How to prepare a talk

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Prologue. The purpose of giving a talk

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The setting. Preparing a talk is very much easier if you keep in mind the purpose of giving a talk. There is some idea in your head, which, at the end of the talk, you wish others to know about and understand.[1] Once this process is understood, all else that can be said is mere technical detail.

To impress this on your mind, consider the following parable:

While travelling in Strange Places you find yourself apprehended by the unscrupulous regime in power there, accused of unspecified crimes and thrown in prison to await trial. The method of trial under that regime is known as Trial by Graduate student. The procedure is as follows:

You are set a topic and allowed a week to prepare, at the end of which you will be given one hour in which to explain some significant result to a graduate student who is certainly no cleverer, and possible slightly less well prepared than yourself. At the end of the hour, he (not you) will sit an exam on the subject. Should he fail, you (not he) will be shot at dawn.

Now you can see the need to be concise, to avoid introducing unnecessary complications, to provide memorable examples, to make sure that your talk is aimed at the right level; in short, to communicate efficiently.

These notes

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The purpose of these notes are to give you a basic method of preparing a talk which, if you take the time to follow the programme, will predictably yield a satisfactory presentation.

Steps:

- The focus of your talk.

[1] It is worth mentioning explicitly now that while you may wish, in the course of the talk, to impress your supervisor, your senior colleagues, the appointments committee, or the lecturer who must write you a recommendation this is not the purpose of the talk.

- Planning your talk.
- Practicing your talk.

Deciding on a focus

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Aim to decide on this a week in advance. You will already have decided what area you wish to give a talk in. For Part III students taking part in the Michaelmas term seminars, you will have decided, for example, to present material from the Lie Algebras course. The first, and often the critical choice is to decide what is going to be the focus of your talk.

I choose the word focus deliberately. Here an appropriate metaphor can be taken from mountaineering.

Supposing you wish to undertake a Himalayan expedition. For the purposes of small talk in the pub, it is fine to say that you intend doing some climbs in the Himalayas next summer. But if you arrive in Katmandu with no more focused plans than to do some climbing, you are likely to waste valuable time poring over maps and wondering where to start.

Of course, you will have chosen one particular peak as an objective, with alternatives perhaps in case of bad weather or actually achieving the objective with climbing days in hand. Moreover, the choice of objective dictates the planning of the entire campaign, the choice of base camp, the placing of higher camps and even the routes to be attempted.

Similarly, the focus of a talk, once properly stated, determines the outline of the talk, and makes detailed preparation a relatively straightforward procedure.

For example, I might wish to give a talk about Lie algebras. Even were I to limit the topic by choosing to talk about the irreducible representations of a Lie algebra, I am left without a very good idea of where to start and where to finish. However, the statement

- The irreducible representations of a semi-simple Lie algebra are labelled by their highest weights.

suggests not only what the objective of the talk is, but defines the organization of the talk as well.

What in practice makes a good focus for a talk? Significant theorems make good foci, as do examples illustrating such theorems, and special cases.

For Part III seminars in the Michelmas term, problems from examples sheets can make excellent topics. For the Lent term Part III seminars on Essay topics, it is quite possible that the focus of the talk will cover only a part of the material you may wish to present in the essay.

Particularly for Part III students, the opportunity to give a talk should provide a welcome chance to act as a working mathematician rather than student. In learning mathematics, students sit in lectures, read texts and papers, and are expected to learn the content of the lecture course/text/paper. In doing mathematics, by contrast, one still attends lectures, reads books and papers, but with the much more agreeable task of getting something, anything, useful and interesting out of it. There is no longer any obligation to digest the whole of the text. The matter of choosing a topic for a talk puts you in the role of the working mathematician, scanning the subject not so much for what is in it, but what is exciting in it. Enjoy!

The organization of your talk - the outline

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To get an outline for the talk, make a list of the words and the results that are strictly necessary to the focus of your talk, and order that set according to which definitions/results depend on which others. Include any definitions/results that your trial graduate student may not know. In the example of the irreducible representations of semi-simple Lie algebras, the essentials might be summarized as follows:

1. semi-simple Lie algebras
2. representations
3. Cartan subalgebras
4. roots
5. weights
6. highest weights
7. Weyl group
8. Weyl chamber

That material must now be summarized, demonstrated, paraphrased, quoted, swept under mathematical carpets in such a way as to make what is absolutely necessary completely memorable, and what is confusing or distracting invisible. The resulting talk must fit in the 50 minutes allowed, which means, plan on 45 minutes. Clearly, there will be little opportunity for detail. The options available include the following:

1. State the result,give the proof/construction in detail.
2. State the result, indicate the major steps of the proof.
3. State the result, describe a simple and memorable example.
4. State the result, state a weaker result which is obviously true or easily seen to be true.
5. State the result as "magic", give or be prepared to give a definite reference.

