

Phys 7857 Graduate Seminar

“How to get a job in physics”

Today: Scientific talks

Communicating verbally your scientific work to an audience is an integral part of your activity as a scientist. It is also a common tool for evaluating you at various stages of your career (when interviewing for a job; when being considered for a promotion).

All of you have some experience giving talks. All of you have seen several talks.

Here we will try to touch upon some points with the objective of making you aware of what makes you a better scientific speaker.

Key references:

“Advice to beginning physics speakers” by James Garland, Physics Today, July 1991 (Not available for free, but if you google it there are several [versions](#), including a [pdf one](#), floating around).

“Suggestions for giving talks” by R. Geroch <http://arxiv.org/abs/gr-qc/9703019> (Oriented to people working in relativity, but general message good).

“One page guides” by John Wilkins at Ohio State <http://www.physics.ohio-state.edu/~wilkins/onepage/index.html>

“Advice on giving a scientific talk” by D. W. Kurtz, [Astrophysics of variable stars 349, 435 \(2006\)](#)

Talks tend to come in two sizes: the one hour presentation and the 12 minute presentation. General concepts apply to both, although the 12 minute format requires tighter time management, obviously.

Talks also come in two levels: the colloquium style talk to a whole physics department, which theoretically should be intelligible to a first-year graduate student, and the technical seminar delivered to a group that specializes in your area. Again, general concepts apply, but with different emphasis.

The first issue to contend with is what are you going to talk about. You have probably done research and obtained results in an infinitesimal area of knowledge. Yet, supposedly there is some importance to what you did. Usually this is revealed by tying it into broader areas of knowledge. This will make your talk more attractive to a larger group of people.

There is a fine line here. If you have to talk to teenage kids at the local planetarium about your research on perturbations of black hole space-times, you probably want the title to be “How a black hole swallows a star”. However, are you prepared to handle all questions that pertain to the broader subject?

Preparing the talk:

Once you've settled on a subject to talk about, the next most important thing is the title. You want something attractive and broad, yet without being overly cute. Too technical and narrow a title will lose you audience. A significant fraction of the potential audience will decide if they attend or not largely based on the title. Never use words that may not be familiar to the audience in a title.

The next step is to plan the talk. Try to break up what you need to say into three or at most four messages. You then need to focus on how to get each message across. It is a good idea to tell at the beginning of the talk what you are going to do, listing each message. It is a good idea to do this while showing a slide containing the outline of the talk.

You then need to decide how much time to allot to each message, which equations or graphs convey better each message, and compose the respective parts of the talk.

A major hurdle is that this is not necessarily the way in which you think about the subject. One tends to think of many interconnected sub-messages, not three or four main themes linearly connected. Audiences just cannot parse such structure in the confines of a talk. You will need to drop stuff that you hold dear to make things clearer, and sometimes add explanations you feel are redundant.

Lying is ok.

Well, not. But you have to realize that you are not on trial in a talk. What you say is not so much what matters as what your audience will take away from what you say. Omitting things that will cloud the appreciation of the message (even though with more careful examination would clarify things) is completely ok.

Don't assume you'll just copy your private notes or what you wrote for a paper. It is much better to take a few steps back and figure out what is the best way to present the material (which might not be the way you actually found the result chronologically in your research). Should you use a simpler notation? Less definitions?

It is a well known adage that in a science book for a lay audience, you lose half the readership with every equation you introduce. Standards are not so bad at talks, but try to minimize the number of equations. They are hard to absorb, slow you down and tire the audience. Never just put up an equation and stay silent, walk people through the equation. Don't use symbols that are undefined. Don't work out derivations explicitly, unless there is something crucial in them. People will believe you can do the algebra and will be happy to believe the result.

Similar concepts apply for figures. Say what you are plotting, what are the axes, what are the units.

At the end of a talk, put up a slide with conclusions, which repeats the main points of your talk. The thing to remember about what a talk does is:

- Tell the audience what you are going to tell them,
- Then tell them, and finally
- Tell them what you told them.

