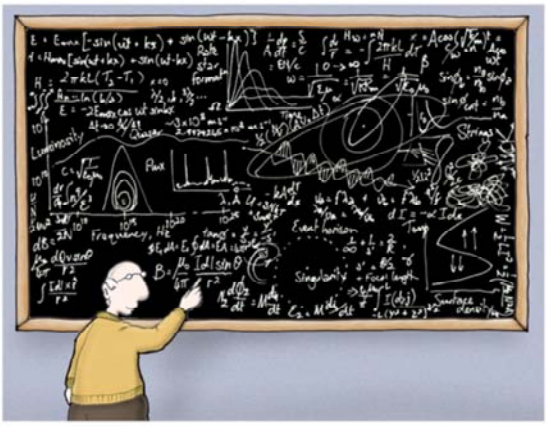
Celia's Tips for Science Talks



Astrophysics made simple

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DISCLAIMER 1: 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 an effective science talk, you want the audience to look at engaging, visually interesting, instructive images and to think about the concepts being presented—***not*** read words.

Effective public speaking is a practice-based skill; take every opportunity to give talks—your future success as a scientist or engineer will depend on your ability to give good talks.

All images in this talk were purchased from istockphoto.com unless otherwise identified.

Goal: Tell a memorable story and teach the audience something

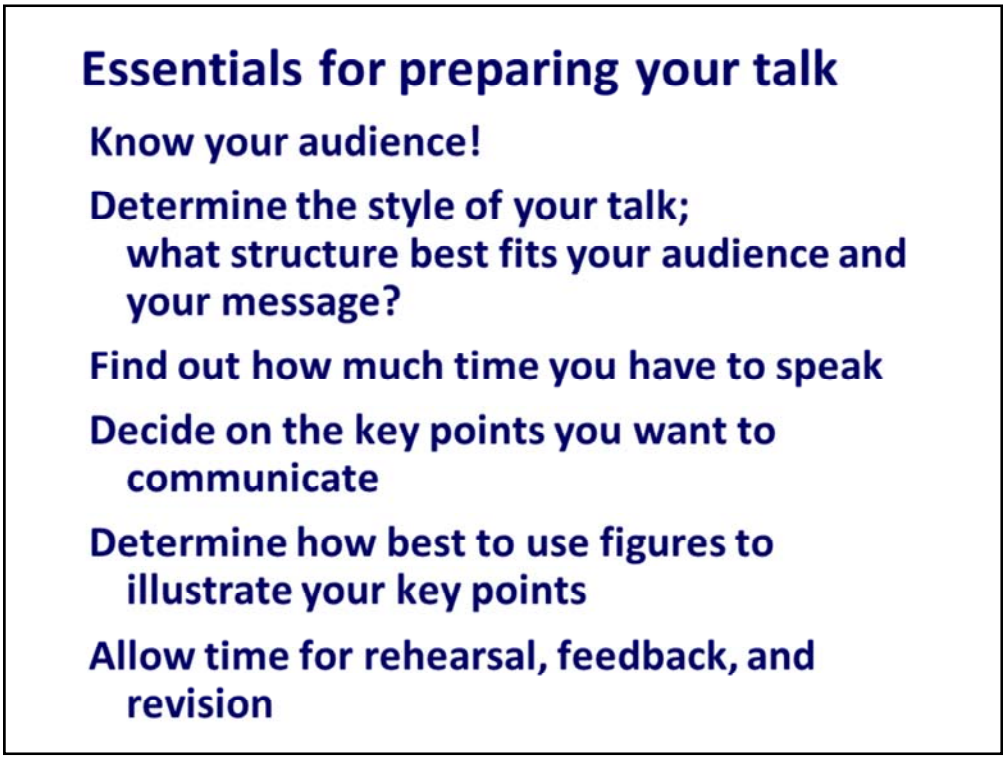
Tip: What made a good story when you were 5? Nothing has really changed since then.

Think about what made a good story when you were 5 years old. The same elements that attracted you as a child still work—interesting pictures, words you understand, simple, direct storyline, a stimulus to your imagination, a logical structure, analogy, an enthusiastic narrator.

For many of the talks you will give or papers you will write as a scientist or engineer, nobody listening or reading will know as much about the subject as you do. You don't have to dumb-down your messages, but you do have to draw your listener in and explain things in terms s/he can understand.

So the first rule of effective scientific communications is ***understand your audience***. Who are they? What do they want to know? What do they already understand? What is going to confuse them? What will engage their interest?

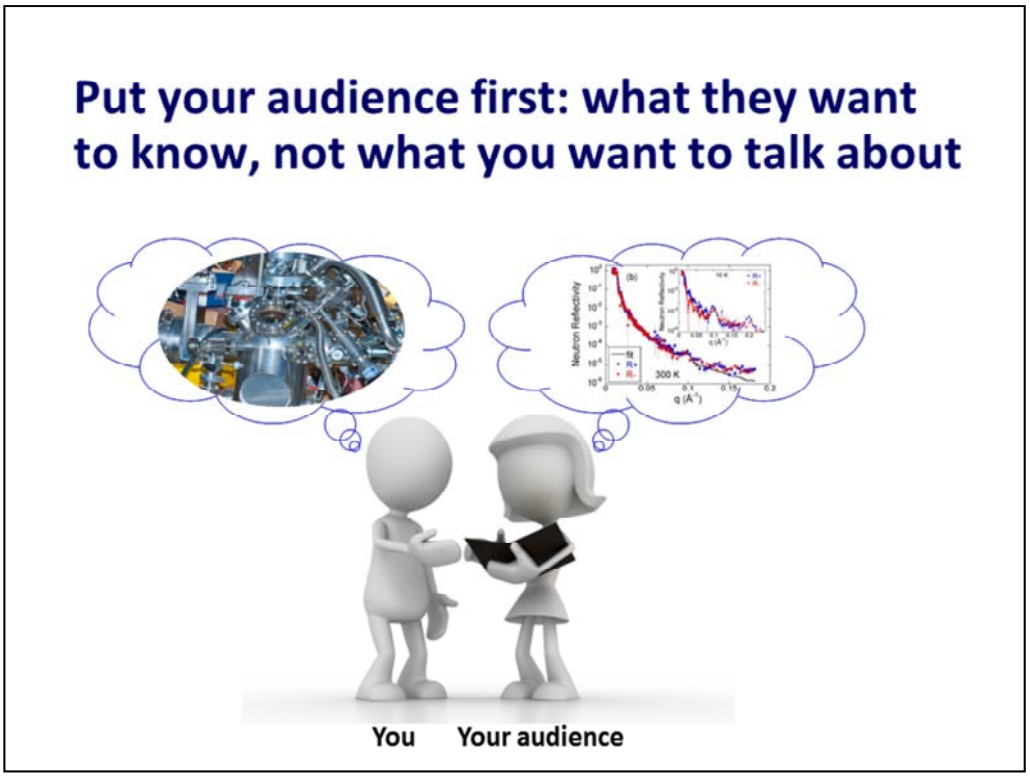
The second rule is ***tell a good story***.



This slide is a horrible example—***do not*** present slides that look 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.

As you attend talks in your field, think about how effectively the speaker held your attention and communicated his or her main points. Who is a "good" speaker and why? Learn to recognize and emulate good practitioners.



A common error that beginning researchers make is that they emphasize what they found most interesting, or what they spent the most time doing, and not what the **audience wants to *know***.

Know thy audience! It's absolutely critical to producing a successful talk or paper (or anything else).

Why is the person attending your talk?
What is her motivation? (What does she want to know?)
What do you want him to learn? to believe?
What do you need to tell her so that she can understand?
What is likely to confuse him?
What will she likely object to? What counterarguments will she raise?

Good advice from Elmore Leonard: "Try to leave out the part that readers tend to skip." (Elmore Leonard's Rules for Writers, 24 Feb 2010, http://www.guardian.co.uk/books/2010/feb/24/elmore-leonard-rules-for-writers)

The next biggest constraint: How much time do you have?

Presentation equation:

$$p = \frac{t}{10}, \qquad [1]$$

where *p* is the number of main points you can make without losing your audience, and *t* is the time in minutes that is allotted for your presentation

Tip: It's harder (and takes more preparation) to give good short talks than long ones

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

It takes about 8 to 10 minutes to adequately introduce, explain, and summarize one major idea or point in a scientific talk.

You cannot present 16 major ideas in a 15-minute conference talk, no matter how fast you talk.

