


Communicating in Science: Celia's Tips for Science Talks



There are **300 million**
PowerPoint users
in the world*

*estimate

They do 30 million
presentations
each day*

*estimate

About a **million**
presentations are
going on right now*

*estimate


50% of them are
unbearable*

*conservative estimate

“Death by PowerPoint”
Alexei Kaptarev
<http://www.slideshare.net/thecroaker/death-by-powerpoint/>

Celia M. Elliott
Department of Physics
University of Illinois at Urbana-Champaign

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Today, we'll look at some ways to enhance the communications value of your slides and some tips to avoid humiliation.

The standard software for most scientific talks is MS PowerPoint. Like it or hate it, that's what nearly all AV systems at conferences are set up to use. If you are determined to be an iconoclast and use some other presentation software, fine, but be prepared for last-minute technical difficulties that will annoy your colleagues and cut into your presentation time. If you demand to use something other than PPT, take a PDF version of your talk that you can use when the computer in the seminar room can't run *Photoshop* or *LibreOffice*.

Alexei Kaptarev's *Death by Powerpoint* is an Internet classic not to be missed:
<http://www.slideshare.net/thecroaker/death-by-powerpoint/>

Important disclaimer: I am not a scientist; I'm a science writer and technical editor, and almost all my experience has been in physics. I think the general rules I'm going to share today are applicable to the physical sciences in general, but your discipline may have different expectations of speakers.

Important disclaimer #2: The opinions expressed are solely those of the speaker are not necessarily shared or endorsed by the Department of Physics or the University of Illinois at Urbana-Champaign. But they should be.

Goal: Tell a memorable story and teach the audience something interesting



**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 logical structure, analogy, an enthusiastic narrator, something that stimulates your imagination and makes you think.

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***.



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>)

Another consideration as you analyze your audience: think about cross-cultural implications. The use of humor, references to popular culture, and sports analogies are very culture-specific. Will your audience understand your reference to the 2016 Super Bowl or an American sitcom?



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

Elliott equation:

$$p = \frac{t}{8}, \quad [1]$$

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

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.

N.B. Equation [1] 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

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

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**

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.

More presentation math:

$$S = \frac{t}{2},$$

[2]



where S is the number of slides that can be presented, and t is the time allotted in minutes

A good “rule of thumb” is to allow about 2 minutes per slide

Allow more time for equations, complex plots, complicated figures, tabular data

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.

Don't use photographic or "fill" backgrounds

 **Yes, it's Illini Orange, but nobody can read the text**

They're distracting to the audience

They make your text too hard to read

 **Even if your talk is about koalas**

 **Even if it's on hydrophobic materials**

 **Even if you think it looks really cool**

Just don't do it!

Don't use photographic or textured backgrounds—just don't do it. They're distracting, they get boring after you've seen the first one, and the superimposed text is often impossible to read on them.

Don't use one of the PPT templates

They take up too much real estate with meaningless graphics

They force you to devote 25% of the slide to the "title"

They trivialize your message by promoting style over substance

Many are just butt-ugly



You want the audience to be thinking about what you're saying and looking at the evidence you're presenting, not swooning (or snickering) over your artistic taste.

DO use the SEEE method to present your ideas effectively

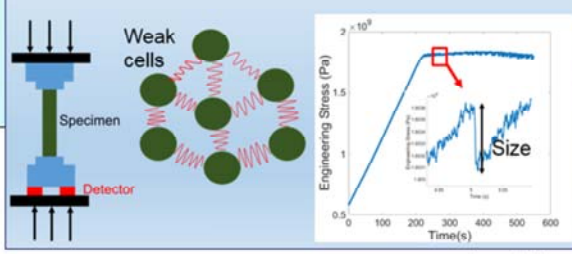
Sate your main point

Evidence Examp

Explanation

What are slip avalanches?

BMG deforms with intermittent slip avalanches
Previous work : Statistics of slip avalanches in BMG can be described using a mean field model
Mean field model: All cells are coupled equally



The diagram shows a mechanical testing setup with a specimen, a detector, and a graph of Engineering Stress (Pa) vs Time (s). The graph shows a stress-strain curve with a peak and a subsequent drop, labeled 'Slip Size'. The graph also shows a zoomed-in view of the peak and drop, with a red arrow pointing to the peak. The graph is labeled 'Engineering Stress (Pa)' and 'Time (s)'. The peak is at approximately 1.8 x 10^9 Pa and 250 s. The drop is at approximately 1.5 x 10^9 Pa and 350 s. The zoomed-in view shows the stress increasing to a peak and then decreasing, with a red arrow pointing to the peak. The graph is labeled 'Slip Size'.

Courtesy Aya Nawano

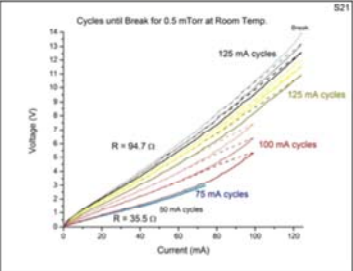
Put a motivating statement at the top of your slide that summarizes the point of the slide.

People pay attention when something changes in their environment—for instance, when a slide changes. Take advantage of that sharpened attention to articulate your message in an immediately identifiable, memorable way.

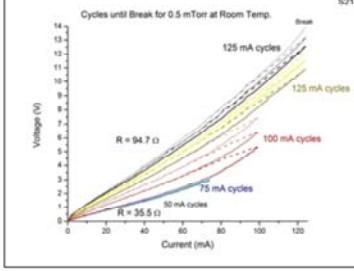
Use the rest of the slide to explain, give evidence for, or provide examples of the idea presented in the motivating statement at the top of the slide.

Replace the content-less PPT “title” with a meaningful motivating statement

Results



/V curves showed an increase in resistance with Joule heating



Plot courtesy Thomas Hymel

Tip 1: Write the statement as a sentence


Tip 2: Turn off the “auto-correct” feature in PPT that reduces the font size if you exceed the number of characters MS thinks you should have on a line

The default for PowerPoint slide “titles” is centered. Change it to left-justified.

Turn off the automatic “fitting” functions in PPT to avoid having PPT reduce your font size if you exceed the number of characters MS thinks you should have on a line.

In PPT 2010, right click inside the text box, then select “Format Shape” from the drop-down menu. In the dialogue box, click on “Text Box” on the left navbar, and then turn on the “Do not Autofit” radio button in the “Autofit” section.

In PPT 2013, from the “File” menu, click on the “Options” link, and then select “Proofing” from the menu. In the dialogue box, click on the “Autocorrect Options” button. When that dialogue box opens, uncheck the “Autofit Title” and “Autofit Body Text” boxes.

No  **unless you're presenting an actual list**

Status of Projects

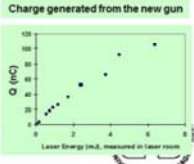
HEP at ANL

Theory

- Connection with UC through Carlos Wagner (appt) has brought two thesis students to
- New Assistant level theorist (Tim T)
- 7 international workshops organized
 - Broad participation by students
- Active work on organizing
- Physics high

Accelerator Physics

- Beam
- Wakefield
- beam configurations, major developments of the
- acceleration to 100 MeV in 1m
- required a major upgrade of their facility, especially electron gun and laser system
 - High power tests of externally powered dielectric loaded waveguides in collaboration with Naval Research Laboratory
- 2 new physics processes affecting electron acceleration discovered (and published)



Charge generated from the new gun

Q (nC)

Laser Energy (mJ, measured in Laser Room)

PROPERTY OF ORNL

24

I recommend turning off the “bullet list” format, which is the default in PPT. Presenting ideas in bulleted lists implies hierarchies or relationships that may not, in fact, exist.


“Lists can communicate only three logical relationships: sequence (first to last in time), priority (least to most important, or vice versa), or simple membership in a set (these items relate to one another in some way, but the nature of that relationship remains unstated). A list can show only one of those relationships at a time.” Gordon Shaw, Robert Brown, Philip Bromiley, “Strategic Stories: How 3M is Rewriting Business Planning,” *Harvard Business Review* 76, 42–44 (1998).

Turning off the bullets also gives you more slide real estate to work with.

Visual images should inform, explain, or persuade, not merely decorate

Improving the Cooling of Blades and Vanes in Gas Turbine Engines

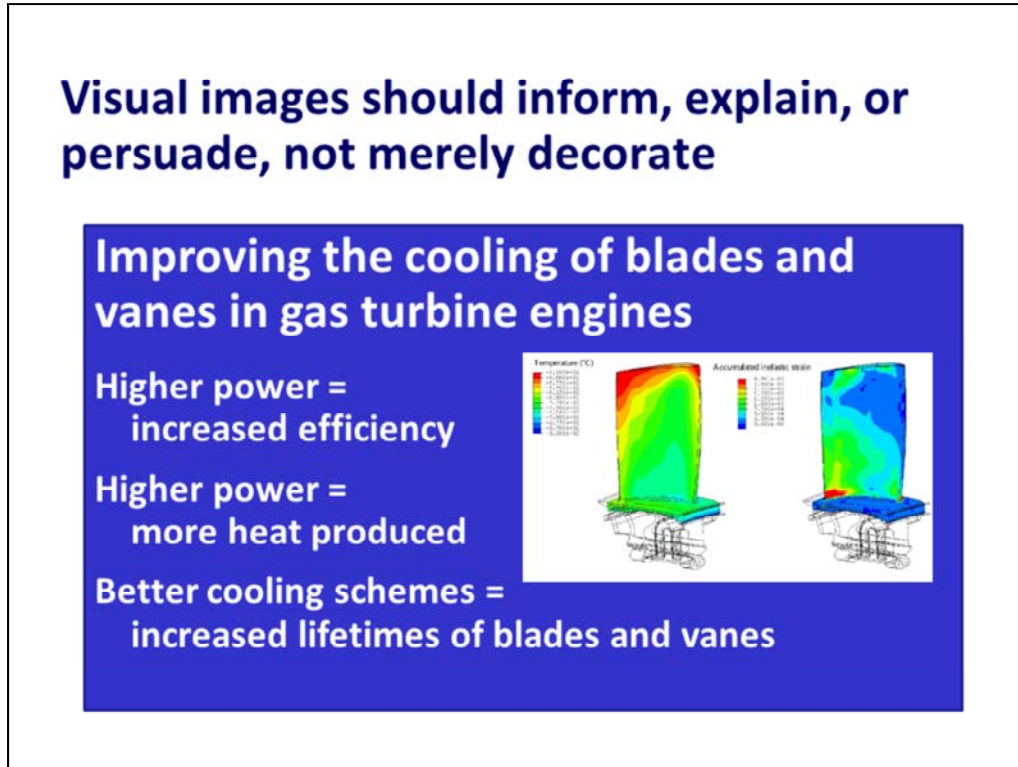
- To increase efficiency, gas turbine engines have to run at higher power
- Better cooling schemes can dramatically affect the life of blades and vanes in gas turbines



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.

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 why a vapor cloud is forming around it?

This slide also illustrates a problem with presenting information in bulleted lists. The narrative text all runs together.



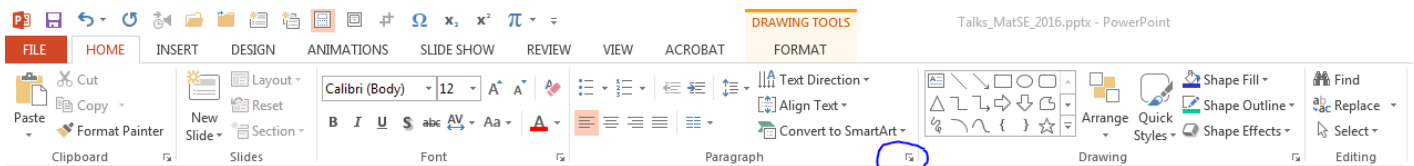
Here's how to improve this slide:

Change the centered title to a left-justified statement.

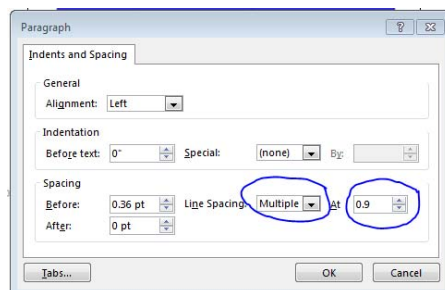
Turn off the bullets, "hanging indent" the text, and add extra space between items to make the text easier to read.

Write short phrases, not full narrative sentences, to make the text easier to read.

Change the interline spacing to make the text more compact, which allows more text per vertical inch and more inter-item spacing. On the "Paragraph" section of the ribbon, click on the down arrow to open the dialog box:




Then change the spacing to "Multiple" and type 0.9 in the box.



Improving the Cooling of Blades and Vanes in Gas Turbine Engines

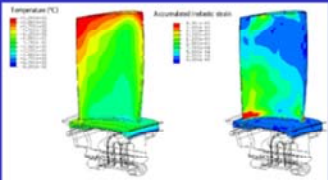
- To increase efficiency, gas turbine engines have to run at higher power
- Better cooling schemes can dramatically affect the life of blades and vanes in gas turbines



← Before

Improving the cooling of blades and vanes in gas turbine engines

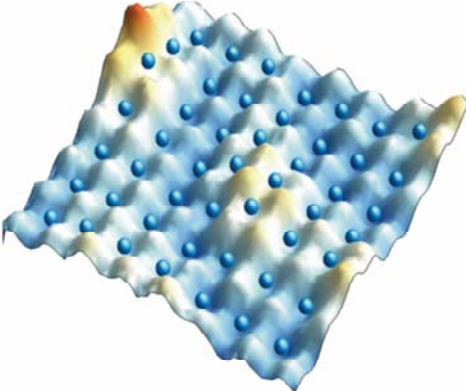
Higher power = increased efficiency
Higher power = more heat produced
Better cooling schemes = increased lifetimes of blades and vanes



After →

Here's the "before" and "after" versions of the slide.

Most people will remember your images better than your words...



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

...and they'll look at the figures first, too

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

**Who can tell me the four reasons to
include figures in your talk?**

Three reasons?

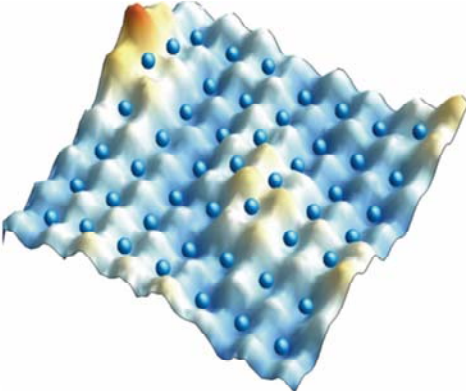
Two reasons?

**Who remembers the image shown on the
previous slide?**

I rest my case...

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

Most people will remember your images better than your words...



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

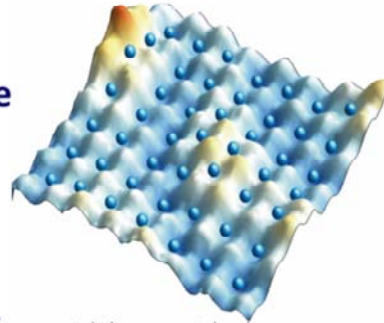
...and they'll look at the figures first, too

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



Rubidium atoms isolated
in an optical lattice
Courtesy B. DeMarco

Tip: Add a brief caption to orient the audience immediately—they're probably going to look at the figure before you explain it

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) that there are four reasons than to sort them out from narrative text presented in paragraph style.

Most Western languages are read from left to right and top to bottom. 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.

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



**That figure you got from somebody else
and added at the last minute...**



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

Choose an easy-to-read font (40 pt)


Make sure your audience (36 pt)

Can easily read (32 pt)

Every one of your slides (28 pt)

From the back of the room (24 pt)

See what I mean? (14 pt)



Tip: The bigger the room—the bigger the font

When you are first setting up your talk, use the “Master Slide” to automatically format text on all slides.

The slide contains the following text:

Use a simple sans serif font Calibri Helvetica Arial Tahoma Corbel Verdana

Serif fonts don't project as well, because the narrow parts tend to fade away

Eschew weird fonts (including *serifs* and *script fonts**)

Use one main font color, **one contrasting color** for emphasis

Use one main font size, **most, one contrasting size** for emphasis

Use **mixed upper and lower case** for text—**WRITING IN ALL CAPS LOOKS LIKE YOU'RE SHOUTING** (and it's much harder to read—and proofread!) *or risk professional ridicule

A large red stamp with the word "REJECTED" is placed diagonally across the center of the slide.

Do as I say, not as a do. This slide, while typical of an academic lecture to facilitate note-taking, has **w-a-a-a-a-y** too much text on it for a science talk.

Keep text to a minimum—use just enough words to orient the audience to what they are seeing. You want them to be listening to you, not reading a novella off the screen.

“Embed” special fonts in PPT to avoid embarrassing surprises at the conference

your computer

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

$$1/\tau_0 = 2.880 \times 10^{-9} n^2 \langle \nu_f^{-3} \rangle \int_{\Delta \bar{\nu}_a} f_{\epsilon}(\nu) d \ln \nu$$

Different computer—Voilà! Pencils!

conference computer

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


$$\frac{1}{\diamond} = (2.88 \cdot 10^{12}) \cdot (n^2) + [\bullet^3] \cdot \int_0^{\bullet} f_{\epsilon}(\bullet) \cdot d \bullet$$

Every computer has its own individual “library” of fonts; if PPT cannot find a font when you open your presentation on a different machine, it just arbitrarily substitutes a font that it thinks is “close.” Often, it isn’t...

PPT can “embed” your fonts in the file, but you have to tell it to do it every time

conference computer

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

$$\frac{1}{\lambda} = (2.88 \cdot 10^{15}) + (n^2 - 1) \cdot \frac{1}{d}$$




**Brian DeMarco's tip: Create your
equation in LaTeX, save it as a .png with
a transparent background, and insert
the image in your PPT slide**

To embed fonts in your PPT file:

- (1). Open the document in PowerPoint
- (2). Click on the “File” tab on the ribbon
- (3). Click on the “Options” link on the left menu
- (4). Click on the “Save” link
- (5). Locate “Embed fonts in the file” option at the bottom of the dialogue box
- (6). Click in the check box to turn on the option

Choose a neutral background and a high-contrast color for the text

Use a light-colored background with dark text

Use a dark background with light text

This isn't high-enough contrast

Neither is this

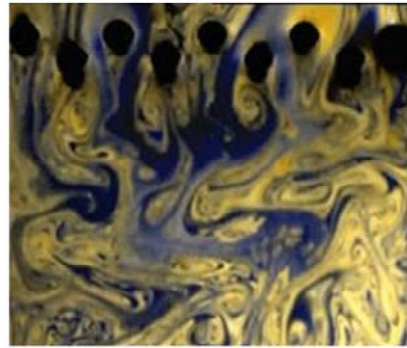
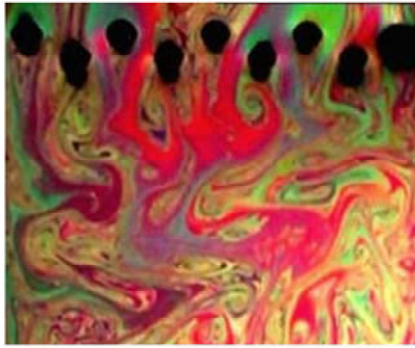
Don't ever put red on blue

Or blue on red

And avoid using gradient fills, too

Be aware that colors that look bright and crisp on your monitor may look entirely different when projected. In particular, pastel colors and thin lines fade away. Use bright, primary colors, bold fonts, and thick lines.

Don't use red or green to convey important information*



Development of turbulence in a soap film as its surface is raked by a wire comb. Courtesy Nigel D. Goldenfeld

***Between 8 and 12 percent of white males are red-green colorblind—who's your audience?**

If you use color to convey information, make sure that information transfers as you intended it and is accessible to everyone in your audience.

Another good resource is <http://www.colourblindawareness.org/colour-blindness/>.

Use manual line breaks so that the text is not interrupted in awkward places

- 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



Avoid big empty spaces, too


To make a line break without starting a new item, press Shift+space bar.

Use the "Order" command on the "Draw" toolbar in PPT 2003 to arrange text and figures in layers. Right click on the item you want to arrange and then click on the arrow to the left of the "Send to Back" or "Bring to Front" options to arrange layers.

Extra text boxes don't cost *anything*. You can use more than one on a slide.

Here's how to do a slide make-over

▪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



Add an informative title

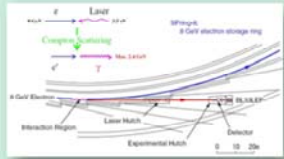
Show some data!

Position important info strategically

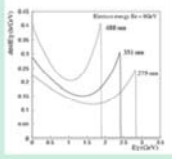
Maximize your slide real estate

Use short captions to orient the viewer immediately

Spring-8 "light" is ≈ 1 billion times more brilliant than conventional X-ray sources




Schematic view of the LEPS beamline and the Compton backscattering process



Differential cross sections for the BCS process between 8-GeV electrons and laser photons

Spring-8: Storage ring for 8-GeV synchrotron radiation
Compton back scatters 351-nm Ar (uv) laser off electrons
Produces 1.5-GeV–2.4-GeV photon beam



Here's how I would improve the previous slide.

- Add a motivating statement at the top of the slide.
- Make the obligatory aerial photo of the accelerator smaller and stick it at the lower right of the slide.
- Turn off the bullets and tighten up the prose to reduce the number of lines of text.
- Use the additional space you've freed up to show a cartoon of the physical process, a schematic of the beamline, and the energy spectra of the photons, and put those images at the top of the slide to emphasize them.

If you just *have* to show the obligatory aerial photo of the accelerator, make it smaller, move it off center-stage, and crop to emphasize the ring, not the surrounding countryside. A scale would be really nice, but although I found 48 different aerial photographs of SPring-8 on the Internet, not one showed how big it is. A label superimposed on the photo that shows where LEPS is located on the ring would be a good addition, too.

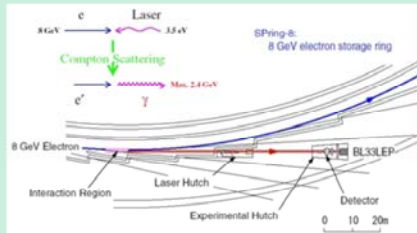
Some technical-editing changes:

- A hyphen is required between 8 and GeV in the first line, 351 and nm in the second line, and 1.5 and GeV and 2.4 and GeV in the last line of text. In every case, the number is combined with the unit to make an adjective that describes the size of the following noun; you indicate that it's an adjective by hyphenating the two components.
- The abbreviation for "ultraviolet" (and infrared) is always written lower case.
- Provide both lower and upper units for numbers in a range.
- Indicate a range by an en dash, not a hyphen.

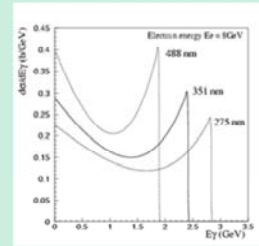
Images taken from <http://www.rcnp.osaka-u.ac.jp/Divisions/np1-b/lepsbl.html>.

Use PPT animation to control the audience's attention while you're speaking

Spring-8 "light" is ≈ 1 billion times more brilliant than conventional X-ray sources



Schematic view of the LEPS beamline and the Compton backscattering process



Differential cross sections for the BCS process between 8-GeV electrons and laser photons

Spring-8: Storage ring for 8-GeV synchrotron radiation
Compton back scatters 351-nm Ar (uv) laser
off electrons
Produces 1.5-GeV–2.4-GeV photon beam



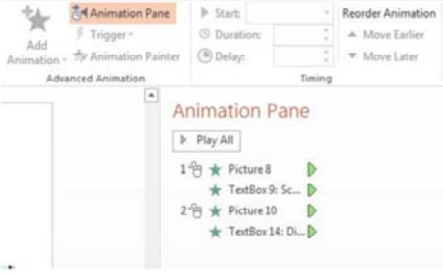

When you present an audience with a complicated slide like this one, they don't know what to look at first and they try to look at everything instead of listening to you. Control their attention by using animations to present bits of information at a time, synchronized with what you are saying.

Using animations requires practice and rehearsal—we've all forgotten about an animation and then were surprised when something popped up when we were expecting that click to bring up the next slide.

Mark up your notes pages to indicate animations so you can keep track of them as you are speaking.

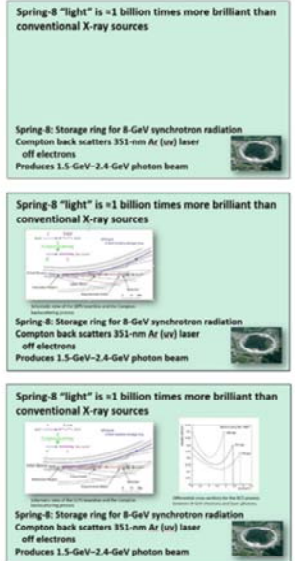
You can “build” slides in one of two ways

Use PPT animation (learning curve)



***Tip: Use the “Insert Duplicate Slide” tool for smooth builds**

Create multiple slides*



The animation tool gives you more control and offers a variety of special effects. However, like anything else, there's a learning curve associated with it, and you'll have to invest time to get good at it.

Creating multiple slides is easier—at least initially—and extra slides don't cost a dime. For best results, do the first, stripped down slide, and then use the “insert duplicate slide” tool to make each subsequent slide. That way, you don't have slight variations in the position of text and figures (which is distracting and annoying) when you switch from one slide to the next.

On the main toolbar in PPT, click on the “Insert” tab.

When the “Insert” ribbon comes up, click on the down arrow on the “New Slide” icon (first one on the far left), and scroll to the bottom of the menu to “Duplicate Selected Slides” and click on it. (I have no idea why MS uses this language; when you click on that item, PPT inserts a duplicate of the slide you are on—you cannot “select” multiple slides. <sigh>)

Technology presents its own challenges
Seminar and conference rooms are increasingly being outfitted with plasma monitors instead of projector screens



Laser pointers don't work on plasma screens

Use a dark background and the cursor to point
Add animated arrows to your slide to point out important features

You could point out features with your hand, but the monitors are often mounted on the wall across the room, or behind you, where you cannot easily reach them without really distracting the audience.

Don't try to use your laser pointer and then say, "Huh! The laser pointer doesn't work. Wow! Now what do I do? Well, I guess you can see what I mean..."

USE THE MOUSE TO MOVE THE CURSOR and hope most people can see it.

To recap:

Think about what the audience wants and how you can best convey that information

Use motivating statements at the top of your slides, not bland, generic "titles"

Use a neutral background with a high-contrast font, and *embed* your fonts

Select colors and images judiciously

Control the audience's attention using animation

Keep up with technology

$$p = \frac{50}{8}, \quad [1]$$



cmelliot@illinois.edu

<http://physics.illinois.edu/people/Celia/>

Notes and Questions: