How to give a good talk

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Fermilab Users' Meeting
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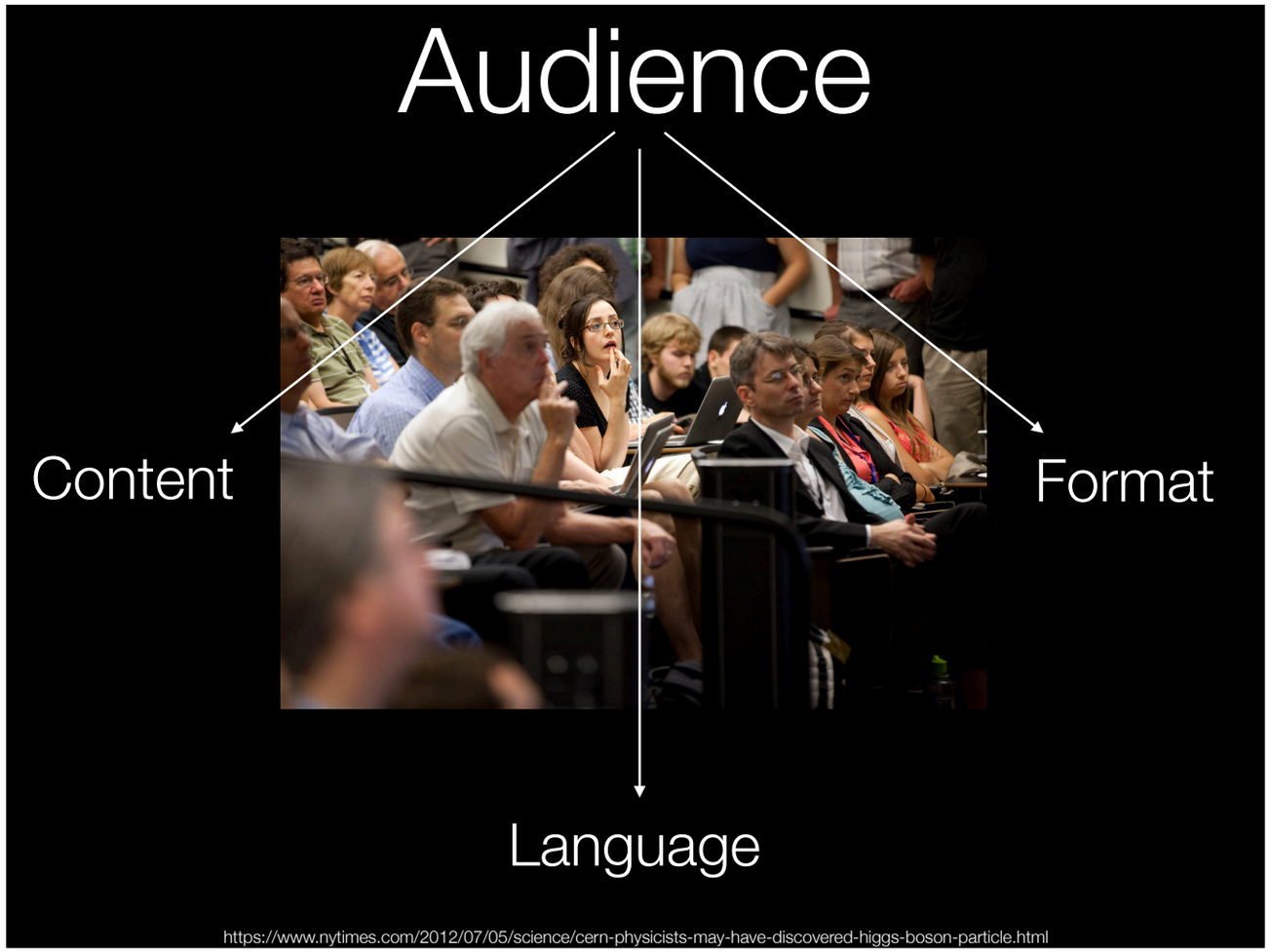
These are some personal tips that I try to follow to prepare for my own high-profile talks. For me the key is to first think about who my audience will be and tailor the content and format of the talk for them. When constructing the talk I try to focus on my story first, and then the visuals.



As you begin preparing your talk, think carefully about who your audience is going to be. Who you will be addressing impacts almost all aspects of your talk. The content of the talk, the language you will use to explain the ideas presented in your talk, and the format of your talk are dictated by your intended audience.

Colloquium Seminar Research plan

Thinking specifically about a job talk there are three basic sorts of presentations you might be asked to give: A colloquium, a seminar, and a research plan. Each implies a slightly different audience. If you are unsure about what kind of talk is expected, ask your hosts to clarify.

