PREPARATION OF EFFECTIVE SCIENTIFIC TALKS

J.D. Callen
University of Wisconsin-Madison
(given by David Newman UAF)

Theses:
• Giving good scientific presentations (talks or posters) is important.
• There are a number of elements involved in preparing effective scientific talks. Practice!!!

Outline:
• Importance
• Steps In Talk Preparation
• Talk Organization
• Preparation Of Visuals
• Some key points and examples
• Special Considerations For Poster Sessions
• Summary
Giving Effective Talks Is Important

- Your Important Results Should Be Communicated To The Scientific Community
  - If results are not important, why is talk/poster being given?

- Your Professional Reputation Will Depend In Large Part On How Well You Communicate Your Key Results
  - If your colleagues cannot understand your work, they will have little appreciation of it or your contributions to it

- Competing Ideas Are Often Forcefully Presented
  - Major laboratories have presentation courses, talk rehearsals, etc. to hone their talks
A Number Of Steps Should Be Followed In Preparing A Talk

- Consider Audience, Level And Mode Of Presentation
  Specialists, generalists, etc.
  Oral, poster, demonstration, etc.

- Decide On Presentation Thesis
  What do you want listener to learn from talk (prepare summary and presentation thesis visuals first!)?

- Prepare Visuals To Develop Sequentially The Key Points Of The Presentation Thesis
  Say only what needs to be said | eliminate irrelevant information
  Put work in proper context for full spectrum of prospective audience
  Take out or explain jargon, especially local jargon

- Give Rehearsal Before Colleagues
  Revise as necessary
Talks Should Be Tightly Organized

- First Visual
  Title, author, presentation, abstract (if appropriate), thesis, brief outline
- Second Visual (if not covered on first visual)
  Presentation thesis
- Third Visual (if not covered on previous visuals)
  Outline of points to be made to support presentation thesis
- Fourth, ... Visuals
  Development of key points that substantiate presentation thesis
- Last Visual
  Conclusion or summary that should follow from presentation thesis and body of presentation
- In Oral Presentations Allow About One Minute Per Visual
Effective Visuals Have 5 Components

(outline of topics covered in most of remainder of this talk)

• **A Title That Is A Thesis**
  What is to be learned from this visual?

• **No More Than Six Major Points**
  More will seldom be absorbed by audience

• **Large, Clearly Readable Lettering Separated By Adequate Spacing**
  Key points should be obvious, not buried

• **Self-Explanatory Major Elements**
  Audience should be able to grasp major points without verbal explanation

• **Maximum Use Of Graphs Or Pictorials**
  A picture is worth 1000 words"
Every Visual Should Have A Thesis

- A Thesis Takes The Form Of A Simple Declarative Sentence With An Action Verb
  The titles of these visuals provide examples

- A Thesis Makes A Statement
  It is a statement of the point made or proved on the visual – "message" of the visual
  It is not simply a label – e.g., not "graph of y versus x," "this is a horse"

- Limit The Thesis To 10 Words Or Less, If Possible
  More words usually just indicates verbosity

- The Major Points Developed In A Talk Should Be Obvious From Reading The Theses (Titles) Of The Visuals
  The titles of the visuals should provide the observer with an outline of the key points of the talk
  They should also lead to the conclusion(s) presented on the last visual
Too Much Information On A Visual Tends To Obscure The Basic Message Which Is Being Presented On A Visual

• Most People Do Not Absorb More Than Six Facts From Any One Visual
• Putting More Facts On Any One Visual Tends To Confuse The Basic Message
• It Is Difficult To Compress A Lot Of Information Onto One Visual
• It Is Better to Limit The Amount Of Information On A Visual To Only The Critically Important Issues
• By Putting Too Many Points On One Visual, One Tends To Confuse Trivial Points With Important Ones
• One Should Decide Which Are The Important Facts Germane To The Thesis Of The Visual And Limit The Visual To Those Facts
• Major Facts Can Be Amplified By Subfacts Subfacts can be indicated by a different typeset or capitalization
• If Too Many Facts Are Presented On A Visual The Audience's Long Term Memory May Be Dominated By A Trivial Fact
• The Various Facts On A Visual Should Be Presented Hierarchally With The Major Facts Obviously Dominant And The Minor Ones Subordinate
• Ample Space Should Be Left Between Separate Points So They Don't Become Blurred Together
• Major Points Should Be Explained In As Simple And Clear A Form As Possible

Example of a bad visual|far too much stuff on one visual
Use No More Than Six Statements Or Concepts Per Visual

• Audience's Short Term Memory Saturates At About Six Facts Per Visual
• More Will Confuse The Audience And Obscure Your Message
• Worse, A Trivial Fact May Replace An Important One In The Audience's Long Term Memory
• Statements Or Concepts Discussed At Each Level Of The Hierarchy Of Visual Elements Should Be Of Comparable Importance
  • Subordinate points can be distinguished by indentation, a smaller font, or less capitalization
Visuals Should Be Very Readable

- Use Large, Clearly Readable Lettering
  - Maximum should be about 10 lines of up to 30 letters per line

- Provide Adequate Spacing Between Major Elements
  - Otherwise points get blurred visually and conceptually

- Make Key Points Obvious Visually
  - Subordinate points should be indented, have smaller letters, not be capitalized, etc.