N.B. This equation is also about as complicated as anything you'd want to show in a talk. Think about how long it took you to process and understand the point that was being made in this slide, using an equation. Do you really want to tackle

$$\left.\frac{\partial f}{\partial t}\right|_{\text{coll}} = \iint g(\mathbf{p}-\mathbf{p}',\mathbf{q})\left[f(\mathbf{x},\mathbf{p}+\mathbf{q},t)f(\mathbf{x},\mathbf{p}'-\mathbf{q},t) - f(\mathbf{x},\mathbf{p},t)f(\mathbf{x},\mathbf{p}',t)\right] d\mathbf{p}'\, d\mathbf{q}\,?$$

More presentation math:

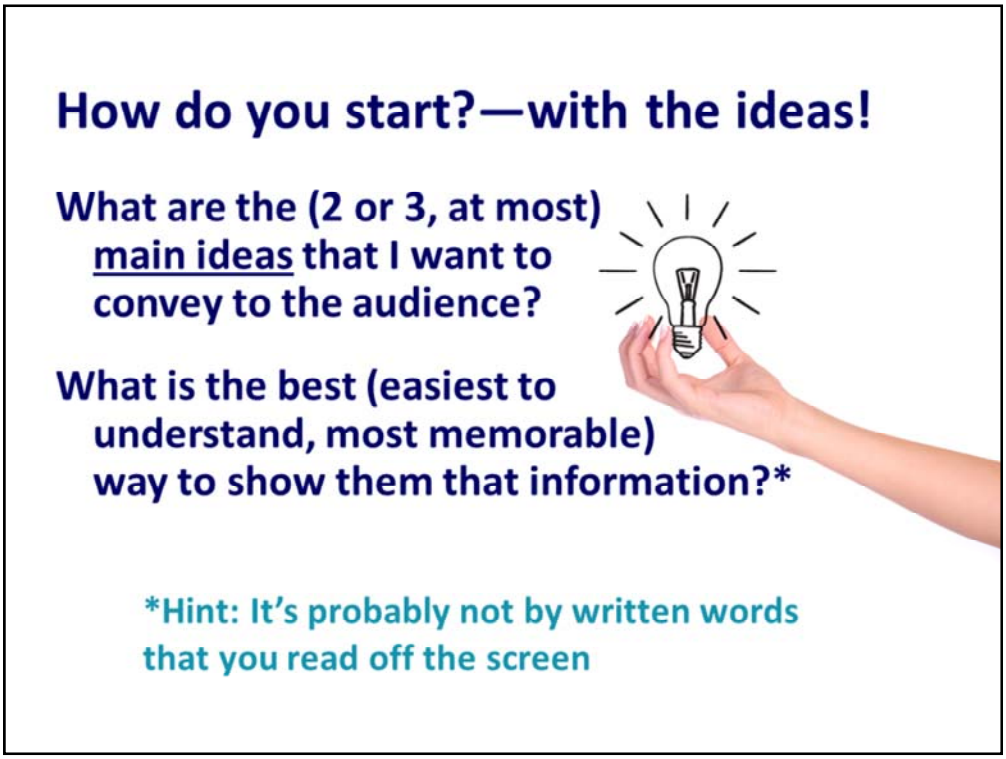
$$\varsigma = \frac{t}{2}, \qquad [2]$$

where ς is the number of slides that can be presented and t is the time in minutes that is allotted for the talk

A good "rule of thumb" is to allow at least 2 minutes per slide

Tip: You cannot show 44 slides in a 15-min presentation, no matter how fast you talk

The amount of time you're allotted also determines the number of slides you should prepare. In general, allow at least 2 min per slide, and more time for slides that present equations, plots, complex figures, or tabular data.



The introductory material flows from these ideas :

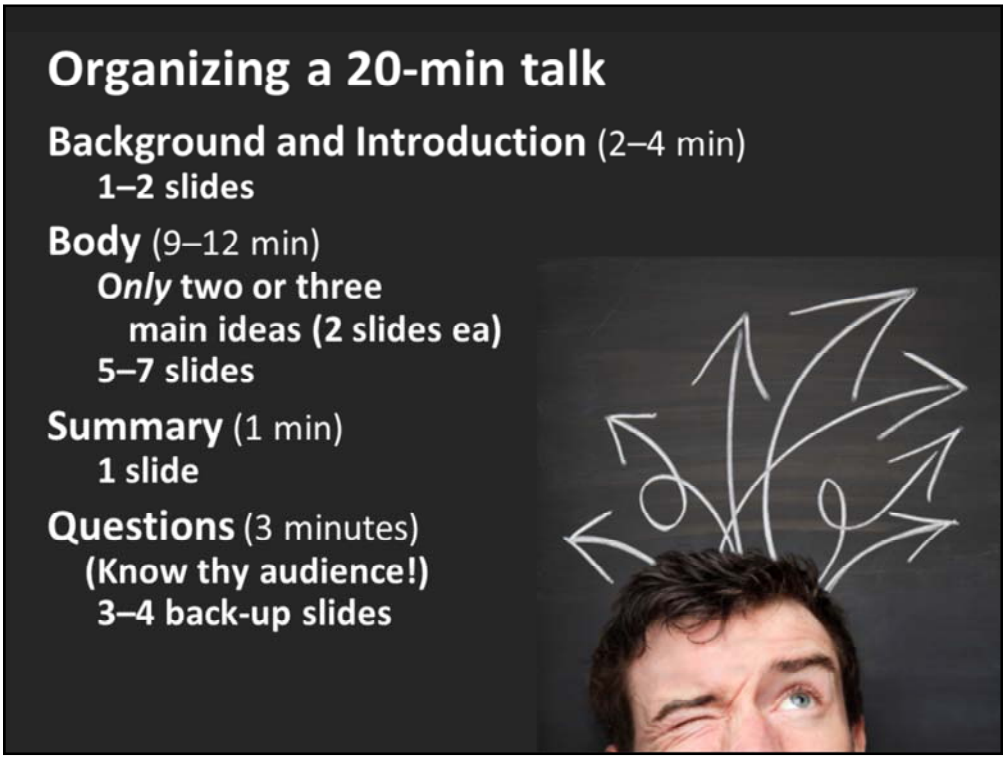
- What motivated the work? How does it fit into work that has already been done?
- What background information does the audience need to understand these points?

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).



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. (Knowing your audience includes anticipating what questions they'll ask.)

Allotted <20 minutes? **Make fewer slides**, don't talk faster.

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
- Acknowledgment of financial support
- Attention-getting graphic

Slide Courtesy Thomas Hymel

Outline or overview of presentation*

- Prepares the audience to listen
- Provides a logical structure for your talk
- Summarizes key points

Tip: Don't waste precious time on an outline 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, emphasizing trends, relationships, magnitudes.

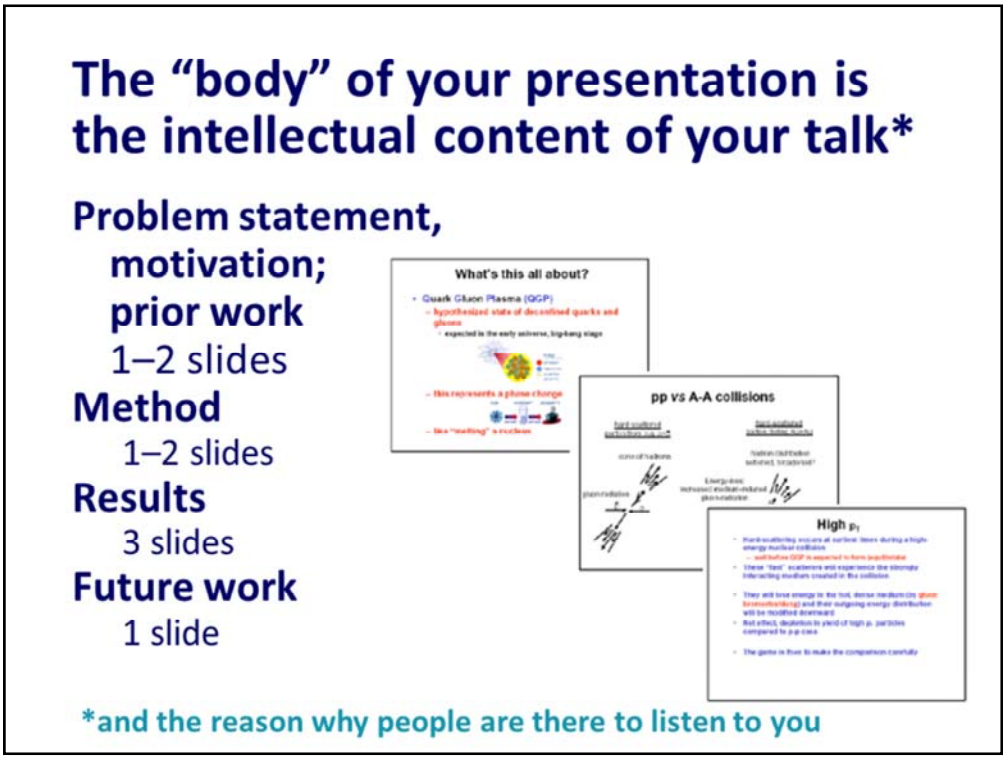
Use printed handouts to:

Facilitate note-taking.