Repetition is a time honored method of learning.

When talking to a mixed audience, it is always a good idea to devote a good fraction of your talk (at least 1/2) to the least experts in the audience. Make sure you cover enough that they leave the room (early if they wish) with your message. Then you can use the rest of the talk to pander to the experts in the audience.

Visual materials:

These days almost everyone uses software (Powerpoint, Keynote). This has a good advantage: one cannot cram as much information on a slide as easily as one can with a fine pen on a transparency. Quality of talks has improved significantly since these new tools were introduced, particularly among theorists (!!).

In spite of this, *avoid the temptation to cram too much information on a slide.*

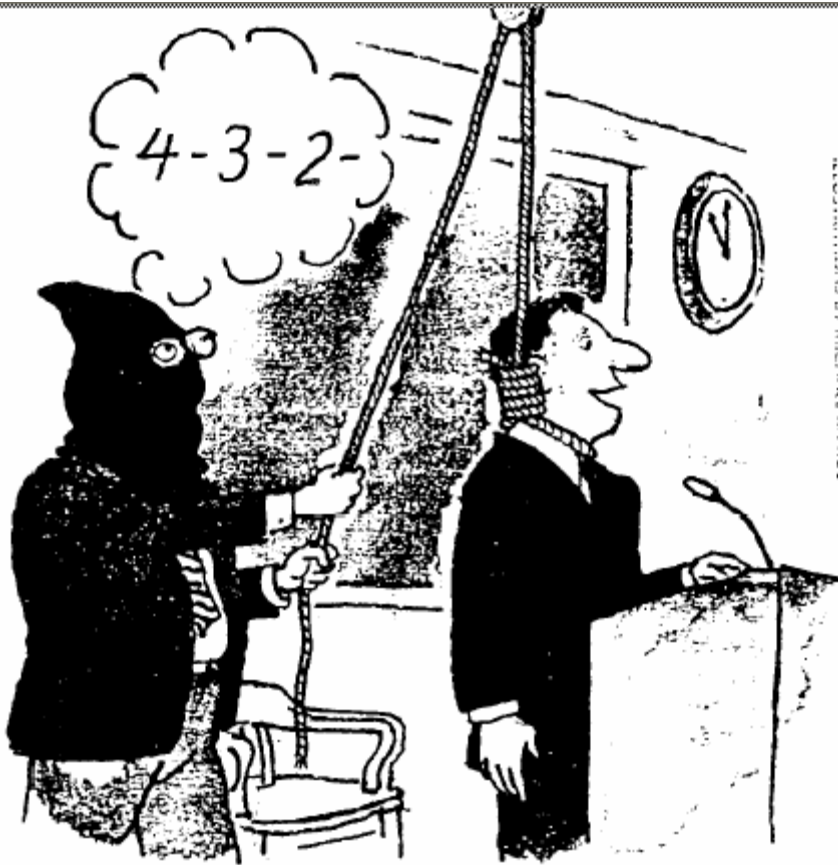
Don't do what I'm doing there, writing complete sentences on a slide. It is better to use bullets, or single phrases.

Anything important has to be on the slides, not communicated verbally. Conversely, don't put on the slides things you don't refer to.

People take time to absorb what is on a slide. Therefore avoid slides with just one thing on them, since you will be forced to move to the next slide quickly.

Make sure colors/fonts/pictures are visible from the back of the room. Practice with a projector (they don't render colors the same way as a screen). Try to leave space on the sides of the slide and top and bottom just in case a problem with the projector cuts off a slice of your slides (these problems tend to be the hardest to fix).

Time management:



*It's a capital crime to exceed
your allotted time*

The more inexperienced you are, the longer it will take to present things compared to your expectations.

Experienced speakers have better sense of time and can speed up to make things happen on time. They are less likely to be sidetracked with questions.

It is strongly advisable that you rehearse your talk. You can do it by your own, but keep time strictly. Or do it in front of your friends. Keep in mind it will take even longer with an unfriendly audience.

A rule of thumb is that every slide will take at least two minutes to present. Therefore don't do more than 30 slides for a one hour talk, or more than 5 for a 10 minute talk.

How could I possibly fit all I have to say in 5 slides?

By focalizing on the important. In a very short talk you will only get a chance to deliver one message. Choose it carefully and build your five slides around getting that message across.

Any subject can be compressed to any length of time of presentation.

But the way NOT to do it is by speaking faster or flipping slides faster.

The Bible in 50 Words

God made, Adam bit, Noah
arked, Abraham split, Joseph
ruled, Jacob fooled, bush talked,
Moses balked, Pharaoh plagued,
people walked, sea divided,
tablets guided, promise landed,
Saul freaked, David peeked,
prophets warned, Jesus born,
God walked, love talked, anger
crucified, hope died, Love rose,
Spirit flamed, Word spread, God
remained.

About yourself:

Giving a talk is an activity quite far removed from scientific research, and very close to *performance acting*. This analogy is quite powerful and pertinent. Think about actors:

- They dress appropriately.
- They wear makeup and other props to make them look good in the light available.
- They have to watch how they speak.
- They have to look cool even while nervous.
- They have to engage the audience.

All of this is to a certain extent true of you giving a scientific talks.

Therefore:

Avoid nervous mannerisms. They tend to spread a nervous contagion in the audience, putting everyone on edge and giving a terrible impression.

If you are shaking uncontrollably (it happens), take a deep breath, grab onto something firm (the podium, for instance), stand squarely and move on with your talk.

Avoid using pointing devices that amplify hand tremors.

Learn about all the technical details of the room before you use it. How do the lights work? Can they be dimmed? What can you see from the back? Will you be close to your laptop to change slides? What kind of pointer is the best? Do all this well in advance, nothing gets you more nervous than a non-functioning projector with the audience already in the room. *People will hold you responsible if things don't work.* Nothing is more distracting than a speaker that has to walk back to a podium every 20 seconds to change a slide.

Try to keep eye contact with people who are paying attention to the talk. Show enthusiasm for your work.

Always speak facing the audience.

Speak clearly. Make sure you are heard. Don't be shy about using a microphone!! People tend to fade out as they get tired, so if at the beginning sound is marginal, it will be bad at the end.

Questions and answers:

Particularly important in the impression you give to people is how you handle q&a.

- a) Let your questioner finish the question. Don't jump into the middle of question. Use the time to collect your thoughts.
- b) Be prepared to rephrase the question. Then everyone will understand what the question is and in a succinct rephrasing you will make the questioner seem intelligent and perceptive.
- c) Keep answers short. Try to start with a `yes' or `no' if at all possible.
- d) Confess your ignorance. If you don't know, admit it graciously, and thank the questioner for bringing the point to your attention. Offer to talk later about it.
- e) Deflect hostile questions. *Never* argue with a questioner. No audience likes a public display of belligerence. So if the questioner attacks, the audience will side with you provided you keep your cool.



*Control
your feelings: never
argue with an aggressive questioner*

Miscellaneous:

Be careful with jokes. Self-deprecation is usually well received. Something humorous or a story at the beginning of the talk will warm the audience up to you. Something funny in the middle can wake people up.

But jokes can be a minefield. A joke that doesn't work will leave you unfocused and make you more nervous. And potential for sexism or far worse things is enormous.

Be careful with animations. They are great when they work. But... They don't transfer well between computers. Make sure the animations work when you are set up. (A simple trick that fixes things is to turn off hardware acceleration in the display settings).

Also, if you overdo animations, people will look at them, not pay attention at you. Similar comments apply to the transitions in powerpoint or keynote.

Finally:

Remember the analogy with performance art. This is not an exact science and great talks come in different forms and shapes. Try to develop the one that best fits your personality. Feeling you gave a great talk can be very rewarding, it is worth the effort just for that..■