- Present Major Elements Clearly
  - Use simple statements, formulas, graphs, etc. and only those necessary to elucidate the key points
Major Elements Of Visuals Should Be Self-Explanatory

- Material Is More Understandable If Audience Can Independently Comprehend The Major Elements
  - Talk structure should reflect logic of critical scientific elements and their interrelationships

- Message Should Be Apparent Without Speaker's Verbal Presentation
  - Key points of talk should be apparent from visuals themselves
  - People don't always listen carefully to what the speaker says

- Audience Tends To Read Past Speaker's Present Point In Presentation
  - Did you read this before I said it?
Develop Analog Graphics For Many Of Your Visuals

- Audience Recall Of Analog Graphics (Curves, Sketches, Graphs, Bar Charts, etc.) Seems To Be Unlimited
- Reinforcement Of Facts And Ideas By Use Of Pictorials Improves Audience Recall By A Factor Of 10
- Analog Graphics Improves Retention Of Facts And Ideas Over Use Of Statements And Equations
Terrible Experimental Data Illustration

No title, no labels, no indication of what the data represent or why there is a line on the graph
How is viewer supposed to figure out what the speaker wants to convey
Poor Experimental Data Illustration

- Title is only a label, not thesis of visual - it only tells us “this is a graph”
- Labeling is not helpful - case 1, 2?, what are n, p₀?
- Not clear what message of this graph is - the author can plot points near a line on n vs. p₀ graph?
Plasma Density Increases Linearly With Filling Pressure

- Better Experimental Data Illustration
  - Simple declarative title with action verb that is thesis of graph
  - Axes and points are labeled physically and understandably
  - Graph supports declarative title/no more or less information than necessary
Bad Theory Visual - no thesis title, too much information that is not well labeled or clearly explained
**EBT Neoclassical Transport Theory For Field Error Effects**

**Done With Multiple-Time-Scale Expansions**

- **Beginning Point Is Gyrophase-Averaged “Drift-Kinetic” Equation**

  \[
  \frac{\partial f}{\partial t} + \frac{v_{\parallel} n \cdot \nabla f}{\text{parallel motion}} + \frac{v_D \cdot \nabla f}{\text{drift motion}} = \frac{C(f)}{\text{collisions}}, \quad n \equiv \frac{B}{B_0}
  \]

- **Magnetic Field Unit Vector Is Split Into “Perfect” And “Field Error” Parts**

  \[
  n = \frac{B}{B_0} = \frac{B_0 + \tilde{B}}{B_0} \approx \frac{B_0}{B_0} + \frac{\tilde{B}}{B_0} = n_0 + \frac{\tilde{B}}{B_0}
  \]

  - "perfect" closed field line
  - "field error" magnetic field

- **Various Frequency Scales Emerge From Drift-Kinetic Equation**

  \[
  \frac{\partial f}{\partial t} + \frac{v_{\parallel} \partial f}{\sim \omega_B} + \frac{\tilde{B}}{B} \cdot \nabla f + \frac{v_D \cdot \nabla f}{\sim \omega_D} = \frac{C(f)}{\sim v_f}
  \]

  - frequencies: bounce \( \sim \omega_B \)
  - drift \( \sim \omega_D \)
  - collision \( \sim v_f \)

- **Better Theory Visual – thesis at top, steps explained and reasonably spaced**


Wednesday, December 11, 13
Poster Presentations Have Additional Special Requirements

- Audiences
  - Window-shoppers (they usually read (at most) title, first visual and summary) - what's new, noteworthy?; what subject area is being discussed?
  - Serious customers (if title, first visual and summary are compelling they may look at entire poster) - what's new, same?; what are details of work done?

- Special Requirements
  - Large, easily read title (1" lettering or greater)
  - Enlarged copy of abstract
  - Brief summary at end in large lettering that can be quickly read by the window-shoppers and understood by serious customers
  - Signup sheet for copies of poster on right side of board
The Mechanics of Giving a Presentation

- Think about the mechanics of speaking...
  - Facing audience
  - Speak loudly and clearly
  - Make eye contact
  - Minimize distractions

- Pointer use
  - Hold against yourself, don’t shine on audience, don’t hold on all the time

- Dynamics
  - Find your style … movement can be good

- Referencing

- Practice
  - DO Lots

- Timing
  - Don’t run over … NEVER EVER EVER!

- Dress .... do ... err on conservative side
Summary

• Giving Good Scientific Presentations (Talks Or Posters) Is Important
  • Your scientific results need to be effectively communicated
  • Your professional reputation will be based largely on the presentations you give

• Scientific Talk Preparation Has A Number Of Key Elements
  • Consider audience, level and mode of presentation
  • Develop a presentation thesis
  • Prepare visuals to prove thesis
    • thesis heading, 6 points or less, readable, self-explanatory, graphs
  • Include summary at end

• Rehearse before colleagues
Presentation and paper

Presentation 10+5 min (paper ~10-15 pages)

Give us title and presentation format

• Science background
  • Why and What

• Profiling

• Optimization
  • What and how did it work

• Parallelization
  • What and how did it work

• Visualization
  • Pretty pictures