The Polymath Jr Program

Your First Math Talk (by Adam Sheffer)

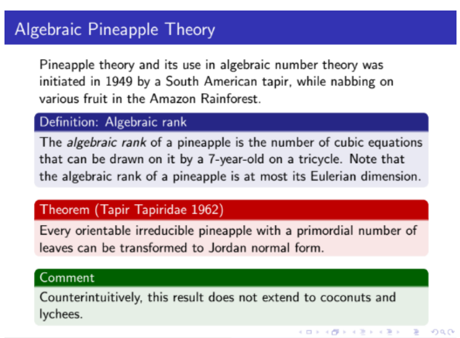
Welcome! This is a guide for students who prepare to give their first math talk. It consists mostly of the personal opinions of the author. Some suggestions below will upset many experienced and successful speakers. Follow only suggestions that you like, ask for other opinions, and read other guides. With time, you will develop your personal speaking style, which is likely to contradict some of the following.

When giving your first math talk, follow the advice of your mentor. They know you, the subfield, and the context in which you are giving your talk. Listen to your mentor even if they tell you that this guide is awful and should be burned.

1. The Setup

The common length of undergraduate math talks tends to be 15-25 minutes. This is unfortunate, since it is much easier to give a 50-minute talk than a 20-minute one. For a 20-minute talk, one should use slides. Board talks are slower, and 20 minutes won't allow you to say much.

Most mathematicians prepare their slides with Beamer, partly because it is based on LaTeX. However, the author believes that presentations created with PowerPoint usually work better. PowerPoint pushes you to add more pictures, explore more styles, and play more with the slides until you are happy. This leads to more appealing slides. Beamer slides tend to mostly look the same:

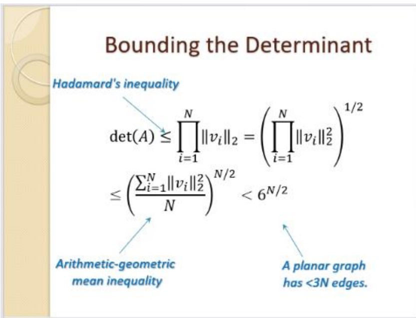


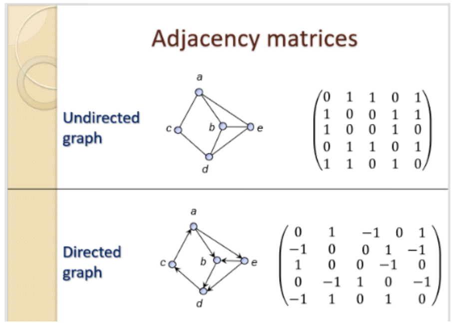
A typical-looking beamer slide.

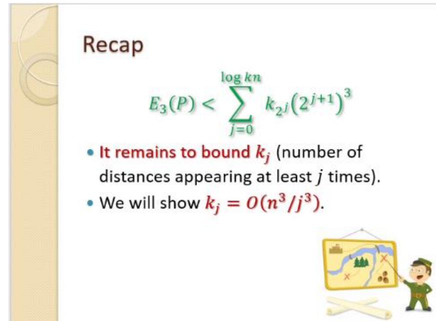
After seeing X talks where the slides look the same, they become less exciting. Less inviting to read. Beamer slides also tend to contain more text, fewer pictures, and so on.

There used to be a reason to avoid PowerPoint slides – bad math support. This is no longer the case. One can now easily write complicated mathematical expressions on PowerPoint, using LaTeX commands. (We are not paid by Microsoft. We promise!)

A few recent mathy slides by the author, all easy to make:







2. Present Less Material

Most people cannot digest much information in 20 minutes, especially at a conference where they listen to talks all day. To make things worse, your mind plays tricks on you: **Some ideas seem simple because you spent months thinking hard about these.** Don't expect others to understand such ideas in the 30 seconds you dedicate to a slide, even if these are experienced mathematicians.

Thought Experiment: Imagine yourself before your research project began. You are at your best: well-rested, focused, and eager to learn. Can your mind roughly understand this much material in 20 minutes?

It is common for beginners to include an amount of material that could not be understood in an hour, not to mention 20 minutes. Be careful! Instead, choose a few main ideas that you wish to convey and dedicate time to each. Instead of quickly defining a new object and moving on to the next one, provide examples, intuition, motivation studying this object, its history, interesting anecdotes, or even bad related math jokes. Give the audience time to get used to it.

