

How to give a scientific presentation

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ABSTRACT

Outlines

- Use an outline: scientific paper (boring), essay (less boring), or, plot (best).
- Greet the audience
- Have a hook and a slant.
- Start with the status quo (state of present knowledge or belief)
- Tell the audience what they will learn (the promise of a change in the status quo)
- Tell the audience your motivation for the study.
- Illustrate your Methods & Results as a chronological story.
- Explain graphs carefully.
- Mention alternative explanations.
- Acknowledge your contributors during the talk (not at the end).
- Signal when you are near the end.
- Don't give a bland summary: emphasize that there is a new status quo
- Don't introduce new material
- Return to the hook near the end.
- Never go over your time slot.
- End with a clincher, immediately followed by "Thank you".
- Listen carefully to each question, repeat it, and keep your composure.

Slides

- Have a simple graphical theme.
- Minimize slides (use blank (black) slides when you speak for more than 30 s.).
- Use 20-36 pt font (except for references ~12-14 pt).
- No ALL CAPS!
- Capitalize first word, like in a sentence.
- Use animation to assemble parts of a slide as you say them, or to circle or point to parts of a figure.
- Never use clip art, comics, or gimmicky animation.
- Simplify the comparisons in your figures (be minimalist).
- Show your data
- Use images instead of diagrams where possible.
- Use color to help make comparisons.

Text

- Eliminate or Minimize text (< 12 words/slide), unless audience speaks a different language. Ideally, limit text to a sentence title for a slide and graph axes.
- Cite authority where appropriate (e.g., when you show a published result).
- Clearly label graph axes.
- Spell out scientific names and jargon on first use.

Style

Practice.
Dress well and uniquely.
Lead your slides.
Smile, move on stage, speak to the back of the room, don't talk to the screen.
Don't use a laser pointer.
Use contrasts and lists of 3.
Use appropriate personal humor, or anecdotes every 1-5 minutes,
or show short relevant videos or images that show action – IF they relate to you.
Keep cool during technical problems; show confidence AND humility. Share your failures as well as your success.

INTRODUCTION

Giving talks is key to professional success. A good talk should advertise your work, advertise you, and connect you with other scientists. Your work only has impact if others know about it. But few people have time to read all the latest journals. Unlike readers of papers, live audiences are captive. They have to stay to the end (Zoom audiences don't). The audience wants you to inform and entertain. And if they like your presentation, they might read (and cite) your papers. When it comes time to get a job, succeed with proposals, or earn an advancement, being known by your peers is a big advantage. As you generate excitement for your work, you will attract collaborators and peers, expanding your science program. But all these benefits hinge on giving good presentations. Giving bad presentations is worse than being invisible.

After giving hundreds of talks and listening to thousands of them, some better than others (both given and heard), I think it is rare to see a talk that could not be improved (my own included). Some of my thoughts contrast with the typical scientific talk (which is often boring or incoherent), so do not treat this as a consensus from the scientific community. This advice is more like what you would get before giving a TedTalk. My advice on scientific presentations applies mostly to talks at scientific meetings, but works equally well for lectures, seminars, thesis defenses, and job talks. In this essay, I first go over three types of outlines, comment on the use of slides, then give tips for presenting an entertaining, coherent, and memorable talk.

OUTLINES

Preparing your outline starts with determining its thesis. The thesis is the main thing (a single idea) you are trying to convince your audience about. Except for the hook, eliminate anything not related to the thesis. You can show many supporting results and give many examples, but you should only have one thesis per talk.

The thesis has as key partner, and that is the problem or question. The problem serves to explain motivation. If you can explain your motivation for doing the research, you can likely also motivate the audience to pay attention to your talk.

An outline will help your talk have structure. Writers use outlines, but when putting together a talk with PowerPoint, it is easy to just move slides around until they feel right. Nevertheless, a formal outline is as important for a talk as it is for a paper. Not making an outline runs the risk of leaving out a key piece and leaving the talk incomplete. Also, for a long talk, the audience will follow you better if there are discrete sections. You will often hear the adage: Tell them what you are going to tell them, tell them, then tell them what you told them." There is a bit of truth to this advice (stick to your point), but a good talk is far more complicated, and much more interesting. At the end of this essay, I provide detailed outlines for three types of talks.

Most boring outline

The most common outline for a scientific talk is the scientific paper. This is OK for presenting a single study in a short talk, and it is a familiar format for your audience. A

scientific paper does not leave the audience waiting for the main results until the end. Instead, the paper states early on what the key result is (or at least its general implications) and then tries to convince them that the methods and results justify the claim. But the scientific paper outline is not supposed to be a mystery novel. If your talk works best with drama, mystery, and surprises, use the more ambitious plot outline below. Although a scientific talk and scientific paper can use the same general outline, the details vary considerably. As I'll discuss below, the oral presentation is far less detailed and less formal than the written paper. Regardless, the traditional outline is the most boring outline.

Less boring outline

If you are giving a longer talk, a review talk, or a job seminar, the scientific paper outline is simply too compact. Here, you can revert to the classic (if tedious) 5-paragraph high school essay outline. This outline also indicates the claim of your thesis early on in the Introduction. The most important part to think through carefully is the introductory section to set up the thesis of the talk. An essay outline often investigates several hypotheses, so the thesis must lay out a broad organizing principle that links them. In the Introduction, it is not necessary to give the results for each hypothesis. Instead, indicate the various types of evidence you will present that support the thesis. The sections of the talk are akin to body "paragraphs" in that each might represent a study, topic, or hypothesis. The audience should know when you move from one body paragraph to another. This starts with a transition between sections that connects both to the thesis. The new section then starts with an introduction that acts like the topic sentence of a paragraph. The concluding section indicates how the evidence you presented supports your thesis. Just as there is one thesis per talk, it is best to have one main point per section. Safe, but boring.

The story outline

If your talk lends itself to a story, and you are ambitious to try something memorable and compelling, you can attempt the plot outline. And why would you want to give any other talk? A plot is a story, and most plots have a familiar outline. A plot starts with an equilibrium (the old thesis), then there is conflict that disrupts the equilibrium (your problem), rising tension leads eventually to a resolution of the conflict and a new equilibrium ensues (your thesis). Even if you do not give a talk wholly based on the plot outline, it is possible to borrow elements of the plot outline to add interest and drama to your presentation.

A plot outline can work if you have made a discovery that changes the way that people think, or a result that was particularly challenging to arrive at. The initial equilibrium might be the prevailing paradigm, and the conflict an observation that does not fit with the paradigm. You can underscore the initial belief by stating what they might have assumed or what your initial beliefs were. E.g., "You've probably heard that the moon is made of cheese.., well I once believed that too."

You want to impress people with your science, but people are naturally skeptical of show offs and turned off by braggarts. "Claiming" greatness is a transparent show of insecurity.

You can avoid this in three key ways. When Introducing your thesis, build on the work of others rather than imply you thought of the question by yourself. This is simply how science works. When you describe the work, give ample credit to assistants and collaborators. When you do reveal your brilliant discoveries, show gratitude for serendipity rather than taking credit.

Your methods illustrate the arc of action from one equilibrium of belief to another. But do not spotlight your wonderful accomplishments or emphasize how difficult your task was. To add rising tension to the arc, you need to describe a series of difficult studies and failures that are inevitable in any quest for a new paradigm. If you describe your methods as actions that you and your colleagues struggled through, your audience will be more compelled by the narrative and interested in the outcome. Plus, your methods create opportunities to add drama and humor. Failed methods are particularly key. Find the humor and absurdity in your failings and successes.

A story is a narrative with a narrator, a protagonist and an antagonist. Getting these straight will help you with the outline. You could be any of these. But you connect with the audience best when you are the humble narrator. As narrator, you guide the naïve audience through a journey of discovery and realization. They are Luke Skywalker and you are Yoda. They are the Karate Kid and you are Mr. Miyagi. Yes, you can be a character in this story, but surrogate protagonists should take the main stage. These are your collaborators, students, and technicians and other scientists that contributed new ideas or advancements. Be generous and tell their stories. Develop their characters. Introduce them by name.

Antagonists can be harder to define, but think of them as barriers to solving problems. Antagonists are not necessarily people. They might be a dominant paradigm, or past misconceptions, or the difficulties of doing field work. But be cautious when defining a competing scientist as an antagonist. Be sure to credit them appropriately for their discoveries or make their failures seem reasonable. Chances are they have friends in the audience (they might even be in the audience).

KEY SECTIONS OF ANY TALK

Your first slide is a Title Slide that gives your title, spells the first and last names of the authors, lists other contributors and funding sources (e.g., with their icons), and perhaps has a single image that hints at the thesis of the talk. The title itself is important to the audience. A rookie mistake is to try to gain a large audience with a vague and general title. Unless you have name recognition, a vague title sounds pretentious and won't attract the people you want to attend. An ideal title specifically indicates your key result, study system, and methods. With that amount of detail, interested audience members will be there for your talk. Your title slide will probably be showing when the moderator introduces you. The moderator will then introduce you, sometimes at length. Be sure the house lights are on because you want to be seen.

A moderator is there to get the audience's attention, introduce you, and the talk. A rookie moderator's introduction can be lengthy, sometimes too long, and perhaps even embarrassing. Try to ask your moderator to introduce you in a way that will frame your talk. Everything about their introduction should be about what you are about to deliver. Their introduction could indicate an anecdote about how the introducer knows you and should indicate why you are a credible expert (without over doing it). It otherwise should minimize biographical information that doesn't directly relate to your theme. The introducer should then indicate to the audience a teaser about what they will ultimately learn from the presentation to give them something to look forward to. If possible, script their introduction for them.

The transition from the moderator to the speaker is often awkward. If for some reason the audience is still not listening, you can't afford to go straight into your talk. For instance, if people are still filing into the room, the rest of the audience will be distracted. In that case, you will need to have a pre-opening prepared. You can refer to previous talks with related themes, or mention an interaction with the moderator, or inject some humor (not a canned joke please). Anything to get the attention directed to you so you can begin your talk.

Your talk really starts when you greet the audience. In addition to the hook and clincher (below), this is the only part of a talk that I advocate memorizing verbatim. You will be nervous and there is a real chance that you will stray into uncharted territory during your greeting. Instead of rambling, you need to succinctly accomplish four things: segue from the moderator to you, signal that the talk is beginning, welcome the audience, and remind the audience who you are. Here is a stock greeting you can use. "Thank you Marty Moderator." (looking at the moderator), Now, walking to center stage, smiling and looking at the audience) "Hello, Welcome and thanks for coming. As Marty said, I'm Pat Professor from Upscale University." Modify this greeting to fit your personality. But memorize it and don't deviate from it or you are at risk of wasting time and drifting into an awkward beginning. Note that the house lights should still be on; don't lower them until you need your first slide.

After the greeting, move directly into the hook. A hook is a literary device used to gain the interest of the reader. And it helps get the audience curious. A hook can be an anecdote "I first fell in love with branchiopods when.." An interesting fact "Darwin's least successful book was about earthworms", a statistic "The largest known ant colony has as many workers as there are people in China", a quote: "Francis Crick once said, 'It is notoriously difficult to define the word living' " Alternatively, a question: "How will malaria change as the climate warms?" A "Why" or "how" question is the easiest hook and a good fallback until you can think of something clever. If possible, try to relate the hook to the audience, for instance, by using the word "you" in the hook, like "You probably have a cousin, perhaps several..." A hook can also be an evocative graphic, memorable dramatization, or a catchphrase. A hook is needed for your opening, but you can also sprinkle them throughout your talk to keep the audience engaged.

Following the hook is a short sentence or two called the slant. The slant is a bridge between your hook and your thesis. This means it is important to have a hook that can somehow be connected to your thesis, if only indirectly. Even though the hook and slant are the first part of your talk, they are often the last thing I finalize. It is a good idea to run your hook by other people to be sure that it works. Hooks are hard, but a good one will get your audience to listen to you from the start.

Another literary device that can connect the audience to your theme is the catchphrase/soundbite. It's rarely used in a scientific talk, but it can be a powerful addition. This is a short phrase (ideally three words, but up to a dozen) that succinctly captures your thesis. The best catchphrases put the most memorable word at the end. The catchphrase should also have a rhythmic or rhyming quality. For Steve Jobs, it was "Reinvent the Phone" for me it might be "Parasites are Pervasive." To make this a catchphrase, you repeat it a various parts of the talk to emphasize continuity with the theme. And, you need to enunciate the phrase to indicate to the authors its special importance. Some catchphrases have two contrasting parts. E.g., to borrow someone else's catchphrase, "its not the meat, it's the motion." A catchphrase may be the only thing your audience remembers a day after your talk. A repeated graphic can also serve as a catchphrase. It might be an important comparison that you want your audience to return to again and again both to drive home a point and stick with the thesis. Think about a single slide that you come back to at key transitions in your talk that helps reinforce your thesis.

After the hook and slant, you should let the audience know what they are going to learn. Many presenters include an outline slide to guide the audience through what will be presented (especially for the essay-style talk). It is a good idea to set up the structure of the talk for the audience, but I think it is too pedantic to put up a detailed outline on a slide. Certainly don't show a detailed outline. And definitely don't put up a slide with the words: "Introduction, Methods, Results, Conclusion". At most, have an abbreviated list of your key topics in the order you will cover them. Normally speakers will say something like, "I will discuss A, B and C." But when listing the elements of the talk, link them explicitly to the theme. Don't just say what you are going to do. It can be more powerful to indicate to the audience what you hope they will learn or understand. E.g., "by the end of the talk, I hope to have convinced you that..." This personalizes the talk and makes it clear that you are speaking with them.

The Introduction tells why you did the study. It takes some time to set this up and you need to know your audience and tailor it to them. Don't just jump into graphs and results. It is essential that the audience first understand your motivation. If you can convey your interest in the topic, the audience will be engaged and share that enthusiasm with you. Moreover, the motivation should be personal. It is not enough to say that you are addressing a question that is interesting to your field (though this is a good thing to say). You need to also say why it is interesting to you personally. But the theme can't just be of interest to you. Very soon in the Introduction, a non-specialist should be convinced that your thesis is relevant to broader issues of general interest. It often helps to give a

brief history of the ideas on the subject – just be sure that the history is neither boring nor distracting from your thesis.

The Introduction is a good place to introduce the general background needed for the audience to understand the topic. Most talks have some technical and specialist concepts and language. Assume the audience has no knowledge of the details. Go briefly into technical details to show depth, but come back and summarize these details for audience's benefit.

Finally, avoid turning the Introduction into a mini-lecture. The audience will grow impatient if they sense you are treating them like undergraduates. They are here to hear about your work. So keep the Introduction short.

Because this is a scientific talk, it is important that you use the language of formal hypothesis testing. Students are often confused by what hypotheses and predictions mean, so here it is in a nutshell. When trying to solve a problem, we start with an observation, pattern, or theoretical expectation that generates unanswered questions. From this, we develop a hypothesis as a potential explanation for the observation. You can make a number of predictions about what might happen if the hypothesis is correct. These predictions are what you will test with your Methods and show statistics for in your Results. Although you should use some formal language, try not to use science jargon. Insecure scientists use jargon as a way to make them look smart. But looking smart is not your goal. Your goal is to communicate to a non-specialist. In many cases, jargon is not avoidable, so you might need to define technical terms. Don't be overly colloquial. The audience cringes when a speaker says something like, "...and then I found some pretty cool results." You might recall that the least cool person at school was the person that tried hardest to be cool.

In most scientific talks, you have the opportunity to describe methods. This is often the most boring part of a scientific paper, but it can be the most interesting part of a scientific talk. For one, it is the way the audience will evaluate your approach and whether or not they trust your results. The methods should be told as a story, often in chronological order, with you (and your collaborators) as the actors. Use the first person ("I", "we") to describe what you did. Keep it enthusiastic, yet humble. This is also the place to indicate your acknowledgements of collaborators and funding sources. Instead of showing the dreaded list of collaborators slide at the end of the presentation, talk about the people that helped you and what they did when you describe the methods. Use their names and affiliations: "John Doe, an undergraduate researcher in our lab", "My coauthor, Jane Smith", "My thesis adviser, Betty Black". Do not refer to them as nameless slaves that you duped into doing your work for you. Show photos of them in action if possible. But do not show gratuitous or embarrassing photos of them (or nobody will want to collaborate with you). As an aside, your audience might contain people that have helped you or done work that helped you. Be sure to find a way to acknowledge these people, they may be expecting it and will be disappointed if you have ignored them. In addition to descriptions (or photos) of people in action (better than headshots), you will want ample descriptions (or images) that describe the lab set up, study sites, species of interest,

procedures and measurements, etc. Use anything that is appealing, even taking slight detours if there is an opportunity to show something unusual, funny or inspiring. But the Methods section does not need to be comprehensive. And do not go into the level of detail that makes Methods sections in scientific papers boring. If someone in the audience needs to know details, they can ask a question or talk to you later. In addition to providing good visuals, the Methods section is often where there is room for a bit of humor. Failed experiments and mishaps are good ways to engage the audience and personalize the story – so long as they do not detract from the thesis. Also, don't directly indicate that the methods were difficult. If they were, the audience will figure it out for themselves without your having to point it out. And always respect your organisms. Never show slides that suggest cruelty or callous disregard for life as an attempt at humor.

The Results are the most scientifically critical part of your talk because they are how the audience will evaluate whether you have supported your thesis. In most cases, results are comparisons or relationships. The more you can simplify these the better. A simple Control vs. Treatment graphic is better than a complicated slide showing procedural controls, and various irrelevant treatments. A scatter plot showing a positive relationship is another simple way to communicate a finding. If you can, show the results in a photograph, instead of a figure. Avoid showing tables. A 3x3 table is about as much as an audience can understand on a slide. Don't show DNA sequences. Because this is a scientific talk, the audience is not expected to take your word about the significance of your comparisons. Accompanying a result should be an indication of sample size and the p-value or confidence limit. If the results are complex, break them down into a series of simple parts. Don't show statistical tables (unless your topic is statistics). In general, do not make the mistake of thinking that showing complicated results makes you look smart. Complicated results make you forgettable.

The Conclusion section of your talk should consider how well your results support your thesis. Start by hinting to the audience that you have reached the conclusion. This will reduce their growing anxiety about how long you intend to keep them sitting. You don't need a slide that spells "Conclusions", verbalizing it will feel less artificial. You will want to also be sure to discuss alternative explanations if you have not already done so in your Results section. This is more important than you might think. Your audience is trained to think critically about evidence. If your results are correlational, admit that you cannot infer causation. If something was ambiguous, be sure to indicate if there were methodological problems, or if more studies would be needed. However, do not dwell on these alternatives, your conclusion is really about emphasizing one to three things about what you want your audience to remember. These things should relate directly to your thesis. Put this in the context of what you hope they remember from your talk. In your Conclusion, try to tie back into your hook. You could say, for example, "going back to my original question", or, "Perhaps Darwin was right to be fascinated by earthworms". Returning to the hook reengages the audience and gives the talk symmetry and completeness. The slide that stays on the screen at the end of the talk should summarize your main points, graphically, if possible.

The last moments of your talk are critical, so do not botch them. At the end of your talk you want to have a “clincher” sentence. Like a hook, the clincher is an attention getter. In addition to your opening line, it is the only thing you want to memorize. Moreover, it wraps up your thesis or reemphasizes it in a new way, driving it home in a succinct, memorable statement. Immediately after your clincher statement, pause for effect, walk to the center of the stage and simply say “Thank you”. That cues the audience that your talk is over and they can applaud. The clincher is like a gymnast’s dismount. You need to nail it for a high score. If you stumble over it, or are awkward, or try a joke, you will lose the connection between your audience and your clincher sentence. Nothing should come between your clincher and the applause but “Thank you”. This is not the time to list acknowledgements or ask for questions. Acknowledgements go in your methods, or title slide, and the moderator will ask for questions after the applause.

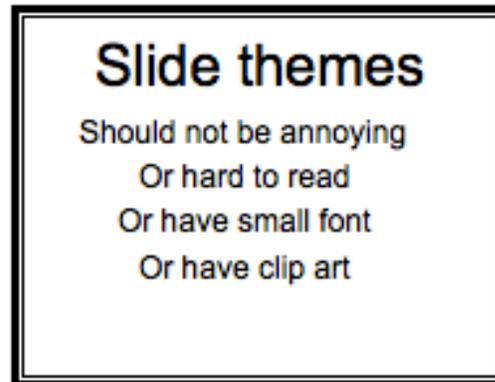
SLIDES

The best slides for a talk are no slides at all. The speaker should drive the lecture, and a powerful speech is one that conveys images inside the minds of the audience, not on the screen. The intimacy between a speaker and an audience can be powerful, so audiences will take any granted opportunity to look away from the speaker to the screen. When the audience is engaged with the screen, they are no longer listening to you, you have lost an emotional connection, and it is easy to lose control of your message. The screen, therefore, is more your enemy than your ally. However, PowerPoint is such a convenient and accepted form of communication that audiences easily acquiesce to one boring slide show after another. So, despite my advice, chances are you are going to have slides, if only out of peer pressure and expectation. If you must be conformist, remember the mantra that less is more. Try to use a slide (or series of related slides) less frequently than once every two minutes. Otherwise, you overload the audience. Do not fall into the trap of letting your slides give the talk with you acting as an optional narrator. Talks with slides that spell out the details in text, or illustrate every point and detail are like the tail wagging the dog. The speaker is forced to obey the visuals as if PowerPoint is in charge of the presentation: “This slide shows X, Y, Z. Now, this slide shows A, B, C, I think the next slide gives the conclusion..”. Instead, the presenter should verbally deliver the bulk of the information, using slides as minimal support when a verbal explanation just won’t suffice. The more experienced you get, the less you should rely on slides.



A coherent talk often has a graphical theme. This relates to the colors, fonts, backgrounds, graphics styles, etc. Themes are nice and show professionalism that makes

the audience think you respect them. However, be conservative in choosing your color themes and font styles. Keep in mind that PowerPoint is a Microsoft product. Its themes are designed with business presentations in mind (which are even more tedious than scientific talks). In particular, minimize color in your themes. You want to save the color for important comparisons and contrasts. In my opinion, the best theme is black text on white background. This is by far the easiest to read and keeps the stage well lit so the audience can see you. But if you know you will have a well-lit podium, white text on black background has the most contrast,

BAD*BETTER*

The only thing worse than showing a slide is showing a text slide. The number one consideration for slides is that when you project text, the audience instinctively reads it. It is nearly impossible for them to read and listen at the same time. You want the audience to listen to you, so the less text you present them, the better. If you need a visual aid, it is preferable to use an image or a graphic instead of text. Ideally, you would have no text slides, but there are some exceptions. 1) If you use scientific names or any words that the audience might not be familiar with, it is a good idea to have them spelled out once during a talk. 2) If you are speaking to an audience that might not understand your accent, text slides can help avoid confusion. If many in the audience do not speak your mother tongue, then give a bilingual talk – put the slides in one language and speak in the other. If I am speaking in a non-English speaking country, I try to add a little more text and to convert the text in my slides to the language of the audience. That way, the text becomes the subtitles to my talk.

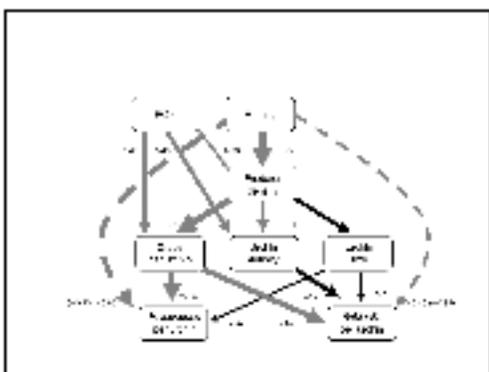
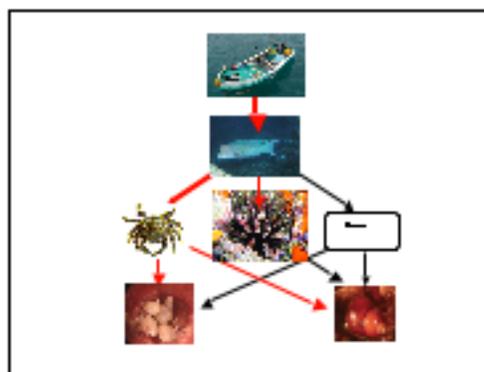
Do not use text as a crutch. It is common to see talks where the presenter scrolls through the outline of the talk on the screen, one agonizing text slide after another. If the audience sees you use the slides to remind you of what you are going to say, they will know that you are unprepared. They can read faster than you can talk, which means they are mostly waiting for you to finish talking. These talks are made even more painful to watch if the presenter points at each line with a laser pointer (see below). Script reading is a recipe for a boring, pedantic talk.

If you must have text slides, keep the text to a maximum of 12 words per slide, eliminate all unnecessary words, and use 20-36 point non-serif (e.g., Arial) font so that we older

folks in the back of the room can read along. Don't use ALL CAPS. If you have a slide where there is so much text that the font has to be small, and you have to say, "I know you can't read this, but.." You might as well have said, "I don't care if you can read this slide because it is just there to look impressive." If you must have text slides use them for quotes, simple take-home points written as a single sentence, spelled out words that might be unfamiliar, and short lists, revealed one line at a time. And give the audience an image to go along with text. But better yet, just say these things to the audience.

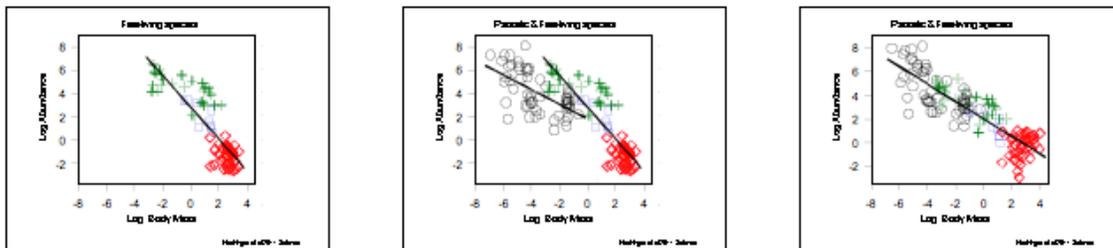
Your graphics should be clean and simple, but there are some bits of detail (and text) that are essential. Some people feel a graphic slide needs a title. I don't. But if you must have a title, write out a simple and complete sentence. A figure needs to have clearly labeled axes. You can use graphics to help point to aspects of the figure that you want to discuss in detail (e.g., a red arrow or a circle). If you use a graph from a published paper, be sure to add the citation in the lower corner of the slide. But most figures from papers are too detailed for a talk. Re-draw figures to simplify them and make your main points. However, where possible, show the data. The audience relates to data more than it relates to abstract data summaries on their own. But don't dump too much data. That never impresses an audience. It just leaves them confused. In particular, don't simply tell the audience to ignore irrelevant parts of a figure or table. Instead, delete those irrelevant parts before hand. Commit to explaining the elements of any data slide - the axes, the markers, the colors, the overall pattern. If you don't have time for that, don't show the slide.

It may seem tempting to dress up graphics with artsy elements (shadows, 3-D bar graphs, etc.), but this can be distracting. A minimalist approach usually works better. An exception is when you can add illustrations that go along with the figure. For instance, if you are showing a graphic about a fish species, an embedded illustration of the species can help the audience link the abstract graphic to something concrete. Finally, here is where you want to (sparingly) use color to help make comparisons. In short, a graphic should show something that it too difficult to explain in words, or a graphic provides evidence that convinces the listener about a result you found. But if you do show a bad slide, don't apologize. Do you best with it and keep moving.

BAD*BETTER*

Microsoft employs a small army to create PowerPoint gimmicks that will ruin an otherwise good talk. Never use clipart unless you want to advertise that you have a complete lack of aesthetics. Avoid gimmicky animations or sound effects. Do not animate images to make them dance or fly around to emphasize a point. Do not show cartoons. Do not show equations unless they are relatively simple, essential to your talk, and you are prepared to go over them in detail. Replace tables, mathematical equations, and complex figures with simple graphics. Leave empty space, especially at the edges and the bottom (your screen will often be smaller than your slide).

To keep the audience on track with what you are saying, do not show multiple comparisons on a slide all at once. Either use separate slides for each minor point, or, to build a complicated argument or figure, use animation to add bits to the slide. For instance, if you have a slide that has three bullet points, do not show all three at once. Animate the bullet points so that they come in one at a time. However, I only recommend animation as a way to break up complex ideas into small pieces. Just have the new text or images “appear” in a sequence as you build a complex slide from pieces of your narrative. This will make it much easier for your audience to follow your logic and listen to you.



If a figure has multiple comparisons, step through it in sequence (e.g., with animation)

You do not always have to have an image on the screen. If you are going to speak for >30 seconds on a topic that does not need illustration, the audience may stay transfixed on the now irrelevant slide that is lingering from the previous topic. For this reason, you can insert blank (black) slides into places in your talk where you are going to speak without referencing a slide. This forces you to use descriptive words to show the audience what you want them to imagine.

DELIVERY

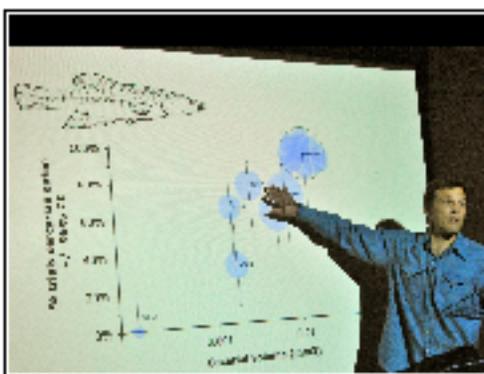
A scientific talk is a performance. As such, it requires energy. Get a good night's sleep before the talk, schedule some private time to collect your thoughts, and procure your normal allotment of caffeine. A flat talk lacks enthusiasm. If you look tired, you'll have a hard time convincing anyone that your science is interesting.

If you are not a natural performer, you should practice your talk a few times after you have the final version to your liking. There are two types of practice. The first is to give a trial talk to your lab group, colleagues, or supervisor. They will see the talk from the perspective of the audience. From this type of practice, you will get advice about your

slides and outline. But be aware that many experienced speakers have long-held habits, and they may foist bad Powerpoint advice on you (“Do you want to borrow my laser pointer?”). The second type of practice can be done alone to help you memorize the main points, know the order of the slides, and work on your delivery. You might need to practice a talk several times before it is ready for an audience. However, practice is not meant to be a way for you to memorize your entire talk (there are only a few short phrases to memorize: your greeting, hook, clincher and thank you). Your talk should feel like a thoughtful, but spontaneous conversation with the audience, not a scripted speech.

Your connection with the audience begins when you get dressed. It is a sign of respect that you are dressed as well or better than your audience. This is not hard to accomplish if you are presenting to a scientific audience. This may sound strange, but dress tall. Wear shoes that give you an extra inch or two so that you can stand higher than the podium and be seen from the back of the room. Finally, dress uniquely. A talk should be the beginning of a conversation with your colleagues, and you want people to talk with you afterwards about your science. Unfortunately, after seeing dozens of talk, the audience may not longer remember who gave which talk (was it that guy with the ponytail and Birkenstocks, or the oxford shirt and loafers?). A unique outfit will help you be recognized during the coffee break.

In addition to PowerPoint, the modern gadgets in the speaking business are laser pointers and remotes. I suggest that you avoid using a laser pointer. Used correctly, a laser pointer is needed at most once or twice a talk. Operating an unfamiliar laser pointer is sometimes difficult, and laser pointers are easy to overuse, particularly if you are nervous. Animation and clever graphics help obviate the need for a laser pointer. If you do need to reference what is on the screen, walk up to it, point with your finger while you face the audience, and speak toward them. A handy gadget to have is a remote slide advance. You can buy a USB version and I suggest using your own and getting used to it because your fumbling with a new remote distracts the audience. The beauty of a remote is that it frees you from the podium. If you can walk the room during your talk, the audience will be much more engaged. This way, you set the pace for your talk.



No laser pointer, speaking to the audience, memorable outfit

Every speaker has been in the audience when another speaker ran over time, yet for some reason, many speakers fail to relate that experience to their own time at the podium. You

have a time slot allotted to you and as you exceed it, the audience begins to loathe you more with each passing minute. This is ironic, given that the main reason speakers go over time is that they feel obligated to tell the audience the whole story. To avoid going over time, know in advance how much time you have, but expect to lose a couple minutes for being introduced, getting to the stage, and loading the talk. Then, be sure to allocate 3-5 minutes for questions. Build your talk with this in mind, and practice it to be sure you can pull it off in the time you have been allotted. Delete lower priority sections of your talk if you are over your time limit. When you are on the stage, be cognizant of the time. Use your watch or locate a clock. Before your session starts, find out who will be the official timekeeper, and be sure that your watch matches theirs. Pay attention to the signals that will be given at particular time intervals (e.g., the moderator stands five minutes before your time period is up). When giving your talk, be aware that being nervous can sometimes lead you into unscripted tangents that can eat up time. This is especially true for the beginning and ending of your talk. So, have a clear idea about how you will start and finish. This will help you roll straight into the talk you practiced and keep you on time at the end. Finally, if it is clear that you are out of time, do NOT just keep going so you can finish. You are not obligated to show your conclusion slide or just one more graph. Your only obligation is to stop on time, finished or not.

