How to give mathematics seminars

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Based on notes originally prepared at the Mathematical Sciences Institute, ANU

Talk Requirements

All honours & MMathSci students (regardless of program) are required to give a talk on their thesis work. It is a way to showcase your work to your peers and members of the school, and give you practice giving academic talks.

The talks are typically around 25 minutes (not including questions), and occur in the second half of your final semester. Your talk is assessed and contributes towards your final thesis mark. Check your handbook/course website for the most up-to-date information.

For HDRs (and postdocs/faculty), academic talks are one of the primary ways to advertise your research. Many academic job interviews also require you to give a seminar. Being able to give good talks is an important part of being a researcher!

Audience

A seminar (or thesis, paper, video, ...) is a piece of communication. You are talking to smart people, so if they don't understand, that's <u>your</u> problem!

- Who is the (expected) audience?
  - Honours/MMathSci: other students in your program, supervisors, interested PhD students/academics
- What do they already know about the topic?
- What are you trying to convey (1 idea)?
  - Don't present your whole thesis, pick the most interesting bits!

You are telling a story: introduction, coherent arc, end with a punchline

Target Audience

Thought Experiment:

- Imagine another maths honours student in a completely different area to you, for example someone studying: number theory, mathematical biology, or Bayesian statistics. It helps if you can think of an actual person you know personally, but it's ok if you can't think of someone.

- How would you explain your thesis topic to them so they could teach someone else the basic ideas of your work?

Audience

For most mathematics seminars for non-specialist audiences (e.g. school colloquia), it is common to assume everyone has the knowledge equivalent to 2nd year undergraduate courses, but there will be specialists in the audience who know much more.

Theory

When presenting theoretical results (especially in pure maths):

- Give proof details (otherwise hard to get a 'taste' of the topic) — but only showing key lines can be a good way to go
- Don't show full generality: simplest interesting case is ideal
    - Mention more complicated cases for the experts
    - "In this talk, I will work in L^2, but everything works for L^p ($1 \leq p \leq \infty$) if you..."
    - "I will work in $\mathbb{C}$, but this works for any field..."
- Vary level of rigour/precision: some definitions & theorems in full details, some as heuristics
- Examples & pictures are always useful
- Notation: consistent, clear, minimal
- If you have original results, cite yourself with initials only [C. F. Gauss & A. B., 2024]
- What are you trying to *ultimately* convey?

Board Talks

- Common in pure maths, unusual in applied maths/statistics
- Slows you down — makes it easier to follow
- Prepare detailed & clear notes
- Do everything from memory, or with minimal checking of notes (slows you down, stops you skipping ahead)
- Handwriting: neat & large

Slides

- <u>Beamer</u> allows you to generate slides in LaTeX (but some use Keynote or Powerpoint)
  - Use a built-in formula editor, don't use images of formulae (usually looks terrible)
- Pick a template that you like: not crowded, but some repeated information can be useful (e.g. name, title)
  - These slides use a modified version of the beamer template metropolis
  - Slide numbers are very helpful for Q&A
- Don't overcrowd information: nobody reads walls of text
- Avoid cross-references (we don't remember what "Lemma 2" or "equation (3)" was)
- Including citations is good
  - Formatting: [Jones & Smith, 1998] or [Jones & Smith, *Invent. Math.*, 1998] is better than [1], since audience can write down immediately (e.g. apalike in Bibtex)
- Plan for 1–2 minutes per slide *including* 'padding' slides (title, outline, etc.).
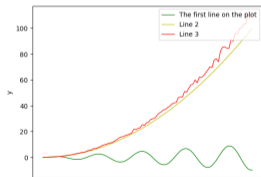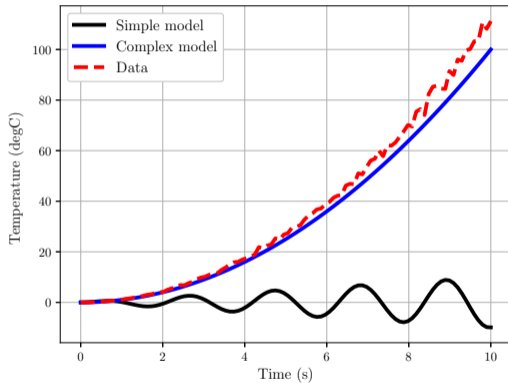
It's easy to make figures look either good or bad:

Figure 1

Comparison to data

Figures

- Keep it minimal: drop unnecessary lines, use short labels, few figures per slide
- Size matters (figure size in the slides, line width ≥ 2, font size for legend/axis labels and numbers)
- Many plotting packages allow you to write LaTeX in labels
- Plots should be readable in black & white (vary linestyle and/or markers)
  - Yellow usually invisible, 1 in 12 men are colourblind (red/green most common)
- Obvious stuff: legend (not blocking important things), axis labels & values sensible, helpful captions
- <u>Talk!</u> Explain what you are plotting, which line is which, give us time to understand (and hints are good: "higher curves are better")

Tables? Almost never a good idea (use bold/colours/etc. to direct attention)

Public speaking

- Talk to the back of the room (unless using a microphone)
- Look at the whole audience while speaking (especially for board talks)
- Don't rush
- Vary pitch — make us *want* to listen to you
- Don't read every word on a slide (or every term of an equation)
    - Talk around each point
    - Slide text shouldn't be full sentences
- Observe others: what do you like/dislike?
- Q&A session:
    - Actually answer the question! Don't lie ("I'm not sure, but..." is fine)
    - Ask good questions: $\leq$ 2 sentences, last sentence ends with a question mark

Practicalities

- Always mention co-authors/supervisors, acknowledge funding bodies, thank organisers (if relevant)
- Practice
- Double-check your notes/slides (mistakes, hard to read, LaTeX compilation errors, embedded videos, etc.)
- Check the room beforehand: layout, IT equipment
  - Projector works
  - Using laptop or from USB (is there a desktop?)
  - Have all required cables
  - Chalk/markers/erasers available? Which markers work? What colour(s) will you use?
- Start with an empty board, even if using slides
- Stick to time
- Arrive early, meet the chair, don't leave immediately afterwards (if possible)

Other views

These slides give one perspective — you may disagree and that's fine! Ask yourself:

- What one thing do I want my audience to remember?
- Would I enjoy listening to my talk?
- What talks/lectures have I enjoyed/disliked & why?

Other views

- `http://www.math.wisc.edu/~ellenber/mntcg/TalkTipSheet.pdf`
- `https://faculty.washington.edu/heagerty/Courses/b572/public/HalmosHowToTalk.pdf`