Clear, Concise, Compelling.
How to Present Your Science to Best Effect
(and Be Your Best While Presenting Science!)

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Career Development Workshop for Women in Physics
ICTP - Trieste, November 2023

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Presenting your research is critical for a successful career in science*

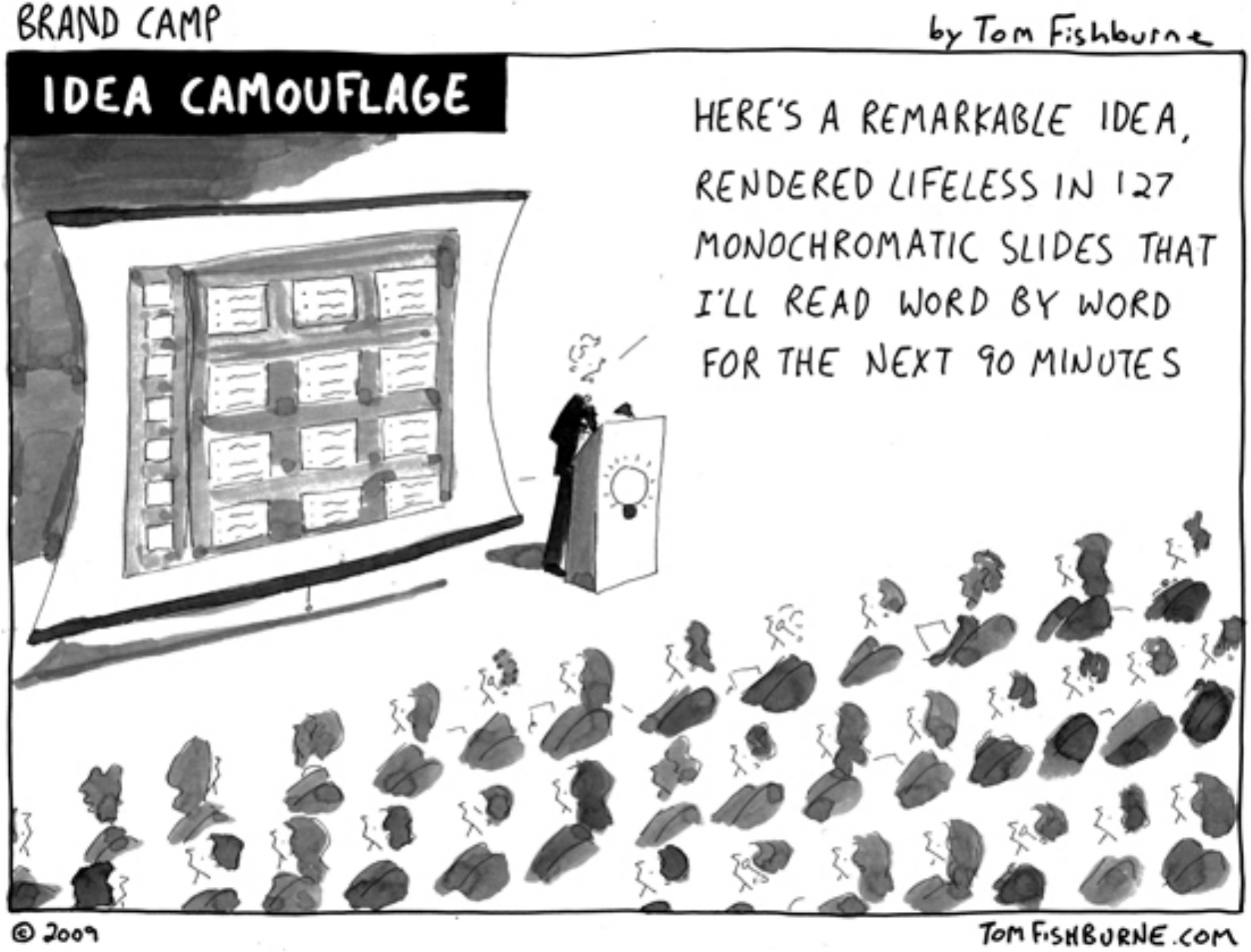
- Seminars
- Conferences
- Meetings
- Job interviews
- Dissertation defense
- Teaching
- Funding proposals/renewals
- Public lectures

*Slides adapted from Dr. Alison Hatt's presentation

Before we start with rules and standard guidelines…

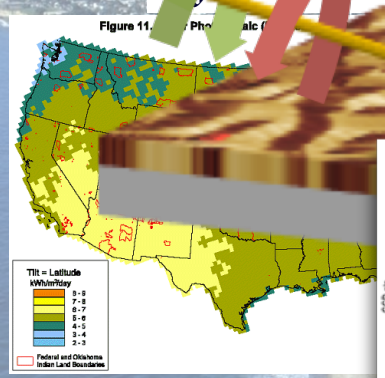
What is the ultimate purpose of presenting and sharing your work?

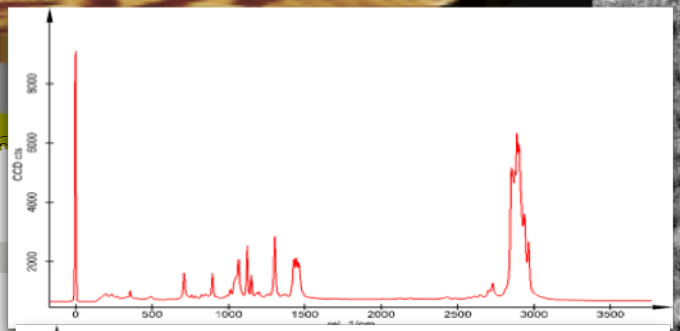
- Being understood
- Keeping attention up
- Sparking interest and curiosity

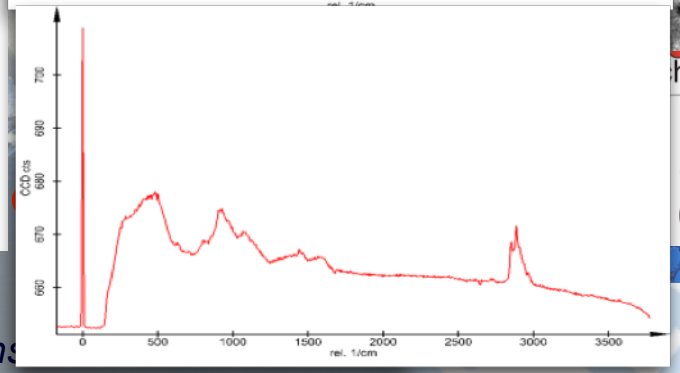

BRAND CAMP
by Tom Fishburne
IDEA CAMOUFLAGE
HERE'S A REMARKABLE IDEA, RENDERED LIFELESS IN 127 MONOCHROMATIC SLIDES THAT I'LL READ WORD BY WORD FOR THE NEXT 90 MINUTES
© 2009
TOMFISHBURNE.COM

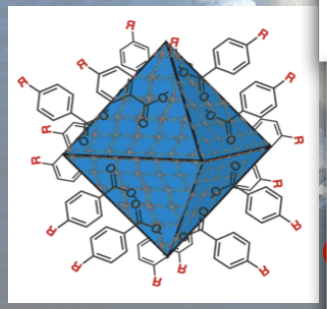
Another approach to camouflaging your ideas using powerpoint overkill….

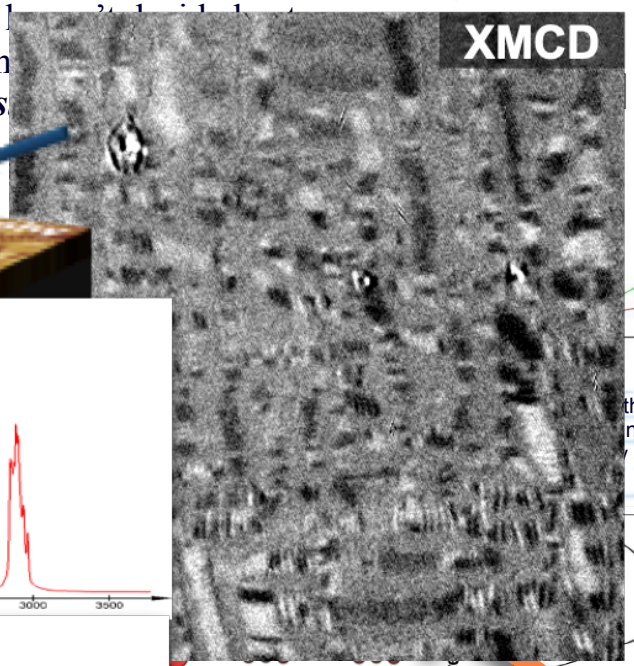
- important fact buried in a long sentence that you won't have time to read
- Another important fact that I will not refer to in the remainder of the presentation
- something that may or may not be important; I
- Yet another bullet that I've included incase som
- O more point, t***his time inexplicably emphas***
its important

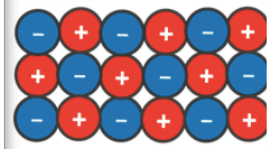


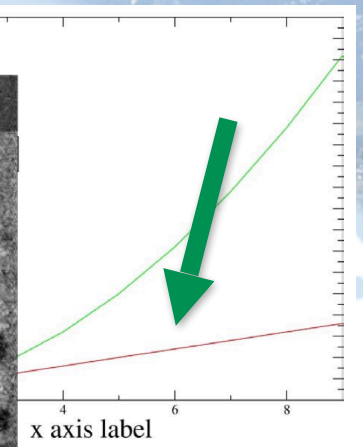




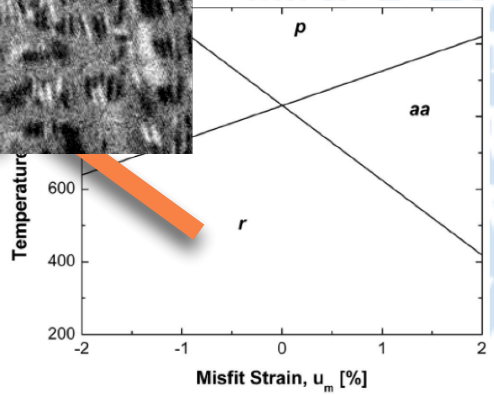








the plot, too small
ncluded anyway
advisor likes



There are six steps to create and execute an effective oral presentation

Plan the presentation

Design the presentation

Make the slides

Part 1

Practice the presentation

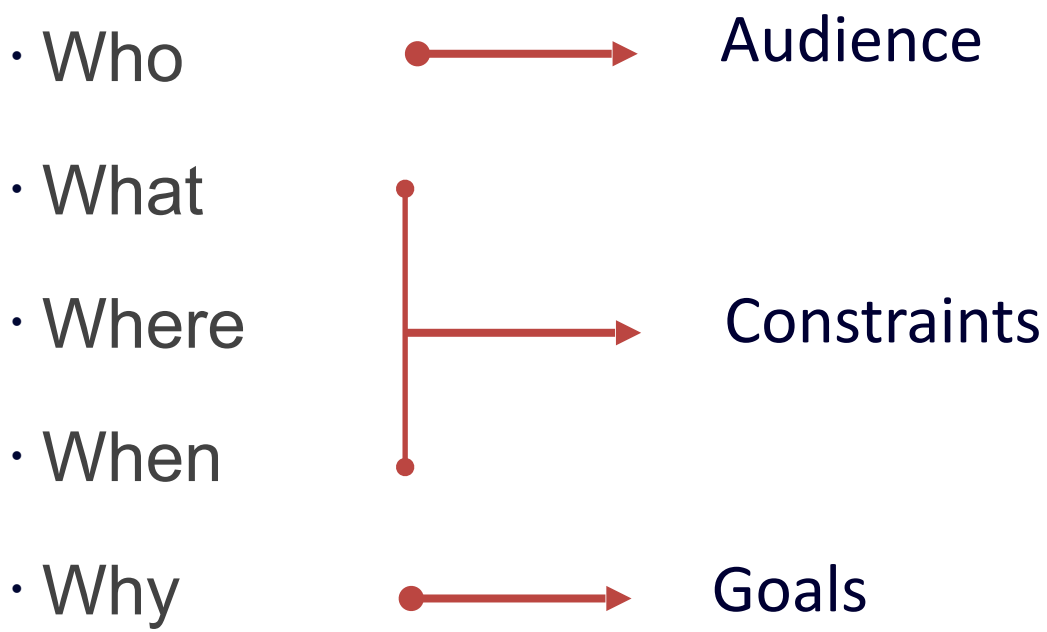
Deliver the presentation

Answer questions

Part 2

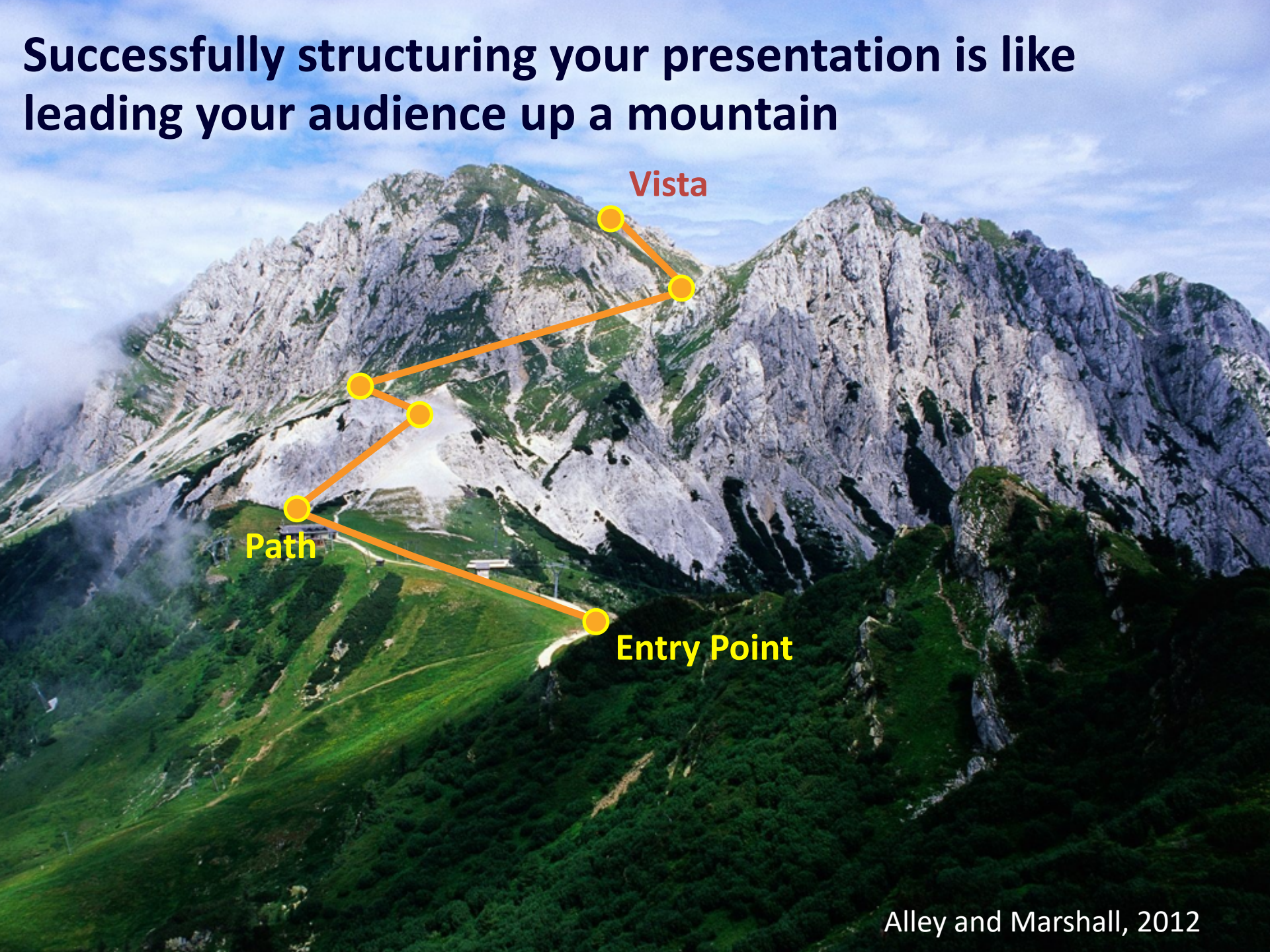
Doumont, 2009

Planning requires identifying your parameters



Doumont, 2009

Successfully structuring your presentation is like leading your audience up a mountain

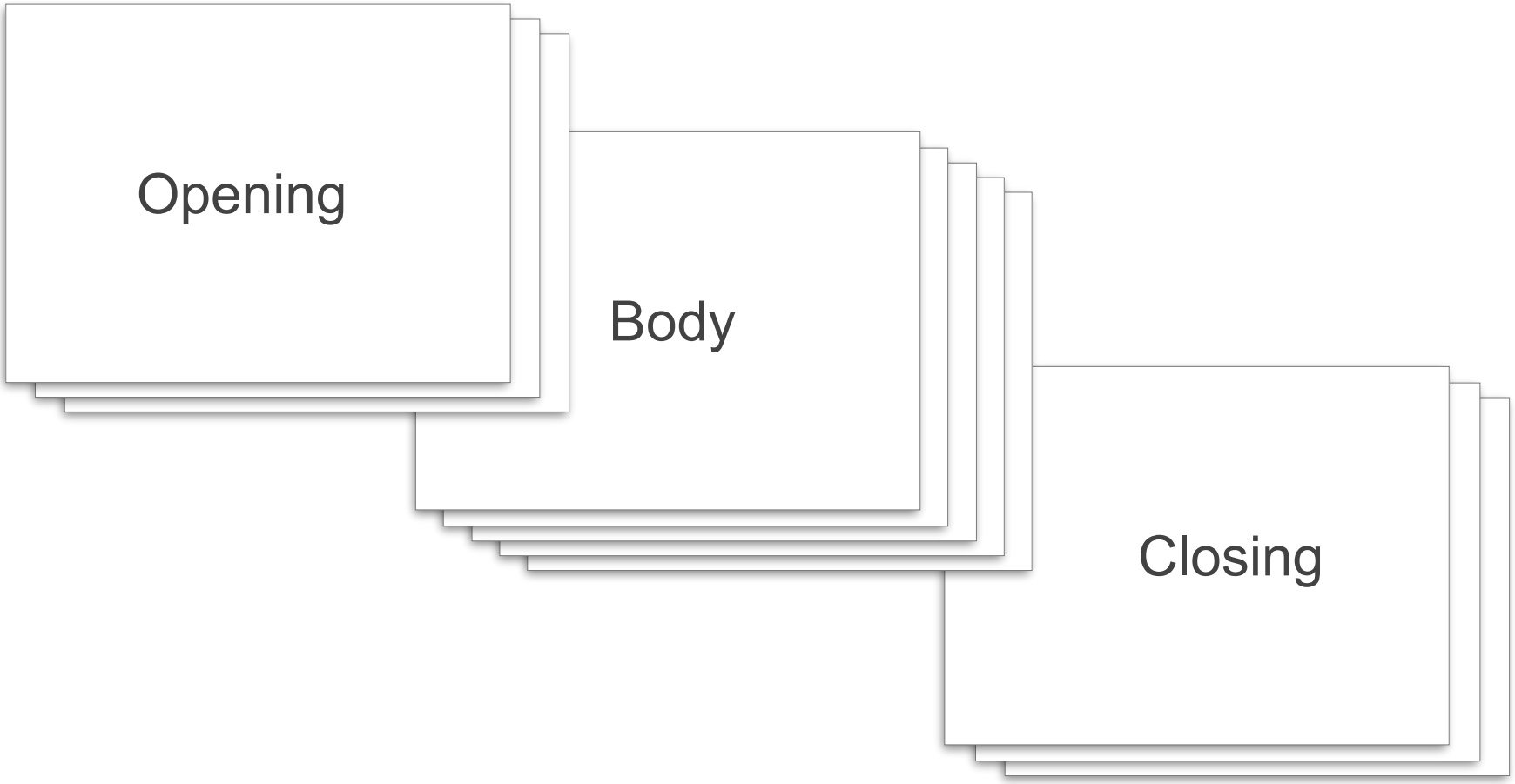


Alley and Marshall, 2012

An effective presentation must have a clear structure

Opening	**Attention getter** **Main message** **Preview**
Body	**Point 1** **Point 2** **Point 3** **…**
Closing	**Review** **Conclusion** **Close**

Use slides to support and reinforce your message



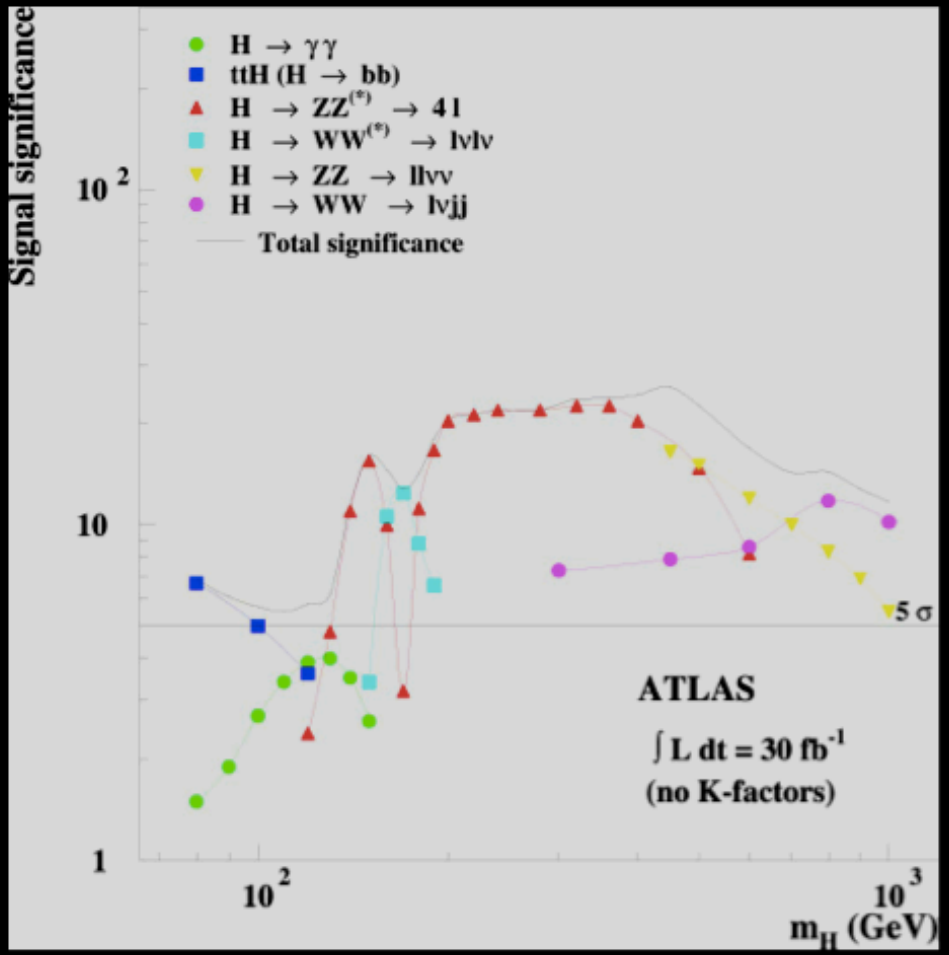
Bad slides are worse than no slides

Context

- NSF/JISC International Digital Library Grant
  - **Cross-Domain Resource Discovery: Integrated Discovery and Use of Textual, Numeric and Spatial Data**
- UC Berkeley DLI2 Grant:
  - **ReInventing Scholarly Information Access**
- UC Berkeley working with the University of Liverpool/ Manchester Computing with participation from
  - DeMontfort University (MASTER)
  - Art and Humanities Data Service (http://ahds.ac.uk/)
    - OTA (Oxford), HDS (Essex), PADS (Glasgow), ADS (York), VADS (Surrey & Northumbria)
  - Consortium of University Research Libraries (CURL)
  - UC Berkeley Library (and California Digital Library)
    - Making of America II
    - Online Archive of California
  - British Natural History Museum, London
  - NESSTAR (NEtworked Social Science Tools and Resources)

Higgs Boson at LHC

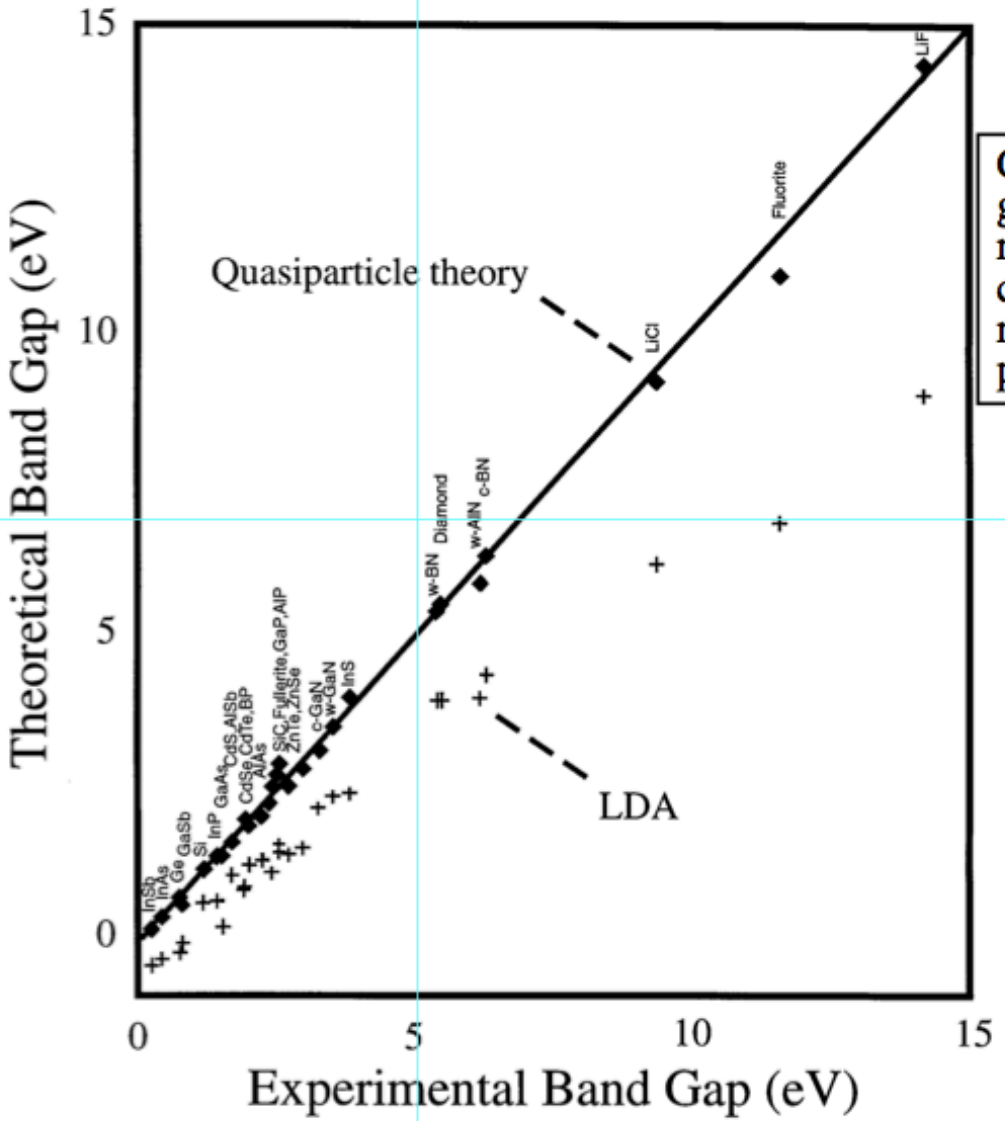
- LHC would discovery Standard Model Higgs boson of any mass within 3 years! (2011?)
- Does it settle the issue? *I'm afraid not*.
- Suppose $H \rightarrow \gamma\gamma$ discovered, cross checked by *ttH* final state
- Technipion? Scalar or pseudo-scalar? Does it couple to *W/Z*?



Band Gaps: GW Quasiparticle Results vs Experiment

Materials:

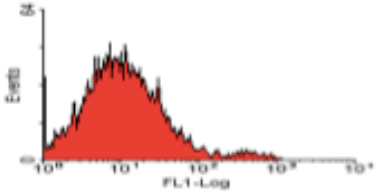
InSb, InAs
Ge
GaSb
Si
InP
GaAs
CdS
AlSb, AlAs
CdSe, CdTe
BP
SiC
C_{60}
GaP
AlP
ZnTe, ZnSe
c-GaN, w-GaN
InS
w-BN, c-BN
diamond
w-AlN
LiCl
Fluorite
LiF

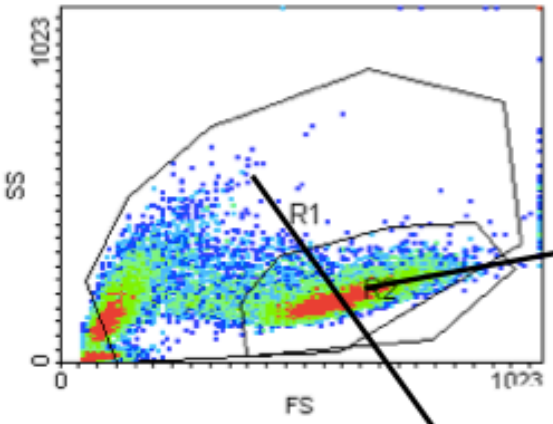


GW also gives good dispersion relations as compared to angle-resolved photoemission.

S.G. Louie in *Topics in Computational Materials Science* (World Scientific, 1997)

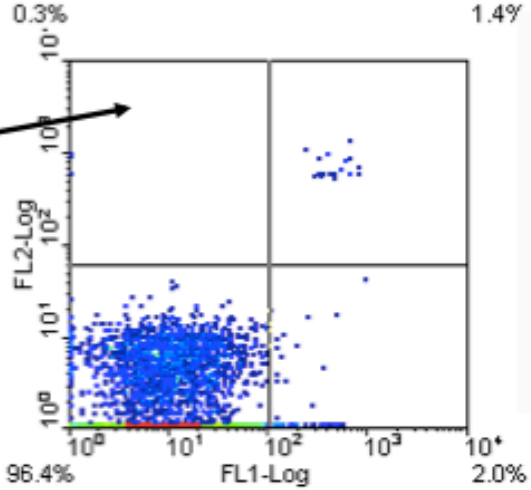
Flow Cytometry Data

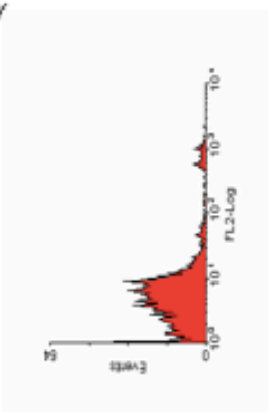


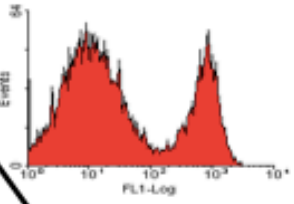


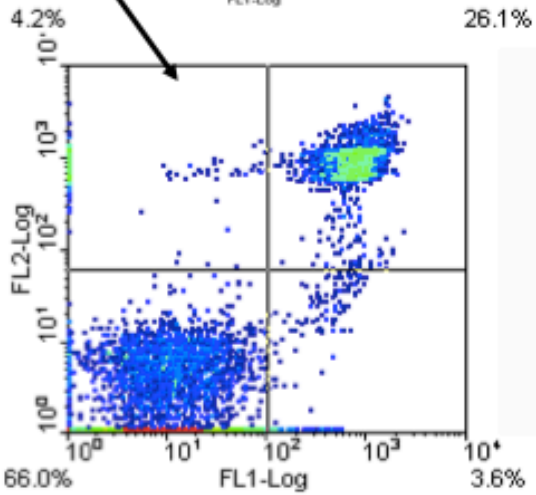
Smaller Region, Live cells mostly

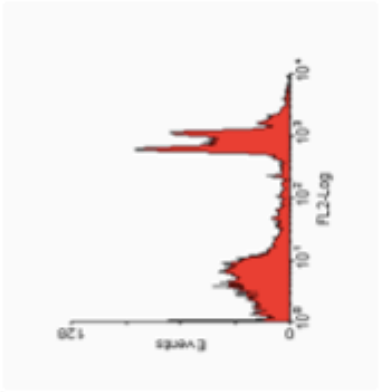
Larger Region includes all cells



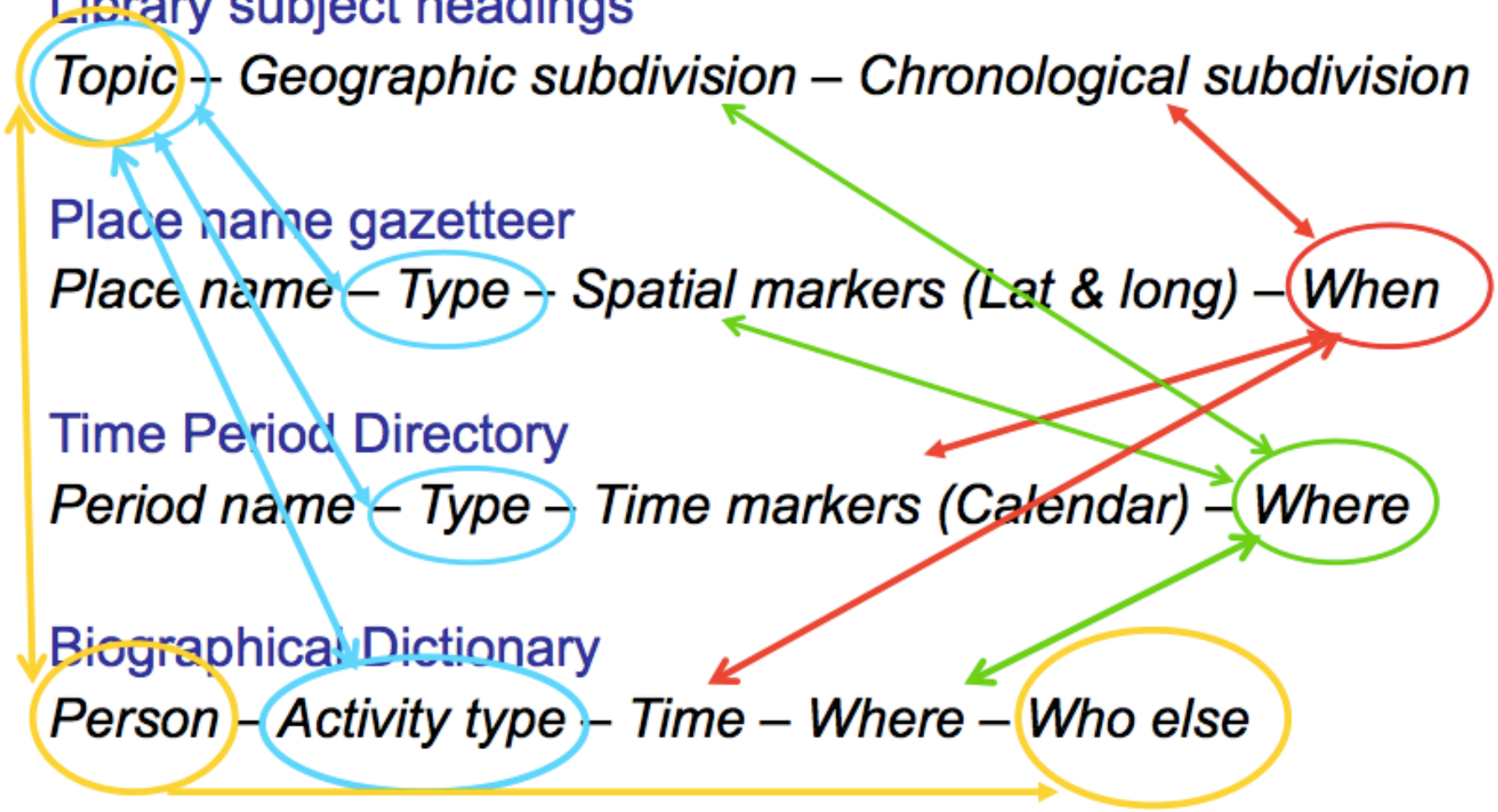








Comment: Facet genres include other facets



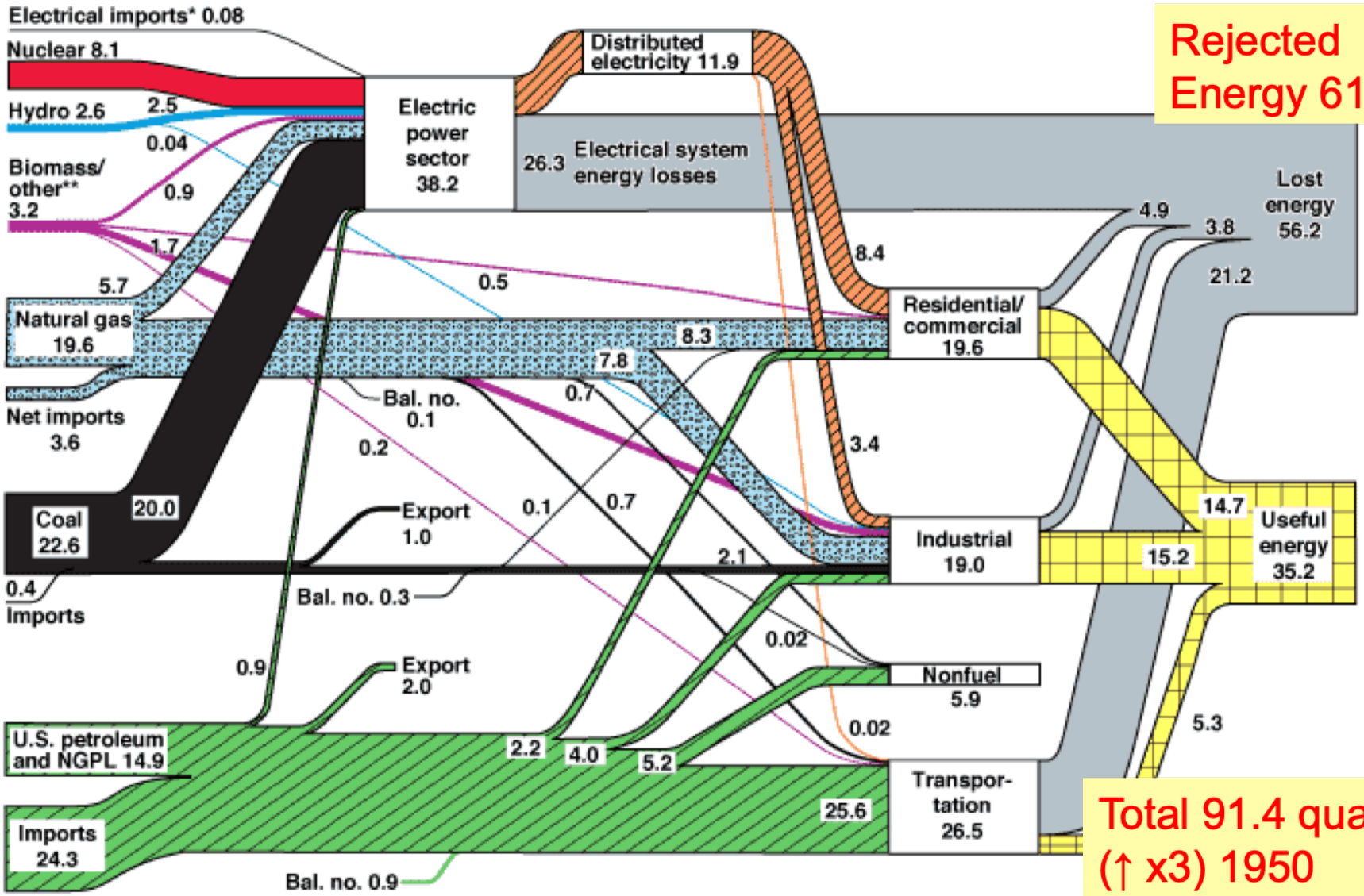
Percent Citing Factor As "Very Important*" in Career Goal Shift		Total	Men	Women
1	Negative experience as PhD student	45%	44%	46%
2	Other life interests	42%	35%	48%
3	Professional activities too time consuming	41%	35%	45%
4	Issues related to children	36%	21%	46%
5	Geographic location issues	35%	28%	40%
6	Feelings of isolation/alienation as PhD student	33%	31%	35%
7	Bad job market	30%	29%	30%
8	Career advancement issues	30%	34%	27%
9	Job security	29%	29%	29%
10	Spouse/partner issues or desire to marry	27%	22%	32%
	N=	956 to 1,201	402 to 529	550 to 666

*"Not applicable" is excluded from analysis.

Yellow shading indicates the group's response is significantly higher than the other group's response (P<.01).

Source: Mason, Mary Ann and Marc Goulden. 2006. "UC Doctoral Student Career Life Survey."

U.S. Energy Flow Trends – 2002
Net Primary Resource Consumption ~97 Quads



Rejected Energy 61%

Total 91.4 quad (↑ x3) 1950

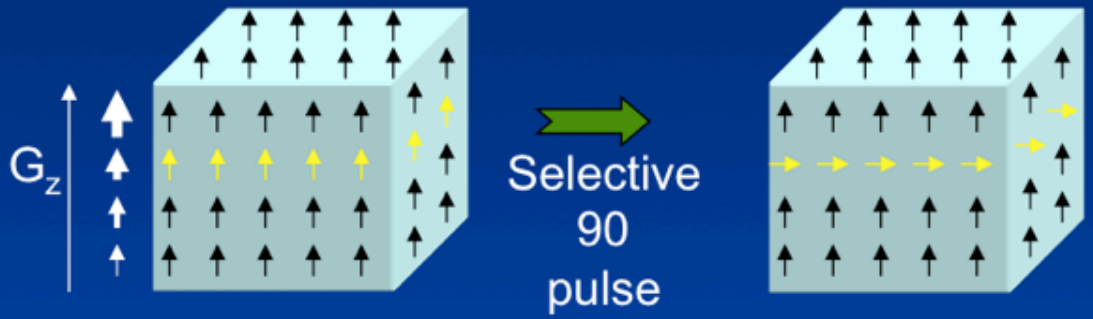
Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2002.*
*Net fossil-fuel electrical imports.
**Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

Principles of 1DMRI

Slice Selection: *z*-Gradient

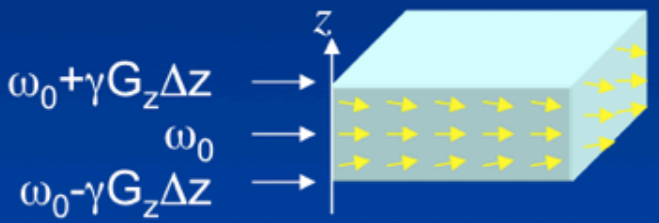
Gradient Echo Pulse. Gradient Echo pulse restores all spins to have the same phase within the slice Δz.

$B(z) = B_0 + G_z z$



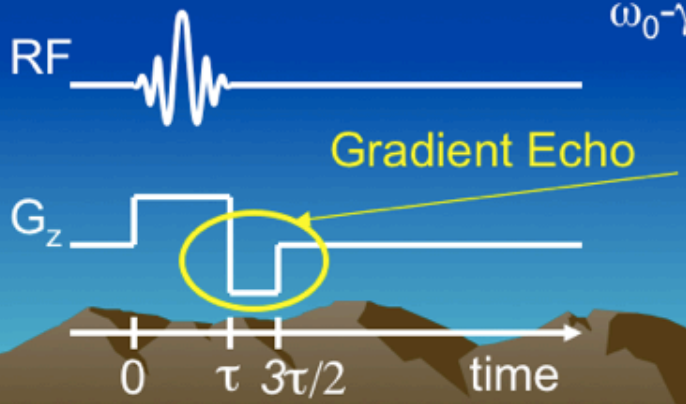
Before Gradient Echo

$t = \tau$

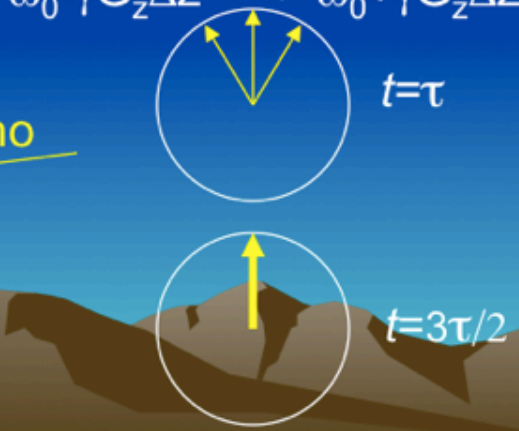


Spins out of phase on *xy* plane

Pulse Sequence



Top View of xy plane



After Gradient Echo

$t = 3\tau/2$

Spins all IN phase

Most slides suffer from the same problems:

Too much information

Too much text

Text hard to read

Noisy design

Unsuitable images

Message not clear

To make a better slide, you need to:

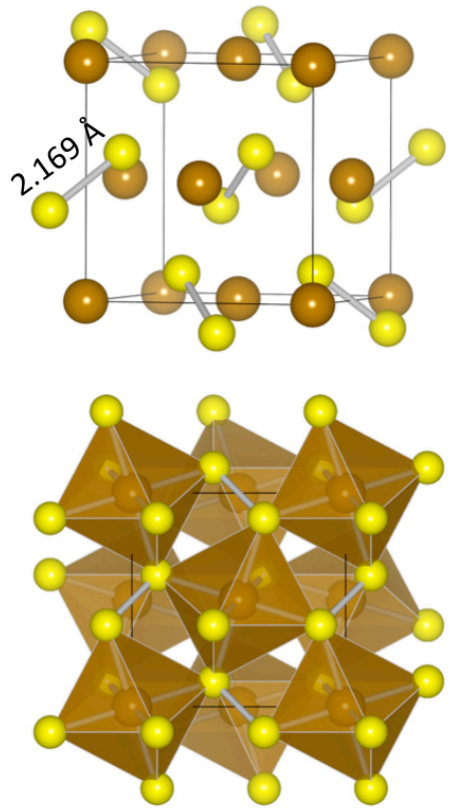
1) Figure out what the message is

2) Make that message as clear as possible

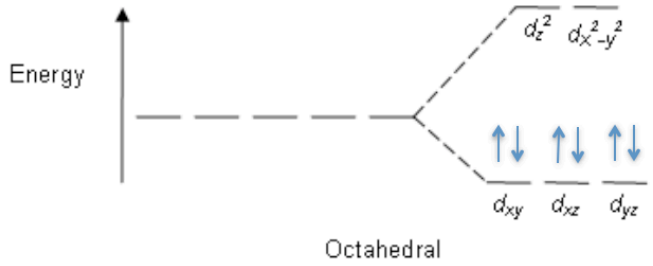
Could this slide be more effective?

FeS_2 Basic Structure

The Molecular Foundry
A Nanostructures User Facility

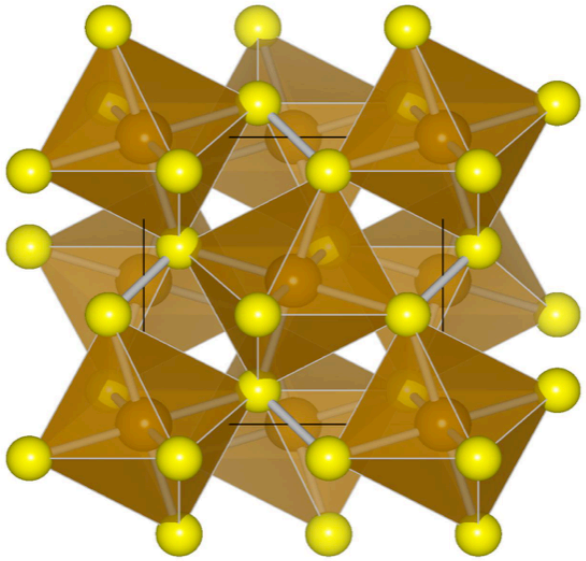


- Face-centered-cubic
- Lattice parameter = 5.416 Å
- Only two unique atom positions
- Low spin semi-conductor
- The Fe^{2+} d-states are split into t_{2g} and e_g states.
  - All six d-electrons fully occupying the t_{2g} states.
  - Empty e_g states

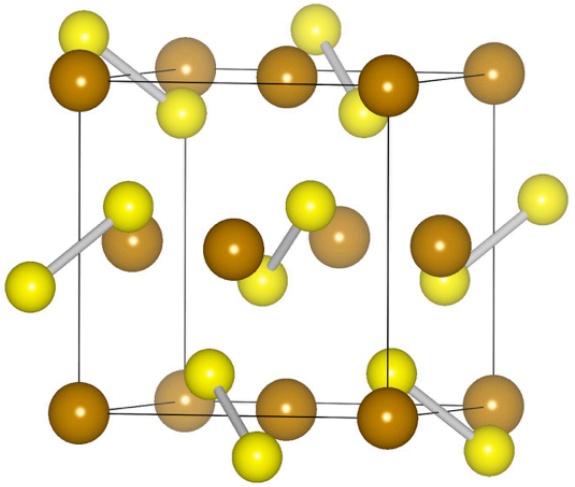


This revised slide has a clear message

The pyrite structure can be described as a system of corner-sharing octahedra or as a network of sulfur dimers



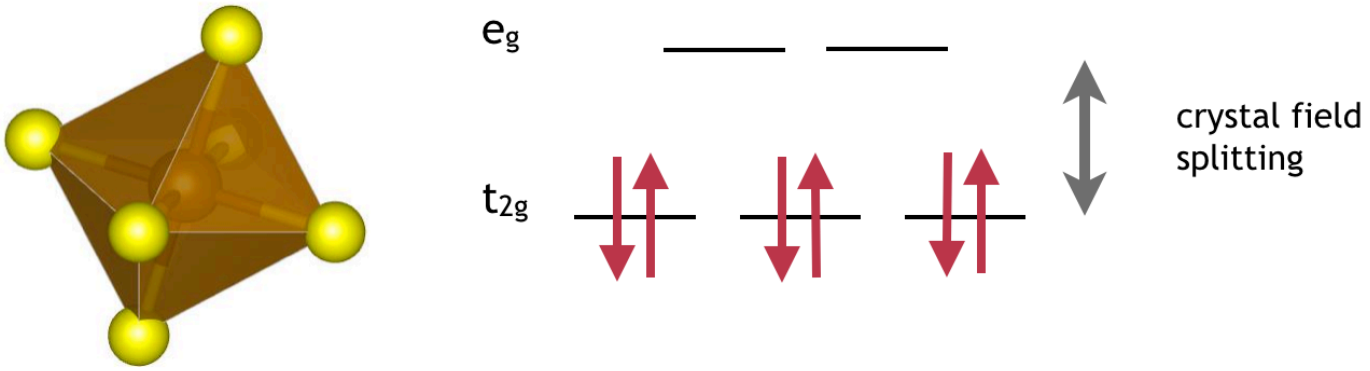
corner-sharing octahedra



network of sulfur dimers

This revised slide has a clear message

The octahedral crystal field splits Fe *d* states into two bands

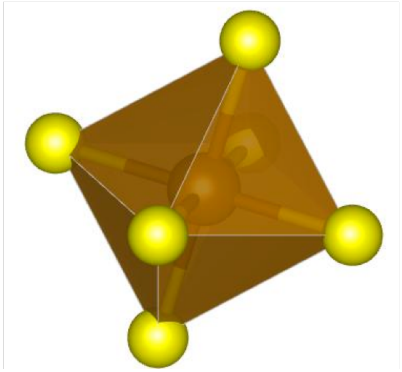


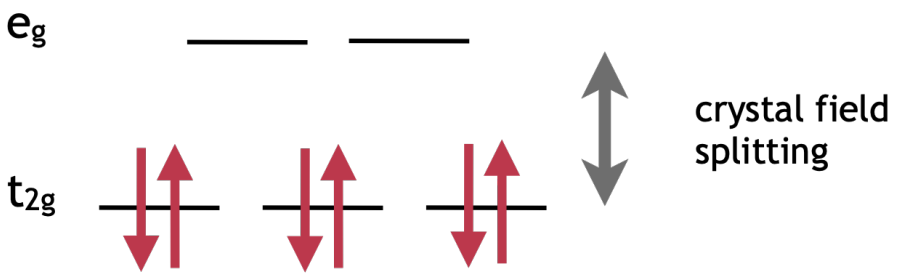
An assertion/evidence slide structure makes the message clear and compelling

Assertion

The octahedral crystal field splits Fe *d* states into two bands

Evidence





Audiences have better comprehension of presentations that use an **'Assertion-Evidence'** slide format

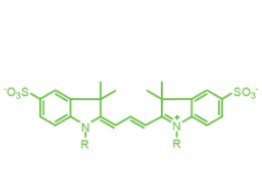
1. Build your talk on messages (not topics)
2. Support these messages with visual evidence (not bullet lists)
3. Explain this evidence by fashioning words on the spot

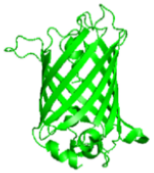
Michael Alley, Prof. of Engineering Communication
Additional resources: https://www.assertion-evidence.com/

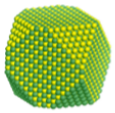
Could this slide be more effective?

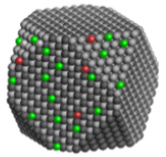
Probes for Single-Molecule Imaging

Pros and Cons









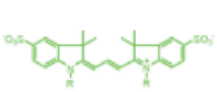
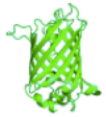
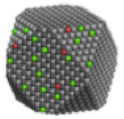
Ideal properties:

	small organics	fluorescent proteins	quantum dots	upconverting nanoparticles
• brightness	✡✡✡	✡✡✡	✡✡✡	✡✡✡
• photostability			✡✡✡	✡✡✡
• emission continuity				✡✡✡
• (lack of) overlap with cellular autofluorescence	✡	✡	✡✡	✡✡✡
• near-IR			✡✡	✡✡✡

MOLECULAR FOUNDRY

This revised slide has a clear message

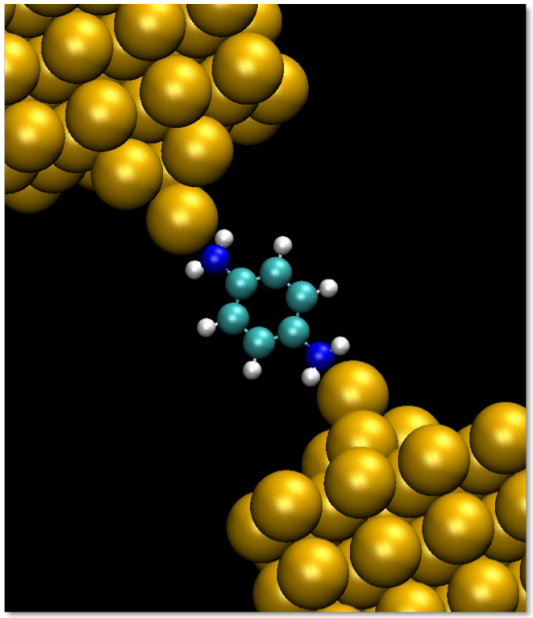
Upconverting nanoparticles have superior properties for single-molecule imaging

	small organic molecules 	fluorescent proteins 	quantum dots 	upconverting nanoparticles 
brightness	✓✓✓	✓✓✓	✓✓✓	✓✓✓
photo stability			✓✓✓	✓✓✓
emission continuity				✓✓✓
minimal overlap with cellular autofluorescence	✓	✓	✓✓	✓✓✓
near-IR sensitivity			✓✓	✓✓✓

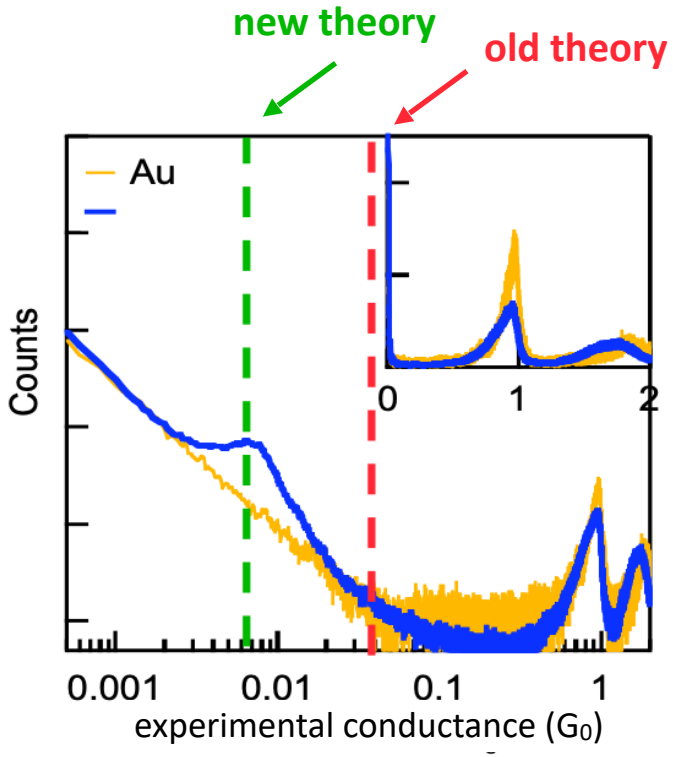
focus of this talk

An assertion/evidence structure makes the message clear and compelling

Understanding charge transport across single-molecule junctions required advances in theory



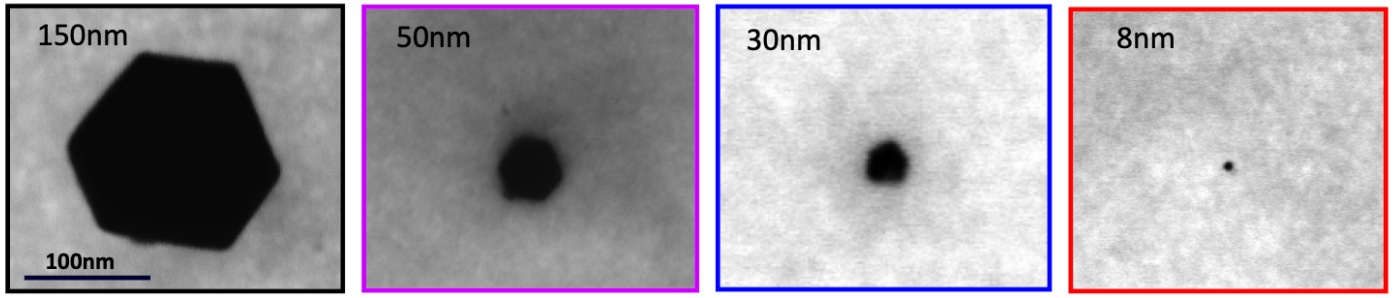
Benzene-diamine between Au electrodes



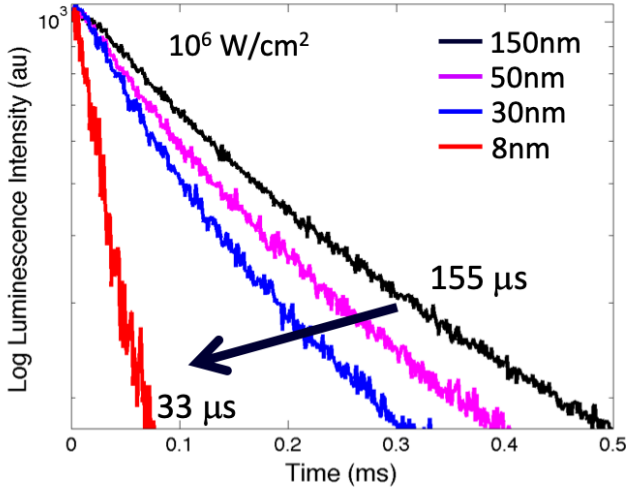
Su Ying Quek, Steve Louie, Jeff Neaton et al.

An assertion/evidence structure makes the message clear and compelling

Surface effects dominate kinetics in small UCNPs



Luminescence Lifetime vs UCNP diameter



Gargas*, Chan*, Altoe, Cohen†, Schuck† *et al.* *Nature Nanotech.* 9, 300 (2014)

We see some emerging guidelines for making effective slides

One or two messages per slide

Maximize signal-to-noise ratio

Assertion/evidence slide structure

More details on the structure of the presentation:

Outlines

Plots

Figures

Text Placement and Fonts

Conventional outline slides are not compelling

Outline

Section I: Semiconducting Polymers for Organic Photovoltaics

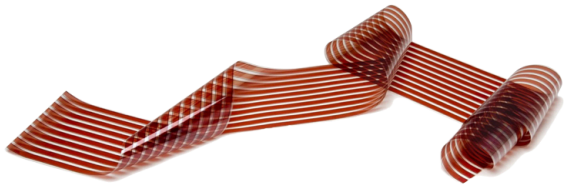
- Background: Conjugated Polymer Photovoltaics
- Methods: Transient and Steady-State Photoconductivity
- Results: Photogeneration of Mobile Carriers
- Future Work

Section II: Solution-Processed Inorganic Semiconductors and Neutron Detectors

- Background: Neutron Detector Principles
- Methods: Radiation Sensing
- Results: Synthesis and Fabrication of Films,
- Results: Photodetectors
- Future Work

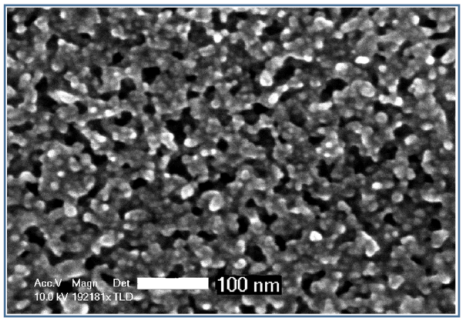
An unconventional outline slide can be much more engaging

Overview: This talk addresses photonic and electronic properties of solution-processed semiconductors



Section I

Measuring transient and steady-state photoconductivity in organic photovoltaics

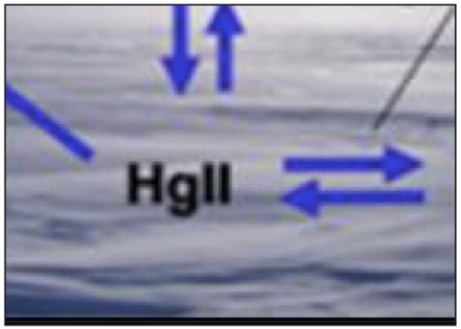


Section II

Detecting photons and neutrons with solution-processed inorganic semiconductors

A “mapping” slide can be used in place of an outline

This talk traces what happens to mercury after it depletes from the atmosphere in arctic regions



Theory for mercury cycling

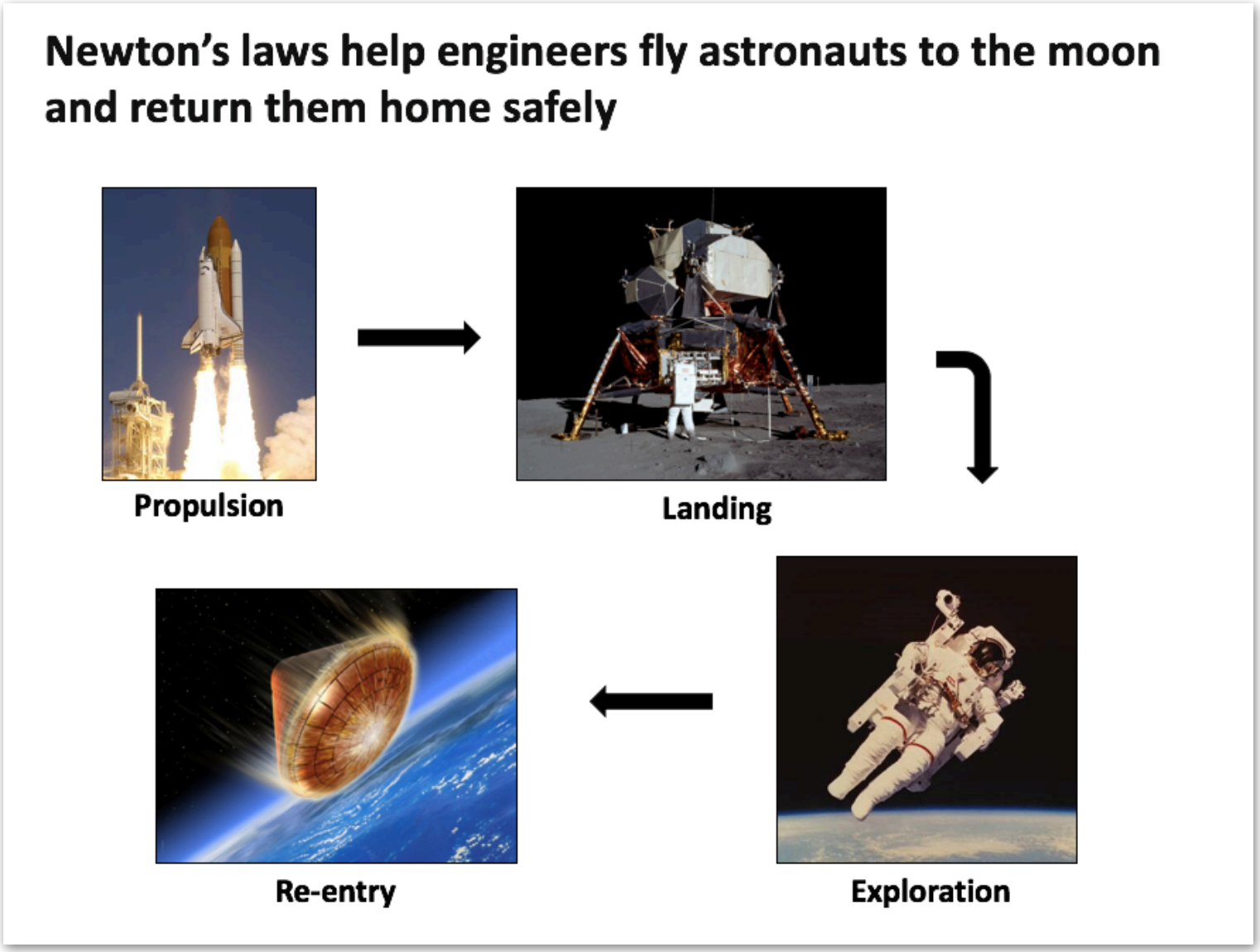
Measurements from Station

Environmental implications

6

Alley and Marshall, 2012

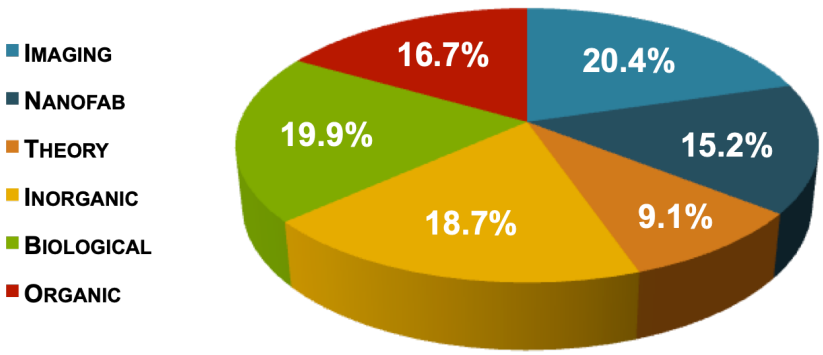
A “mapping” slide can be used in place of an outline



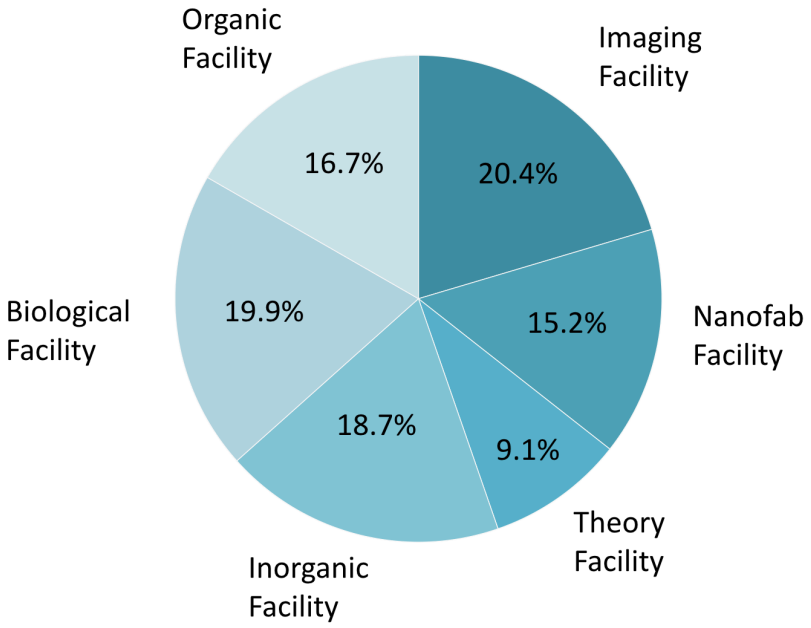
Alley and Marshall, 2012

Plots should be designed for maximum clarity

Bad!

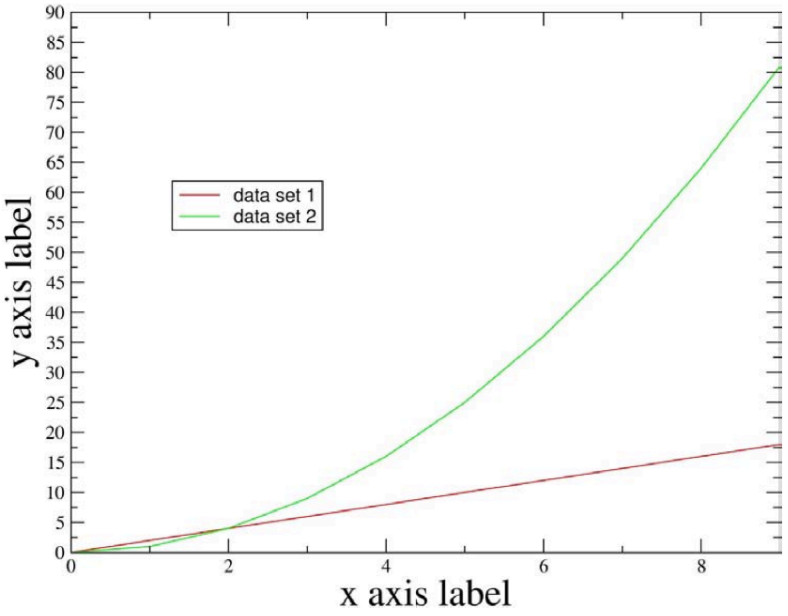


Better!

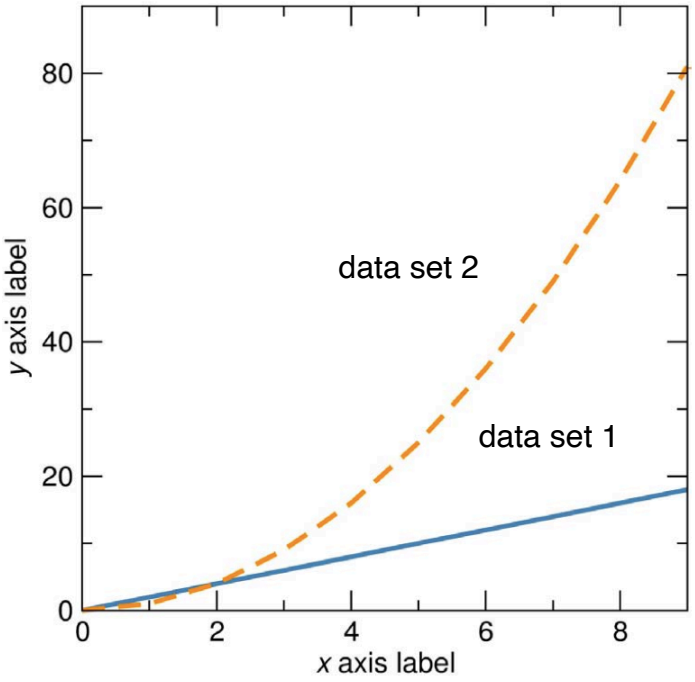


Plots should be designed for maximum clarity

Bad!



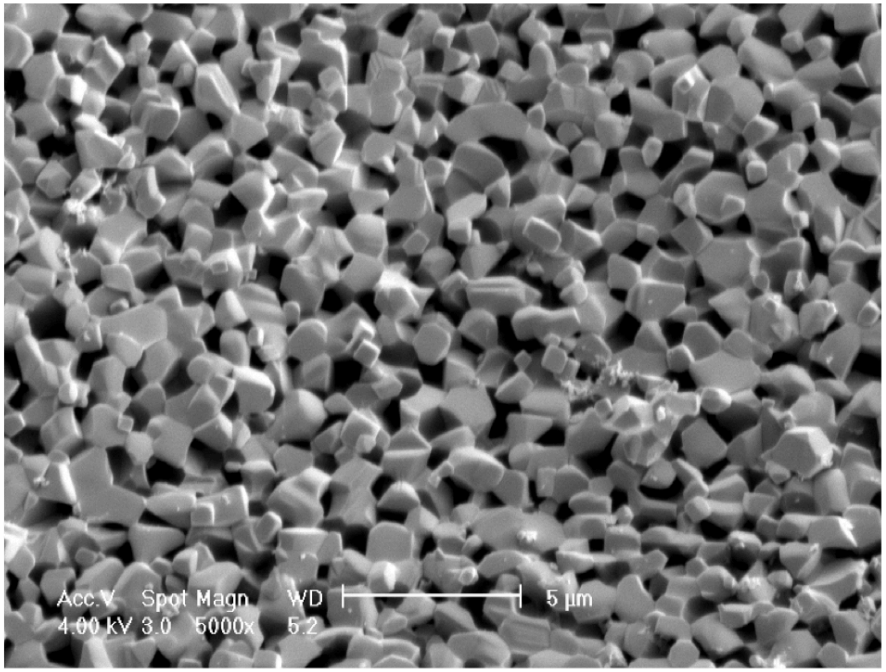
Better!



Seshadri, 2010

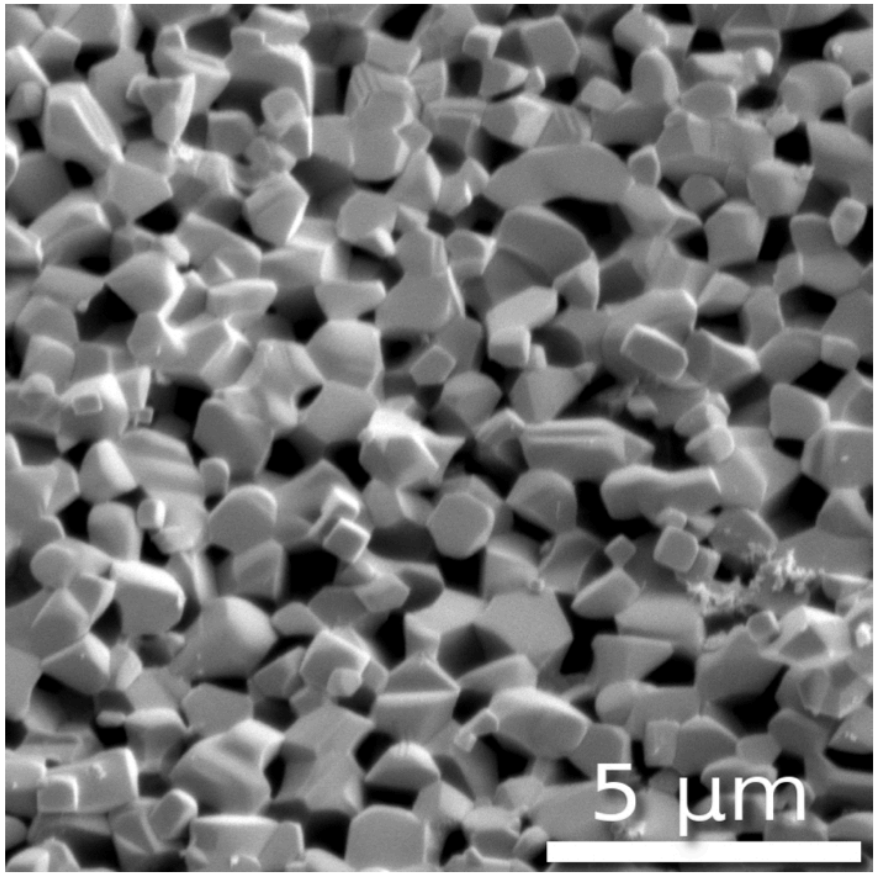
Microscopy images usually need to be modified

Bad!



As output from microscope

Better!



Modified for presentation

Seshadri, 2010

Use simple, clean text formats to maximize slide clarity

Use simple, clean text formats to maximize slide clarity

Use simple, clean text formats
to maximize slide clarity

Colored backgrounds with light text is harder to read than black on white.

Simple, sans-serif fonts are easiest to read
(Arial, Calibri, Helvetica…)

Stylized fonts are harder to read than simple fonts.

Serif fonts are harder to read than
sans-serif fonts.

Remember: if it’s not signal, it’s noise!

Summing up, we have discussed the first three steps for effective presentations

- Planning — **Identify your constraints and goals**
- Designing — **Map a route up the mountain**
- Making slides — **Communicate messages**

Resources and References

“Preparing figures for publication and presentations,” Ram Seshadri, 2010.

https://www.mrl.ucsb.edu/~seshadri/PreparingFigures.pdf

Free download.

“The Craft of Scientific Presentations.” Michael Alley

http://www.craftofscientificpresentations.com/

See website for templates and tutorials on the assertion-evidence approach.

“Trees, maps, and theorems. Effective communication for rational minds.”

Jean-luc Doumont.

http://www.principiae.be/X0300.php

Before we start with rules and standard guidelines…

What is the ultimate purpose of presenting and sharing your work?

- ✦ Be understood
- ✦ Keep attention up
- ✦ Spark interest and curiosity

Now to undo some of the things I have mentioned…

What is the most effective way for YOU to achieve that?

Thank you for your attention!