How to give a good scientific talk

Scientific talks have become one of the most important communication forums in the scientific community. Scientific conferences, where most talks are given, have become both more numerous and better attended in recent years, making it possible, in many cases, that more people will listen to your talk than will read the paper that you write that is based on the same data. Because a scientist's research reputation may be enhanced (or diminished) by their scientific talk, all scientists must be able to deliver a well organized, well presented one. A poorly prepared talk does not merely waste the time of the speaker and audience. It also makes a statement that the speaker does not care about the audience, and perhaps does not care much about the subject.

1) Prepare your material carefully and logically.

Tell a story. Constantly remind yourself (and therefore your audience) what the "big picture" is. Remember that you are doing science. The story should have four parts:

(a) Introduction (b) Method (c) Results (d) Discussion and Conclusions / Summary.

(a) The *Introduction* should excite the audience about your topic, and your question, just as much as you are excited by it. Rather than merely being a statement of the hypothesis, your intro should reveal your motivation to solve the problem—and your enthusiasm should be contagious enough to compel your audience as well. In other words, the speaker must try and convince the audience that the problem is important to them as well as the speaker. Many good talks also establish the topic in its broadest context: Are there ecosystem-wide implications for this research? Will you be able to generalize to trends not yet explained? Could this upset currently held-wisdom in the field? (But don't be uppity.)

(b) The *Method* includes your approach and the caveats. The Method often becomes more interesting to the listener if this section represents some of the actual non-linear nature of science. Is science actually done as reported in textbooks? No. Scientific investigations follow paths that dead-end, or twist back on themselves, and this is both interesting and important to future researchers. Consider, therefore, presenting a narrative methods section which admits setbacks—"I did A and then B, but B didn't work so I tried C…" This is often more revealing about your skills as a scientist, and the question that you are trying to answer, than simply reporting "The final result was obtained using method X." Also, use the active voice when describing what you did—otherwise the audience is left wondering who did do the work you are describing.

(c) The *Results* section is a brief summary of your main results. Try to be as clear as possible in explaining your results - include only the most salient details. Other details will emerge as people ask questions, or in your written paper.

(d) The *Discussion*, *Conclusion, and Summary* section(s) should both condense your results into a meaningful form, and interpret those results for the audience. What are the implications of your findings? It is often useful to include a summary slide in bulleted or outline form, which describes what you found, and what you think it means. Be sure to connect your results with the overview statements in the *Introduction*. Don't have too many points—three or four is usually the maximum that people will remember.

These four items are the core of a good talk. Good speakers may also add a fifth item: *Future Research*, which allows the speaker to talk about the next step that ought to be taken in order to continue broadening scientific understanding of the topic in question.

One way to think about how to give talks can be summarized this way: **"Tell'em what you're going to tell'em. Tell'em. Then tell'em what you told'em."** The point of this aphorism is that people absorb very little information at first exposure—multiple exposures are the best way for ideas to sink in. Thus, it is okay to state some of your results in the introduction, and then to repeat your main points in the results and conclusion sections.

2) Choosing the material to include: Less is more

- **Don't put in too much material.** Good speakers will have one or two central points and stick to that material. In too many talks, the speakers squander their time on unessential details and then run out of time at the end. The point of a talk is to communicate scientific results, not to show people how smart you are. *Less is better for a talk.* Realize that a relatively small fraction of what you know shows up explicitly in a talk, and trying to cram it all in there will guarantee a shoddy presentation. Finally, know your audience, and if you have reason to believe that they are not all specialists in your field, assume that most of the audience will know very little about the subject, and will need a clear explanation of what you are doing, not just details.

- **Be careful in your use of equations.** Show only very simple equations if you show any at all. Ask yourself—Is showing the equation important, or do I just think it's really cool that I know what this means? Is it central to my talk? Realize that equations are dense mathematical notations indicating quantitative relationships. People are accustomed to *studying* equations, not seeing them flashed on the screen for 2 minutes. When you put an equation up, your audience will stop listening to you and start studying the equation (or take a nap). If you have to show an equation, simplify it and talk about it very briefly.

  Using equations profusely and gratuitously will not ingratiate you with anyone except, perhaps, those who derived the equations in the first place. It is usually assumed that showing absurd numbers of equations is a sign of arrogance, and even, sometimes, an attempt to confuse the audience into not following or asking questions.

  If you really do have one or two critical equations (or definitions) that will be new to some members of the audience, but will be necessary for them to understand and retain to "get" the talk, write those things in large letters on the board so that they stay up for the duration of the talk. Do not rely on the memory of the audience members to keep up with a complex presentation. This is probably not the only talk that they will see on this particular day.

3) **Polish your visuals**. Some clues to making better graphics include:

A. **Use large letters.** Putting up words that can't be read by the audience practically guarantees that you will lose their interest. This include the axes and captions for graphs. In general, for PowerPoint presentations, 24 point text is about as small as you want to go to be easily readable.

B. **Use few words.** As soon as you put a new text slide up, everyone in the audience stops listening to you, and starts reading. If you want to get their attention back quickly, limit the words on display to keywords, which you can use to cue yourself to complete the thought verbally. Exceptions to this rule are when you have a special reason to use a complete quotation.

C. **Keep it simple—reduce the number of *things* on each slide.** Don't show graphs or tables that you don't intend to discuss. Everyone knows that you are not discussing everything that you did; you don't need to prove this by displaying all possible graphs that could be generated from your data.

D. **Keep it simple—reduce the number of *styles* on each slide.**
   i. Don't crowd the screen with flourishy details that are likely to distract.
   ii. Don't switch between fonts frequently—you'll end up with a ransom note rather than a scientific presentation.
   iii. Don't animate when you don't need to (PowerPoint makes it easy to animate; resist the urge unless you have a compelling reason to use this feature).
   iv. Never put dark text on a dark background, or light on light. And red text is hard to read for almost everyone.
   v. Have pity on the color-blind, and don't put red on green, or vice versa.
   vi. While keeping points i. – v. in mind, realize that a clear, visually interesting presentation is more memorable than a dull one, so if you have any graphic sense whatsoever, use it, or ask someone who does.

E. **Use schematics and/or humor to make a point when possible.** Schematic representations of a system that you are describing can make your work more accessible to audience members who aren't already in your inner circle. Cartoons can also be used to illustrate a scientific result to good effect.

F. **Allow at least two minutes each for text and data slides**; less than that and the audience will feel rushed, and may well tune out for the rest of your talk.

A few particulars with regard to graphics include:

- Have a title slide that includes your name, institution, and the date & title of your talk
- Recurring outline slides may be helpful as well, to let the audience know where you intend to go, and to remind them at points during the talk where you are in that plan.
- Include an acknowledgment slide, even if you gloss over it relatively quickly. Failing to thank the people who really did help you is a good way to lose friends, colleagues, and respect.
- PowerPoint has some glitches with regard to graphics and audio files—some ways that you insert these things won't show up in your final presentation unless you move the original (sound or image) file to the same folder your presentation is being given from.

4) Practice your talk.

This gives you

a) better familiarity with the material;
b) a clear sense of what flows and what doesn't;
c) a sense of how long it actually is; and
d) reveals tics that you may not have known you had.

There is no excuse for failing to prepare in this way. The best way to familiarize yourself with the material and get the talk's timing right is to practice your talk. If you do not practice, you are likely to exceed the allotted time, which is guaranteed to irritate everyone in the audience, often to the point that what people remember about you is not that you did some really interesting research, but that you were the guy who went on too long and kept everyone from their cookies.

Even though you will have practiced, people often speed up in front of an actual audience or, in some cases, slow down, such that the talk that was 12 minutes in practice is now 16, or 8. Keep track of the time as you are giving the talk, and come prepared with extra material, and an ability to cut material as well. Pad, or thin, your talk as necessary.

So, practice, both by yourself, and in front of a small audience of friends who can be honest with you. Listen to them when they tell you that something is unclear, and change that part of the talk, even if it is the night before you have to speak. Listen to them when they tell you that you have a heretofore unknown nervous tic that makes concentrating on your words damn near impossible. Such tics include pacing up and down in front of the screen, interjecting "umm" or "ahhh" every time you take a breath, jingling the keys or coins in your pocket (hint: remove everything from your pockets before getting up to speak), talking to the screen instead of to the audience, speaking in a whisper or a monotone, and rambling incoherently. Seriously try to overcome these tics, if it turns out that you have them.

Also, be brave enough to make eye-contact with people in the audience; it actually makes the talk easier to give, and will keep you from completely losing track of their response.

5. The Talk Itself

- If you have an electronic presentation, check out the technical aspects of the system before your talk.

- Dress nicely, but not in a remarkable way. Do you want people to remember your science, or your hat? Even if in other contexts you might answer "my hat," now is not the moment for fashion statements.

- Be ready for questions. Questions after your talk can be scary. But questions are very important—they are the part of the talk that becomes a conversation, and it is often through discussion that we learn the most about a topic. Questions from the audience can reveal what piqued their interest the most, and what you failed to communicate, while also helping you focus your research.

Here are a few tips for answering questions:

1. **First, repeat the question.** This gives you time to think, and the rest of the audience may not have heard the question. Also if you heard the question incorrectly, it presents an opportunity for clarification.
2. **If you don't have any idea how to answer the question, admit it by saying "I don't know, I will have to look into that.**" That said, you should have thought of most possible, relevant questions pertaining to your talk, so let yourself think on your feet, and out loud, in front of people while you try to figure out an answer. This can be very rewarding for both speaker and audience, and the audience will likely be impressed with both your knowledge and courage. At the same time, be honest and humble. You are only human and you can't have thought of everything.
3. **If the questioner disagrees with you and it looks like there will be an argument, defuse the situation.** "Do you want to take this outside?" is not an appropriate response while giving a scientific talk (unless the question is one of local natural history). A better response to a tense situation might be "We clearly don't agree on this point, but let's move on to other questions, and you and I can talk later." ("…over a stiff drink." is an alternate way to end that sentence, which may itself help defuse the situation)
4. **Refer to other people's work when appropriate.** Never, ever, take credit for work that you have not done. You will be found out. And then you will go down in flames.

Above all, **don't panic.** And bring a towel.

Acknowledgments and Disclaimer: This represents my (Heather's) thoughts on the subject, with use of web-based resources as well, including "Ten Secrets to Giving a Good Scientific Talk" by Mark Schoeberl and Brian Toon, and two anonymous documents from the web with similar names.)