

Advice on Giving a Scientific Talk

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Abstract. What makes one speaker exciting and another boring? You have been to good talks and you have sat through far too many poor ones, so what makes the difference? It doesn't really matter whether it is a scientific talk, a public talk or a classroom lecture: Your prime concern is to think about the audience. *You* are talking to *them*. You are performing. Look at them; talk to them; think about what they are hearing and seeing. They very much want you to give a good talk – that is why they have chosen to be your audience. But at the start of your talk they are worried you might not, so they are nervous. Your first job is to relax them and get their trust that you are going to do a good job. Then *you* will relax and you will be off to a great start. Of course your content matters; if you have a great discovery, they will forgive you anything. But it is still better to make a good presentation. I give some advice here on what to do, and what not to do, when giving any kind of talk, but with emphasis on short scientific talks presented at conferences. You *should* be a little nervous at the start of a talk - that is caused by your concern to do a good job. With a good start your talk will flow, you will then present your discoveries, and with a good ending your audience will applaud appreciatively and want to ask you questions. You will have enjoyed performing and want to do it again. Speaking can be fun for you, and rewarding for your audiences.

1. Introduction

In the early 1860s the Reverend Charles Lutwidge Dodgson, an Oxford Mathematics professor, told some fanciful stories to the young Alice Liddell – stories that everyone now knows as *Alice's Adventures in Wonderland*. Mr. Dodgson, as he was known to Alice, took the *nom de plume* Lewis Carroll, derived from his middle name Lutwidge, which he Latinised to Ludovicus, then Anglicised to Lewis; and first name Charles, Latinised to Carolus and Anglicised to Carroll. Early in *Alice's Adventures*, after she has fallen down the rabbit hole following the white rabbit (who is late for a birthday party), Alice eats a small cake that makes her grow to a height of 2 miles! This is a crime in *Wonderland* (rule 42, in fact) and she is tried by the King of Hearts. The white rabbit is required to give evidence at her trial, and asks, “Where shall I begin, please Your Majesty?”. “Begin at the beginning,” the King said, very gravely, “and then go on till you come to the end: then stop.”

This was wise advice 150 years ago in *Wonderland*, and it is good advice now for giving a scientific talk: “Begin at the beginning, and then go on till you come to the end: then stop.” It is the last of these instructions that is the hardest to obey, “then stop,” and we will return to that. But for now let's begin at the beginning.

2. The Beginning: talk to your Audience

While as a scientist you will have a presentation – in most cases nowadays with a computer and data projector – this is not your “talk”. Your presentation is important support for your talk, but your talk consists of the words you say to your audience. So begin by talking to your audience, not to your slides on the screen; not to your feet; not to the ceiling; not to your shoes. Do *not* close your eyes. *Look* at your audience and talk to *them*.

Your audience is friendly. In other professions this is often not true – say for a politician, or a lawyer – but for a scientist it is. Whether you are giving a professional scientific talk or a public talk, the audience has come to hear *you*. They want to hear what you have to say, so they are well-disposed towards you. When you first stand up to begin your talk, before you do anything else, look at them; make eye contact and verbal contact. This can be as simple as just looking around the audience and saying hello.

If you are unsure how to go about “saying hello” to your audience, pay attention to what other speakers do. Many of them will fail to follow the above advice; notice how you feel their neglect. Others seem very relaxed and friendly with their words of first contact. Notice that you immediately warm to these speakers, and think about following their examples.

This last advice is general. Notice how other speakers make their presentations. Even many senior scientists, with years of experience giving presentations, still do not do a good job, and some can be very bad. Other speakers, both young and experienced, give brilliant presentations. By all means concentrate on the science they are presenting – that is why you are there – but also think their style, then emulate the good ones and avoid the mistakes of the poor ones.

2.1. Your Nerves and their Nerves

You will be nervous. Almost everyone is and this is a good thing, as long as it is not totally debilitating. It is because you care about doing a good job; you want to be well-received and appreciated. So you are worried. Your nervousness is not as obvious to them as it is to you, so cover it as best you can and they will not notice. You may have a strong inclination to hide from the audience by *not* looking at them, by looking anywhere but at them. That they will notice, so overcome your inclination to do this and look at the faces who are watching you. Some of them will be “friendly” faces: people who just look like they are on your side. Find a friendly face or two and talk to those people to start with. That will help you relax much more than trying to pretend the audience isn’t there. You will find that your nerves disappear very quickly as you get off to a good start.

So you are nervous, but so are *they*! How many times have you gone to a talk and had the speaker turn his back to you and mumble, while showing unreadable slides? You get nothing out of the talk and spend the time thinking about other things, waiting for it to be over in the hopes that the next speaker will be better. Your audience has also had this experience, and they are a little worried that you may be about to do the same thing. You need to look at them, greet them and get them to relax in the assurance that you are in control and are going to give a good talk. Then you will relax.

2.2. The Beginning: What to do when Things go Wrong

With modern talks you often have to set up your own laptop computer at the start of your talk. Try to avoid this, if possible. Have your computer set up if you are the first speaker, or use their computer and set up ahead of time. Whatever you do, no matter what kind of talk you are giving: *Never trust the equipment!* Check it out *well before* you give your talk. If you have an equipment problem, the audience will hold you responsible. This may seem unfair to you, but you are the one who is in charge, so you are responsible. Make sure in advance that everything is going to work.

If you have a computer problem, or any other kind of technical problem at the start of your talk, if at all possible, let someone else deal with it. Usually, there is technical support and you can leave it to them to fix the problem. *You* have come to give a talk, so talk to your audience. You do not need slides to do this. Face the audience, look relaxed and unworried (even if you are close to panic), and begin your introduction. You *can* do this without your slides. Imagine you are on an aeroplane and the person sitting next to you has asked you about your research. You can tell them about it without a computer and projector. So you can do the same for a talk; this is especially easy for the introduction.

That way you use your time well by beginning your talk while someone else sorts out the problem. Remember that any time spent with equipment problems has to come from your all-too-short time allotment for your talk. There is no slack in the meeting schedule; you cannot have part of the following speaker's time. If you stand there wringing your hands, looking stressed and saying nothing, you are throwing away your own precious minutes that are better used telling the audience about your research.

2.3. Podiums and Lecterns

Do not hide from the audience. Get out from behind the furniture when you talk. Walk away from the podium, if there is one. Stand out front with nothing between you and your audience. Physical barriers are psychological barriers. Walk around some, but do not bounce or fidget nervously; do not do callisthenics. A reasonably animated speaker holds an audience's attention better, so move around, show some enthusiasm in your voice and body language. The audience will respond well to that. A rigid speaker droning in a monotone tends to put people to sleep – even if the material is interesting.

3. Going on: the Hook

So you have said hello; you have made eye contact and verbal contact with the audience. Now you need “the hook”. Your words and first science slide tell why your talk is important. First and foremost you should talk about the physics of your research, not the details. Details come next. Even if you are giving a technical talk about equipment, or computer programmes, or data reduction, talk first about the ultimate applications of your work – what problems it will solve. You want to grab the audience's attention well at this point. You have just started, you have said hello to them in your own way, and they are all still listening to you. But they do have a tendency to drift away mentally and think about other things. With your first science slide you tell them why the

astronomy research you are about to talk about is really interesting *to them*. This is your “hook” for the talk. This is what it is all about.

For example, should you start your talk like this: “The 47 astronomers from 21 institutions in our group have observed for 117 nights on 12 telescopes over a time-span of 2 years and discovered 55 pulsation modes of three different degrees, with many multiplets detected in HD-something-or-another?” No! You should start with, e.g., “We have discovered differential internal rotation for the first time in any star other than the sun, and we are able to show that it is inconsistent with all previous expectations of theories of star formation.” You can talk about the details of your team and data later. Get their attention with the hook, with the physics of your talk. Right at the start, answer this question for the audience: “What is the purpose of this research?”

3.1. An Outline?

Do you start your 15-minute talk with an outline? Many people do, but I do not understand why they do this. Personally, I would never do it for any length talk. You have come to tell a story, so get on with it. When I am listening to a speaker who begins with an outline – “I will first tell you about what I am going to talk about, then I will talk about it, then I will come to some conclusions and tell you what I have already told you, and then I will finish by talking about future research in my field” – all illustrated with the same words for me to read, I switch off. This is dull stuff, indeed. Usually, when the speaker finally gets on with telling about the science I mentally come back, but not everyone will. Why waste time in a short talk giving an outline? Get on with the talk. That said, sometimes an outline is not bad, and may even be mildly helpful to some in the audience. But for scientific talks of 10, 15 or 20 minutes, this is generally not a good use of your precious time.

4. Going on: the Details

Now that you have their attention, it is time to give the details of your research. Think about your audience. *Always* think about your audience. *Think* about your audience. There. I have said it three times, so it is true. (This is another quote from Lewis Carroll; in case you do not recognise it, it was said by The Bellman in *The Hunting of the Snark*.) Think about what your audience is seeing and hearing. Can they read your slides? Can they hear you? Are you speaking clearly? Have you left them enough time with each slide to read and digest it? Do they understand your graphs? Have you put too much in? What do *you* look like and sound like to *them*?

4.1. Words on your Slides

It is a common fault to pack too many words on slides. If you do not want your audience to read what is on your slide, do not put it in. If you do want them to read it, then give them the time to do so. Do not pack your slides with words. The slides are not your lecture notes so that you can read your talk, although they may act partially as that. They are important points you wish to emphasise visually, as well as say in words. Remember also that the less you put on your slides, the more flexible your talk is. With a rigid time limit, you

may need this flexibility. Slides covered in many words makes for rigidity, and usually a dull talk. Use big letters. Your slides should be readable for someone sitting at the back of the lecture theatre. I recommend 24-point characters and larger for all main points.

4.2. Plots, Graphs, Pictures and Graphic Illustrations

Plots, graphs, pictures and illustrations are a different story. They tell many things that you cannot say in words. Make sure that all axes and labels on your graphs are readable; make sure that everything you point out can be resolved *from the back* of the lecture theatre. Do this by projecting your talk and going to the back – where many people choose to sit – and seeing for yourself if your plots are readable. When you put up a plot, your audience has to figure out: “What is on the x-axis? What is on the y-axis? What are the scales?” They have not spent the last two years looking at your plots, as you have, so they need some time to appreciate what they are. Make sure they have that time. If you move on to the next slide before they have even figured out what your axes are, they have got nothing out of that part of your presentation, and you have just wasted your time and theirs.

You may, after having made contact with the audience and caught their attention with your hook, turn to talk to your slides. They are looking at them, too, and it is fine if you do. But regularly, turn back to your audience and look at them. You need to know how they are responding. Are they interested? Are they watching your slides, or looking around the room? Are they sleeping, or working on their computers? You may not keep everyone with you, but you need to know how you are doing; you must be aware of your audience, and that requires looking at them.

If you must reproduce a plot from a published paper so that the axes and labels are not readable, spend the time to annotate the plot, or at least take the time to say what is on both axes (unless it is a standard plot everyone knows, e.g., an HR diagram). If your audience cannot figure out what is being plotted, they will not get whatever point you are trying to make with the plot.

4.3. Tables

Tables can be useful, but more often they are misused. Do not fill a slide with a vast table full of tiny numbers, unless the only purpose is to give the impression that you have a lot of whatever is in the table. Otherwise, take the time to extract the few numbers from the table that you wish to discuss and put only those on the slide in large characters so they are easy to read. If you inundate your audience with extraneous detail, some of them will be trying to figure it out, instead of listening to you.

4.4. Colours

With computer presentations you have a wide choice of colours for backgrounds, lettering, and everything else in your slides. Only a few combinations of colours work well, are easy to read and attractive. Whatever you choose, project your talk before giving it and go look at how it appears with the lights on from the back of the lecture hall. For example, red letters on a blue background may look good on your laptop screen, but projected they can be invisible. Avoid red on

blue. Be careful, too, with your choice of background. If it contains recognisable scenes, your audience may concentrate on the image in your background and not on your foreground messages. Keep your backgrounds fairly plain, or at least unobtrusive.

4.5. Animations

Scientific computer animations can demonstrate research and results spectacularly well. For example, no still pictures or word descriptions can show the formation of a ring galaxy as well as an animated computer movie of the gravitational interaction during the collision of two galaxies. That is great stuff. If you have animations of your results that give new insight into the science you are doing, they are very important to your talk and impressive to the audience. Everyone is fascinated with new ways of picturing things, and animations can do this well.

But animations are also deadly. Any time you have something moving on the screen, you should be talking about whatever it is that is moving. Think about it: you may hate television, but if there is one on in a room you are in, it is difficult not to look at it – even though garbage is normally being broadcast. For your slides, if you have a cute little animated character bouncing around on the screen, your audience is looking at it. They are not listening well to you, and they are not studying the plots and points on your slide; they are watching the cute little animation. So never put in gratuitous animations. For your serious scientific animations, your audience will be watching them while they are playing; you will have no trouble getting them to direct their attention there. When you want the audience's attention back on you, or elsewhere, stop the animation.

Along these lines, so not be too clever with the entrance of slides and words. For example, if you have a list of points you want to make, be conservative about animating all the points. You may spend your whole talk pressing the computer mouse button just to get the next few words or bits to appear on the screen. Then you never look at the audience; you give your talk to the mouse. If you must have many entrances of separate items, but sure you have a hand-held mouse that you are familiar with, so your activation of the transitions are not apparent to the audience.

Do not use variety in the transitions of your slides, so that one comes from the right, the next comes from the left, the following one comes from above . . . By the time you get to that point the audience is not listening to you well; they are mentally betting the next one will come from below, and you may even get an unwanted laugh from them when you prove them right.

You want the presentation to be smooth and polished, but your audience should simply have the impression this is true, rather than be specifically watching your slide transition technique. That is, unless, they are studying your presentation technique. Most will not be doing that, and they should be unaware of all but your science message.

4.6. Can they Hear you? The Microphone

How many times have you heard a speaker start a talk by shouting at the audience, "I DON'T THINK I NEED THE MICROPHONE. CAN EVERYONE

HEAR ME?” A few people shout back “yes”, and the speaker then turns his back on the audience and mumbles inaudibly to his slides, so no one hears him. Groan. *Why* do people do that when they have seen so many others do it?

Use the microphone. It is your friend. For reasons that are beyond my comprehension, a large fraction of astronomers are *frightened* of microphones. When given a hand-held microphone it is often held at belly-button level, or worse, behind the back! That is not where the sound is supposed to be coming from. You have all seen professionals use microphones: Put it a few centimetres in front of your mouth and talk normally. Then *listen* to the output from the speakers to judge the sound level.

Usually for a scientific talk, you will be given a clip-on radio microphone. This should be positioned directly under your chin, not to one side or the other. Remember that you are going to be turning your head to look at your slides. If you put the microphone on your left collar, then turn to the right to look at your slides while speaking, your microphone will not work.

As with other equipment, you should check out the sound system before giving your talk. Try the microphone out from various places in the lecture room, including the back, to hear what you are going to sound like to your audience.

At a meeting a few years ago in South Africa, there were complaints about some speakers not speaking loudly enough and not using the microphone well. A senior theoretician, who will remain unnamed here, stood up to give his talk, held what he thought was the microphone right under his mouth and spoke loudly and clearly. There were no complaints; no one noticed because he was easy to hear from all parts of the room. I found myself, however, unable to concentrate on his talk, because I was close to bursting out laughing. Finally, I had to interrupt his talk and say to him, “That is the laser pointer you are speaking into!” No problem, of course. We all had a good laugh and he then continued speaking clearly into the real microphone. The important point is: make sure your audience can hear you.

There are rare speakers with booming voices who do not need a microphone, even in a large lecture room. There are even a few who speak so loudly that they have to be kept from using the microphone, so they do not do damage to the hearing of the audience! But for you, unless you have training as an opera singer and great mastery of your voice, just use the microphone.

4.7. Dress: what to Wear

What you wear when giving a scientific talk is not a very important point. We scientists are mostly unconcerned about the dress of a speaker. If you are at all concerned what people think of you and the way you dress, then a good rule-of-thumb is that you should dress a bit better than the audience is dressed. A tuxedo is out-of-place unless it is your idiosyncratic trademark, so-to-speak, as it is for a well-known British historian of astronomy, who is one of the best speakers I have heard. So do not overdress. But likewise, do not come as a slob. If you are very poorly dressed, it does say to your audience that you don't care what they think of you, and this is not a good message to start your talk with.

The type of dress you choose is a matter of taste and culture. In any case, do not dress for the disco! If you dress provocatively, some of your audience will not be listening to your scientific message. You want their attention on your

talk, not on your person. Dress demurely and sensibly, but within a wide range. As I said, we scientists are not very concerned about your dress, unless you blast us in the face with something extreme. Stay within 2σ of the mean, while being comfortable in what you wear. Finally: the more important your talk and your audience is, the better you should dress.

5. And then Go On till You Come to the End

Make your science case any way you like. Just remember that you are telling a story. Make sure that there are enough interesting points to stitch together the details you need to present, while keeping the audience's attention. Particularly, make sure your talk is at a level that is correct for your audience. If you are speaking to experts in your field, you may assume they have the background, know the acronyms you use and recognise the plots. Otherwise, explain these to be sure your audience can follow. Of course, that means you can present less material during your short time, but it does no good to present lots of material that is not understood. On the other hand, talking down to your audience – meaning explaining that which is obvious to them – will just irritate them. So hit the right level.

Language is a potential problem, since astronomy is so thoroughly international. Many speakers and many listeners are non-Anglophone, some without complete mastery of English. Some Anglophones, and even some non-Anglophones, speak so quickly that much of their message can be lost to the audience. This problem can be partially overcome by putting your major points *succinctly* on your slides to be read, since reading is always easier than listening in a foreign language. This does not over-ride my previous advice about not putting too many words on a slide – that is why I said “succinctly”.

6. Then Stop

Should you summarise your whole talk at the end? No. You just gave it, the whole talk was only 15 minutes, and your audience knows what you have just said. Finish with one or two of your most important conclusions. Refer back to your hook to remind your audience that this was the purpose of your research. And say something about your future work, but not too much. THEN STOP!

7. Epilogue

Having said that, however, I am not going to stop here. There are some other points I still want to make.

7.1. Going Overtime – Managing your Time

Going over your allotted time is a scientific sin. Do not do it. Your audience will stop listening to you; they just want you to stop. The chair of your session will be agitated and unhappy. Any extra time that you do take has to be at the expense of another speaker, or a loss of time in the breaks. No one is going to be happy with you for this.

The amount of time you are given for your talk is too little. That is always the case. So what do you do when the time runs out and you haven't finished? If you have lots more slides and no time, you will have to flash through them to get to your conclusions, and it will be obvious to everyone how poorly you have managed your time. As I said before, put less on your slides so you are more flexible. You cannot hide your slides from the audience. If you have to skip them, it will be obvious. But if you are mostly talking to your audience and find you are running out of time, you can say less and no one will know what you have left out.

You can also have more than one ending, if you are very unsure how long your talk will take. Then if you do finish with some time left, you can make another point or two. Although this may upset your polished ending, it is better than stopping with significant time left. That sends the message that you really do not have much to say, and gives the impression that your research is not very significant. With some practice, timing problems will not happen often, but you may still want to have a few more slides in anticipation of potential questions that may be asked.

The chair of your session will give you a warning a few minutes before your time runs out. You should be paying attention to your audience and the chair, so when this warning comes you see it without the chair having to jump up and down, or walk right up to you. If you force the chair to go to extremes to get your attention, he or she will also get the attention of the audience, and distract them from listening to you, just as you reach your conclusions.

The message is: Be aware. Be aware of your time; be aware of your audience; be aware of the chair. You want your talk to end right on time, not over (bad management), and not a lot under (too little of significance to say).

7.2. Do not Point out Faults in your Talk

If you do have problems – e.g., you have put your presentation on the organiser's computer and some of your slides are not right – do not point this out to the audience. The same goes for any other problems you have had in preparation or delivery. Do not apologise and draw the audience's attention to your minor faults. Mostly, they will not notice the problems, unless you draw attention to them.

7.3. A Polished Presentation: Does it Matter?

Does it matter if your presentation is polished? Does it matter if you have put a great amount of effort into your slides, your graphs, your animations? Does your audience care? The answer is yes. If you have obviously put in a lot of work in preparation, it says to them that they matter to you, that you consider them to be important. You have gone to a lot of trouble to give them a good talk. Audiences appreciate that and will be more receptive to your science.

7.4. Humour

Even for a public talk where you may have an hour to speak, unless you are experienced, do not tell jokes. For a scientific talk this is a waste of time and will backfire on you. However, humour is useful to warm up an audience, to get them receptive to listening to you. So you may tell an appropriate short anecdote

or an amusing story of your own (time permitting), and you may be mildly self-deprecating to show you do not take yourself too seriously. At the start of your talk, a brief bit of appropriate humour can work well to get a rapport with your audience. During your talk a light touch is appreciated, and keeps an audience's attention. When people have an appreciative laugh or chuckle at something you have said, anyone not listening is immediately sorry they missed what you said, and you have their attention again, so humour can work well to keep an audience with you.

But keep it very short for a 15-minute talk; otherwise the message is that you do not have enough science to fill your time. Humour is a nice touch, but it is not required, so use it cautiously until you find what works with audiences.

7.5. Hecklers

Never attack a member of the audience. If you get a heckler – someone who asks aggressive, unpleasant questions, has a derogatory tone of voice, or even outright verbally attacks you – do not attack back. The group dynamics of audiences are such that the whole audience will turn against you if you attack one of their number – even in self-defence. Remain calm, cool, rational and stick with discussing the science. You will have an air of authority then. If you lose your cool and become aggressive back, you will lose the sympathy of the audience.

8. Keep your Perspective

In the end you must keep your perspective: If you give a great talk, but there is little or no scientific content, no one will be impressed. On the other hand, if you have great scientific results, your audience will forgive you for a poor talk. In fact, in that case, they will forgive you most anything. They are there to hear about your research. A good presentation matters, but the science you are doing matters more. If both are great, then you will be a star! And that is not a bad goal for an astronomer.

Think about your audience, “begin at the beginning, and then go on till you come to the end: then stop.”