This talk is divided into two parts. In the first part, we’ll talk about the nitty gritty of putting together a good talk:

- Why scientists give talks
- Goals for a talk
- How to organize a talk
- Presentation software tips
- Effective figures
- Presenting numerical data
- Handling questions

The second part consists of some practical advice from the veterans—things to do, and not do, when you’re preparing and giving your talk.

DISCLAIMER: Do as I say, not as I do. The slides for this talk are standard for an academic lecture. They have way too much text on them for a science talk. In a science talk, you want the audience to look at engaging, visually interesting, instructive images and think about the concepts being presented, not read words.
“Never rise to speak till you have something to say, and when you have said it, cease.”

Witherspoon, John (1723-1794), was the sixth president of Princeton, a signer of the Declaration of Independence, and from 1776 to 1782 a leading member of the Continental Congress. He came from Scotland in 1768 to assume the presidency of the college and held office until his death a quarter of a century later.

Although Witherspoon’s advice was no doubt influenced by his experience in the Continental Congress, it remains good advice for scientists. Don’t attempt to give a talk until you are thoroughly prepared, say what you have to say, and then sit down.

Why science needs talks:
Publications lag months to years behind discovery—talks get ideas out into the community and move science forward.

Putting your thoughts into words and organizing them will crystallize your thinking and give you insights you can gain no other way.

Your future job will require presentations:
   You will give talks as a job candidate
   Your will give presentations as an employee
   You will give presentations as an instructor
Before you pick up a pencil, answer four strategic questions...

What is your motivation for giving the talk?
To disseminate your results to other workers in your field.
To test your ideas on other scientists and get their feedback.
To establish precedence by announcing your results before your competitors can.
To teach the audience something.
To achieve fame and fortune; to get noticed or hired; to establish future collaborations; to gain the respect of the community.

What is the purpose of the talk?
Reporting original, significant research results.
Documenting methods or establishing standards.
Warning of a hazardous condition.
Examining the feasibility of a project.
Reinterpreting previously reported results.
Providing an overview of the topic for non-experts.

Who is the audience for this talk?
What are their needs, interests, level of knowledge, motivation for listening?

Can you talk about it at all?
Do you have permission from your adviser and your collaborators?—You cannot patent anything that has been publicly disclosed.
Essentials for preparing your talk

Know your audience!

Determine the style of your talk; decide on the structure that best fits your audience and your message

Find out how much time you have to speak

Decide on the key points you want to communicate

Determine how best to use graphs and figures to illustrate your key points

Consider effective slide aesthetics

This is a horrible example—do not present slides like this at your talk. It has way too much text and zero visual interest. It tells your audience “I might be able to be more boring, but I frankly don’t think it’s worth finding out for the likes of you.”

In the next few slides, we’ll look at each of these concepts in more detail, and I’ll present examples to guide you as you craft your own talk.
Rule #1: Know thy audience!

A successful talk is tailored to the listeners’ wants and needs

Informal seminar  Scientific conference  Report to funders  Job interview

Who are they? What is their level of expertise? How motivated are they to listen?

How large is the group?
The size of the group will affect your presentation style—will you need to prepare slides that can be projected in a large room, or will you all be sitting around a table?

What do you want your audience to do for you?
- Give constructive feedback?
- Learn about what you are reporting?
- Participate by asking relevant questions?
- Give you new ideas or insights?
- Hire you? Give you a grant?
- Buy your product?

Use what you know about the audience to build rapport with them. The audience must want to pay attention to you. You want to earn their respect. If you do not build a good relationship with your audience, they will not listen to you, no matter how brilliant or groundbreaking your research is.

What two or three key points from your talk should they take home? What background information do they need to understand these points?

If you can answer these questions, you can prepare your talk to help you get what you want and need.
The next biggest constraint: How much time do you have?

Presentation math:

\[ \frac{t}{10} = p, \]

where \( t \) is the time in minutes you are allotted for your presentation, and \( p \) is the number of points you can make without losing your audience.

The amount of time you’re allotted determines how much material you can cover in your talk.

It takes about 10 minutes to adequately introduce, explain, and summarize one major idea or point in an oral presentation.

You cannot present 10 major ideas in a 15-minute APS-style talk, no matter how fast you talk.
Key Goal: Communicate your ideas!

Our group is making seminal discoveries, so you should pay attention to us!

This fundamental goal should govern every aspect of the design and presentation of your talk!

You are not here to tell the audience everything that is in your publications. You are here to make them interested enough so that they want to look them up and read them!

You must, however, give your audience one or two important points to take with them now.
How do you start?
Write down the two to three key ideas you wish to convey!

The introductory material flows from these ideas
- What motivated the work?
- What background information does the audience need to understand these points?

The body of the presentation also flows from these ideas
- What supporting evidence and data must be presented?
- How can you most effectively present those data—in text, figures, graphs, equations?

N.B. In most cases, “text” is the *worst* way to convey scientific data.

For a wonderful introduction to how to present quantitative information, see Edward Tufte’s *Visual Explanations* (Cheshire, CT, Graphics Press, 1997).
Setting the overall structure of the talk also follows from the key points

Motivate the key messages (Introduction)
Preview your main messages (Introduction)
Provide support for your messages (Body)
Summarize your messages (Conclusion)

In other words, don’t let ’em leave without “getting” your main messages!

Ideally, you’ll convey your main messages to the audience three times during the presentation—first in the overview or introduction, next in the body of the talk, and finally on a summary slide.

Take it from a mother—telling somebody something three times is not overkill.
Organizing a 20-min talk

Background and Introduction (2–4 minutes)
  Title slide
  Overview slide
  1–2 additional slides, if needed

Body (9–12 minutes)
  Develop only two or three main ideas (2 slides ea)
  5–7 slides

Summary (1 minute)
  1 slide

Questions (3 minutes) (Know thy audience!)
  3–4 back-up slides

Follow some simple “rules of thumb”:

If you’d write or draw something on the blackboard or a piece of paper while
explaining your ideas to a friend, make a graphic of it.

Allow about 2 minutes per slide.

Allow more time for the audience to “process” slides that present:
  Equations.
  Complicated schematics.
  Numerical data in tables or graphs.

Back-up slides; consider likely questions or objections and make a slide to answer
each of them.
The title slide and outline prepares the audience to listen and tells it what to look for

Title slide
- Your name and affiliation
- Venue and date
- Attention-getting graphic

Outline or overview of presentation*
- Prepares the audience to listen
- Provides a logical structure for your talk
- Summarizes key points (limit to two or three for a 20-min talk)

*Tip: An outline isn’t necessary for a short talk

Use a combination of slides and handouts to deliver your message

Use slides to:
- Emphasize main points
- Illustrate experimental apparatus, schematics, samples, photographs or simulations of results
- Present and summarize data

Use printed handouts to:
- Facilitate note-taking
- Reinforce main points
- Convey complicated information, e.g., numerical detail or equations
- Provide additional details and contact information
The “body” of your presentation is the intellectual content of your talk

Problem statement, motivation; prior work
1–2 slides
Method
1–2 slides
Results
3 slides
Future work
1 slide

Have one “Problem Statement” slide that tells the audience why your work is important and why they should listen to you. How does it extend prior work? What important question have you answered?

Method—keep this section short unless you are employing an exciting new method, which is one of the main points you want to make. If the audience wants to know the exact composition of your samples and where you set the dial, they’ll read the paper.

Results—this is what the audience came to hear. The “results” section should be the longest part of your talk and should provide the most detail.
Use figures to illustrate your key points

Figures promote audience interest, provide supporting evidence, help explain complex ideas and relationships quickly, and give the audience something to remember.

Myosin “walking” on actin
Courtesy of P. Selvin

Figures:
1. Promote audience interest.
2. Provide supporting evidence.
3. Help explain complex ideas and relationships quickly.
4. Give the audience something to remember.
Who can tell me the four reasons from the previous slide for why you should use figures to illustrate your talk?

Who can describe the image on the previous slide?

...I rest my case.

People remember images, even after only one fairly brief exposure. They don’t remember words.

Design your talk to be *visually* interesting and memorable.
Not all figures are created equal

**Good figure**—visually interesting, attractive, and memorable

**Bad figure**—visually boring, contentless, and forgettable

Tip: “If a picture isn't worth a thousand words, to hell with it” —Ad Reinhardt

First figure could be better; the black background does not offer high-enough contrast, and it is not clear what the white arrows in B are supposed to mean. (uncondensed and condensed actin filaments; at high multivalent ion concentrations, the ions collectively form a CDW and bundle actin filaments)
Label all elements in a figure

Point out important features
Label both axes of graphs and show units
Provide a scale
Give credit

The Nike laser system uses discharge pre-amplifiers. (Courtesy US Navy)

Sample normalized signals from the two-beam optical drive. (Courtesy C. Michael)

Scientists differ on whether “captions” are needed for figures on slides. (They’re absolutely mandatory for figures in publications.)