Reinforce main points.

Convey complicated information, e.g., numerical detail or equations.

Provide additional details, citations, and contact information.



These suggestions for the number of slides to include in a talk are guidelines and are wholly dependent on (1) your purpose for giving the talk and (2) who your audience is.

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 the point of giving the talk is to tell people about the exciting new method you've developed. If the audience wants to know the exact composition of the samples and where to set the dial, they'll read the paper.

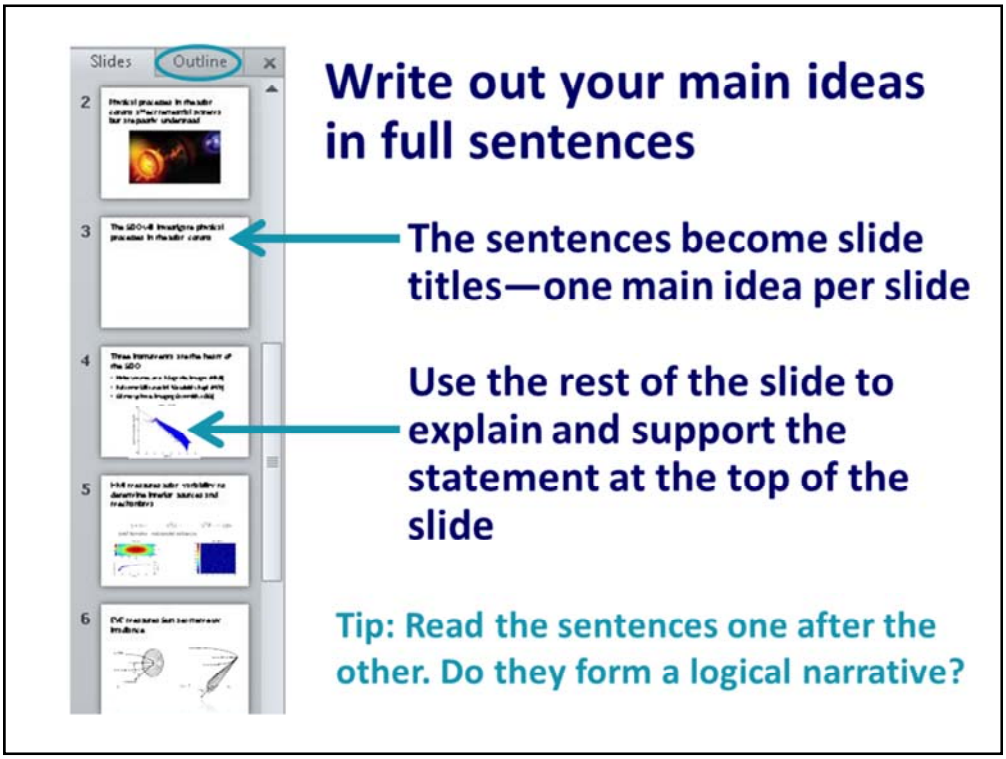
Results—this section is probably what the audience came to hear. The "results" section should be the longest part of your talk and should provide the most supporting detail.

Don't try to tell "the whole story"*

- Distill your talk to a few key points (q.v. Eq. 1)
- Present only enough data to
  - Illustrate your main points
  - Support your conclusions
  - Demonstrate the originality of your work

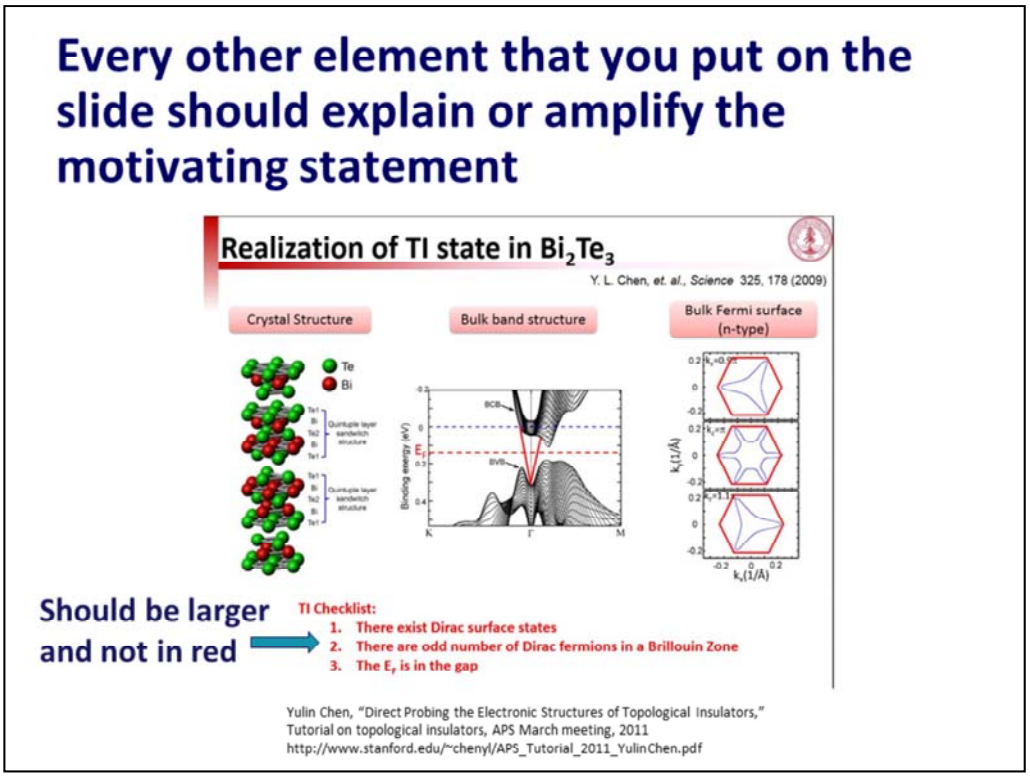
*Your objective is to get the audience interested enough to *read the paper*

Again, a talk is not your paper projected onto the wall. Your job as a speaker is to thoughtfully select the important points in the paper and convey them in a way that is meaningful and memorable for the audience.



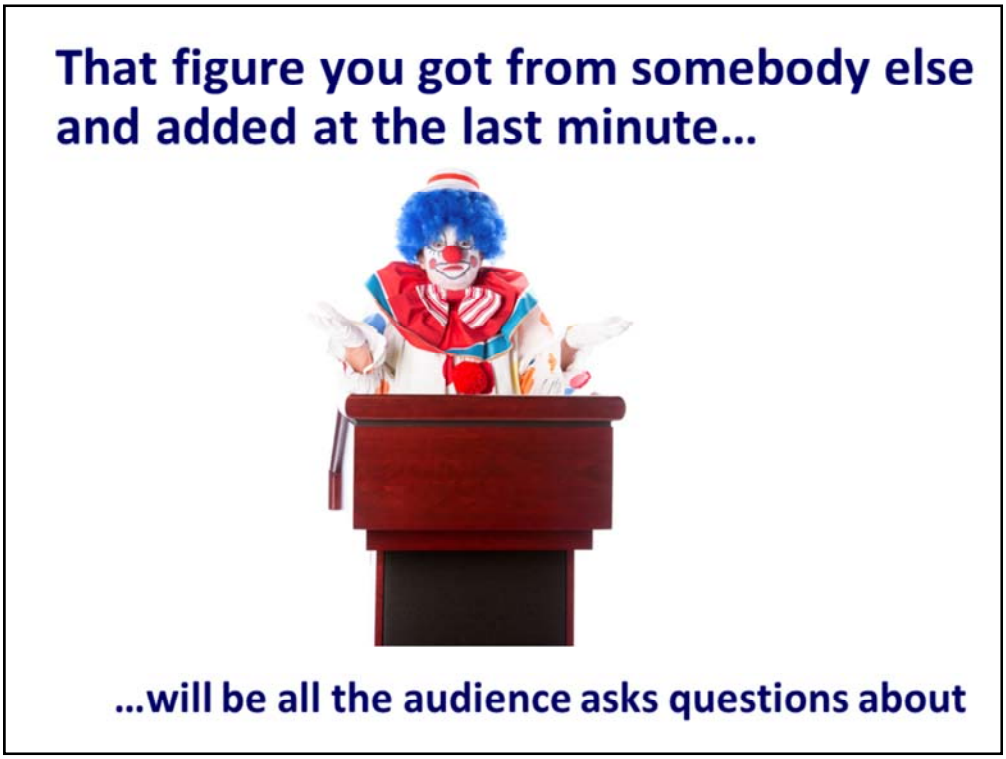
These key sentences encapsulate your whole talk; they provide the motivation, describe the methods, highlight the key results, explain your conclusions.

