

# Research Methods

## comp4809/7809

### Week 3

# Announcements

- Tutorials
  - **Not** compulsory – come along if you need help with the deliverables or would like to talk about your project
- Ask for extensions when you need them
- Get the deliverables done and handed in, even if they're not perfect

# Move your focus to writing and making progress

- Week 1: Getting started.
- Week 2: Find literature and methods
- Week 3: Understand the issues, build methods skills
- Weeks 4-5: Start writing, make progress
- Week 6: Completing the progress report

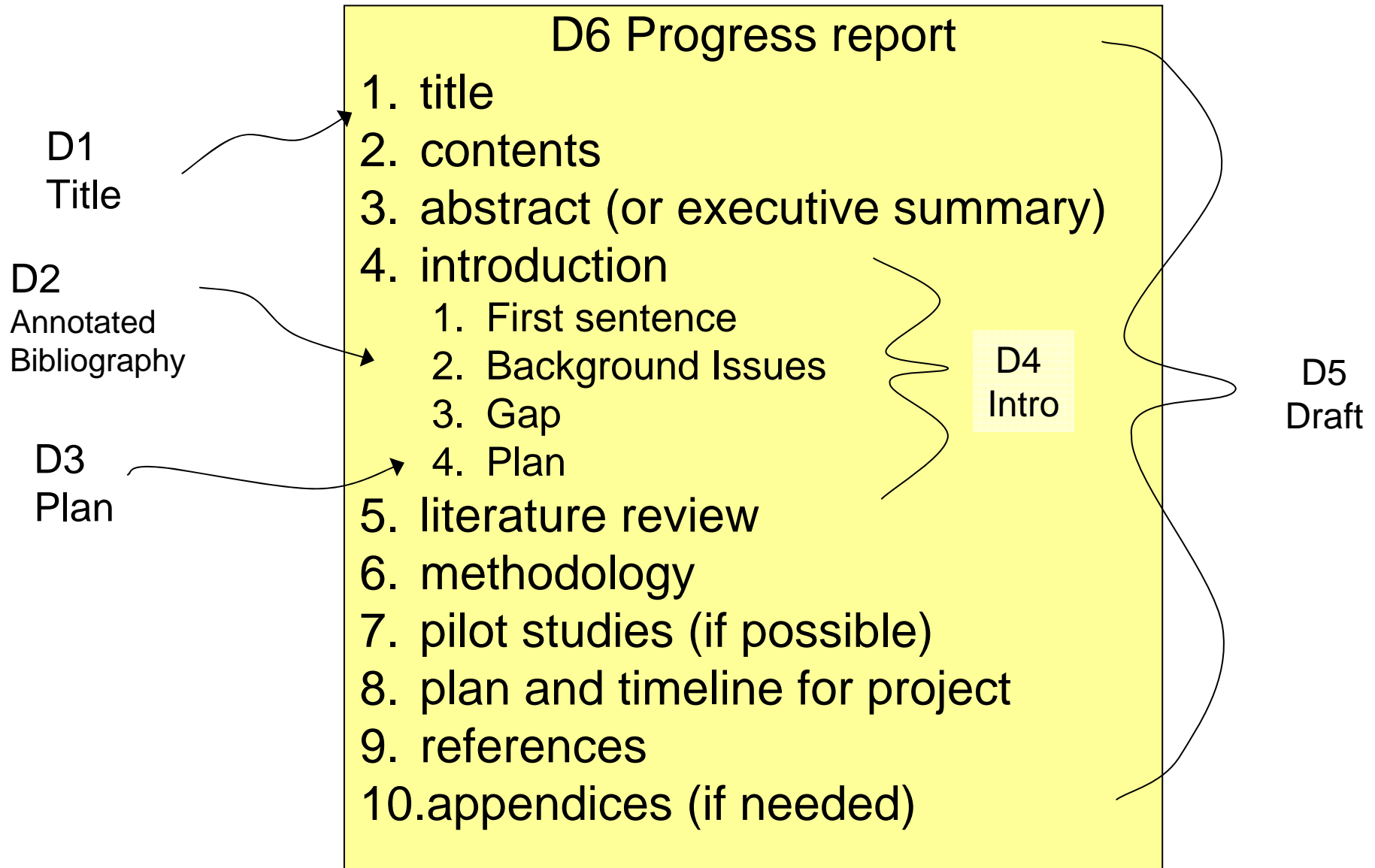
## D2. Annotated bibliography

- General tips:
  - If someone can't tell whether you've referenced a book, conference paper, journal paper, etc., then you've done something wrong.
  - Never use an online-only reference (e.g., a paper downloaded from someone's homepage) if you can help it. Find the online journal through the library and download it from there.

# D2. Annotated bibliography

- Most common problems:
  - Missing issue numbers for journals
  - Missing publisher and place of publication for books and conference proceedings
  - Incorrect capitalisation
- Tips for Endnote, BibTeX, etc.
  - They generally won't tell you when you haven't included enough information
  - If you give them slightly wrong input, they'll gladly give you very wrong output – check it!

# How the Deliverables fit together



# D3. Project Plan (Swales 4b)

## Task

1. State your name, student number, supervisor and title of your project.
- 2. Describe the specific aims for your project and the methods to be used, including references if applicable (200-500 words). Define all technical terms.**
- 3. Summarise the progress made in the first three weeks of the project (60-70 hours of work).**
4. Show your description to your supervisor and get their signature

## Tips.

- Look at the methods sections from past project reports, or from relevant journal and conference articles.

# **D4. Statement of research question and project introduction using Swales format**

## **Task**

1. State your name, student number, supervisor and title of your project.
- 2. State your research question or thesis-of-the-thesis (25-200 words).**
- 3. Project introduction (800-1000 words) providing a brief description for each of the sections below (these elaborate on the headings of the Swales format discussed in class in week 3).**
4. State the word count.
5. Show your description to your supervisor and get their signature

# The Introduction

- What is the role of an introduction?
- What format should it follow?
- What challenges does the introduction pose?

# Exercise: Introduction

Put 8 sentences from the introduction of a journal paper in order.

# Exercise: Introduction

1. Concurrently with experimental progress in gene control networks, several alternative modeling frameworks have been proposed.
2. Stochastic models address the deviations from population homogeneity by transforming reaction rates into probabilities and concentrations into numbers of molecules.
3. In the continuous-state approach, the concentrations of cellular components are assumed to be continuous functions of time, governed by differential equations with mass-action (or more general) kinetics.
4. Gene products often regulate the synthesis of mRNAs and proteins, forming complex networks of regulatory interactions.
5. In this paper, we present a methodology for testing the robustness of discrete models with respect to stochasticity in the order of updates.
6. Understanding how genetic information is translated into proteins to produce various cell types remains a major challenge in contemporary biology.
7. Finally, in the discrete approach, each component is assumed to have a small number of qualitative states, and the regulatory interactions are described by logical functions.

Chaves, M., Albert, R. and Sontag, E. D. (2005). Robustness and fragility of Boolean models for genetic regulatory networks. *Journal of Theoretical Biology*. 235 (2005) 431-449

# Exercise: Introduction

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# Introductions a la Swales<sup>^</sup>

## **Move 1. Establish field**

- Assert centrality
- State current knowledge

## **Move 2. Summarise previous research**

- Outline issues in literature

## **Move 3. Prepare for present research**

- Indicate a gap
- Raise a question

## **Move 4. Introduce present research**

- State purpose
- Outline present research

<sup>^</sup> Swales is a professor of literature who does “genre analysis”. (i.e., he analyses common structures for different types of writing)

# Examples of sections from an Introduction

# 1a. Claim of importance

## First sentence

As mobile autonomous robots become ubiquitous, communication between robots and humans becomes more important.

*What's this project going to be about?*

## 1b. What's already known

With respect to robot navigation, using a human readable map is a difficult task for robots, while other methods are being developed where the robots have internal representations that are difficult for humans to interpret. [more details here...]

## 1b. More details ...

Language is a research area of interest to many fields, and many issues have been identified as relevant to the computational modelling of language (Kirby, 2002): Language provides the potential for producing infinite meanings with finite signal set; No one is born with the ability to communicate with language yet almost every one can master the system by six years without being taught or having reliable feedback on performance; The ability to communicate in a community has little to do with biological parents and nearly all languages equal functionally; and no other species has this ability.

## 2. Literature

- Identify the main issues and what studies have been done so far.

The evolution of language is a problem that can be considered from many perspectives. ...

Several different models have been used in simulations about the evolution of language. These include feed-forward neural networks, recurrent neural networks, autoassociator networks, movement of robots, discrimination trees, lexicon tables, definite clause grammar (DCG) and finite state unification transducer (FSUT).

What's the difference between an annotated bibliography and a literature review?

- An annotated bibliography lists a series of articles and for each one, it gives a short precis (ie summary) of the relevant information for the project.
- A literature review leads the reader through a series of issues that are relevant to the project and discusses each one, giving references where necessary

# Turning an annotated bibliography into a literature review

- The annotated bibliography is a list of relevant papers.
  - For each paper, list the main issues.
- Create a table with one paper per line, and one issue per column.
  - Each paper will typically have several issues that are relevant and each issue will typically be covered by several papers

# Turning an annotated bibliography into a literature review

Consider 4 articles which discuss 3 important issues

	Issue 1	Issue 2	Issue 3
Article 1	X		X
Article 2	X		
Article 3		X	X
Article 4		X	

# The literature review

- Discuss each issue in turn, one or more paragraphs per issue, giving references where needed

# Example

The components of a good annotated bibliography

Version 1: <Reference> <description>

Marocco, Cangelosi & Nolfi (2003):

- describe the issue they were addressing ...
- describe what they did ...
- describe what they showed ...
- describe their conclusions ...
- describe the relevance to your project

Transform the annotated bib on the second draft

## Draft 1 Format: Reference – description

Marocco, Cangelosi & Nolfi (2003) did simulations with agents with arms that touch or avoid spheres and cubes in their environment. These experiments support the hypothesis that categorization was a basis for the evolution of words and language, and that perception and action are linked. The agents had neural controllers linking the sensory, hidden and motor neurons. Marocco et al's (2003) research is relevant to my project because (1) their results about the relationship between categorization, perception and action are important for the design of the simulations; and (2) the types of controllers they used may influence my design choices.

The second draft covers the main issues

## Draft 2: Issue (ref)

The relationship between categorization, perception and action forms the basis of the evolution of words in an embodied robot. Simulations of simulations with agents with arms that touch or avoid spheres and cubes in their environment showed that [describe the actual findings] (Marocco, Cangelosi & Nolfi, 2003)... [more about other studies on this topic]

A variety of neural controllers have been used in both robot and simulation studies including neural controllers that link the sensory, hidden and motor neurons (Marocco et al, 2003); ...

## 2b: Summarise literature review

- In summary, <the current state of the art>

# 3: Gap

- Many open questions in evolution of language and robot communication
  - ...
- Specifically no-one has evolved a language using autonomous robots
- What would a robot language for spatial terms be like?

# 4: Aims

- Overall goal: to build a demonstrator of robots that have evolved a language for space
  - Why? To provide a practical communication system
- Specific goals: ...
- Methods to be followed: ...

# Attendance sheet

Break

# Honing in on a good project

- **Good research addresses important questions**
  - But not just any important question will do.
    - Reinventing the wheel is not good research; but
    - Nor is failing heroically on an insoluble problem.
  - The right kind of question is one that can be investigated using the resources and methods available for the project, including the time and skills of the researcher.
- **Background context**
  - Understanding project context is essential to designing an effective project plan.
  - Preplanning at the beginning provides a foundation for writing at the end.
  - One of the core skills of a researcher is matching the methods of a project to a good research question.
    - This is a skill that can be learned.
- **Question or methods first?**
  - Some projects start with the question, and select appropriate methods.
  - Others start with the methods and find appropriate applications.
  - Most are somewhere in between, with some aspects of the research question and the methods determined at the outset and then refined during the project.

# Doing the right project and Doing the project right

- There are two parts to a project: **doing the right project** and **doing the project right**.
  - Both are critical to success
  - Good projects rarely fall into your lap: you are given a general topic and you need to find the good project within it

How do you find the right project  
within a general topic?

# A Tale of Two Projects

## Case A.

Robots and language – get the robot working

## Case B.

Robots and language – find out what simulation methods work and how to make them efficient

# Know your project

- When you take on a project, find out why it is important
- Find out what is generally known about the topic.
- Find out what specific projects have been done already both in your research group and in the wider research community.

# Know your project

- Identify the gaps that need addressing.
  - There will be many ways to address those gaps.
  - Think about what they are, which one your project is targeting, why it is targeting that gap, and why it is taking the approach it is.

# Know your project

- Succinctly state the specific aim of your project.
  - Find out what methods are to be used if known, or learned if they are new.
  - Itemise the resources needed and check them against those available.
  - Take inventory of the skills needed for the project, and match them against those you have, and those you will need to develop.

# Honing the project theme

- 1. Understand the wider context and importance of the project**
  - a. State the general topic and make a claim about why it is important.
  - b. Describe what is generally known about this topic.
- 2. Summarize previous research**
  - a. State the core ideas in the literature and structure them in a logical sequence.
  - b. Draw conclusions from the literature review by summing up the relevance of the literature review for the project and listing the informed decisions that need to be made.
- 3. Prepare for the current research**
  - a. List the gaps.
  - b. List possible methods for addressing the gaps.
  - c. Select a gap and a methodology for addressing it.
- 4. Research plan**
  - a. State the purpose of the research.
  - b. Outline the methods to be followed.

### 3. Prepare for the current research

#### a. **List the gaps.**

That is, given all the research reviewed in Step 2, what is left to be done? An accurate summary of this situation is one of the critical aspects of a project. Are there gaps related to an area that has not been studied, or to a new method that needs developing?

### 3. Prepare for the current research

#### **b. List possible methods for addressing the gap.**

For a large project, usually at least five different approaches are possible.

Understanding the breath of questions that could be addressed is a major step in understanding why your project is addressing the gap that it is.

### 3. Prepare for the current research

#### **c. Select a gap and a methodology for addressing it.**

A gap can be selected because new technology, theoretical tools or methods have recently become available. It can be constrained by length of time available for the project or by resources available.

### 3. Prepare for the current research

- The gap is frequently large
- Appreciating that many approaches would be valid helps you to:
  - see what aspects you will be able to address with your chosen methodology; and
  - see what will be outside the scope of the project.
- Don't confuse the gap with your research plan (which is the Step 4).
  - It is conceivable that someone else could address the same gap using the same general methodology but design a different specific plan.

## **Exercise:** To the person next to you

- Summarise the methods of your project (what you will do)
  - Explain why these methods are appropriate
- Describe the specific aims of your project (concrete and detailed aims)
  - Explain why these aims are important
- Describe the overall goal of your project (big picture description)
  - Explain why this overall goal is important

# Summary of Week 3

- Using a structured approach to writing the introduction helps you think about your project
- Clear thinking about your project clarifies your writing
- Swales structure of an introduction

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# Announcements

- ...

**There is perfection in timing not just in doing the work.**