systematically

How to Start

- Write a thesis statement
  - 1 sentence
  - 1 paragraph
  - 1 page
- Everything you write should be directed at this
  - Thesis (noun).
    1. A proposition maintained by argument
    2. A dissertation advancing original research

Thesis Statement

- Agent programming languages are limited, by typically being restricted to single agent systems and predictable domains, and need to be modified to address dynamic, unpredictable and multi-agent domains.

Thesis Statement

BDI agent languages have been used mostly in the context of single agents based on a plan library of behaviours invoked reactively. Though they provide a theoretically sound basis for agent systems, they offer limited support for multiagent systems with dynamic plan libraries.

In particular, when new plans not foreseeable at initial design time are required, an agent must be redesigned. In addition, agent languages provide at most a communication language with no other consideration of interaction.

To address these limitations, we extend AgentSpeak(L) to decouple goal achievement from plan execution, and generate new plans at design time. We also introduce a simple cooperation mechanism and a normative mechanism to provide a degree of societal control.

Thesis Statement

One of the most widely studied agent models is based on the notions of beliefs, desires and intentions (or BDI) as mental attitudes that guide the selection of course of actions. However, BDI agent languages have been used mostly in the context of single agents based on a plan library of behaviours invoked reactively and, though they provide a theoretically sound basis for agent development, they offer limited support for multiagent systems with dynamic plan libraries.
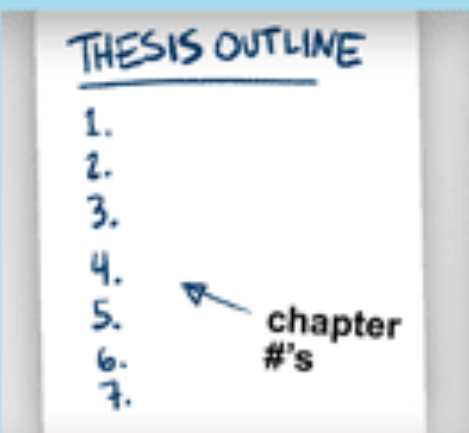
In particular, when new plans not foreseeable at initial design time are required, the agent must be redesigned. Moreover, when designing multiagent systems, agent languages provide at most a communication language with no other consideration of interaction.

This thesis aims to address these limitations by introducing a new agent language and architecture that includes a mechanism for processing goals in a manner that decouples goal achievement from plan execution, as well as generating new plans to cope with unforeseen situations at design time. It bridges the gap between agent languages and multiagent systems by introducing a simple cooperation mechanism together with a norm processing mechanism aimed to providing some degree of societal control.
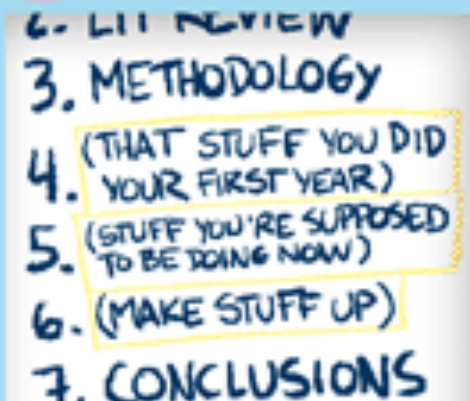
Table of Contents I

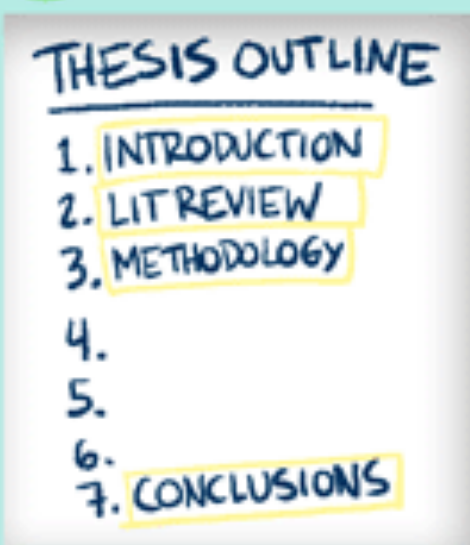- Introduction

  - Thesis statement

- Background

  - Literature Review
  - Context, definitions, notation

- Theoretical or algorithmic developments

- Empirical results

- Analysis

- Related work

- Conclusions

  - List contributions

Table of Contents II

- Introduction
  - Thesis statement
- Background
  - Literature Review
  - Context, definitions, notation
- 2-3 Content Chapters
  - Theoretical or algorithmic developments
  - Empirical results
  - Analysis
  - Related work
- Conclusions
  - List contributions

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Table of Contents

- Background & related work overlap

  - Need to discuss related work at start to set scene
  - Need to discuss related work at end to demonstrate your originality

- Often one chapter per workshop or conference papers

  - But not cut and paste!

Timetable

- How long will it take?
  - Depends on many factors
  - How much you've written as papers
  - …

- Heavy-tailed distribution
  - Min = 2 months (very rare)
  - Max = infinity
  - Mean = infinity
  - Median = 6-9 months

NEWTON'S THREE LAWS OF GRADUATION

Though famous for his seminal work in Mechanics, Isaac Newton's theories on the prediction of a doctoral graduation formulated while still a grad student at Cambridge remain his most important contribution to academia.

FIRST LAW

"A *grad student in procrastination tends to stay in procrastination unless an external force is applied to it*"

This postulate is known as the "**Law of Inertia**" and was originally discovered experimentally by Galileo four years before Newton was born when he threatened to cut his grad student's funding. This resulted in a quickening of the student's research progress.

Galileo's observations were later perfected by Descartes through the application of "Weekly Meetings."

Before Galileo's time, it was wrongfully thought that grad students would rest only as long as no work was required of them and that in the absence of external forces, they would graduate by themselves.

(From Encyclopaedia Britannica)

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NEWTON'S THREE LAWS OF GRADUATION

First published in 1679, Isaac Newton's **"Procrastinare Unnaturalis Principia Mathematica"** is often considered one of the most important single works in the history of science. Its Second Law is the most powerful of the three, allowing mathematical calculation of the duration of a doctoral degree.

SECOND LAW

*"The age, **a**, of a doctoral process is directly proportional to the flexibility, **f**, given by the advisor and inversely proportional to the student's motivation, **m**"*

Mathematically, this postulate translates to:

$$age_{PhD} = \frac{flexibility}{motivation}$$

$$a = F / m$$

$$\therefore F = m\,a$$

This Law is a quantitative description of the effect of the forces experienced by a grad student. A highly motivated student may still remain in grad school given enough flexibility. As motivation goes to zero, the duration of the PhD goes to infinity.

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NEWTON'S THREE LAWS OF GRADUATION

Having postulated the first two Laws of Graduation, Isaac Newton the grad student was still perplexed by this paradox: If indeed the first two Laws accounted for the forces which delayed graduation, why doesn't explicit awareness of these forces allow a grad student to graduate?

It is believed that Newton practically abandoned his graduate research in Celestial Mechanics to pursue this paradox and develop his Third Law.

THIRD LAW

"For every action towards graduation there is an equal and opposite distraction"

This Law states that, regardless of the nature of the interaction with the advisor, every force for productivity acting on a grad student is accompanied by an equal and opposing useless activity such that the net advancement in thesis progress is zero.

Newton's Laws of Graduation were ultimately shown to be an approximation of the more complete description of Graduation Mechanics given by Einstein's Special Theory of Research Inactivity.

Einstein's theory, developed during his graduate work in Zurich, explains the general phenomena that, relative to the grad student, time slows down to nearly a standstill.

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Timetable

- "Your thesis is your baby": P. Prosser
  - Give it 9 months
    - Write it up
    - Fill in gaps, experiments …

- "You have to know when to let it go"
  - Put a fence around what you've done

Writing chapters

- Don't start with the Introduction or Conclusion

- Start where you feel happiest

  - Typically a middle chapter
  - Write outwards
  - Finally Conclusions and end with the Introduction

- Write everything with your thesis message in mind

- Get feedback before you write too much

  - One person to read each chapter as it is written
  - Another person to read thesis in order

Writing chapters

- Lay some good groundwork

  - LaTeX macros

  - Bib file

  - Indexing

  - ...

- You'll discover holes in your research

  - Theorems you haven't proved

  - Experiments you didn't run

  - Different problems or parameters

- Mix writing with more research

Rule of Three

- Within each chapter, repeat yourself 3 times
  - Introduction: We will show ..
  - Body: Show ..
  - Conclusion: We have shown ..
- Within thesis, repeat your contributions 3 times
  - Intro chapter
  - Main chapters
  - Conclusion chapter
- But don't bore reader
  - E.g. in introduction be brief, in conclusions be broader

Common Mistakes

- Informal text

  - Examiners will jump on imprecision

- Opinions

  - ".. The main problem in CP is modelling .."

- A thesis is an argument!

  - ".. A major bottleneck preventing the uptake of CP is modelling [Freuder, AAAI-98]

- Complex sentences full of long words: "*Preponderate*"

  - A thesis should be a simple, convincing argument!

- Entertainment or humour

  - Joke footnote

Common Problems

- It's never possible to cover all issues
  - So you will never finish?
  - It's sometimes enough to *identify* the issues
  - Examiners greatly appreciate you identifying limitations
  - Examiners greatly appreciate finding a few mistakes
- Ideas become obvious to you
  - You stop writing to a sufficient level of detail
  - Especially hurts the opening chapters as they are often written last
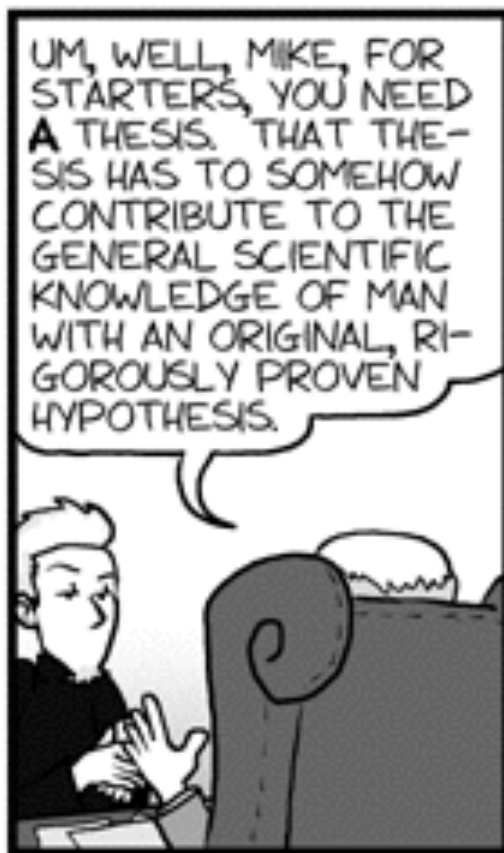
Common Problems

- Writing too much
  - There are rules about maximum length
  - But rarely rules about the minimum
- Nash's PhD thesis
  - 27 pages long
  - Won him a Nobel prize
- At some point, your brain will surely become toast
  - Take a break
  - Eat properly, exercise, sleep …

Other Issues

- Review of literature

  - Is the literature relevant?
  - Is the review critical or just descriptive?
  - Is it comprehensive?
  - Does it link to the methodology in the thesis?
  - Does it summarise the essential aspects?

- Methodology

  - Is there a clear hypothesis?
  - Are precautions taken against bias?
  - Are the limitations identified?
  - Is the data collected appropriately?
  - Is the methodology justified?

Other Issues

- Presentation of results
  - Have the hypotheses in fact been tested?
  - Are the results shown to support the hypothesis?
  - Is the data properly analysed?
  - Are the results presented clearly?
  - Are patterns identified and summarised?
- Discussion and Conclusions
  - Are the limits of the research identified?
  - Are the main points to emerge identified?
  - Are links made to the literature?
  - Is there theoretical development?
  - Are the speculations well grounded?

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Your supervisor

- Your supervisor is on your side
  - Your success is their success
- Intellectual support
  - Quality assurance
  - What standard a thesis should reach
  - Indication of when to stop
- Do not expect:
  - Smiles
    - If draft chapters contain simple spelling mistakes and typos
  - Mind-reading skills

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Preparation

Pre-Defence Preparation

Read the thesis

- Re-read your thesis several times in the week preceding the defence
  - Probably a gap of at least a month between submission and the defence
  - Even though you think you know what you wrote, you will have forgotten some things
  - Examiners should not get the impression that you don't know where things are in your thesis, especially if you want to argue with them by referring to something you have written

Check out your examiners

- Ensure you are familiar with the research work of your examiners

- Check out their broad areas of research

  - especially what they are doing now!

- This will give you a feel for their views on research and the sorts of things they are likely to concentrate on

Check out your supervisors

- Ensure you are familiar with the research of your supervisor!

- Examiners are often research colleagues of your supervisor

- They will know what research your supervisor is undertaking at the moment
  - may be interested in how your PhD fits into this overall picture

Questions

- It is impossible to predict the exact nature of the questions that will be asked in the defence itself, but ...

- There are several common types of question that are likely to arise

- Having thought about these in advance you will be able to produce better answers

- It's useful to prepare some notes (to which you can refer) for these questions.

Questions: your research

- Summarise the research work you have undertaken.
  - This is often used as a starting question to get you talking
  - You should describe (taking about five minutes) what research you have undertaken.

Questions: novelty

- What is novel about your research?
  - This is the key question for a PhD
  - Make sure you are clearly able to articulate the key ways in which your thesis advances the state of the art.
    - It's the *contributions*, Stupid!

Questions: shortcomings

- What are the main shortcomings of your research?
  - It is acceptable to have shortcomings, although this list should be shorter than your contributions!
- How can these shortcomings be addressed?
- If you were starting again, what would you do differently?

Questions: collaboration

- If you have performed the research in a collaborative project or in partnership with somebody else other than your supervisor, you may be asked about the relative contributions of the participants.
  - In particular, the examiner will want to understand precisely what you did. Answer honestly!

Questions: publication

- If you have not published much from your thesis to date, why not?

- Which of the chapters you have written would be appropriate for publication, and in what sort of forum?

More common questions

- Why is your research topic an important one?

- What impact do your results have for the wider research community?

- If somebody was to start their Ph.D. by building upon yours, what would be the key pieces of advice that you would give them?

Participation

The Defence Itself

What NOT to say at your defence

1. "Ladies and Gentlemen, please rise for the singing of our National Anthem..."
2. Charge 25 cents a cup for coffee.
3. Stage your own death/suicide.
4. "I'd like to thank the Academy..."
5. Answer every question with a question.
6. "Laugh, will you? Well, they laughed at Galileo, they laughed at Einstein..."
7. "I could answer that, but then I'd have to kill you."
8. Show slides of your last vacation.
9. Try to use normal printed paper on the overhead projector.
10. "Please phrase your question in the form of an answer..."

Basics

- Know the date, time and location of the defence
- Be alert
  - no wine, women/men or song the night before!
- Aim to arrive at least 20 minutes before the start
- Dress reasonably smart
  - it is an important day
- Bring your copy of the thesis
  - the same as the one you sent the examiner (they will say things like on page 79, para 3 you said X).

"An excellent defense. Let's give her the doctorate."

J.B. Handelsman (9/14/1987)

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Examiners

- The role of the examiners is to attack the thesis
- They will ask you difficult questions, and they will aim to tease out the limitations of your work
  - They will concentrate on the novelty aspects that you claim
  - They will want to be convinced that you can substantiate under questioning the claims that you make
  - They may also ask you to go in detail through particular parts of the thesis (for example, a particular proof) to ensure that you can reproduce it

Examiners: context

- Examiners will want to be clear that you understand the wider implications and context of your research
  - They will ask about related work that is in your thesis
  - They may ask about work in the more general community that you have not referred to
  - This is difficult to prepare for, but you should at least have some vague knowledge of the papers presented at recent important conferences in your field

Examiners: stupidity

- Sometimes, examiners like to ask apparently stupid questions to ensure that you can discuss issues sensibly and coherently

- Sometimes they simply try to see if you can identify that what they're arguing is not sensible

- Some examiners deliberately say that they couldn't see reference to X in your thesis (even when they have seen it) to work out if you did actually write the thesis!

Responses

- Always be courteous to your examiners
  - They are not attacking you personally, but the work: this is their role
- If you do not understand a question, ask them to clarify what they mean
  - Better than starting off on the wrong foot
- Your thesis will have shortcomings and limitations
  - Don't be afraid to admit it

Responses

- If an examiner points out something not addressed, then admit it and explain why you have chosen not to deal with this issue

- If an examiner asks about some related work that you don't know about, say so

  - Some people say that you should concede to the examiners at least once in the defence!

- If you genuinely do not know the answer to a question then say so.

Who's the expert?

- Remember that of all the people sitting in the room, you are the expert in the particular topic of your PhD

- You know it better than anybody else

- Don't be afraid to argue your case based on what you have done

Role of the supervisor

- In the UK, in general, supervisors have no role in the defence

- They cannot interfere in the process

- Do not look to them for help or advice

- Talk with your supervisor in advance
  - Many will try to assist by taking notes for you so that you can concentrate on the questions and discussion with the examiners.

Good Luck!

A rabbit is sitting outside a cave and is very intent upon writing. A fox comes along and asks the rabbit what he's doing. "I'm writing a thesis on how rabbits eat foxes." says the rabbit. "No way," says the fox. So the rabbit takes the fox into the cave and a few minutes later out comes the rabbit looking very smug and holding a fox skull. Some time later, a wolf comes along and asks the rabbit what he's doing. "I'm writing a thesis on how rabbits eat foxes and wolves." says the rabbit. "No way," says the wolf. So the rabbit takes the wolf into the cave and a few minutes later out comes the rabbit looking doubly smug and holding a wolf skull. Some time later, a bear comes along and asks the rabbit what he's doing. "I'm just finishing my thesis on how rabbits eat foxes, wolves, and bears." says the rabbit. The bear roars his disbelief and follows the rabbit into the cave. And, as you might expect, back in the cave is a huge lion who promptly gobbles up the bear, just as he did the wolf and fox. The rabbit bounds happily out of the cave holding his PhD.

Moral: It's not the content of your thesis that counts, but your advisor.