Tips for creating and giving scientific presentations

This pie chart shows how much pie I ate while making this chart.
How to get started?

Step 1: Identify your audience: this will control the level of your presentation and the amount of background material you need to orient everyone in the audience.

Step 2: Determine how much time you have for your presentation: this will control how much time you have to talk about each part of your outline (see below).

Step 3: Identify the main points you want to convey: you can reasonably convey only 2-3 main points in a 20- or 30-minute talk.

Step 4: Create an outline of your talk: this will build in the logical organization of your presentation and help you decide what figures and other supporting evidence you need to make your points.
Organizing a 25-minute scientific talk

**Background and Introduction** (~6 minutes)

⇒ 4–5 slides

~1 Title slide - Your names, date, citation to paper
~1 Outline slide – Organization of talk
~1 Overview slide – Why is this research important?
~1-2 Background slides – Provides essential background for non-experts

**Methods** (~6 minutes)

⇒ 2–3 slides

Theoretical/experimental methods used in paper
Organizing a 25-minute scientific talk

**Results** (~9 minutes)

⇒ 4–5 slides

~ What did you (or the authors) find?

Only develop 1-2 key results

**Critique and Citation Summary** (~3 minutes)

⇒ 2 slides

1 critique slide – What was wrong with/good about the paper?
1 citation slide – What happened with the result/field after the paper?

**Summary** (~1 minute)

⇒ 2 slides

1 Summary slide - Review the main points/ criticisms
1 Acknowledgment slide – Acknowledge sources of material, help received, etc.

*Journal club only*
The title slide and outline prepares the audience to listen and shows organization of talk

**Title slide**
- Your names and affiliations
- Paper citation (for JC)
- Venue and date
- Attention-getting graphic

**Outline or overview of presentation**
- Prepares the audience to listen
- Provides a logical structure for your talk
- Provides motivation and context
- Summarizes key points (limit to two or three for a 20- to 30-minute talk)
Particle Physicists Ask …

1. Why matter?
   - CP Violation

2. Why mass?
   - Higgs field

3. Why this standard model?
   - SUSY or other extensions

Great outline slide, especially for a general audience
Overview

Black holes and star clusters

The galactic center

Intermediate-mass black hole kinematics

Here, we have a VISUAL and WRITTEN outline and it’s not too long!
The “body” of your presentation is the intellectual content of your talk

Problem statement, motivation
~1–2 slides

Previous work
~1-2 slides

Methods
~1–3 slides

Key Results
~5–6 slides
Provide a “summary” slide

Recap key results and conclusions
Reiterate main critiques (for JC)

This slide will probably stay on the screen during the question period and will thus get the longest audience exposure—make it count!

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
Summary & Conclusions

- All g-2 data published
  - Systematics lowered again

- Consistent results, consistently above theory
  - ee – tau controversy sill quite active
  - considerably more “ee” type data on the way

- The systematic limit is “far” away …we should go there

Note e-mail and web link

hertzog@uiuc.edu  Copy of talk: www.npl.uiuc.edu/~hertzog/ASPENg2.pdf
Tips for preparing your talk (cont.)

Have only 1 idea per slide

Use the header to state the main idea of the slide, and use the body of the slide to support that idea

Use well-labeled graphs and figures to illustrate your key points...this makes the slide more real and interesting to the audience

Avoid too much text....
Tips for preparing your talk (cont.)

Have only 1 idea per slide

Use the header to state the main idea of the slide, and use the body of the slide to support that idea

Use well-labeled graphs and figures to illustrate your key points...this makes the slide more real and interesting to the audience

....or too many distracting images
Use figures to illustrate your key points

Figures:

- enliven slides
- promote audience interest
- provide supporting evidence for key points
- help explain complex ideas and relationships quickly
- show how things work, etc.

Myosin “walking” on actin
*Courtesy of P. Selvin*
Label all elements in a figure

- Point out important features
- Label both axes of graphs and show units
- Provide a brief caption
- Give credit to source

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

Sample normalized signals from the two-beam optical drive. (Courtesy C. Michael)
Presenting data is your most important and challenging task

- Avoid copying a graph from a formal article – they have a different style, e.g., labels are too small
- Use color and make lines thick, labels legible
- Label axes and annotate important points with arrows and add words
- Use tables sparingly – if used highlight important parts

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<table>
<thead>
<tr>
<th>Count</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^3</td>
<td></td>
</tr>
</tbody>
</table>

some wiggles here

All silver data, simple fit

<table>
<thead>
<tr>
<th>res</th>
<th>Entries</th>
<th>Mean</th>
<th>RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>resid</td>
<td>857064</td>
<td>3990</td>
<td>5823</td>
</tr>
</tbody>
</table>

Residuals from simple fit to all silver data

Some wiggles remain
Show the equipment IF it helps as part of your proof – but sparingly, not just because you love it

- **Photographs** give scale and reality – but add labels
- **Schematics** provide concept
- **Diagrams** strip away unnecessary details
- **ALL OF THESE** can be useful in combination

OK, but could be better
Experimental Apparatus

Here we add detail to picture of the optical bench—much more useful
$a_\mu$ is proportional to the difference between the spin precession and the rotation rate.