Do not give any result in a more complicated form than is necessary unless this presents no additional conceptual challenge.

Having settled on a focus, the real quality of a talk comes from the care taken in this step. The ingenuity with which difficult results and ideas can be presented as natural and obvious next steps is often indicative of a mathematician's creative potential. (Students inviting members of staff to observe talks for the purpose of writing letters of recommendation please note.)

Rehearsing your talk

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The method I recommend is brutal but effective. You may, probably will, take short cuts, but the day may come when it really matters that the talk you give is the very best you can do. Perhaps it would be a good idea then to practice this method once or twice, so you know you can use it when you need to.

Do not bother to write the talk out first. Start just with your outline, chalk, and blackboard in an empty room. Begin your talk, saying out loud what you intend to say, and writing on the board what you intend to write. Get through the introduction, say (about five minutes). Then repeat just

that section until the words come fluently, and the notation is consistent. Time that section. Then move on to the next. Continue. At the end you will have confidence that you can get through from beginning to end, your notation is consistent, your arguments logical and complete. You will also know exactly how long your talk will last. Rehearse it one last time, from beginning to end, this time using pen and paper, timing the subsections. These are your notes, but you will not actually need to use them if you have followed these instructions!

Almost certainly your first effort will be too long. You will have to go back and summarize, quote without proof and simplify until the talk fits into the time allowed. Do not imagine that miraculously on the day time will expand so it will fit. Aim for your talk to take five minutes less than the time allowed.

The empty room is important. I know no harsher critic than an empty room. It is almost impossible to bluff an empty room - the walls seem to snigger if you try. If you can give your talk before an empty room, even having critical senior mathematicians in the audience is unlikely to shake your confidence. In addition, unless you have had previous experience at a blackboard/whiteboard, it is a valuable chance to practice writing clearly. As a poor second, substitute pencil and paper for chalk and blackboard, but speak out loud. That actually needs to be practiced.

Transparencies. In certain mathematical cultures these are regarded as essential props for giving a talk. It is certainly reassuring to have all the material already copied correctly onto acetate. There are also occasionally compelling reasons for using them - particularly pretty diagrams, tables or pictures that would be difficult to draw freehand. Occasionally I have listened to talks where speakers discussing complicated expressions involving many indices have used transparencies to excellent advantage, drawing attention to the remarkable characteristics of the formulae by using striking colours. But do remember, the point of giving a talk is to transfer information, and for a variety of reasons transparencies seem to be less effective:

- **It is far quicker to put a transparency on an OHP than write on the board**. This is not an advantage in transferring understanding. Your audience has been conditioned to learn by copying. Your audience will be struggling to copy, and will be frustrated by trying to listen at the same time. Having to write on the board at least slows you somewhat to your listener's pace.

- **Having the slides prepared is often a little too reassuring**. There is a distinct tendency to assume that if the slides are prepared, then the saying of the words will work out somehow, and that giving the talk will be easy. There is no guarantee that it will. The only way to have confidence that the right words will come out in the right order is to practice saying them. If the slides are prepared, the tendency is not to bother actually rehearsing the talk. The result will be short of the best you can do.

- **Understanding appears to be linear, therefore being presented by a page of text at a time can be distracting**: That is, listening to an explanation that is being written as it is being given, the audience concentrates on the idea being discussed at that moment. When a transparency is placed on the screen, the eye takes in the whole page. This is at the least distracting. Some speakers make use of transparencies effectively by covering the bottom part of the page and showing lines only as they come to discuss them.

- **Typeset transparencies are the hardest to learn from.** Possibly because usually the print size is far too small to be clearly seen, possibly because the tendency is for far too much to be written, the eye and mind tend both to give up.

If you still wish to use transparencies for any of the part III seminar talks you are very welcome. Simply bear in mind the additional difficulties your audience will experience, and practice sufficiently so that your talk is still fluent.

This plan for preparing talks works

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