

(My personal opinions on) how to give a talk

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- What makes a talk a good talk is often more about opinions or style than about provable facts.
- The ideas sketched in these slides thus should more serve as a repository of ideas than as axioms that definitely have to be followed.
- You will see that I violate my own rules—especially when it comes to the aspect on how to design slides. I do it on purpose since these slides are not only slides used for actual talks but also serve as a collection of reference material.

Before you start

The structure of the talk

Body and spoken language

Slides

Some more special formats

Preparation

Further reading

Why do you do what you do and when?



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Why do you do what you do and when?

You might like, love, or hate the people on the last slides. But, as a matter of fact, all of them had a clear idea of what they wanted to tell to the people.

It might have been completely stupid anyway, but all of them had the “I now tell the people the following ...”-kind of conviction.

This is why they are great speakers, independent of whether we like them or not.

Preparation is everything

Before you start, ask yourself the following questions:

- Why do you give the talk?
- What is your purpose?
- What are the main take-home-messages that you want to spread?
- Who is your audience?
 - Make an assumption what the average person might be familiar with and with what not. If in doubt: assume less, explain more.
 - A PhD defense requires different things compared to a talk in a (more or less) informal research seminar
 - This might also apply to the clothes that you have/want to wear
 - Slides for a conference talk (you talk in front of experts) need to be completely different from slides you use for teaching
- How much time do you have?
 - Stay in time!
 - Preparing shorter talks is usually harder than preparing longer ones
- What kind of a talk is expected?
 - Slides? Blackboard? Using handouts? Reading out a carefully designed written speech?

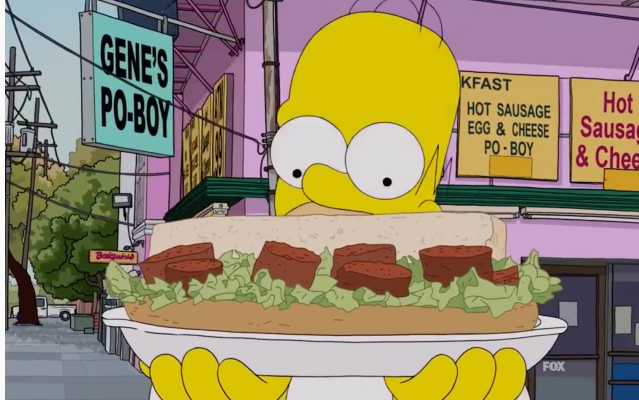
Answer all these questions **before** you start preparing your talk!

One example

- If you give a 20–30 minutes talk at a conference, it shouldn't be the purpose to explain every technical detail of your latest paper
- A talk should advertise your paper—not replace it
- On the contrary, you should convince people that the problem(s) you are working on are important or that the methods that you are developing are useful and interesting

The perfect result is that people download your paper **after** your talk because they gained some interest in what you are doing.

The sandwich technique



1. Say what you're going to say
2. Say it
3. Tell what you've said

The beginning of the talk

Greet at the beginning and get the attention of the audience

- Try to have a strong opening to really get the attention of the audience
 - Maybe use humor as well as pictures or you can ask an initial question or tell a story
 - A poll-like question can also work very well as an opener
 - One example: I remember an (excellent) elevator pitch talk by → Aleksandr Kazachkov starting with a smartphone photo of one (of the very few) elevator doors in the entire conference building. Of course, he had the attention of everybody at the beginning of his talk.



The beginning of the talk ... continued

- Sketch the outline of your talk and give the audience the high-level picture
- Tell the people what they will know at the end of the talk they (maybe) not know at the beginning of the talk
 - By the way: That's usually why the people came to your talk.
 - Provide a promise upfront: What will you learn today is ...
- Explain the structure of the talk
- Try to state the main message(s) of your talk as early as possible
- Put the list of collaborators at the very beginning and not at the very end
 - If your co-authors are in the same room, point to them—researchers always are happy if they are mentioned

A classic math-talk-crime

- Do not step right into the technical details of your last paper
- Motivate first what you are doing and then do it!

- Having an “Outline” slide is fine
- ... but there are (at least) three pitfalls
 1. Do not be too specific: if you use many notions on this slide that you have not yet introduced, nobody can follow
 2. Do not be too detailed: knowing what you will do in section 5.1.7.3.9 does help not anybody
 3. Do not be too generic: Saying that you first will say something about the preliminaries, that you then will present your results before, in the end, you will conclude the talk is a waste of time as well.

The ending of the talk

- Endings are very important!
- Summarize the main message(s) again
- Give again the bottom line of your talk
- It might be a good idea to have an explicit take-home-message(s) slide



- Avoid having ten (or more) conclusion slides
 - Yes ... that happens!
- Have an ending that really everybody understands to be the ending
 - It is always bad and feels strange if the audience does not really know when to start with the applause

The ending of the talk ... continued

- Do not end your talk with a “Questions?”-slide
 - The chair of your session/your seminar will ask for questions anyway
- Do not use a “Thank you”-slide
 - It is maybe the slide that is visible for the longest time
 - A simple “Thank you” does nothing for you
- Do not use “References”-slide(s) in the end of your talk
 - Nobody will read them anyway—neither will anyone remember!
- Better use a “Contributions”-slide as the last slide
- A “Future work”-slide might also work
 - ... if you really have some nice ideas for future work
- Carefully think about the final words of your talk
- It is good to end with a joke
 - Psychology says that if people have fun in the end they think they had fun the entire time
- Don't say thank you before the applause starts
 - That's really tough. I personally never manage to do so.
 - For a discussion of this aspect; see → [“How To Speak” by Patrick Winston](#)

One more thought on the final slide

- Usually, this slide will be visible much longer than any other slide since you typically have a Questions-and-Answers-part after the talk
- Take the chance!
- The last slide should serve your main objectives as much as possible
 - That's why a simple “Thank you” slide is not the best option
- Moreover, the last slide can also be used to help the audience asking “the right” questions

Voice and spoken language

- Use “we” and “us” instead of “I” ... although there might be reasonable exceptions from this rule
- Speak in a loud voice so that everybody can clearly hear you
 - ... but don't be too loud—you do not have to shout at the audience
- Have a clear pronunciation
- Use good English; prepare and practice the talk and you will already get what words you're missing
- Use short sentences that are easy to understand
- Avoid gap-fillers such as “äh”
- Don't speak too fast; the audience should not have the feeling that you're in a hurry
- Make pauses, stop for a while, and give the audience some time to understand what you are saying
- Use humor if appropriate; cartoons or funny pictures might work ... or might not. This also heavily depends on your personal style.¹

¹This bad idea of using a footnote on a slide is misused here to let you know that this slide is packed too tightly.

Asking questions

- Ask rhetorical questions if appropriate to get (back) the attention
- Asking good questions is not easy
- The questions that you ask need to be carefully chosen
 - They should neither be too trivial nor too hard²
- You can (and maybe should) also ask for questions from the audience
 - Asking for questions always looks confident
 - It also induces a short break and reduces the pace of your talk
 - Good slides to ask for questions are those on which your table of contents is given again when you head over to a new part of the talk (if you have these slides at all)
 - Maybe you also want to tell the audience at the beginning that it is ok to interrupt and ask questions (if this is really ok for you)

²Another bad footnote is telling you here that a slide that is too empty is somehow as bad as a slide that's too packed.

Body language

- Smile and be friendly and people will like you and your talk ☺
- Control your arms; do not gesticulate too much
- Take care of your hands
 - For instance, closed hands can make a defensive impression
- Take care of your standing position
 - When do you want to stand and where?
 - You should move a bit throughout your talk—but as always; don't overdo it
 - When do you want to sit or be in a half position?
- Avoid the tennis match feeling
 - Do not stand too much away from your slides
- Hands in the pockets
 - It might feel cool—but usually it's not.
- Be dynamic, have energy, be engaged, show passion
 - If you don't talk about your content as if you love it, nobody else will start loving it
 - It's passion what is inspiring people

Try to have as much eye contact as possible!

- The laser-pointer crime: avoid to use your pointer all the time to highlight something on your slides and look at the slides at the same time
 - Using the laser pointer too much is also bad if you are nervous because the audience will see your pointer shaking
- You should always be aware of people in the audience raising their hands to ask a question or to make a comment
 - If you are staring at your own slides all the time this is impossible

- Some of the ideas on the last slides (regarding spoken and body language) may lead to a very strange talk if you overdo it.
- As always, it depends on the dose ...
- ... and it depends on your personal style. If you don't like telling jokes you also should not tell a joke every three minutes of your talk.

Here's the first and most important insight:

People cannot read your slides and listen to you at the same time.

- Design your slides very carefully!
- The purpose of bullet points on your slides is **not** being a list reminding you of all the points you want to make.
- Do not read out your slides. People can read on their own!

- The main pitfall of using slides is that—as the speaker—you can more or less go as fast as you want³
- Especially you can easily get at a much faster pace than the audience can follow
 - Using overlays on your slides may help to not being too fast
 - Overlays can be useful also for proofs that you develop one step after the other
- Be aware of this pitfall and try to avoid being too fast.
- Attention: This sounds much easier than it is.

³Try to avoid these single words in a new line like the “can” here—and, by the way, avoid footnotes like this one on your slides.

“Less is more”

→ Ludwig Mies van der Rohe

- Do not have too many slides
- Do not put too many things on a single slide
- Prefer keywords over complete sentences
- Bad slides are often simply bad since they have too many words on them
- Try to have a clear structure for every slide
 - Use block environments, overlays, columns, itemize, enumerate, etc. to structure the presentation
- Use media such as audio and video if possible and if appropriate
- Use pictures if possible and if appropriate
 - “Minimize words and maximize pictures” (→ Jonathan Shewchuk)
- Use different colors for different meanings
 - Attention: red-green blindness
 - Always take care of good contrasts
 - Avoid yellow font on white background or blue font on black background

“Form follows function”

→ Louis Sullivan

- Do not use a too small font size
- Use a spell-checker. There shouldn't be any mistakes on your slides.
- Get rid of all background junk
 - It's just distraction
- Get rid of the logos
- Get rid of as many words on your slides as you can
 - You should tell them to the audience anyway
- By reducing the number of words on a slide you allow the audience to pay more attention to you
 - ... and a talk is always about you and not about your slides
- If there is a lot of stuff on the slides, people think that is it important and read it
 - Problem: they do not pay attention anymore to you as the speaker
- Avoid clicking back to slides you already discussed
 - You can repeat (e.g., a notation slide) better than clicking 20 times to get back to the right slide and then clicking 20 times again to get back to the slide that are on right now

- If you are doing math, use $\text{\LaTeX}$ and the beamer package
 - These are $\text{\LaTeX}$ beamer slides as well; using the [metropolis](#) theme
- You can, of course, also use Powerpoint or Keynote (with their LaTeX-style equations), but I prefer $\text{\LaTeX}$
- Use sans-serif fonts; avoid times-like fonts
- Reduce the amount of graphical stuff on your slides
 - Usually, it holds “the cleaner the better” since there are less distractions
- Use numbered slides since this makes asking questions easier after the talk
- Prepare your slides so that you get a PDF since this can be read on almost every computer

- Do not use (at least not heavily) numbered equations. Nobody can remember in a few slides that the equality

$$a^2 + b^2 = c^2 \quad (42)$$

was the one with number 42.

- On more technical slides, try to remind the audience what the notation is, when it comes up again. This can be done on the slide, but more often it can also be done verbally.
- Always use the same style for the same things. Example: If you have a definition with the defined notion in bold, always use this bold font for definitions.

- Really take care of your titles
- If people read something on your slides at all, it will be the title
- If people doze off for a minute (or more) and wake up again, the first thing that they read is the title of the current slide

- It might make sense to have a carefully chosen list of references that are included in your talk
- The references crime
 - Using numbered references in your slides that refer to a list of references that you will reveal at the very end of your talk (which, by the way, is not a strong ending) is **completely useless**
- At least, use an author-year style for referring to the literature
- ... while the title of the paper or, maybe, the journal in which it is published can just be told but does not need to be written down

- You do not have to use the huge table from your paper with very many numbers
 - A summarized table that only contains the relevant numbers is much better suited for a talk
 - You can keep the full table on some backup slide at the very end of your slides
- If possible, try to replace tables with figures
- ... but be aware a classic figure-crimes such as very small font sizes
- Label your axes and lines or bars as clearly as possible
- Check if all the lines in your plots are thick enough
- Highlight the key parts of the table or figure
 - Use, for instance, bold fonts or different colors

- When your talk starts, check that your audio is really working
- Can really anybody hear you well?
- Minimize background noise
- Speak more slowly
 - Audio gets garbled far more in virtual talks
- Turn on your video. Your audience should be able to see you.
- Think about your lighting and your background
 - Example: If the background is darker than you are, that's good
- When you start, check that your video is working
- As you talk, look at the camera more than at your screen
 - That's where you make "eye contact" with your audience

- Keep space for your face when designing your slides
 - Keep the open space in a consistent spot
 - For instance, always use the top-right corner
- Slide layout: Dimensions change.
You should prefer widescreen (16:9) over the “classic” 4:3 format
- Plan in advance what you will use as a replacement for your laser pointer.
Your mouse can serve this purpose.
- Already think about this in advance: Do you want people to tweet about your talk? You can get a much broader audience!
 - Think of virtual seminars as an outreach opportunity. Who else might be watching, who normally wouldn't tune in? Your family? Others?
- If you use apps like GoodNotes, share the slides and not the entire app with all the buttons etc.
- If you use such apps anyway, think about a combination of prepared slides and content that you “develop live” by writing into the slides
 - If you do so, plan in advance where you will do this on your slides.
- Always use full-screen mode.

- When you're writing at the board and speaking you should now that your are not speaking **towards** the audience
- Are you loud enough (and not too loud)?
- Pronounce clearly!
- The black board is perfect for informing, for teaching, for lecturing
 - In contrast to “informing”, slides are better suited for “exposing”, which is what we do, e.g., in conferences⁴
- Use different styles to distinguish content: bolder font, capitalization, different colors, underline headers, ...
- Take care of your language: What's on the board should be readable.
- Again: prefer keywords over entire sentences.
- Turn to your audience as much as you can.
 - Your back can never be as charming as your face can be.

⁴Another bad footnote: Count the commas. Do you think that such a sentence is a good one for a slide?

“If you rob a bank you shouldn’t see the bank
the first time during the robbery”
— Patrick Winston

- You need to be perfectly prepared
- State your messages as easy as possible—but not easier
- You need to know what you will say at what point in time and at which slide
- This especially means that you do not need to use notepads (and you should not!) that you carry with you during your talk
- Speak freely and do not just read from the slides

Be prepared: organization and technical aspects

- Where is your talk?
 - Be sure that you know where the room is in which you give the talk
- Bring your own technical equipment
 - Is your laptop fully charged?
 - Turn off your screen-saver!
 - Also close apps like WhatsApp; you maybe don't want that the entire audience reads the messages you get from your wife
 - Do you have your own presenter (laser pointer) that you want to use?
- Get familiar with the technical equipment in the room of your talk
 - Where is the beamer? How to connect to it?
 - Do this early enough!

The analogy of giving talks and riding a bicycle



Practice again and again and again ...

- Learning to give a good talk is like learning to drive a bicycle. You don't learn by only watching others doing it. You have to do it on your own.
- As always: If you want to get better at something, you have to practice ... a lot
- As a bachelor or master student, try to give as many seminar talks as you can
- As a PhD student, try to give as many research seminar or conference talks as you can
- Practice your talks—even if you are alone. If you do so, measure the time that you need so that you are sure that you'll stay within the time limit of your talk
- Practice in front of you colleagues, friends, ... or even when you're alone
- Better practice three times than zero times
- If you have the possibility, record yourself while giving the talk. Seeing yourself afterward can be a bit painful, but you will for sure learn and improve your skills a lot.

Again: The don't-overdo-it warning

- Prepare very(!) well ... but not too well
- This may sound very much like a contradiction
- ... but ... in the end, the lecture should not look like it has been learned by heart
- This wouldn't feel natural and people will be bored right from the beginning
- Often, it helps to have the first two or three minutes (or two or three slides) prepared very well since this also helps to overcome being nervous

Learning to give a good talk is like learning to drive a bicycle.
You don't learn by only watching others doing it.
You have to do it on your own.

- That's still true!
- However, attending many talks of other exceptional speakers will help you a lot in developing your own skills.
- Go to the talks of the “big-shots”. They aren't big-shots without reason.
- There are many brilliant examples on the web; see, for instance, all the fantastic → [TED talks](#) or those extraordinary talks that Steve Jobs gave to promote another new version of the iPhone.
- You now might think “Well, I'm not selling smartphones.” True. But you still sell something—let it be a new algorithm, a theorem, or whatever you have.



There is exactly one solution to get rid of the fear of giving a talk:
Giving talks!

Many of the things that have been listed in these slides are not written down here for the first time.

If you are interested, here are some ideas for further reading:

- The book → [Handbook of Writing for the Mathematical Sciences](#) by Nicholas J. Higham also contains chapters on “Writing a Talk” and “Giving a Talk”
- The website → [Giving an Academic Talk](#) by Jonathan Shewchuk also contains many useful material and ideas
- Many nice thoughts are collected on the website of → [Ulle Endriss](#) as well
- Same for the slides → [Vorträge in einem Seminar](#) by Prof. Volker Schulz
- The ideas on virtual-talks are inspired by the material on → [Zoom zoom zoom: Some do's and don'ts of virtual lectures](#)

There are also good examples of talks on the topic on how to give a good talk:

- → [How To Speak by Patrick Winston](#)

Here are some examples of talks of some “big-shots” that I really love and find inspiring. (Do you feel how much they love what they do?)

- → Bill Cook: The Traveling Salesman Problem: Postcards from the Edge of Impossibility
- → Daniel Kahneman: The riddle of experience vs. memory
- → Cédric Villani: What’s so sexy about math?

- This is a “living document”.
- I will extend it from time to time.
- I will re-organize it from time to time.
- If you have any feedback, please let me know.
 - For instance, is something completely missing that needs to be said?
 - Are there further resources for further reading that I completely missed? (Which is, for sure, the case.)

I already got a lot of feedback on these slides. All were constructive. That's nice.

To be more specific, thanks to ...

- Aleksandr Kazachkov
- Fränk Plein
- Christina Lienstromberg
- Thomas Kleinert
- Roland Herzog
- Mathieu Hoffmann