It is important that your audience has confidence in you. This means that you should only talk about a topic that you have confidence in. If you do not really believe in what you are presenting, do not present it. Therefore, do not self deprecate in the area of your capability or intellectual ability. But don't do self-promotion either. Audiences hate that. As in a written paper, you can cite authority as a way to gain credibility. This is particularly useful in your discussion where you are bolstering your thesis. If someone else came up with the observation or hypothesis, be sure to cite them (the more personally the better). Your audience will be comfortable accepting a statement accompanied by a citation. You should also project confident body language. This is why you stand up straight, face the audience, look at people, smile, and speak loud and clear. Don't mumble the ends of your sentences, look at the floor, read your talk, talk to the screen, or fidget with your keys. Your hands should not be in your pockets, clasped over your crotch, behind your back, or on your hips. Nor should your arms be crossed, unless you are trying to appear defiant. Don't touch your head, or play with your hair. Keep your hands loosely at your sides (not rigidly locked at the elbows), raise them to below you chin to make a point. Save larger gestures for dramatic emphasis. If you don't think you do these things, video yourself. But prepare to have your soul crushed on the replay.

Ten minutes into the average talk, only half the audience is paying attention due to distraction, frustration and fatigue. To keep the audience with you, do something that breaks up the monotony about every 2-5 minutes. This is the biggest challenge for a successful presentation. Occasional humor is a good way to keep your audience engaged, but it is not easy to pull off unless you are a naturally funny or charming person. Irony or absurdity can get your audience to laugh. Self-deprecation is fine only if it is about something unrelated to your abilities as a scientist. Do not use self-deprecation to undercut your science, because your audience will lose their confidence in you. If something goes wrong (like forgetting a point, or having to go back to a previous slide),

don't apologize. Just keep moving. Above all, avoid, cruel, rude, or obscene humor. Even if your natural sense of humor runs this way, it can make the audience uncomfortable. Finally, the humor should be yours. Do not use a canned joke or show a comic as a way to break the monotony. Comics can be funny, but rarely do anything but detract from a talk. The same goes for cute photos. It is hard to know if intentional humor will work, so be sure to trial it on a friend in advance. There are many other ways to break up the monotony of a talk besides humor. Short (<1 min) and dramatic video or audio clips are a good example. A quick anecdote or aside can also help, so long as it does not eat up too much time and stays relevant to your thesis.

A pleasant speaking style makes the talk easier to listen to. Smile at your audience and the person that introduces you. Smiles are contagious and a smiling audience is a friendly one. The most important part of speaking is volume and diction. When the room fills, and the projector turns on, your voice will not carry very far. This means that you need to project your voice as if you were speaking to the person in the back of the room. When speaking to the audience, find individual people and make eye contact with them. Also, address the audience directly by using the word "you". Gauge their body language for feedback. Move your gaze around the room, so that the audience feels like you are speaking to everyone. At some point, you may engage the screen to make a particular point. Unless you have a strong voice, facing the screen will mean that your audience can no longer hear what you are saying. It is best to always face the audience when you speak.

The talk should not drone on. There should be a mix of intense engagement and thoughtful pauses. Ask your practice audience if you say "um" or "ah" or something else to fill the silence or end your sentences. Try to replace these with pauses. Most importantly, do not pack so much material into a talk that you feel you need to rush your speech. Most scientific presentations have technical information that takes time for the audience to process. If you rush, your audience will not be able to digest your most important points and be left with nothing concrete to remember.

Finally, your speaking style will benefit if you lead your slides. Many speakers do not remember what slide comes next and use the slides to remind themselves of where they are in their outline. It is far more effective to start talking about the next slide BEFORE you advance to it. This way, the audience is forced to listen to your introduction before being distracted by new visual material. This either requires memorizing the order of your slides or using the PresenterTools Option in PowerPoint (under the view menu). PresenterTools shows the current slide plus the next two slides, your notes and a timer. It is also a very good aid for practicing your talk. The advantage of an effective style is that the audience can focus on your science and listen to what you are trying to communicate.

There are several rhetorical strategies for a good talk. Speechwriters and preachers use these extensively. You do not want to sound like either, but you can adopt a couple of useful points. One is the benefit of a good pause. This takes time to perfect, but it should usually precede and follow an important point. When speaking, look for opportunities to make contrasts: X is Y, but Y is never Z; A goes up at the same time that B goes down.

Our brains are wired for contrasts and process them easily. In many cases, you will want to communicate a list. The ideal number of items in a list is three. Less than three is not much of a list and more than three is too much for our brains to process easily. If you have more than three points, try to break things up. Whenever you show a graph, take a little extra time to set it up. First, explain what the two axes are and then explain what the main pattern is. Once you carefully explain a particular figure comparison, you can use repeated versions of the figure without having to repeat the explanation again. When trying to communicate a general or abstract concept, tie it into an example, or better yet an anecdote or bit of humor. The audience will find it easier to understand your concept if you can help them visualize it.

You can minimize the chance of a technical problem if you get to the lecture hall early and try out your talk. That can buy you time to get the right cable, or delete a slide that fails to project. You can also check out the lighting to see how many lights you can afford to leave on during your presentation (keeping the hall as lighted as possible). Still, give enough talks, and something will go wrong (they used to go wrong a lot more). Perhaps the room has been changed and you get a late start. Or you notice a typo in your slide. Or your videos won't load. Or the computer won't recognize your presentation. Perhaps the power goes out. Or the audience distracts you because somebody spills their coffee, or a cell phone rings or someone walks out mid way. You are already under stress, so it can be difficult to predict how you will respond. But it is essential to retain your poise. Here are some important tips. First, you are not contractually required to deliver the talk just as you prepared it. Be OK with adapting your talk to get around problems. Second, if the audience can't tell there is a problem (like a graphic was missing or a slide was out of order), don't point it out for them. They don't need to know about it. Third, if it's obvious a problem has occurred. Don't say "I'm sorry". If it is a fixable problem (like you ran out of power on your laptop), say "excuse me", while you fix it. If it can't be fixed quickly (like your video won't load), just tell the audience you will skip it and move on. Fourth, don't take it personally if the audience does something disruptive, it is usually an accident. Fifth, if all technology fails, just give your talk without aids. You will be a memorable hero. The best talk I ever gave was during a power failure.

Questions can be the best or worst part of a talk. Unfortunately, while delivering a talk, your mind is not in conversation mode. It is focused on delivery and performance. You can get into a presentation groove, and time takes on a new dimension. Under this altered state, it can be hard to listen. Therefore, it is important, after you say "thank you" and receive your applause, to remind yourself that it is now time to listen. The sign of a good talk is several questions. If your moderator is active, they will select the members of the audience that wish to ask questions. Otherwise, it is up to you (confirm this with the moderator in advance). Listen carefully to the question, and nod to indicate that you are paying attention. After the question is asked, pause, thank the speaker, and then repeat the question for the audience, especially if you are in a large room. Repeating the question also gives you a second chance to listen to it carefully and think about a response. Feel free to pause before you answer. If the question sounds threatening, do not be upset and take it as an attack. Focus instead on your answer. You always have the option of suggesting that such a question might be better to discuss in person. Some questions will

require a simple clarification. Other questions allow you to expand on topics or details you did not have time to think about. The best questions give you new insight into your project. In some cases, you can anticipate what the obvious questions will be. You can either rewrite your talk to account for these questions, or prepare some potential slides (placed after your final slide), that help you address your question.

You should now be better able to inform and entertain us. That's good because speaking is critical to your success. It is remarkable how many job searches end with statements like, "He was the best candidate on paper, too bad he gave such a lousy talk". Your talk is much more personal than a scientific paper. If you show other people your enthusiasm for your work, they will be enthusiastic about it too. You should maximize your performance and minimize your reliance on text slides. Respect your audience's time and listen to their questions. Get feedback from people and try to do a better talk next time. You will listen to far more talks than you will give, so find out what you like and don't like in other people's talks and plan your own accordingly.

The next section has 3 outlines which can help you prepare your best talk ever.

APPENDICES: 3 TYPES OF OUTLINES.

Title: should contain conclusions, keep short, avoid jargon, be specific, list acknowledgements and funding sources (true for all outlines). All talks should start with a short memorized greeting.

Paper outline

Introduction (use present tense in reference to previous work)

- 1) hook/slant. Then identify the subject, question or problem (thesis)
- 2) identify your motivation
- 3) state your hypotheses
- 4) give a brief literature review of the subject
- 5) describe pertinent aspects of the biological system
- 6) introduce and justify your methodology
- 7) give the predictions that stem from your hypotheses
- 8) briefly give your principal results

Materials and Methods (use past tense)

organize chronologically or in sections (use sub-headings)

- 1) describe your lab set up or study sites
 - 2) for each section,
 - A) describe experimental or sampling design and exp. subjects
 - C) describe experimental or sampling procedures
 - D) describe the measurements taken
 - 3) give methods of analysis (don't cite ordinary statistical procedures)
- Also: provide enough detail for repeatability
include data that verifies methods

Results (use past tense)

- 1) present by methods subheadings or present order that tests hypothesis
 - A) reiterate brief description of the experiment
 - B) for each comparison, give mean values (controls first), p values or confidence intervals and sample size
- 2) make graphs of correlations and regressions
- 3) keep the results brief

Discussion (use present tense in reference to previous work)

- 1) return to the hook
- 2) indicate whether your results support your predictions
- 3) present the principles, relationships and generalizations of the results
- 4) point out the exceptions to general patterns
- 5) relate your results to the literature
- 6) discuss theoretical implications
- 7) state your conclusions and summarize the evidence for each
- 8) discuss the importance of your results

Essay outline

1) Introductory paragraph

Hook/Orient the reader to the section

Identify the focus/purpose

Background (anything that needs defining or introducing)

Outline the Scope (what are the boundaries of the topic)

State your thesis/expectations

List the evidence you will present for your thesis (the body paragraphs)

2) Body paragraphs (3 is the classic number) in linear order

Topic sentence to introduce this part of the thesis and how they relate

Background

Supporting details

Counter arguments

Concluding sentence supporting the author's point

3) Conclusion paragraph

Return to the hook / Restate thesis

Summarize evidence for the thesis

Clincher sentence (a punch line of sorts) or new idea

Plot outline

- 1) First equilibrium (e.g. the dominant paradigm or current state of knowledge)
- 2) Conflict/Call to Adventure (what makes you question the first equilibrium)
- 3) Rising action (what was the process of discovery)
 - Could be organized as a series of body paragraphs, include failures and challenges
 - Sometimes this is an oscillations of “what was thought” and “what is learned”
- 4) Resolution (the key new findings)
- 5) Second equilibrium (what is the new state of knowledge) and Call to action (how should the audience act on this new knowledge).

Also known as the Pixar outline

- 1) Once upon a time there was....Every day....
- 2) One day....
- 3) Because of that....Because of that....
- 4) Until Finally....
- 5) And they all lived happily every after. (and so can you..)

REDO FOOD WEB TALK...

- 1) Here is what we thought about food webs and why they are important
- 2) My discovery of parasites v what people thought
- 3) Rising action (what was the process of discovery)
 - Could be organized as a series of body paragraphs, include failures and challenges. Delay the biggest implications as long as possible..
- 4) Now we know....
- 5) Summarize the arc. what parasites do in food webs....