I personally recommend that figure captions be eliminated or kept very brief, but point out important features so the audience knows what it’s supposed to be looking at.

If you’ve used somebody else’s figure, you should at a minimum give credit for it, and perhaps provide a URL or bibliographic reference for where the original may be found.

Another tip for ALL figures—if you show a photograph or drawing of something, provide some sort of visual clue to its scale. The audience may have no idea if the apparatus shown below is 5-cm long or 5-m long from just looking at this image.
Use graphs and tables to present numerical data

Use to show trends or reveal relationships
Specify units of measure (in SI units)
Provide a title for each graph or table

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Quality</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.463</td>
<td>2100</td>
<td>Umbrella (?)</td>
</tr>
<tr>
<td>2.533</td>
<td>4400</td>
<td>Rocking</td>
</tr>
<tr>
<td>2.573</td>
<td>10700</td>
<td>Rocking</td>
</tr>
<tr>
<td>2.886</td>
<td>10700</td>
<td>Potato Chip</td>
</tr>
<tr>
<td>2.916</td>
<td>4900</td>
<td>Potato Chip</td>
</tr>
<tr>
<td>3.290</td>
<td>6900</td>
<td>Six Node</td>
</tr>
<tr>
<td>3.320</td>
<td>7300</td>
<td>Six Node</td>
</tr>
<tr>
<td>3.932</td>
<td>7800</td>
<td>Eight Node</td>
</tr>
<tr>
<td>3.962</td>
<td>8100</td>
<td>Eight Node</td>
</tr>
<tr>
<td>3.840</td>
<td>3400</td>
<td>Umbrella</td>
</tr>
</tbody>
</table>

- Identify 10 normal modes
- Complementary Mode Pairs

Avoid showing tables of raw numerical data—people just cannot process it and listen to you at the same time. If you absolutely have to show a table (and the size of the audience is amenable), make some hard copies and pass them out.
Keep graphs and tables simple—convey ideas, not raw data

Verbosity Index


<table>
<thead>
<tr>
<th>University</th>
<th>Rank/Score</th>
<th>PhD Students</th>
<th>Women %</th>
<th>PhD Recipients</th>
<th>% Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard</td>
<td>1 / 4.91</td>
<td>149</td>
<td>13</td>
<td>14</td>
<td>100</td>
</tr>
<tr>
<td>Princeton</td>
<td>2 / 4.89</td>
<td>110</td>
<td>13</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>MIT</td>
<td>3 / 4.87</td>
<td>315</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>California-Berkeley</td>
<td>4 / 4.87</td>
<td>283</td>
<td>9</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Cal Tech</td>
<td>5 / 4.81</td>
<td>154</td>
<td>18</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Cornell</td>
<td>6 / 4.75</td>
<td>182</td>
<td>18</td>
<td>12</td>
<td>40</td>
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<tr>
<td>Chicago</td>
<td>7 / 4.69</td>
<td>154</td>
<td>14</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>UIUC</td>
<td>8 / 4.66</td>
<td>20</td>
<td>8</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Stanford</td>
<td>9 / 4.53</td>
<td>135</td>
<td>13</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>California-Santa Barbara</td>
<td>10 / 4.43</td>
<td>117</td>
<td>13</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

Regrettably, does represent actual data

The example on the right shows how you can present tabular data in a form that people listening to your talk can immediately process. By highlighting the relevant line, you convey the main idea—that UIUC was ranked far down the list. The audience probably doesn’t care that Illinois’s score was 4.66 and Harvard’s was 4.91; they care that Illinois is ranked toward the bottom of its peers, and its percent of women was in single digits. (We’ve improved since 1998.)
Use equations only if *absolutely necessary* to convey your message

If you use equations…
Slow down; talk through step by step
Explain relevance
Make them large enough to be easily read
Define your terms!

PowerPoint animations can be useful in presenting equations:
• Highlight relevant terms in different colors
• Drop out terms
• Blow up parts of the equation as you walk the audience through it
Provide a “summary” slide

Recap key results
Reiterate principal conclusions
Repeat your contact information

Summary

- Non-Gaussianity in the CMB tells about creation of the initial density perturbations in the universe.
- The probability distribution of the nonlinear parameter in our model gives drastically improved constraints on non-Gaussianity.

Next: generalize our method to smaller scale fluctuations and apply to COBE and MAP data

Contact: Michael Schneider, mdschnei@uiuc.edu

The summary slide lets you reiterate your key points and cues the audience that you will soon be taking questions.