Arrange the key sentences, one per slide, and move them around until you have a logical, coherent narrative story line.

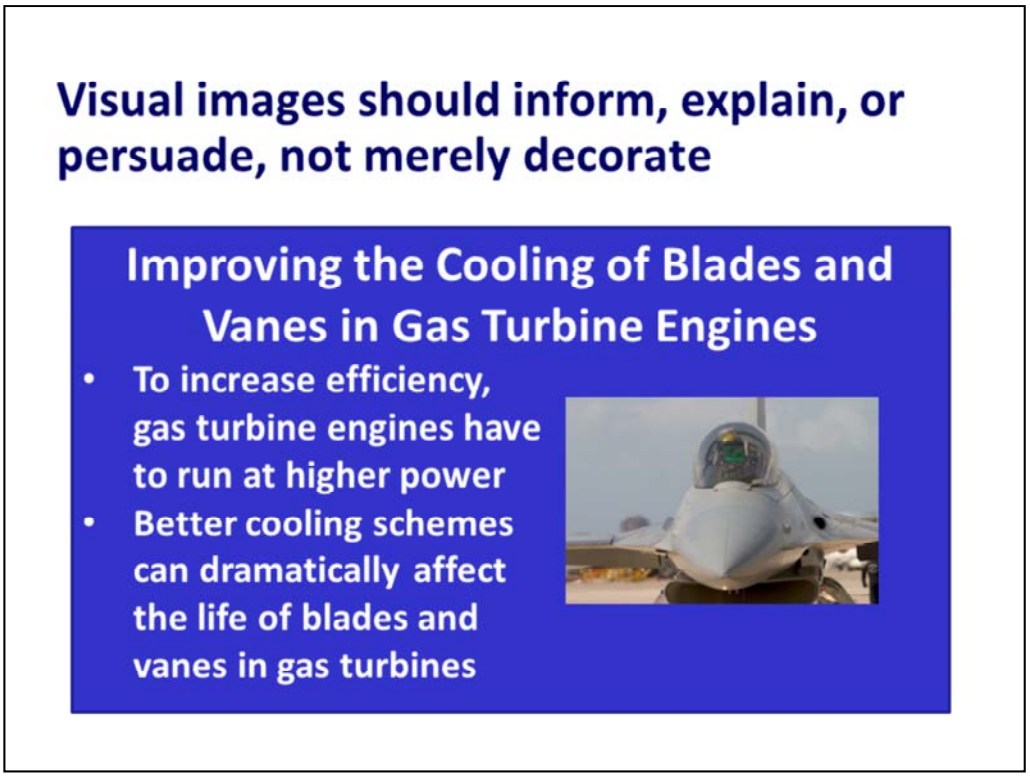


People read slides from top down, and they'll look at the statement at the top of the slide first. Make it state one of your key points. People pay the most attention at the beginning of the slide. Keep them engaged and interested by what they look at next. Make it the supporting evidence for your statement.

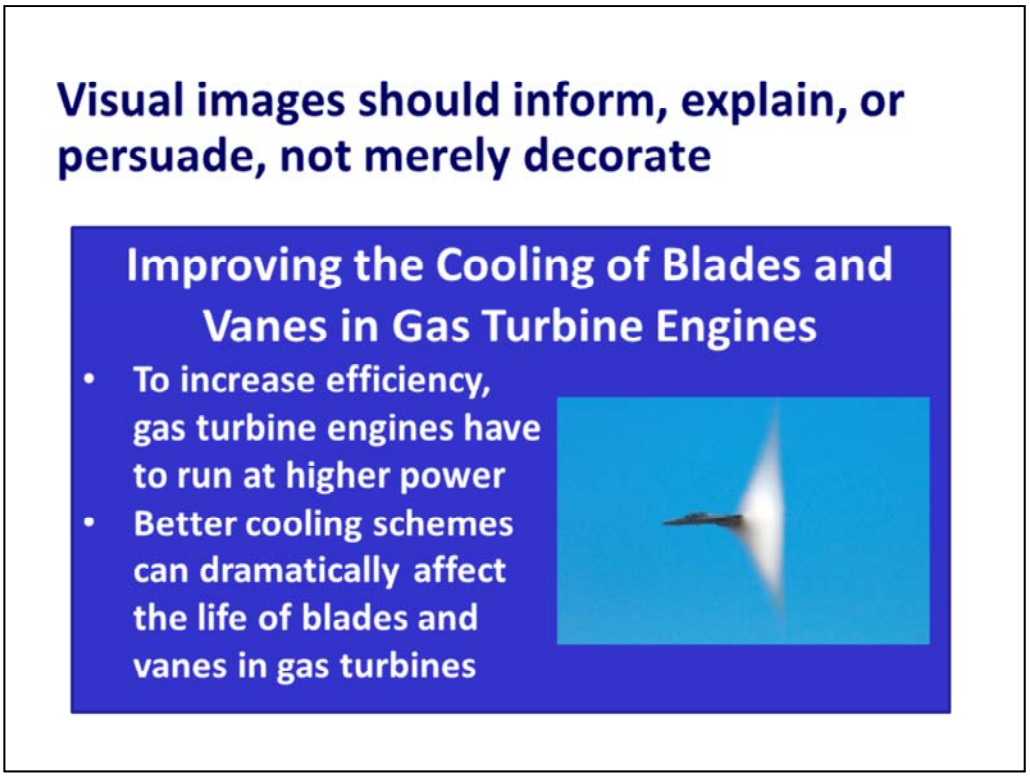
Never *ever* put *anything* on a slide that you do not thoroughly understand



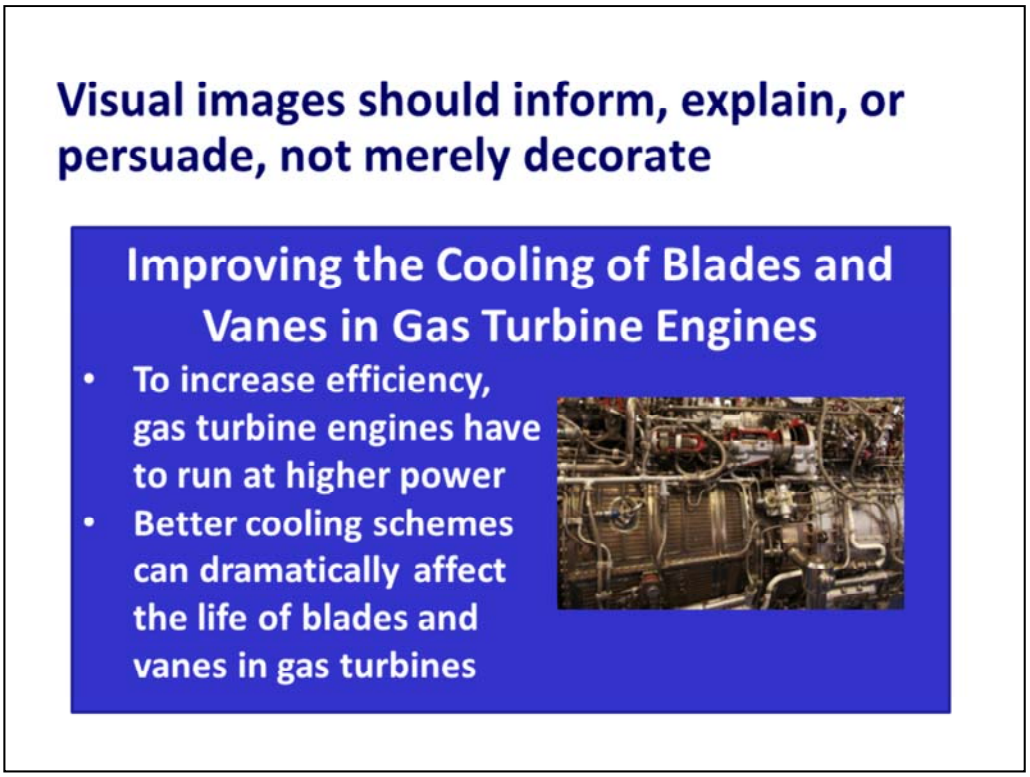
By the same token, don't put anything on a slide that you don't explicitly discuss in your talk.



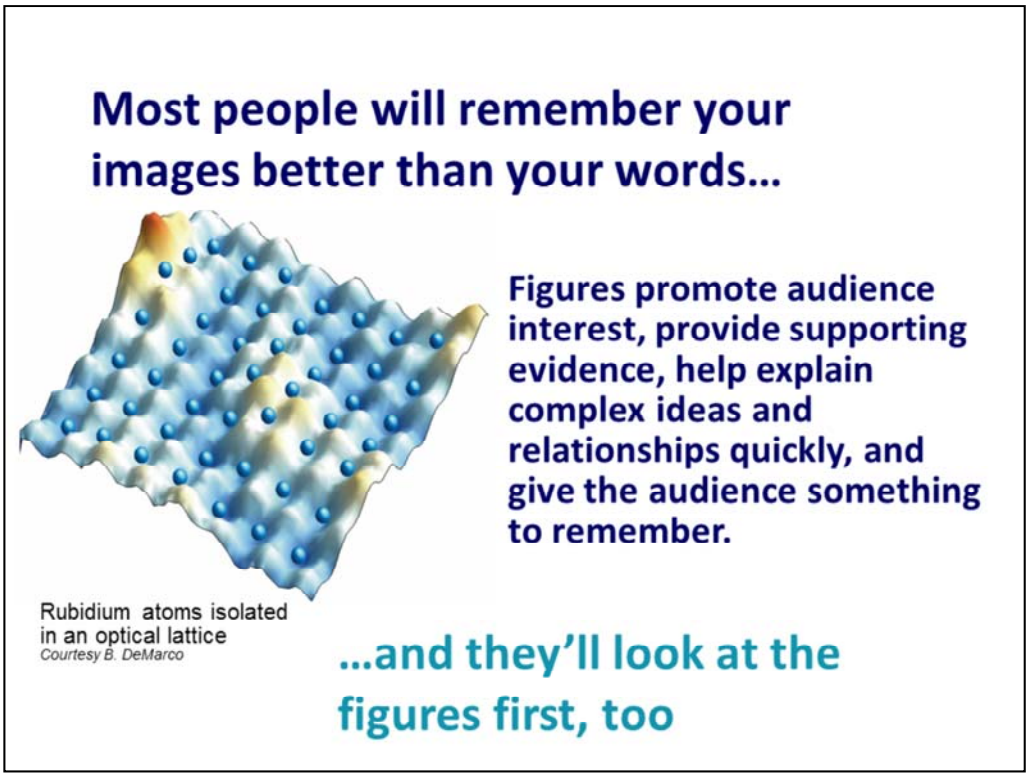
Anybody going to this talk probably already knows what a jet airplane looks like. All this image does is distract the audience from the information the speaker is trying to convey. Who wants to pay attention to the boring, dense text when they can try to figure out what kind of fighter jet this is and how the photographer captured this scary, nose-on photo?



While a spectacular and captivating photo (of a vapor cloud forming around an F-18 Super Hornet as it approaches the sound barrier), this image has ***nothing*** to do with cooling schemes for gas turbine engines. Instead of explaining or amplifying the talk, the photo competes with it.



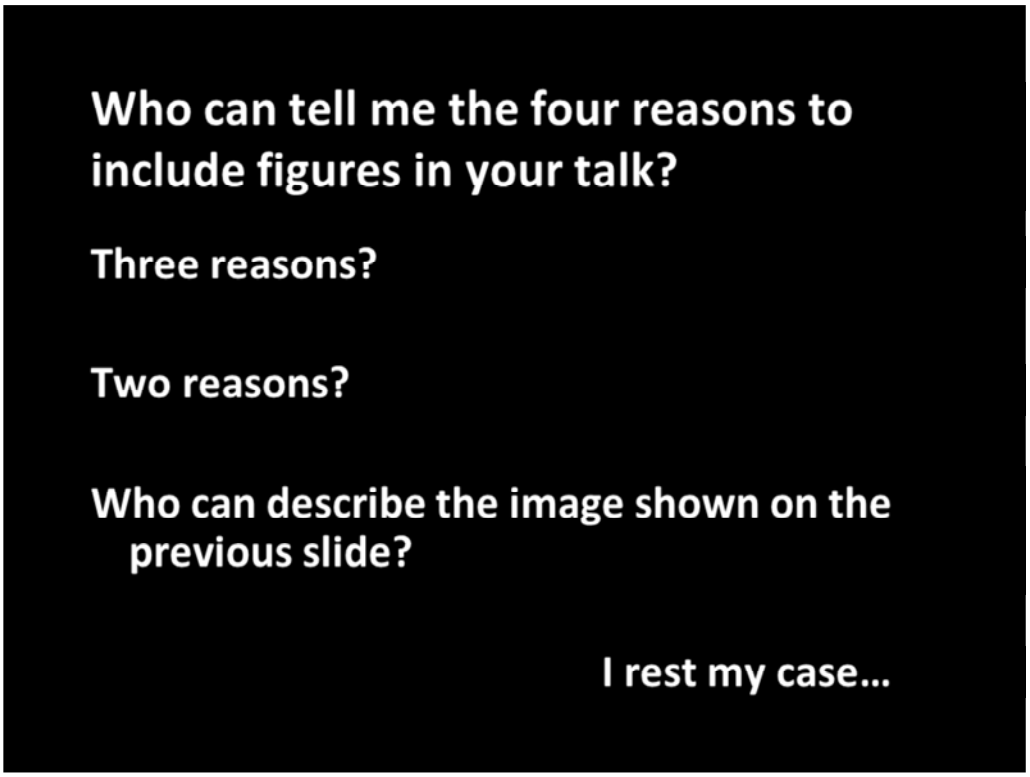
Again, this photo, while an impressive display of engineering chops, does not explain the concepts being presented and does nothing to inform or persuade the audience.



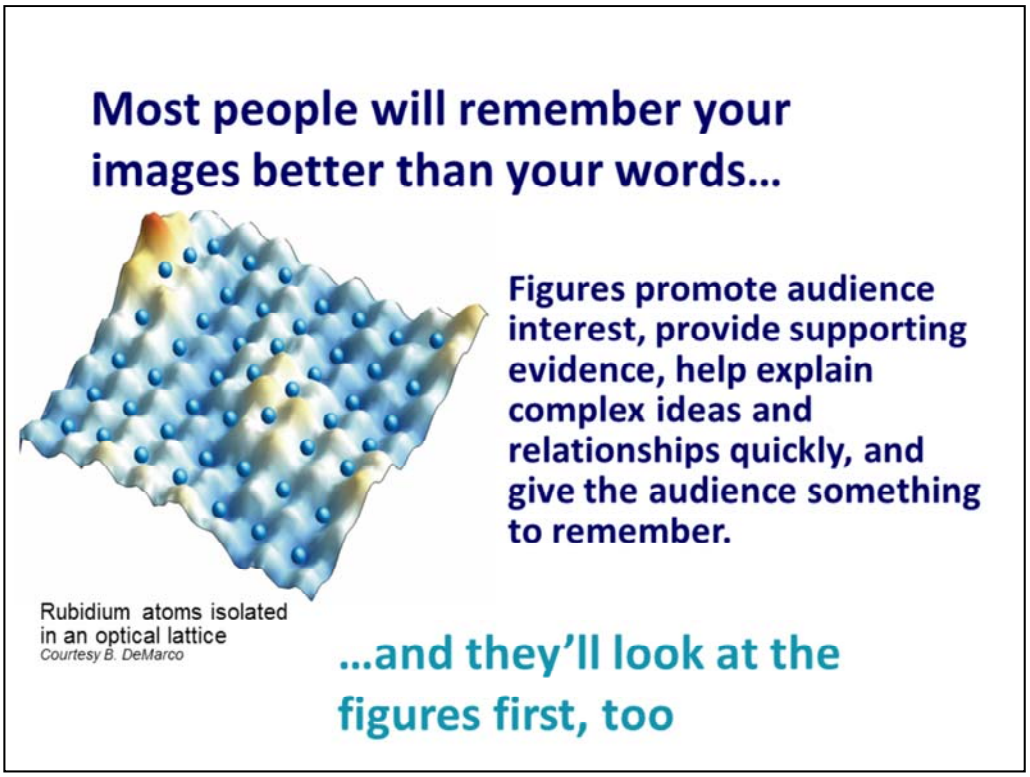
Use engaging, visually interesting figures to draw a reader in to your story and give them something to remember.

Illustrate each of your main points with an engaging image.

"Graphic excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest place."—Edward Tufte



People remember pictures much longer and better than they remember words.

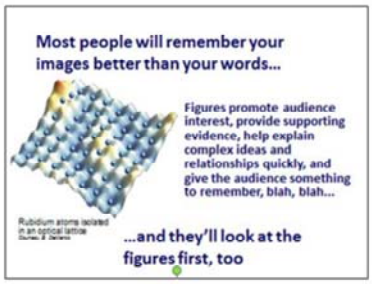


If the purpose of this slide was to convey to the audience the four reasons why they should use engaging figures in their talks, it was set up from the beginning to fail, simply by the way the material was presented on the slide.

In the next slide, I'll show you why and how to fix it.

Figures serve four purposes in talks

1. Engage the audience and capture their interest
2. Provide supporting evidence
3. Help explain complex ideas and relationships quickly
4. Give the audience a visual, memorable "hook" to hang your key ideas on*



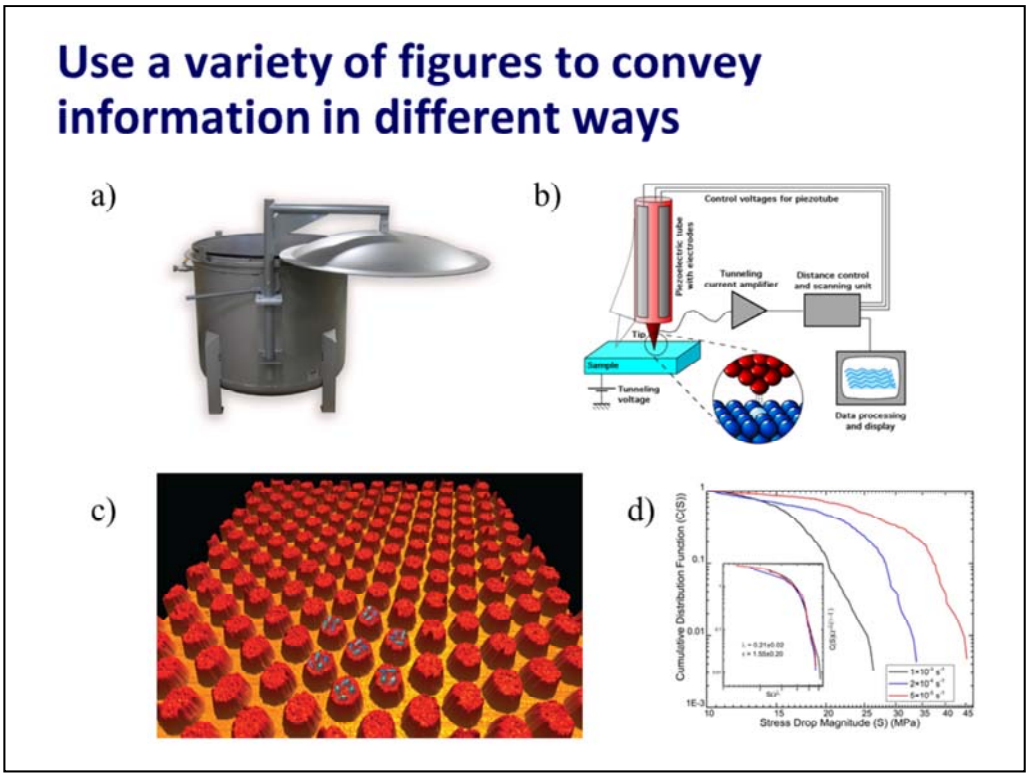
Tip: People remember pictures better than words, and they look at color first

First, change the motivating statement at the top of the slide to emphasize the idea that there are ***four*** reasons to use figures. In the original slide, the message in the title is "remember the figure," and the subtitle is "look at the figure first."

Present the points in a numbered list—easier to process (and remember) than narrative text presented in paragraph style.

English speakers read from top to bottom and left to right. Place your important points strategically—at the top of the slide and along the left margin. Put your illustrative pictures at the right and lower down on the slide.

Put important ideas in a contrasting color—people look at color first, too.



The main advantage of photographs is realism. If you show a photograph or drawing, though, be sure to include something to indicate scale. It's impossible to tell from the photograph of a) whether the device is something you could put on a table top or you'd have to haul around on a truck.

A cut-away drawing can show the inner workings of something that a photograph cannot. It also allows control of detail, so that important features are revealed and emphasized.

A diagram can illustrate a process or the flow of a variable through a system.

A plot can reveal relationships among variables.

a) stainless steel top-loading cylindrical vacuum chamber, 30" × 30"

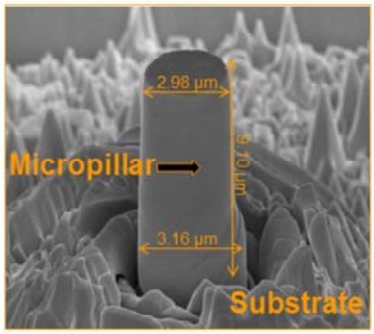
b) Schematic of a scanning tunneling microscope; Michael Schmid, TU Wein;
Creative Commons Attribution ShareAlike 2.0 Austria License.

c) Colorized three-dimensional atomic-force-microscopy image of superconducting Nb islands on a normal-metal substrate. The superimposed cartoon arrows depict fluctuating phases of the superconducting order parameter. *Courtesy Serena Eley, University of Illinois.*

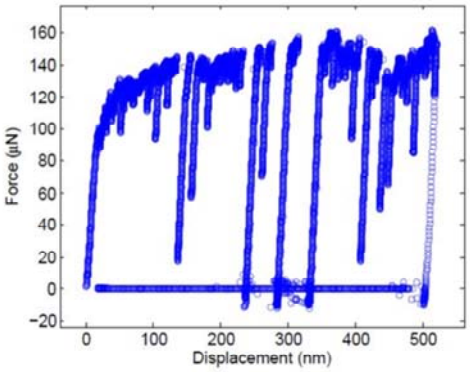
d) Complementary cumulative distribution functions (CCDFs), or survival functions, of stress drops for samples of $Zr_{64.13}Cu_{15.75}Ni_{10.12}Al_{10}$, 2-mm in diameter and 4-mm in length, compressed at various constant strain rates at 298 K. *Courtesy James Antonaglia, University of Illinois.*

Label all elements in a figure

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



SEM image of gold micropillars
(Courtesy M. Wraith)



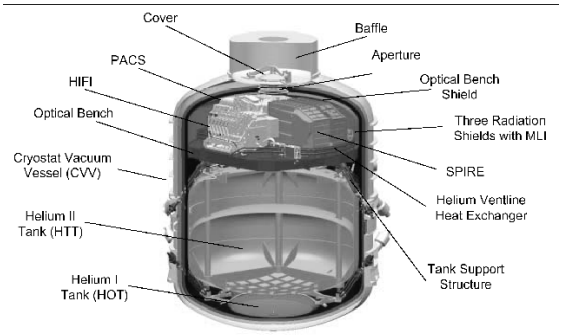
Displacement controlled compression of the micropillars
(Courtesy M. Wraith)

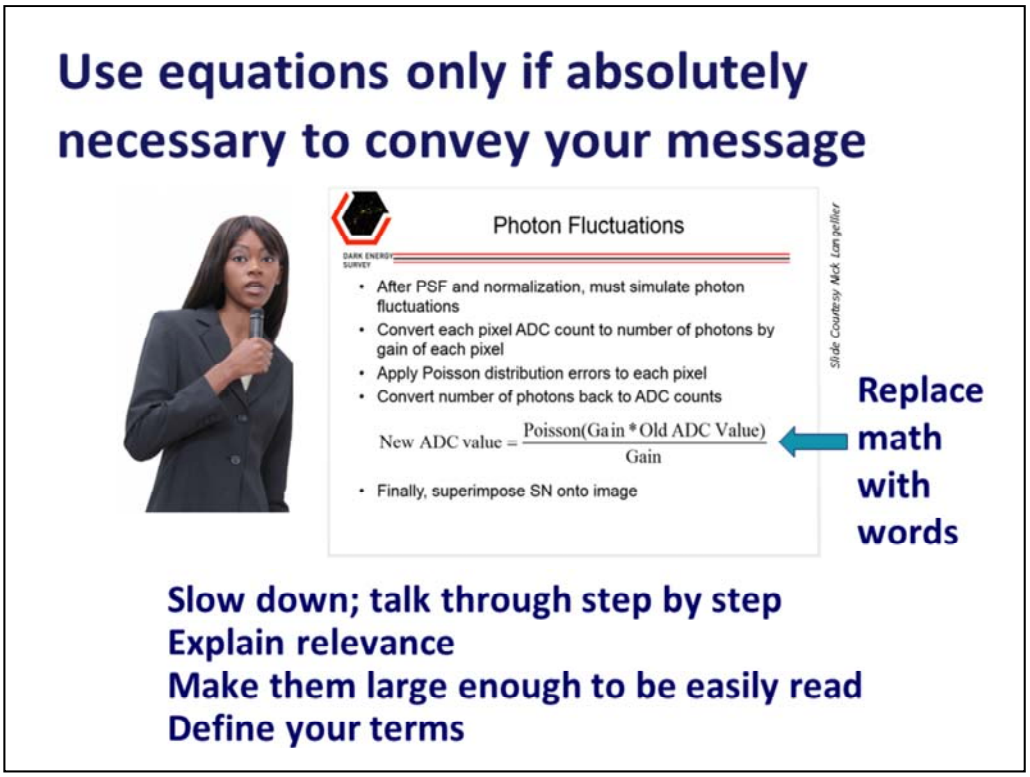
What about captions? Every figure in a paper ***must*** have a caption that explains the figure and points out important features. Some scientists say that figures for talks don't require captions or labels—you're standing there explaining them, after all.