$\Delta \omega = \omega_a = \left( \frac{g - 2}{2} \right) \frac{eB}{mc}$

This supports assertion in sentence headline.
BNL Storage Ring

Features:
Blue/Black circles are part of the physics story
Diagram allows description of components that enter in the data analysis

incoming muons

Quads
Some more examples of data

A photograph, which reveals the detail

10 nm wires: AuPd on DNA

Make sure you provide something to show scale, and include a short caption to explain what the audience is looking at.
Use equations sparingly

Use equations only when necessary

If you use equations
   Slow down
   Talk through step by step
   Explain relevance
   Combine with a picture that illustrates the physical principle involved

If you must use mathematics in your presentation, slow down, and talk the audience through each equation...
The Radiative Transfer Equation

\[ \frac{dI}{ds} = -ln(q_a + q_s) + S \]

Number of Photons  
Density of Dust Grains  
Distance Traveled  
Absorption Coefficient  
Scattering Coefficient  
Source Function  

(from geometry and composition of dust grains)

Requirements to solve analytically:
• \( n \) is a constant
• \( q_a = 0 \) or \( q_s = 0 \)

We want turbulent clouds. \( n \) is not a constant

I think this is a great and effective example of introducing an equation from one of our students.
Bad equation example:

\[
\frac{\Delta T}{T} = \frac{T(hv, F_o) - T(hv, 0)}{T(hv, 0)}
\]

\[
\Delta \alpha(hv, F_o) = -\frac{1}{L} \ln \left(1 + \frac{\Delta T}{T}\right)
\]

\[
\Delta n(\lambda) = \frac{\lambda^2}{2\pi^2} P \int_0^\infty \frac{\Delta \alpha(\lambda') d\lambda'}{\lambda^2 - \lambda'^2}
\]

\[
\psi(\lambda) = \tan^{-1} \left[ \left(\frac{\lambda}{4\pi}\right) \frac{\Delta \alpha(\lambda)}{\Delta n(\lambda)} \right]
\]

Data provides some help...

What does this mean? Better to provide a physical interpretation in words next to equations
Remember, your goal is to convey your ideas, so avoid distracting text and effects!

Don’t overuse PowerPoint animations and sounds!

Make sure there is good contrast between text and background

Use simple (or no) backgrounds on slides

CP
- Parity invariance fails, combine it with charge conjugation to create a new invariant
- Converts the right-handed anti-neutrino into a left-handed neutrino - exactly what we observe in nature
- Neutral kaon experiment
Eschew weird fonts

Don’t use calligraphy or serif fonts

USE THE SAME FONT THROUGHOUT THE TALK

Make all text at least 20 pt
Use San Serif Fonts

Use San Aarif font (e.g., Ariel)

Not Sarif font (e.g., Times New Roman)

Skinny parts disappear when projected
Use “normal” colors

DON’T use red/green or red/blue as contrasting colors.
Make sure colors looks the way you expect using an LCD projector!
Avoid neon colors and pastels.
Don’t use many random colors; people expect color to mean something.

Superconductivity is an electronic state of matter that exists below certain currents, magnetic fields, and temperatures.

$I_c$ - Critical Current
$B_c$ - Critical Magnetic Field
$T_c$ - Critical Temperature

$I$ - Current
$B$ - Magnetic Field
$T$ - Temperature

Normal state of matter

Superconducting region
Tips for giving a scientific presentation

Astrophysics made simple
Pointers for giving the best possible talk:

Maintain eye contact with audience
Don’t stare at screen or monitor

Do not read your talk!

Avoid nervous mannerisms
Pacing, bobbing, waving arms, jingling coins

Use 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 “fillers”: “uh”, “like”, “um”, “okay”

Be enthusiastic!
If you don’t act excited by your results, don’t expect the audience to be!
Pointers for giving the best possible talk:

Don’t show any material on slides (e.g., figures, equations, text, etc.) you can’t explain!!

Rehearse how you’ll end your talk

Don’t end with “Well, I guess that’s it…”
Don’t just stop and let the committee guess that you’re done
Thank the audience!
The best way to prepare for a talk is to **Know Your Material**

Practice, practice, practice

Focus on communicating, not performing
   Humor is good, but don’t overdo it

Keep it simple

Prepare key phrases
   It’s okay to write out material first
   Write the key point to make for each slide
   If the slide doesn’t have a point, eliminate it!!!

Stay on track
   Small (planned) digressions fine if motivated,
   but get back on track (shows you are paying attention to audience)

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

Bring a copy of your slides if giving a PowerPoint talk
- this will help you practice
- you can distribute these to interested people

Make appropriate use of the screen:

don’t underfill the screen, and don’t put key information at the edges of the screen.
Rehearse Your Talk!

A few days before
Practice in front of friends and check timing
Rehearse likely questions
Solicit feedback about logic and clarity
Revise (*shorten*)

The night before
Go over one more time
Put all materials *in order* (number your slides!)

Prof. Per Ahlberg delivering the Presentation Speech for the 2001 Nobel Prize in Chemistry at the Stockholm Concert Hall.
Check everything just 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

Arrange your slides, notes, and other materials
Be able to reach everything without moving
Be able to go through your slides without fumbling

Have a watch handy to check the time
“Stage Fright”? Be Prepared!

Know your subject thoroughly
- Practice in a big room in front of real people
- Have all your materials in order
- Arrive early
- Familiarize yourself with the equipment

Ask a friend to sit in the middle of the audience and speak primarily to him or her
- Tell him to look interested and nod frequently
- Ask her to smile and nod encouragingly whenever she catches your eye
For Talks To an Inexpert Audience:

Do not use slang or ‘laboratory’ terms

Choose the simplest word

Don’t use acronyms

Speak slowly and distinctly

Present less information than in a talk to an “expert” audience, go into more detail.
Handling questions is an essential part of giving a talk

As part of preparing your talk, try to anticipate questions you might get
   In each slide, try to identify what the weak points are, what questions you might ask, etc.

Be prepared to repeat simple derivations of equations or estimates presented on your slides

If you don’t know the answer?
   Say “That’s an excellent question. I’m not sure; I’ll have to look into it” or “Let’s talk about it afterward”
Express your thanks

At the beginning of your talk
  Acknowledge colleagues and collaborators who contributed to the work

At the end of the talk
  Thank your committee for their attention