

Giving a (STEM) academic research presentation

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This document gives rules, guidelines, and tips for preparing an academic presentation (on your own research or on others'). First, here are a few sources, which I have hewn together into the present document:

- From Tia Newhall's material at: <https://www.cs.swarthmore.edu/~newhall/presentation.html>,
- From Jonathan Shewchuk: <https://people.eecs.berkeley.edu/~jrs/speaking.html>.
- from Michael Ernst: <https://homes.cs.washington.edu/~mernst/advice/giving-talk.html>.
 - Note the section on 'In-class presentations' (about someone else's paper).
- From Matt Might <http://matt.might.net/articles/academic-presentation-tips/>.

Much of the material in the present pdf is from the above sources (without line-by-line attribution), sometimes without modification, sometimes with some modification. The current document is still a rough draft.

First: Organize your talk

Create a talk outline. Organize in a top-down manner:

- Introduction, the big picture: what, why and why we should care, and how. Be sure to include:
 - a statement of the problem being solved (what)
 - motivation and putting the work in context (why and why should we care)
 - a high-level view of the solution (how)
- Details of solution
- Results demonstrating your solution
- Critiques of the work (possibly compare to related work)
- Conclusions and future directions for this work

Always ask:

- What needs to be understood to convey the big idea?
- What can I expect the audience to already know? (*A question of academic statistics cultural knowledge!*) “Know your audience”!
 - Different audiences: academics in your subfield, academics in your discipline [very senior/experienced/successful vs mid-career vs young vs PhD students vs...], undergraduates, freshman undergraduates ...
 - Unless you are giving a talk at a conference in your subfield, even though it may not be the part you focus on the most in your own research (or reading, if a talk on someone else’s paper), you need to spend a significant chunk of your talk (perhaps 1/3!) on background and motivation.
 - * Note: for your first job talk, it is more OK to do a small bit less background and a bit more emphasis on your technical contribution, because your contribution to the field really is being carefully assessed. But your presentation ability is also being assessed so don’t skip background too much!

Next: Design your slides

- **Number of slides:** As a general rule, it should take roughly 2 minutes per slide, so for a 30 minute talk you should have maybe 15 slides. If there are too many ideas in your work to present completely in 30 minutes, then pick one or two (the most interesting/important parts) that you will discuss in detail, and present the other parts at a higher level. Also, you can create back-up slides for specific details that you don’t plan to talk about, but may get questions about. This guideline varies some and there is always some variability from slide to slide, but if you have 40 slides for a 45 minute presentation your audience will panic that either (i) you will keep them there all day or (ii) halfway through you will say the dreaded ...
- “Oh, I am low on time, I will speed up.”
 - This does not have the desired effect (a desired effect of a talk is that the audience understands as much of the talk as possible).
 - Of course, it can happen sometimes that you will be low on time. (Really, this should only happen because you got extensive questions, more than you planned on receiving [generally you should plan on allocating some minutes for questions] during the talk. Cf below, you should have practiced and thus timed your talk.] You then need to triage, which at its core involves choosing

some things the audience will not get to hear/understand in order to present other things that the audience will still get to understand. Presenting all of it at 2x speed means no one understands any of it.

- **Be realistic about how much time you will give the audience to absorb each slide.** The reason you can't just have 40 slides for a 30 minute talk is because you need to give the audience a realistic amount of time to absorb the content. For some reason, even though we have all sat through talks that went too quickly, we often maintain the tendency to pretend that because we now understand our subject matter it will be instantaneous for the audience to understand it. This tendency must be unlearned/avoided.

You will at times need to write math or notation-heavy statements on your slides; but in that case you have to be sure you explain it clearly and the audience can understand it. I sometimes laugh when people use the phrase “under some assumptions” (with no further details) in presenting their theorem; if the speaker is renowned enough, then we probably trust them, but otherwise it renders the result almost content free. Ideally you can somehow present the assumptions. But you have to do the work of figuring out how to not overload the audience with the assumptions while still giving them the big picture, which is certainly hard.

- **Use (informative) pictures or plots.** This does *not* mean just use pictures at random; it means that pictures or plots, when clearly designed and explained well to the audience, can provide information more rapidly than a slide with a lot of words (or math). (Some talks use lots of graphics or images or cartoons [E.g. clip art from pop culture or the internet, rather than figures or plots you have created] to avoid giving more details or presenting actual information. I feel that this is insulting to your audience except perhaps in small doses. Your goal is to convey information; ask “what information is being conveyed?”)

A corollary of the fact that a plot can condensed form of information is ... a plot can be a condensed form of information. In order for it to work well (provide information quickly) you often have to do extra work (so the audience does less)! This is the audiences first time seeing this plot! Tell/read to them what is on each axis! What each different line/bar/etc. is! And of course tell them the big picture takeaway, usually initially and again at the end (see below on ‘repeat your point’). Most students do this last bit but skip helping the audience actually reading the plot.

- **Be realistic about your audience remembering your notation.** If they have to remember all your notation (and you do not help them) to understand your talk, and they missed a bit of it, or forgot it, then your whole talk is lost on them.

- **Less is sometimes more.** Everything you put on a slide should be part of the talk, is something you will explain or refer to. If not, excise it. (Anything on a slide is fair game for the audience to question you on, especially in a job talk! So the more you put on the more prepared you need to be!)

From <http://web.archive.org/web/20060217145720/http://homelessprofessor.blogspot.com/2005/10/learning-how-to-give-talks.html>, as referenced by <https://people.eecs.berkeley.edu/~jrs/speaking.html>:

We got explained two models of giving a talk: the clew model and the onion model.

The clew is a logical, linear argument building up to a conclusion at the end of the talk, like a clew unwinding until you finally come to the core. Miss one step in the talk and you lose the plot and miss the point. And yes indeed, this is exactly what happens when I listen to most conference talks and some lectures. In a three days' conference, I actually follow the first five minutes of one or two dozen talks. That is more or less it. After those five minutes, I get lost. I miss a slide because I am still thinking about the previous one, get distracted by some random personal associations I had with something the speaker said, or simply doze off because the speaker has a tiring accent.

The onion talk starts with the main message, and adds depth in successive layers around it, always returning to the main message between layers. Since the main message and the main ideas are repeated often, a listener can still follow most of the talk even after dozing off for a minute. Also the talk does not get screwed up near the end when the speaker is running out of time, because by then, the most important things have been said already and the speaker has no reason to hurry.

I find it is often much easier to give the linearly-ordered type talk, and at least somewhat necessary to have things ordered linearly! But to the extent you can manage it, the "onion" style is more 'robust' and audience friendly.

Finally: Prepare your presentation

- **Provide a talk road-map** Tell the audience where you are going with your talk. Give audience a road-map of your talk at the beginning by using outline slides. Immediately after the title slide, put up an outline slide and tell the audience the main organization of your talk. Another alternative is to first have a few slides motivating the general topic, and then put up an outline slide giving the audience a road-map of your talk.

Note: the outline is not just a formality where we all agree to write “Introduction”, “Main Results”, and “Simulations” on the slide after our title slide. It has a goal which is to provide an outline of the talk to your listeners. If you choose to have an outline slide you should then use it to help let the audience know some details of what is coming. If your outline slide could be re-used for any other talk, then you should remove it; but I think better than that is to give an outline slide that is helpful to the audience to understand what this talk is going to be about. Maybe this happens after your first few introductory/motivating slides.

It should be clear when you start a new high-level part of your talk. Use good transitions from one slide to the next, and from one main topic to the next...“We just talked about the implementation. Now we will look at how well the system performs.” You may want to use the outline slide at other points in your talk to provide a visual transition between parts of your talk.

- **Repeat your point** There is a rule that says you have to tell your audience something three times before they really hear it: Tell them what you are going to say. Say it. Summarize what you said. This is particularly important for figures and graphs. For example:

This graph show how algorithm A performs better than algorithms B and C as the number of nodes increase. The X axis is the number of nodes, the Y axis is the execution time in seconds. The red curve shows the execution time of A as the number of nodes increases. Thus you can see that as the number of nodes increases above N, algorithm A performs better. This is because...

- **Talk to the audience.** Do not just read your slides off the screen. If talking to the audience rather than staring at your notes or the screen means you need to take a break to check your notes or recalibrate yourself every once in a while, that is totally fine.
- **Practice your talk!** Without this, the rest becomes mostly irrelevant. (All of the reference websites at the top give lots of tips on practice and you should read them. Here are a few comments.
 - For a very serious presentation, like a job talk, you should practice so many times you have the talk memorized and can give it without the slides.
 - For other presentations you cannot make time to practice that much, but a single run through is not enough.
 - * You should go through it enough times that the amount of time it takes to go through it is stable!!! Often the first time (while you stammer through words) is much longer than the last. I do not time myself for

the first few times often.

- * The harder the slide is to explain, the more you practice it.

Tips, tricks, caveats

Young presenters often are afraid that if they go too slowly or define simple concepts or acronyms, they will appear naive or foolish. The opposite is true. Your audience are human beings, and they do not know your research as well as you know it (after you've spent months or years thinking about a problem they may not have seen since they took a class a long time ago, or they may have never seen it before). Much of your talk is thus spent explaining the very beginning of your problem, the setup, the previous literature (and the gaps in the previous literature that lead to your problem). If you want to talk to them about your dissertation, you have to start at the very, very beginning (where you started before you began your problem).

Rehash or rephrasing of the ideas about organization:

- Why is the problem you are solving worth solving?
- What is the core difference between your method and all those that came before? This is really a two-part question (which new/young presenters sometimes mess up by answering only the second part).
 - What does your method accomplish that no previous method accomplishes?
 - What key methodological/technical/proof/conceptual idea enables your method to accomplish more?
- What is the evidence that your method is better in some circumstances? (And what are those circumstances?!)
- What is the one big idea that you want people to leave your talk with? If you try to get across five ideas, you will often impart none (at least to the non experts). If you choose one main idea and focus on advertising it, you will usually succeed. "Give them something to take home."

There's a misconception that an academic talk based on a paper has to be a lecture on what's in the paper.

It takes hours of thoughtful reading to digest the average paper in detail.

At best, a talk can catalyze that digestion; it cannot replace it.

The talk should present the same idea in the paper, but on its own terms.

After you've rehearsed your talk, ask the following questions:

- Could a listener remember the motivation?
- Could a listener state the main idea?
- Could a listener summarize the talk in three sentences?
- Would a listener know when to consult the paper?