I, however, think images in talks should have short, explanatory labels that orient the audience. They're going to look at the picture on the slide first—before you explain it—and they're going to want to know immediately what is being depicted.

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.

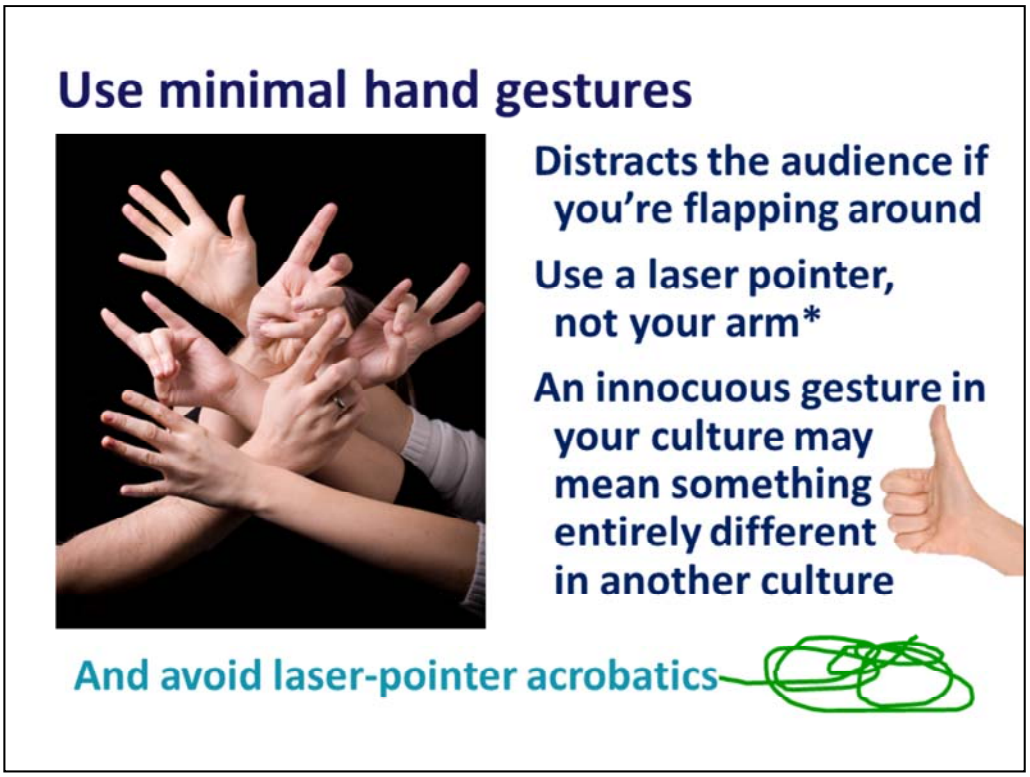
Another tip for ALL figures—if you show a photograph or drawing of something, provide some sort of visual clue to its scale. The audience may have no idea if the apparatus shown below is 5-cm long or 5-m long from just looking at this image.



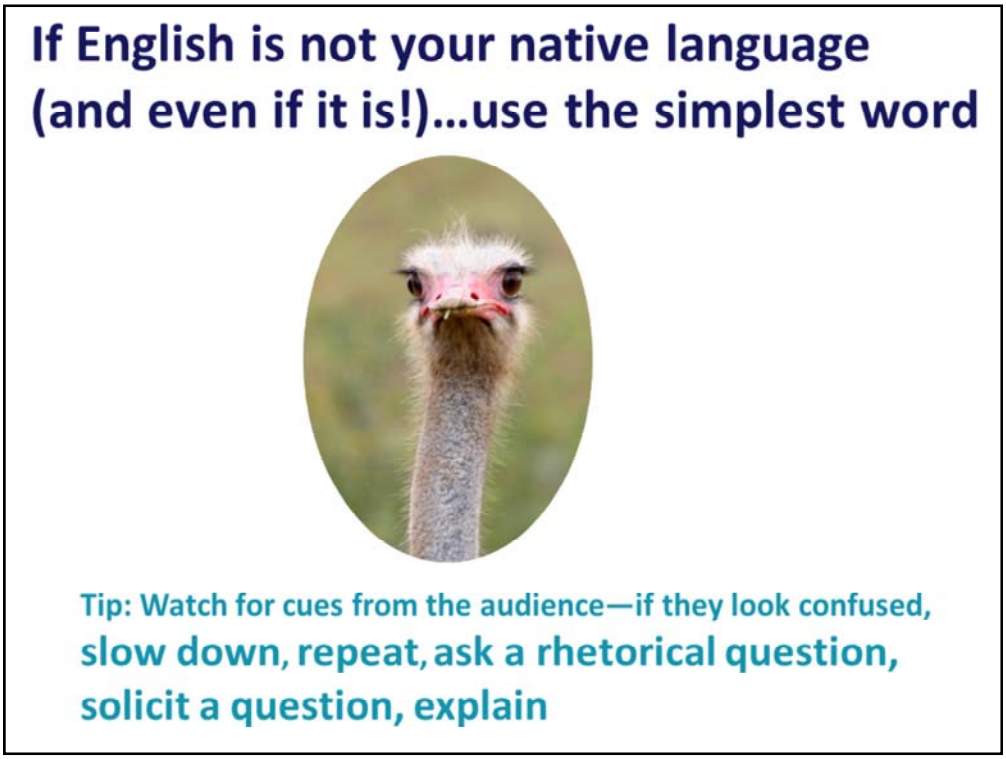


PowerPoint animations can be useful in presenting equations:

- Highlight relevant terms in different colors
- Drop out terms
- Replace symbols with words
- Blow up parts of the equation or use arrows as pointers as you walk the audience through it



See http://www.cracked.com/article_16335_7-innocent-gestures-that-can-get-you-killed-overseas.html. The examples are quite true, but the language is a bit too colloquial for this straight-laced Midwesterner. Read at your own risk.—*cme*



Do not use jargon unless you explain it (What is SPH, anyway?).

Choose the simplest words—imagine that you are giving a talk in English to people who don't speak English as a first or even a second language. In science, you probably are!

If English is not your first language, do not be embarrassed to ask a native speaker to review your presentation.

Practice speaking slowly and distinctly, whatever your first language is.

A word about appropriate dress…

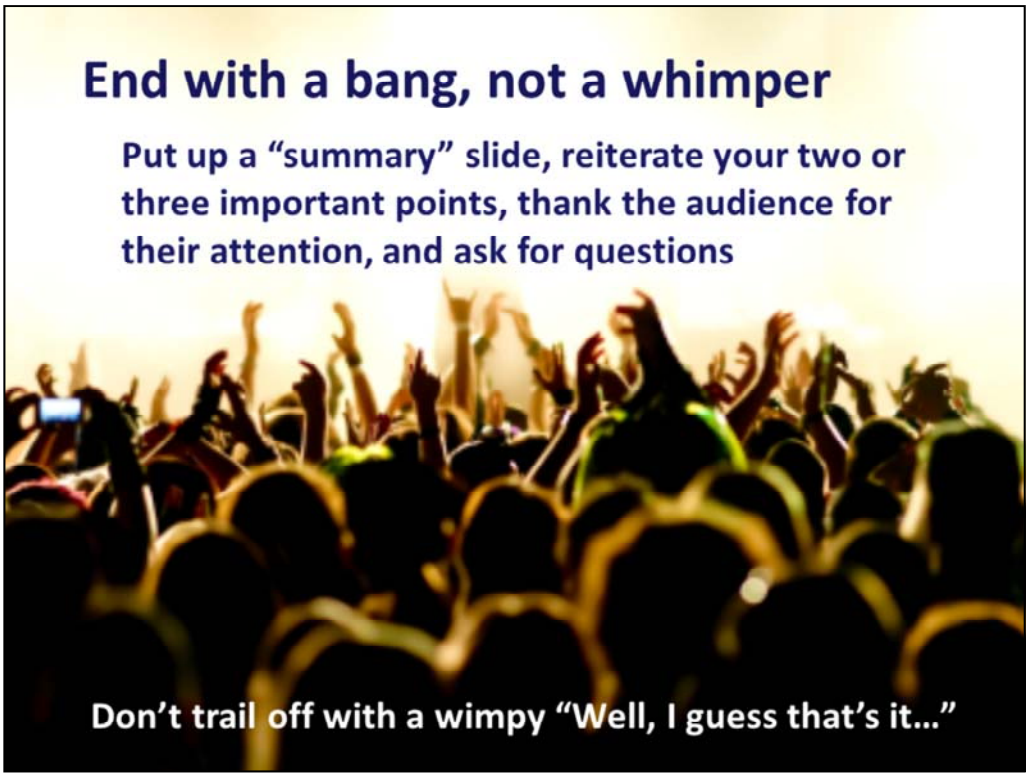
Tip: Wear comfortable clothes that present a neat, professional appearance (and to which you can attach a lapel microphone and power supply)

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

Wear comfortable shoes.