Some beginners wish to include all their results in the talk. It is tempting to share all your clever ideas and everything you've managed to show. However, the audience may lose you in this sea of ideas and results. Worse than that, someone may think that you present many small results because you don't have a result worth discussing in detail. Focus on a few main ideas!

People explain their work better when talking to a friend than when giving talks. When speaking to a friend, one is more likely to first go over the basics, provide simple examples and intuition, have a slower pace, have fewer side remarks, and more. When you prepare your talk, it is helpful to think how you would explain the material to a friend. You could also go talk to a friend and see what works well.

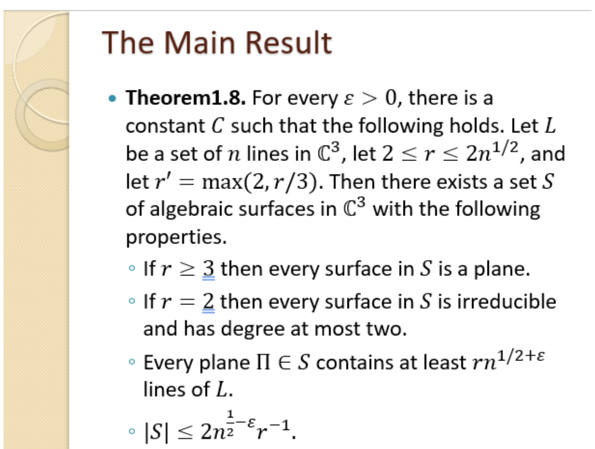
It is common to dedicate the last third of your talk to experts of the sub-sub-subfield. During that third, you can go faster, assume more previous knowledge, and get more technical. This also makes sure that nobody accidentally thinks you didn't do anything advanced.

3. A Slide

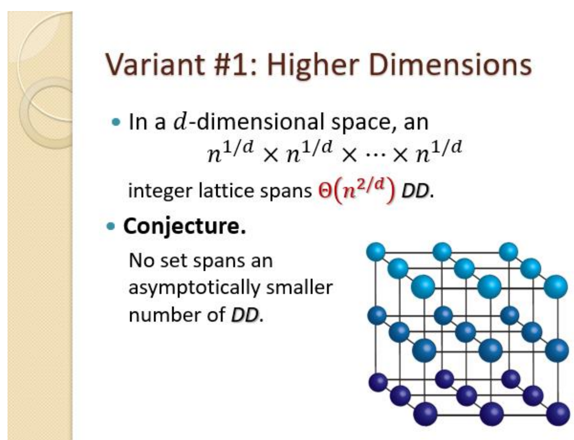
Many of the best math speakers lie a lot. Perhaps the statement of their theorem requires a long paragraph, but their slide only shows one or two of the main sentences. Perhaps they do not mention that their proof technique includes additional cases. Perhaps one of their arguments is wrong without addressing a tricky technicality.

You should also lie! As you dedicate more time to small details, you may lose more of your audience. Say that you wish to present your innovative proof technique, but this technique does not work without addressing a variety of annoying technicalities. When presenting the technique without these technicalities, your audience may be happy to learn a new technique. Then, if they wish to find out more about it, they could talk to you later or read your paper. If you address all the technicalities, the audience may lose you in a sea of details and learn nothing.

A slide should be appealing, making the audience wish to read it. Slides with a lot of text have the opposite effect. It is not always possible to avoid packed slides, but it is worth trying your best.



A slide that nobody will ever read.



A slide that is more inviting to read.

A few suggestions for obtaining slides with less text:

- Lie! Do not include technicalities, special cases, disclaimers, minor comments, and so on. It is fine to present a simplified and technically false variant of your theorem, to avoid technicalities. Mention that to the audience.

- Do not copy-paste sentences from your paper. If the paper contains the sentence "Let x denote the number of edges in the graph G", a slide can say "x = number of edges" or even "x = #edges".
- Use large fonts. Beyond limiting the amount of text per slide, large fonts also make a slide more appealing.
- Whenever possible, illustrate ideas with figures instead of text.
- It is sometimes reasonable to split a packed slide into two.

4. Miscellaneous

End your talk on time! It is difficult to stress how important this is. People are impatient. You can give a fantastic talk, but some of the audience may only angrily remember how you kept them for an extra five minutes. When speaking, most people have a strong urge to cover everything they planned, which pushes them to continue speaking. They then speak too fast, while the audience wonders how long this will continue.

One solution is to put an optional part at the end of your talk. You only go over that part if there is time for it.

Practice alone. If possible, be alone in a room and give the talk to the air or to your favorite stuffed animal. When saying things out loud, as opposed to just thinking about it, you discover many things. Sometimes, you discover that what you are saying does not sound quite right and needs revising. Other times, you discover that you don't quite know how to express what you had in mind. It is better to feel awkward about speaking to Biscuit the stuffed alligator than to feel awkward when saying this for the first time in front of an audience.

The big picture comes first. It could be tempting to present a clever proof idea that you are proud of early in the talk. This does not work well, since the audience does not yet have enough context to appreciate your idea. For the talk to make sense to the audience, they first need to understand the big picture: the problem, what was previously known, your result, and so on. Make sure that you are not getting into technicalities before the audience understands the context. Some people may also not wish to listen to the technicalities before they know what these are useful for.

Be enthusiastic. An exciting topic can become hard to listen to if the speaker seems to suffer when talking about it. There are many variants of this – a speaker may keep sighing during the talk, seem like the topic is not interesting to them, appear as if they really want to go to sleep, and more.

<u>Experiment:</u> When you listen to talks, try to note if the speaker is doing one of these things. Once you notice such a case, think about how it makes you feel when listening. Is it harder to stay focused? How is the rest of the audience responding?

Some people have less enthusiastic personalities or come from cultures where one is not supposed to seem enthusiastic. That's completely fine - nobody expects you to become a different person. Just try not to keep sighing during your talk or give the impression that this is not worth your time.

Attire. Naturally, students may be worried about their appearance in their first talk. There is no correct answer to this question and different people may wish to make different impressions. Instead of an answer, let's make sure that you understand what is common. Then, you could make an educated decision.

There is no dress code in standard math conferences. A few people wear luxury suits or dresses, a few come in shorts and flip-flops, and most are on the spectrum in between. People in leadership positions or from fields such as financial math are more likely to dress elegantly. The person who is almost kicked out of the conference because they are mistaken for a homeless person is likely to be a world-famous mathematician. (You might think that this is an exaggeration, but most mathematicians have at least one such story to tell. Go ask your mentor.)

Students tend to dress more elegantly than the average, probably because they are more worried about making a bad impression. That makes sense: Talks are opportunities to make first impressions, so if your talk is aimed to get you noticed for a future grad school or a future job, you may want to consider that in choosing your attire. That said, it is not worth getting too stressed about your appearance. There is no need to carefully think about each accessory and small detail.

Don't assume that everyone knows everything. As a beginner, it is common to assume that experienced mathematicians know all main objects in your talk. This may be true if the audience consists mainly of experts in your sub-subfield, but that is rarely the case.

Centuries ago, a scientist knew most things about most scientific fields. As fields grew, this became impossible, so a mathematician became a person who is an expert on most parts of math, but not outside of it. As the mathematical subfields kept growing, this also became impossible. Already 100 years ago, most mathematicians were experts on a few mathematical subfields. These days, most mathematicians will not even know important concepts from other corners of their own field. For example, people working in extremal combinatorics may not know concepts from enumerative combinatorics.

Unless you wish to address only people from the specific sub-subfield, go over the definitions. At the very least, this could be a reminder for people who have seen these objects before but do not quite remember. Most people are fine with seeing definitions that they know well, but not with following a talk without understanding the basics.

You may now complain that this guide contradicts itself. It spent several paragraphs stressing that you should not include a lot of material, but now it asks to include more. This is a key tension in preparing good talks – we need to define our objects to make the talk clear, but more than a few definitions could have the opposite effect. Think hard about what pieces must be in. Unfortunately, there is no one clear answer here.

Another small thing to avoid. Don't have a slide with a text such as "Lemma **6.3**. Let x be…" It does not matter if this result is Lemma 6.3 in your paper. This information does not help the audience, but rather confuses them. The slides are not the paper and should make sense on their own. Similarly, a reference such as [4] in the middle of a slide is not helpful.

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