This slide will probably stay on the screen during the question period and will thus get the longest audience exposure—make it count!
Handling questions is an essential part of giving a talk

Always repeat the question
What if you don’t know the answer?
If the questioner disagrees, don’t argue
Never insult the questioner

Always repeat the question (summarize or paraphrase it) before you plunge ahead with your answer. Not everyone may have heard it, and repeating it not only allows the questioner to clarify if you’ve misunderstood, it also gives you a few precious seconds to think about your answer.

If you don’t know the answer, *don’t bluff!* Simply say, “That’s an excellent question. We haven’t looked at that.” or “I’m not sure; I’ll have to think about that.” It’s okay not to know the answer; it’s not okay to make something up on the fly.

If the questioner disagrees, or wanders too far off-topic, you can always say, “Let’s talk about this further after the session...”
From Professor Lance Cooper:
Maintain eye contact with audience; don’t stare at the monitor or read off the screen. Making eye contact with the audience will build rapport with them and will actually make you feel less nervous.
Do not read your talk! It’s okay to look at notes, but know your material well enough that you can speak about your points naturally. That takes knowing your material thoroughly and practicing.
Avoid nervous mannerisms—pacing, bobbing, waving arms, jingling coins.
User laser pointer or stick directed at screen
   Don’t point directly at overhead on projector
   Don’t block the screen
Train yourself to speak slowly and distinctly—practice! Avoid verbal “fillers”: “err”, “like”, “um”, “okay.”
Turn off your cell phone—and anything else that could distract you.
Be enthusiastic! If you don’t act excited by your results, don’t expect the audience to be!
Remember, your goal is to convey your ideas, so avoid distracting text and effects!

Use PPT features judiciously and sparingly.
Don’t annoy the audience with cheesy text animations, distracting backgrounds, and obnoxious sound effects.
*Tip: Write the statement as a sentence and left-justify it.*
**Slide “aesthetics” are important**

*Don’t use calligraphy or serif fonts*

**USE THE SAME FONT throughout the talk**

*Avoid distracting backgrounds*

Use sans serif fonts; they show up much better when projected on a large screen.
Choose an easy-to-read font (36 pt)
Make sure your audience (32 pt)
Can easily read (28 pt)
Every one of your slides (24 pt)
From the back of the room (20 pt)
See what I mean? (14 pt)

The larger the room, the bigger the font size!

If the room is not full, have the members of the audience come up to the front of the room. You’ll establish an immediate rapport with them if you invite them to come up and be a part of your small, select circle.
Choose colors carefully*

*Tip: Avoid using red and green. Between 8 and 12 percent of white males are red-green colorblind—who’s your audience?

Strive for easy reading

Strive for easy reading

Strive for easy reading*

LCD projectors change color appearance; text and background that looks fine on your computer screen may look entirely different when it is projected to an image 1.5-m high and 2-m wide.

In particular, pastel colors “disappear” when projected; use a neutral background with a high-contrast, dark text.

Don’t use color randomly; people expect color to mean something.

Avoid using red and green.

To see what your image will look like to someone with color blindness, there’s a very useful, free emulator at http://asnetresources.com/tools/colorblindness.aspx.
Consider the appearance of the text on the slide

LEPS at Spring-8
- Spring-8: electron storage ring for synchrotron radiation, 8 GeV
- LEPS = Laser Electron Photon beam @ Spring-8
- Compton back scatter 351 nm Ar (UV) laser photons off electrons
- produces 1.5-2.4 GeV photon beam
- tag by measuring bending angle of scattered electron by dipole magnet in the storage ring

Arrange line breaks so that the text is not interrupted in awkward places.

In PowerPoint, type SHIFT + ENTER to insert a manual line break.
"Embed" special fonts in PPT to avoid unsettling surprises...

The Strickler-Berg relation opens the door for comparing measured spectral quantities

Strickler-Berg Relation

\[ \frac{1}{\tau_b} = 2.880 \times 10^{-5} n^2 (\rho_f)^{-2} \lambda^{-1} (\rho_s / \rho_w) \int \text{cdim} \]

Different computer—Voila! “pencils”

(1). Open the document in PowerPoint.
(2). Click on the "Tools" tab on the top menu.
(3). Click on the "Options" link.
(4). Click on the "Save" tab.
(5). Locate “Font options for current document only” and "Embed TrueType fonts.”
(6). Click in the check box to turn on the option.
(7). You have to do this for every presentation; PowerPoint does not automatically embed fonts unless you tell it to—every time.
Critique this slide...

What is structure of the nucleus and the origin of the elements?

Top schools:
MSU
Yale
Notre Dame
Texas A&M
Duke / Rutgers

www.phy.ornl.gov/nitusu.html
www.nxsl.msu.edu

Nuclear Landscape

proton number Z

less than 200 stable

terra incognita

known nuclei

neutron number N

MSU Facility
This slide is an example of an “eating the elephant” slide

Where do you take the first bite??

It’s too busy, and it’s really ugly.
End with a bang, not a whimper

Don’t trail off with an ineffectual “Well, I guess that’s it…”

John Witherspoon’s advice aside, don’t just stop and let audience **guess** that you’re done.

Put up a “summary” slide, reiterate your two or three important points, thank the audience for their attention, and ask for questions.
Practice your timing—you will get cut off unceremoniously at conferences. Set your watch for a two-minute warning.

**Do not compensate for having too much material by trying to talk faster**—

- Simplify.
- Cover fewer points.
- Eliminate slides.

Think about the importance of each slide. What if, for some reason, your talk must be shortened by five or ten minutes? What slides would you take out?

Use the “hide slide” feature in PPT to easily remove slides.
The best way to prepare for a talk is 
know your material*

*Tip: Knowing your material thoroughly is also the best antidote to stage fright.

It takes three weeks to prepare a good ad-lib speech...

Practice, practice, practice, practice …

Focus on *communicating*, not performing.

  Humor is good, but it must be relevant to your subject matter, in “good taste,” and understandable across cultures.

Keep it simple.

Prepare key phrases (*Notes Pages*)

  Okay to write out material first.
  Write down each slide’s main point.
  If the slide doesn’t have a point, eliminate slide!

Stay on track.

  Small digressions are fine if motivated by a question (shows you are paying attention to audience), but get back on track.
Check everything before your talk

Check the projector
Make sure you know how to turn it on
See that it is plugged in
Check which way to position your slides
Adjust the focus

Check microphones, pointer, other tools
If a clip-on mike is used, make sure it is fastened securely, check the volume, and then leave it alone

Arrange your slides, notes, and other materials so you can reach everything without fumbling

Do not expect the conference organizers to take care of all of your needs if you do not tell them what they are ahead of time. Did you request an overhead projector? Slide projector? video-tape player?

Make it easy for the audience to pay attention. Clean up clutter; if the room next door is noisy, ask them to quiet down, adjust the lighting.

Arrive ahead of your appointed time. Don’t dash in at the last minute, panting and out of breath, in your coat, umbrella, galoshes, with a bag of exhibit-hall geegaws.

If you are nervous, take some deep breaths.

Do not daydream during the presentation just before yours!

Be patient if the session is running behind schedule, and be flexible if the moderator asks you to adjust your talk to take a lesser amount of time.
A word about appropriate dress…

*Tip: Wear comfortable clothes that present a professional appearance.

The day of your talk is not the day to try out your new thong underwear or strapless underwire bra.

Wear comfortable shoes.

Wear a shirt or blouse that you can clip a portable microphone to, so that it is positioned about 5–6 in. below your mouth. Turtlenecks and tee shirts should be avoided, because there’s no good place to clip the microphone where it won’t slip.

Wear slacks or a skirt with a waistband or pockets for the microphone’s power supply.
If English is not your native language (and even if it is)!...

*Tip: Watch for cues from the audience; if they looked confused, they don’t understand you.

1. Do not use jargon unless you explain it (SPH).
2. Choose the simplest words—imagine that you are giving a talk in English to someone who doesn’t speak English as a first or even second language!
3. Do not be embarrassed to ask a native speaker to review your presentation.
4. Practice speaking slowly and distinctly.
Express your thanks—briefly

At the beginning of your talk:
   Acknowledge colleagues and collaborators who contributed to the work.
   Thank the conference organizers for allowing you to speak.

At the end of the talk:
   Thank your audience for their attention

Keep your thanks very brief.
Remember your purpose in preparing and giving a talk

Your purpose is to tell an interesting, memorable story of your work

*Not* to read a book
*Not* to demonstrate how smart you are
*Not* to attack others’ work
*Not* to show how fast you can talk
To recap…

- Identify two to three main points that you want to convey to the audience
- Design your talk to make these points as clearly as possible
- Preparation is crucial
- Graphics enhance audience interest and retention
- Be relaxed and (try to) keep audience attention
- Finish on time
- Giving good talks is a learned skill; the more you practice, the better you will get

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