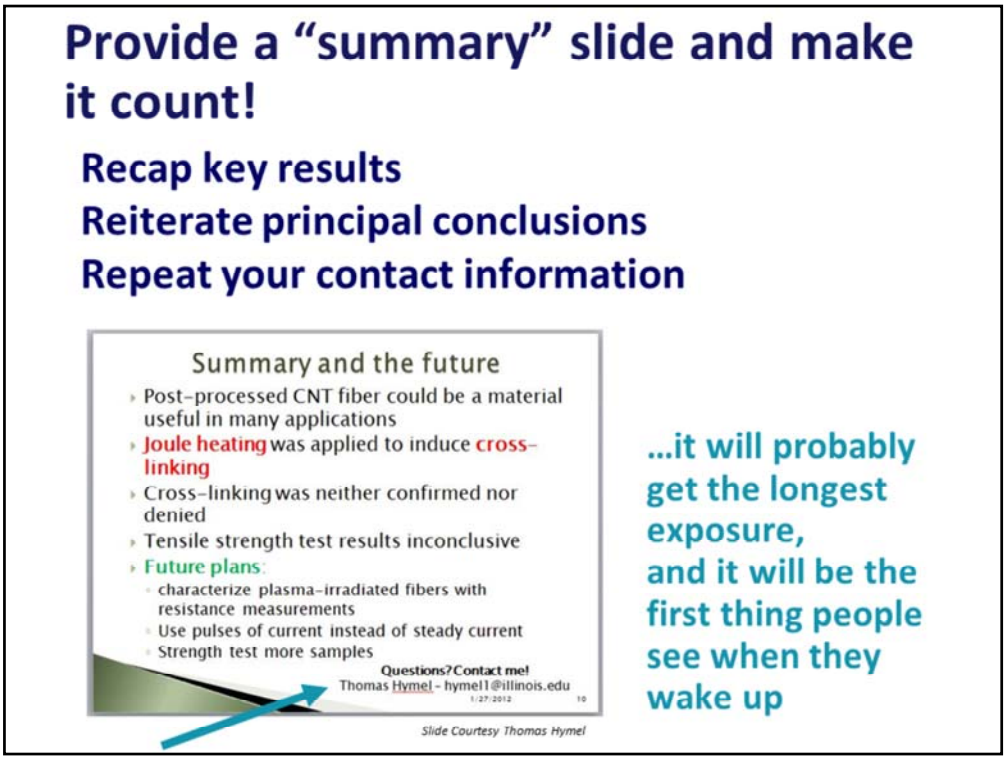
Wear a shirt or blouse that you can clip a portable microphone to, so that it is positioned about 5–6 in. below your mouth. Turtlenecks and tee shirts should be avoided, because there's no good place to clip the microphone where it won't slip.

Wear slacks or a skirt with a waistband or pockets for the microphone's power supply.



Don't trail off with an ineffectual "Well, I guess that's it…"

Put up a "summary" slide, reiterate your two or three important points, thank the audience for their attention, and ask for questions.



The summary slide lets you reiterate your key points and cues the audience that you will soon be taking questions. Leave it on the screen during the "questions" period—it will help people review what they've learned and remind them of questions they want to ask.

Add your contact information at the bottom of the summary slide; people may not remember it from your title slide.

Practice your timing—you will get cut off unceremoniously at conferences.

Ask if the session moderator will give you a two-minute warning if there's no time-keeeper. Put your watch or cell phone on the podium where you can see the time.

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.

Before you leave for the conference, email an editable copy of your talk to yourself, at an address you can get to from the road

Laptops fail

Thumb drives get lost

Files get corrupted

The person who was supposed to load your talk on the seminar room's computer gets sick or forgets

Take along a printed copy of the "notes" pages, too. Use them to rehearse on the plane. Mark where the animations occur.

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

Check everything before your talk.

Check the projector:

Make sure you know how to turn it on.

See that it is plugged in and accepting the signal from your laptop.

Adjust the focus.

Check microphones, pointer, other tools.

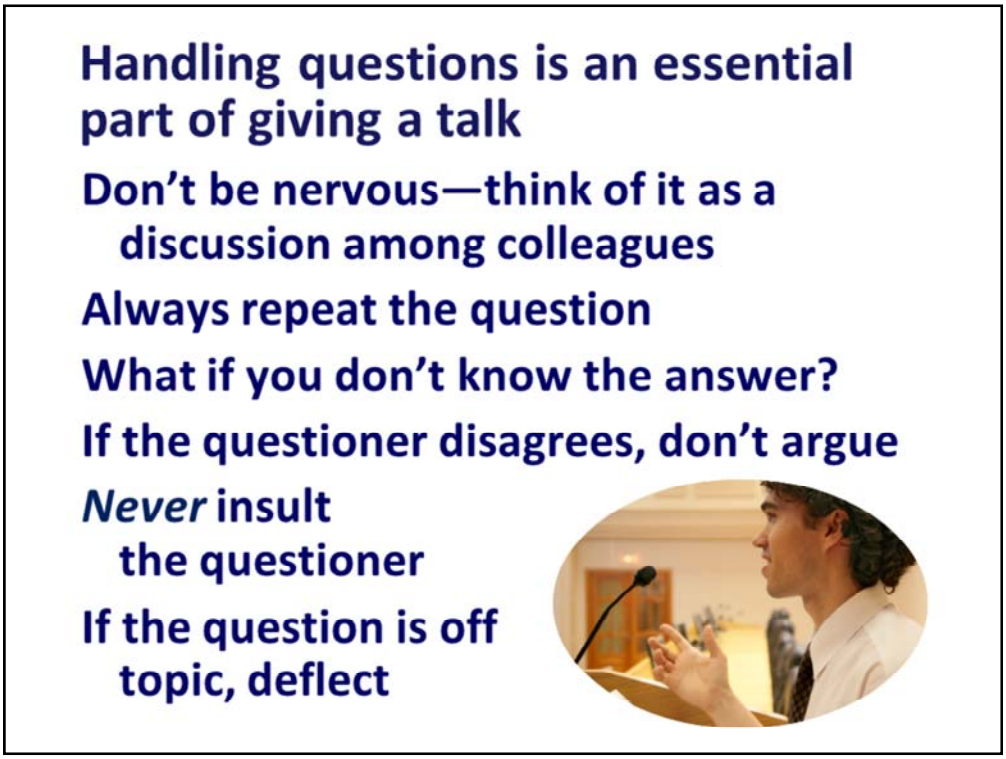
If a clip-on mike is used, make sure it is fastened securely, check the volume, and then leave it alone.

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

If the battery on your laptop dies or the bulb burns out on the LCD projector, can you still give your talk? (Here's where the hard copy of the notes pages are essential.

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? An adapter for your Mac?

TURN OFF YOUR CELL PHONE!!



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, "Thank you for sharing these interesting ideas. Let's talk about this further after the session..."

Resist the temptation to set a questioner straight, particularly if said questioner is ignorant, deluded, or obnoxious. You'll just look bad. A talk is a forum to share your ideas; it's not a point-scoring debate.

Sources of good advice:

***The Craft of Scientific Presentations*,**
2nd ed., Michael Alley (Springer, 2014)
http://www.craftofscientificpresentations.com/

Any of the Edward Tufte books
http://www.edwardtufte.com/tufte/

Alexei Kaptarev's *Death by PowerPoint*
http://www.slideshare.net/thecroaker/death-by-powerpoint

<shameless self-promotion alert!>

Celia's PowerPoint Tips
http://physics.illinois.edu/people/Celia/PPT-Tips.pdf

To recap…

- Decide on your goals and analyze your audience
- Identify one or two main points that you want the audience to take away with them
- Design your talk to make these points clearly, concisely, and memorably
- Rehearse and revise (shorten!)
- Take every opportunity to speak
- Finish on time!

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NOTES: