On giving a scientific talk

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November 10, 2023

Do you want to give a great presentation at a conference or a (student) seminar such that every single person in your audience becomes excited about what you are presenting, can fellow easily every step from the first to the last slide, has lots of questions at the end, feels better entertained than by their favorite Netflix series, and remembers you and your presentation for months after your talk?

Ok, I think that this is too much to expect from a scientific presentation. However, I find that there are many aspects when giving a scientific talk that can make a big difference and I describe some of them in this document. Any comment or feedback is appreciated, you can reach me via `andreas.wiese@tum.de`.

1 Beginning of the talk

The beginning of the talk is very important. This is the moment when you get the attention and the interest of the audience... or you don't. If you don't then it is unlikely that you will get it later during your presentation, as harsh as this may sound. There are many possibilities for what you can do in order to get the attention of your listeners:

- **State a quote** related to your topic. A colleague of mine once started his presentation with the quote by Thomas Jefferson "Never put off till tomorrow what you can do today." And then he said that he will show in his talk that Thomas Jefferson was wrong. He definitely had the attention of the audience after that.
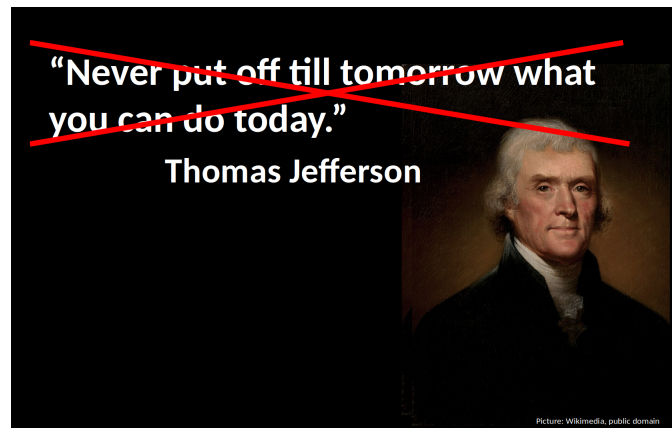
- **Ask a question** to your audience. I recommend you to use yes/no questions since then people can simply raise their hands in order to answer "yes". You can ask for example "Who of you likes classical music?", "Who of you plays a sport regularly?", or "Who of you always follows Thomas Jefferson's advice?" ;-). If you raise your hand whole asking the question, your audience will understand immediately that they are supposed to raise their hands (it is fine if you raise your hand even if for you the actual answer would be "no"). After that, you connect your topic with the question. In general, I

think that anything that makes you audience do something (think about a specific question, raise their hand, etc.) is helpful.

- **Latest news.** If there is anything in the news that has happened recently and that is related to your topic, go ahead and mention it. For example, some years ago a colleague of mine started his presentation talking about the Mars rover that had been launched to space recently and he connected his topic with the mission of the Mars rover. In general, I think that it is good if you can relate your topic to something that your audience already knows.

- **Personal story.** If you feel like it, you can tell a personal story. This does not need to be anything private or secret, it is totally enough if it is something about you as a person (while we scientists love science, we are also humans, and humans care about other humans). This could for example be something related to the place that you are from, a hobby of yours, or simply some short story that has happened to you. If you can find something that makes you relate with your audience (for example because something similar has happened to them) this is a plus.

- **Media.** Feel free to use different kinds of media in your presentation, like short a short video, a piece of music, or just show an interesting photo. In one of my talks I played the music of Game Boy Tetris to the audience and then related the game to my topic. In general, I think that you will get the attention of your audience if you do something that people do not see typically in other talks.

- **Something funny**. It is not necessary that you are a stand-up comedian or that you are the greatest story-teller. If you make you audience at least smile a bit then you already achieved a lot. Remember that they do not expect anything funny or anything that is entertaining as such. If you give them more than they expected (and practically they do not expect anything) then this is already a plus. For example, in the talk with the Tetris music, I later said that there are some similarities of Tetris and the topic of my talk, e.g., both are NP-hard. However, there are also differences: for example, in Tetris there is this wonderful music by the composer Nikolay Nekrasov, while in my talk there is no music and you have to listen to me.

- **First sentences**. Make sure that already the first sentence of your talk starts with something interesting and that you make eye-contact with your audience. Just omit sentences like "In this talk I will speak about problem X." etc. and instead start immediately with your actual content. If you watch TED talks, you will see that essentially always already in the first sentence the speaker starts straight away with what she/he wants to say. In any case, I recommend you to avoid starting your presentation with phrases like "This is joint work with my co-authors X and Y" (in my experience a large fraction of talks at conferences start with that sentence) or "I speak about a paper by X and Y". In particular, there is a strong temptation to look at the slide while saying this, instead of keeping eye-contact with the audience (which you should, in particular at the very beginning). I think that it is fine if only after a few sentences you give credit to your co-authors and say the title of your talk/paper out loud. Also, it is a good idea to remember your first few sentences by heart. Before your talk you might be nervous and if you start well into your presentation, this will give you confidence and make you feel comfortable during your talk (and your audience will see and like that).

- **Title slide**. I believe that almost all scientific talk I have seen started with the title slide, showing the title of the talk/paper and the names of the authors and/or the speaker. Actually, it is not necessary that your first slide is the traditional "title slide" with the names of the authors. Instead, you can as well do one of the things listed above, maybe introduce your topic a bit, and only after that put the "title" slide. This could make your story much nicer. Also, at that point your audience might have a much better chance to understand your title (in particular if the title of your talk/paper is hard to understand for non-experts, which in my opinion is the case for most paper titles).

Once you have the attention of your audience, you want to **introduce** and **motivate** your **topic**. Make sure that you spend a lot of time on the motivation of your presented results and how they fit in in the scientific

literature. Chances are that you worked for a long time on that topic or that you have spent a lot of time reading the paper that you are presenting. Then it is totally clear to you what had been known before it and why it is interesting and important. In my experience, topics become more interesting the more you know about them, and chances are that your audience knows about it much less than you. Therefore, spend time to motivate it well. Also, your audience might appreciate to learn not just the results of your paper, but also the general state of the art in that area.

2 Main part of talk

Now that you have the attention of your audience and motivated your topic, you want to speak about the core content of your presentation. In many scientific talks, here you talk about one or more new results. Here are some things to pay attention to when you do that.

- **Tell a story** in the sense that there is some logical order that connects your slides and what you say. It is a very good sign if you can connect two consecutive slides with the words "but" or "therefore". An example for such connections is "Once, there was the evil Darth Vader who wanted to control the universe. *Therefore*, he wanted to built a death star that can destroy entire planets. *But* there was also the Rebel Alliance that heard about these plans and wanted to prevent them ..."

- **Structuring your presentation**. When you prepare your presentation, make sure that you *first* plan its structure and only *then* make your slides. In this way, you make sure that you get a nice story for your presentation *before* you invest a lot of time into making your actual slides. For example, you can take post-it notes, one for each slide, and write on each of them the topic or possibly a sketch of its content. Then you can reorder them easily, add a slide if necessary etc. Another way is to create the file of your presentation and write a topic on each slide (but nothing else).

- **Know your audience.** Think about who will be in the audience and what these people already know about your topic. Chances are that you are an expert on the topic, e.g., because you invested a lot of time into reading the paper that you present or because you are even one of the authors of that paper. It is very likely that your audience is *not* an expert on that topic and knows much less about it than you. Then it can happen easily that you overestimate how fast the audience understands things and develops the right intuition for the topic, simply because for you many things feel natural. Keep this in mind.

- **Big picture first**, **details later.** First make sure that your audience first understands your topic/paper on a high level, only then go into details. In many papers the sections after the introduction are structured in a linear way. However, for your talk it is probably better to start with a broad overview and only then go into details. Also note that some people in the audience will get lost at some point during your talk (I think that it is impossible to avoid that). It is good for you if they understand at least the high level idea of what you are talking about.

- **Convey intuition** of why things are as you claim, but do not get lost in details. Sometimes it is hard to identify this intuition and select the right points. In a talk of about 20min (which is a typical length of a conference talk) do not give mathematical proofs, at best give some high level ideas. In a talk of around 45min (the typical length of a seminar talk) you may want to give a mathematical proof or two, but also here it is preferable that you focus on the intuition why a certain proof works, rather than the mathematical details and calculations. Note that it is hard to pay attention for 45min if the content is very dense and your audience probably sees your content for the very first time during your talk.

- **Keep notation sparse**. There is some notation that is standard in the respective field, e.g., V for vertices or E for edges of a graph, and it is ok if you just use it. Avoid other notation as much as you can. A rule of thumb is to define at most one bit notation in a 20min talk, and maybe two in a 45min

talk. When you do this, say explicitly out loud what your notation means, e.g., "For the rest of this talk I will denote by U the capacity of each input edge."

- **No outline slide**. In my personal opinion, for a 20min talk you do not need a slide that shows the outline of your whole talk. Instead, your story should speak for itself. When you show an outline slide early in your talk, there is a good chance (or rather say risk) that it will include terminology that you have not introduced yet. In that case, this information is useless for your audience and I find that then you should rather skip it in order not to confuse people. Also, 20min are so short for a talk that there is only a small chance that people will get lost because they are missing an outline slide. However, make sure with your story line that your audience always knows what is going on and what you are talking about right now. If you give a (long) talk of about 45min, you *might* want to introduce an outline slide *at a suitable moment during your presentation.* In particular, when you show your outline, every single term on it should be clear to your audience. However, I think that in most cases there are better ways to guide the audience than giving the outline of the entire (!) talk.

- **Last slide: repeat the main message** of your talk. You should have 1-2 points that are clearly your main messages (having one is better than two). If you have too many "main messages" and they all seem equally important to you, this is a sign that you might want to focus your talk better. I think that if you manage to get *one* message across to your audience such that they will remember it, then you achieved already a lot. This is particularly true in the context of a conference during which the attendees listen to many talks during the conference.

- **"Thank you" slide**. There are many talks on whose respective last slide it says literally something like "Thank you for your attention". I personally think that it is nice to say this, but I would not write it on the slide itself. The more you write on the (last) slide, the more people get distracted from your main message, which is what you want to get across (rather than the fact that you thank them for their attention).

3   Slide design

When you design your slides, a general rule is that you want to make sure that **you are in the center of attention** and **not your slides**. You have your slides in order to help you getting your points across, but they are not the presenter (you are!). Whatever you put on your slides, let it be text or pictures: your audience will read it/look at it, and this will take a bit of their attention, which they will not give to you. Therefore, make sure that your slides contain only things that actually help you to illustrate the points of your presentation.

- **Do not write completes sentences** on your slides. If you really want to have a full sentence on a slide (e.g., because it is a quote of somebody) then read it out loud for your audience. For all other whole sentences: condense them, e.g., change "We obtain an improved approximation factor of 3" to "Improved approximation factor of 3" etc.

- **As few text as possible**. Your audience will read everything that is on your slides and therefore pay less attention to what you say. Try to avoid that. If you are not sure whether you should something as text on your slide, probably it is better to omit it and just say it.

- **Graphics instead of text**. The advantage of graphical elements is that people can parse them much faster than text. Thus, they will have more time to pay attention to what you say (which is what you want). You can replace a lot of text by graphics, probably more than you think at first. Take the following slide.
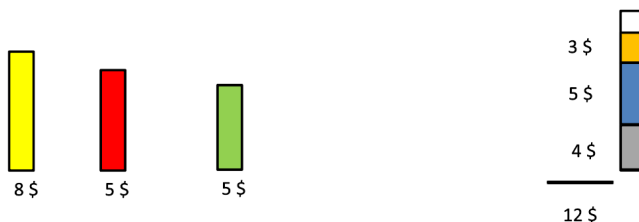
Knapsack problem

- set of items I
- knapsack of size B
- each item i $\in I$
  - size a_i
  - profit p_i
- goal: select subset $I' \subseteq I$ with $\sum_{i \in I'} a_i \leq B$
- maximize $\sum_{i \in I'} p_i$

3 $
5 $
4 $

12 $
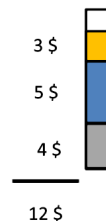
The text on this slide is relatively sparse, but still you can make the same statement with much less text like this.

Knapsack problem

8 $ 5 $ 5 $

3 $
5 $
4 $

12 $

In particular, this version of the slide does not use notation (like I, B, a_i, p_i, etc.), but simply shows the same information graphically. There are certain things that you need to say in order to explain them, but these are things that you should say anyway.

- **Do not put the current date** on your slide. For your talk it is completely irrelevant if it is April 25 or April 26, so do not write this (not even on your title slide).

- **Do not put the venue**, e.g., "European Symposium on Algorithms 2022" or "Seminar summer term 2022". Your audience already knows which conference or seminar they are attending, they do not need your slide for this. If you want to remember for yourself where you gave this talk, you can still add a slide that is hidden, i.e., not part of your presentation. Or include the name of the venue in your file name, e.g., "ESA2022-my-talk.pptx" or "seminar-talk-summer-2022.pdf".

- **Avoid corporate design elements** if you can. Some organisations require you to put their logo or other design elements on each slide. If you can avoid this, you should definitely omit these elements.

In my opinion, corporate logos mainly serve marketing aims of the organisation, but they do not help you to make your presentation better (on the contrary, they make your presentation worse).

- **Slide numbers** are useful to have on your slides if you ask other people for feedback after your talk. Then they can say something like "On slide 12 I have the following comment... ". Other than that, they are not useful in my opinion. Your audience will not understand you better because they know that you show them right now slide number 12 etc. Do not use a slide numbering of the form "slide 12/18" etc. People will not understand you better because they know that you have 18 slides in total. They might rather see in this a progress bar ("Great, only 6 slides between me and the coffee break."). There are some layouts for e.g. Latex Beamer that indicate visually how many slides there are left. Avoid them for the same reason.

- **Disable the navigation bar** if you use Latex beamer, i.e., the navigation bar on the bottom right with which you can go to the next chapter etc. I have seen many talks with Latex Beamer but I have essentially never seen anybody using them. On the other hand, they take up space, might overlap with figures etc. so better disable them. The command for this is `\setbeamertemplate{navigation symbols}{}`.

- **Your name in the footer** of every slide. This can be good for you so that people remember your name better. For the presentation itself, in my opinion it does not help since it is one more item on the slide that can distract your audience. So you need to weigh what is more important for you.

- **Font size.** Regarding the font size, my personal rule is that I always use a font size of at least 18, but a larger font size if possible. If you present in a very large room, font size 18 can be already quite small. Also, you might not know before your presentation how good the projector is, what its resolution is, etc. Since you should not have too much text on your slide anyway, you should have enough space to make your text large.

- **Slide for next part of talk.** When a new part of your talk starts, it can be useful to have a slide that has only the "title" of this part on it (in large font, in the center of the slide). Then it is clear for everyone that a new part starts. Of course you should also say this, but it is useful if you have a slide that underlines it.

- **Omit the slide title** if you can. This may sound odd to you, given that naturally one may think that every slide should have a title. Also, when you add a new slide in a program like PowerPoint it kind of tells you to add a title, so the natural thing to do seems to indeed add a title.
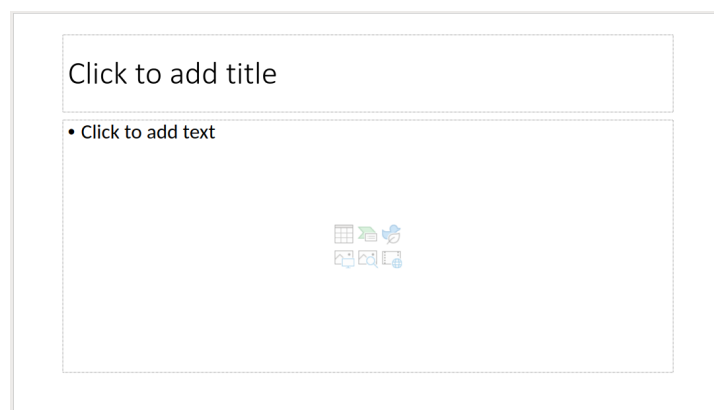
In my opinion, many slides do not need a title since they serve their purpose also very well without a title. On the other hand, your audience will read the title when it is there and thus pay less attention to you. So feel free to omit the title if you want.

- **Colors.** When you use colors, use colors that can be distinguished easily. When your slides are projected, the colors can look quite different than on your screen (depending on the projector). In many cases you will have little control over the color settings of the projector in the room in which you are presenting. So it should not be important that people can distinguish light red from dark red when they see your slides. Use instead colors with stark contrast like plain red, yellow, green, blue, etc.

- **Test for your slides**: if you can give your slides to somebody and this person could understand from your slides what you want to say on each slide (also known as PowerPoint karaoke ;-)), then there is still too much text on your slides. Better get rid of some of the text then.

- **Program to use**: there are different programs out there to create your presentation, e.g., PowerPoint, Keynote, Latex beamer, etc. All of them have their advantages and disadvantages. I cannot give you a recommendation which software to use, since this depends a lot on your preferences, operating system etc.. Keep in mind however that with each software certain things are easier and certain things are harder. For example, with a program like PowerPoint it is quite easy to add many figures on your slides while it is harder to put formulae and mathematical notation nicely. For a software like Latex Beamer it is quite the opposite. I think that when you prepare your presentation, there is a temptation to do more of the things that are easy with your program, and less of the others. So when you use, e.g., Latex beamer, avoid the temptation to put lots of formulae and heavy notation (because it is easy and looks nice), but remember to put many figures.

4 Delivering your presentation

Suppose now that you prepared your slides very nicely. What is left to do is to actually deliver your presentation. Here are some points to pay attention to when you do this.

- **Practice your talk a lot**. How much depends on how experienced you are with giving presentations and how important the talk is for you. If you do not have a lot of experience yet, you should definitely practice your talk several times in full length. Check how much time you need to give the full talk.

- **Ask for feedback** from a friend, a fellow student, or a colleague (depending on your situation). In this way you can figure out what is not clear for your audience and where you need to improve your talk. Also, ask them to stop the time that you need. You might realize that you need more or less time when you give your talk in front of an audience than if you practice the talk just for yourself.

- **Have fun**. If you enjoy giving your talk and talking about your topic, then this will activate your audience and they will be more likely to listen to you. After all, you want to make your audience excited about your topic, so the first step is to be excited about it yourself. When you talk about your own research results, this often comes naturally because you, e.g., like your work and you are proud of it. When you speak about something that you are less excited about first, try to motivate yourself and look for reasons why you want to speak about it (rather than because you have to in order to to pass the seminar course or because your boss said so).

- **Respect your time limit**. At conferences you typically have a strict time limit, and also in (student) seminars the participants will not like it if you go overtime with your presentation. Therefore, you should obey your time limit no matter what. In the worst case, skip parts of your talk if you see that you are running out of time. In particular, make sure that you have enough time to repeat your main message at the end of your talk again, so that you get this point across well. At seminars and similar venues, there might not be a strict time limit. However, people in the audience typically do not like it if you take more of their time than you are supposed to. So be respectful to other people's time.

- **Use a remote presenter**. In this way you are much more flexible and you can interact with your audience in a much better way. If you don't have one yourself, feel free to ask the person in charge of the seminar whether they can lend you a remote presenter (often they can).

- **Keep eye contact with your audience**. You want your audience to pay attention to you, so it is important that you also pay attention to them. If you do not look at them, chances are that they will not look at you either and at some point think of something else.

- **Change your position in the room** from time to time. In particular if you give a longer talk (like 45min), it can be a good idea to walk, e.g., from the left side of the projected picture to the right and back. Don't worry if you block the slides for a few seconds. It can happen easily that you focus on the people in the audience that sit close to where you stand, so when you change your position you will give your attention to other people. It can happen that there are people in the audience that are particularly important for you. Make sure that you give attention to them.

- **Be open for questions**. It is good for you if somebody asks you a question during your talk because then most likely also other people have the same question. If something is unclear to your audience, there is a good chance that they will not understand what you will say on the next slides. So it is good that they ask. If you know that you have enough time for sure, it can be a good idea to encourage people at the very beginning to interrupt you and ask questions during your talk when they like, and to ask explicitly for questions at certain important points (e.g., when you defined a problem that you will talk about). When you ask for questions, wait a bit because people might not ask a question immediately but only after a few seconds. If somebody asks a question, it is good to thank the person for the question, and to say it if you find the question particularly interesting or smart.

- **Do not use a laser pointer** to point to parts of your slides. Typically, the point of the laser pointer will shake a lot because it is impossible to hold the laser pointer completely stable in your hand, and even more so if you are nervous. Sometimes you know before your talk that you will point at something on your slide. Then you can simply put an arrow there.

- **Make slide content appear click by click**. In particular if you have many objects on your slide, in this way you can help your audience find the part of the slide that you talk about, e.g., make text or figures appear only when you refer to them. I personally do not see the point of having part of the slide grayed out at the beginning and make it appear later (Latex Beamer has such a feature). In my opinion, there is a good chance that people will try to read that part before you want them to do it and they will invest more effort for this because that part is hard to read (in gray).

- **Do not use fancy animations**. Programs like PowerPoint allow you to make animations like moving objects that change their color while they move or text that appears letter by letter. Do not use this, it will just take away attention from your audience, and they will not understand you any better because of this.

- **Get people's attention back.** In particular if you give a long presentation (e.g., 45min) it is natural that the attention of your audience will drop over time. Therefore, it can be a good idea to do something in the middle of your talk to get people's attention back. For this, you can do something similar to what you did at the very beginning of the talk. Avoid to say something that suggests that people stopped paying attention, e.g., "In case that you are already sleeping, now is a good time to get back because now in the second part of my talk I will speak about something completely unrelated." (I have really heard people saying something like this in actual presentations.)

- **Test the projector.** Before the actual presentation, make sure that you test whether the projector works with your laptop/tablet. Ideally, you do that at a point in time so that there is enough time left before your presentation to look for a plan B (in case that something does not work). My experience is that the less adapters (e.g., HDMI to VGA) you need the better works the connection with the projector (and the less adapters you can forget to bring with you ;-)). In my experience most modern projectors have HDMI connections while old ones often have only VGA. So make sure that you have an adaptor for VGA, even if normally you do not need one.

- **Be yourself.** There are many ways to give a good talk. Some very good speakers are extroverts who tell funny jokes, interact with the audience a lot, and are very entertaining. Other very good speakers have rather quiet personalities but give engaging and well-structured presentations that make the audience listen from the beginning to the end. The important thing for you is that you find a style that fits to you and your personality. For example, do not try to behave like an extrovert if you are none. It would look artificial and as if you want to pretend to be somebody who you are not. Instead, give your presentation in a way that fits to you and it will be perfect this way.

5   Conclusion

I think that it can make a big difference whether you give a good presentation or not, for you and for your audience. Therefore, I think that it is good if you invest the time to make a good presentation. As with many things, the more often you give a presentation, the better you will become at it, and then many things will become automatic for you. Also, it is important to constantly ask for feedback in order to become a better speaker over time. I think that there is no fast way, magic pill, or shortcut for this, you need to give many presentations and ask for feedback to improve.

I hope that the points above are useful for you and that you have fun preparing and giving your next talk!