Colloquium

Seminar

Research plan

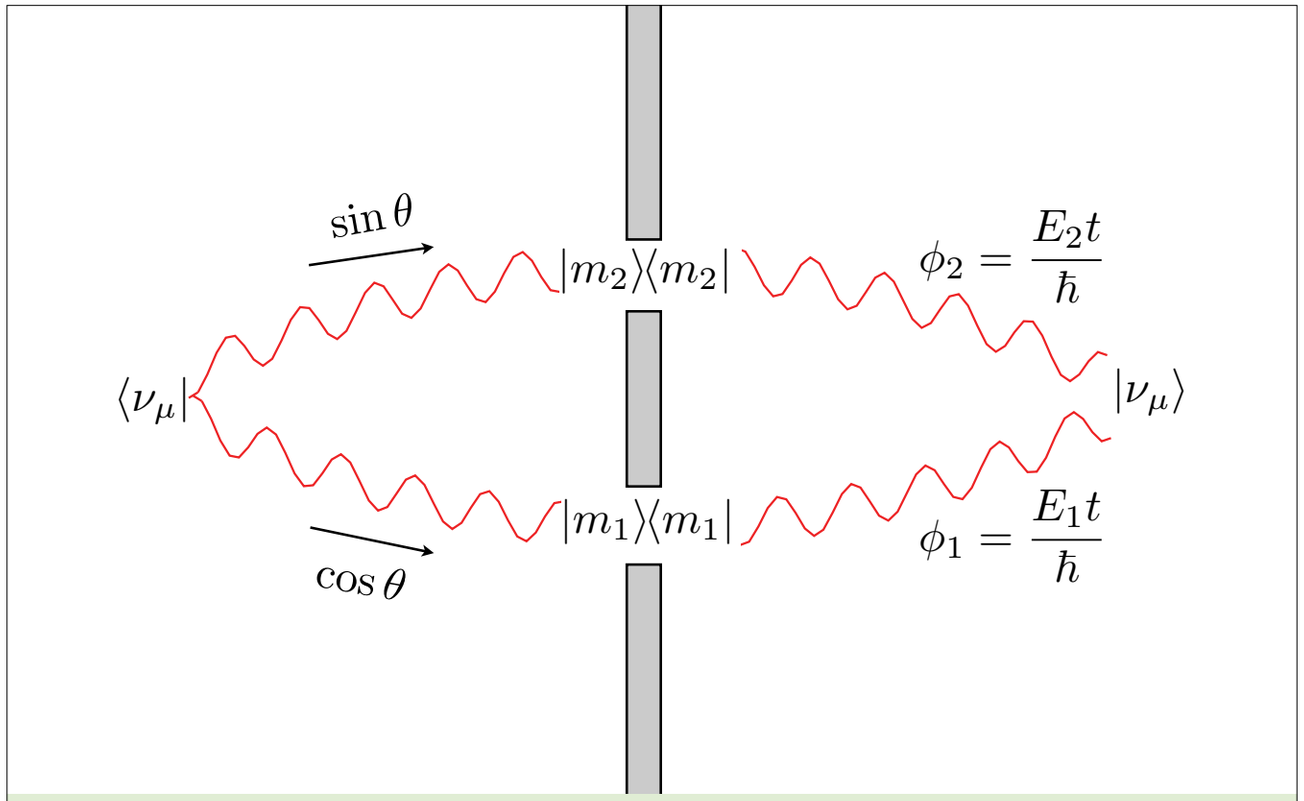
Audience: An entire department

Content: Place your work in the context of physics as a whole

Language: Use language shared by all physicists that undergraduates can understand

Colloquia are attended by the entire department. This means high energy physicists, condensed matter physicists, biophysicists, theorists, experimentalists, graduate students, undergraduate students. So when thinking about your content, think about how your research impacts “physics” and not just, say, high energy physics. Make sure to take a step back and spend some time during your talk to place your research in a very broad context of physics and culture.

Be sure to use language that the entire physics community understands. Avoid jargon and complex equations. Instead, give your audience some simple models to understand the topics you are presenting. If there’s a simple cartoon, excellent! Perhaps there’s a good analogy you can draw on? Don’t be shy about using these simple models; lean into them and make them work for you. Of course, some of the details will get left behind, but your audience probably doesn’t need the details yet, they need the gist.



$$P(\nu_\mu \to \nu_\mu) = 1 - \sin^2 2\theta \sin^2\left(1.27\Delta m^2[\mathrm{eV}^2]\frac{L[\mathrm{km}]}{E[\mathrm{GeV}]}\right)$$

If you can explain your research drawing on concepts from physics I or physics II, that's great.

Courtesy of CERN

If there’s a simple cartoon, excellent! Perhaps there’s a good analogy you can draw on? Don’t be shy about using these simple models; lean into them and make them work for you. Of course, some of the details will get left behind, but your audience probably doesn’t need the details yet, they need the gist and to not get left behind.

When thinking about colloquia, I often reflect on articles I've read in, say, Scientific American or Discover magazines. These are directed broadly at people interested in science and serve to inform and entertain. They are pretty good models for constructing a colloquium.

Colloquium

Seminar

Research plan

Audience: An entire department

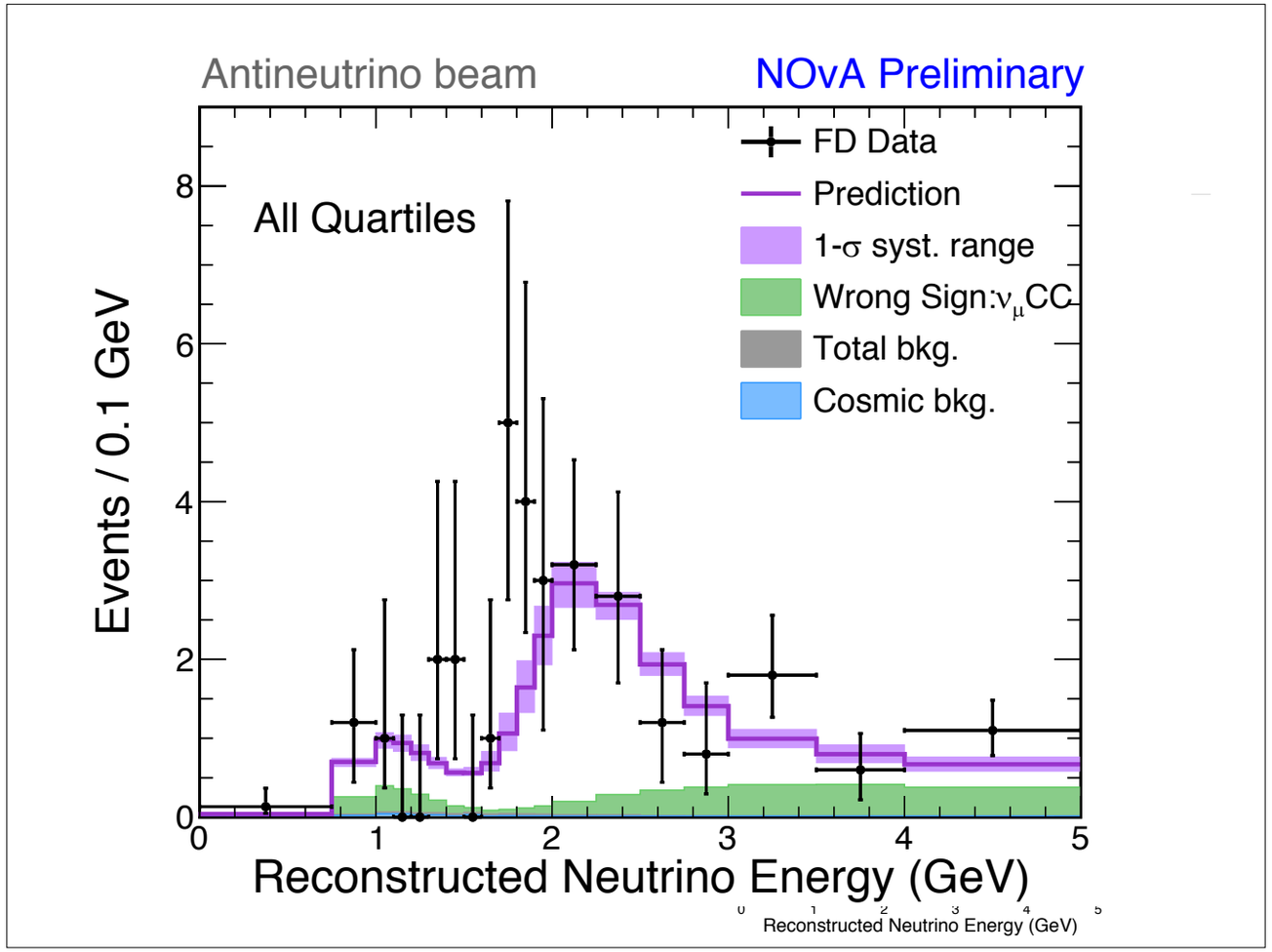
Content: Place your work in the context of physics as a whole

Language: Use language shared by all physicists that undergraduates can understand

Format: Your only audience is in the room. Talk to them!

In terms of format, for a colloquium your audience is in the room. Your slides aren't likely to get posted on the web or referenced by other people doing research in your field so you don't need to expend effort trying to communicate with people who will read your slides later without you there to interpret them.

There’s really no need for any explanatory text on your the slides, it will only distract your audience creating a conflict as they decide whether they should listen to you or read the slide. And it may distract you, bringing your eyes to your slides and away from your audience. Tend towards big, clear pictures and graphics.



No more than one plot per page is a good starting point. Try to engage your audience in a conversation and let them focus on what you're talking about.

Colloquium **Seminar** Research plan

Audience: Theorists and experimentalists drawn from your subfield and related subfields

Content: Place your work in the context of your subfield as a whole. Provide some detail you think the audience will find interesting.

Language: Use language shared by experimentalists and theorists from your subfield that a beginning graduate student can understand.

Format: Your audience is in the room, talk to them!

You might be asked to give a seminar. A seminar is generally different than a colloquium because the audience is drawn from people in your area, usually graduate students and faculty. There will still be a mix of experimentalists, theorists, cosmologists, collider physicists, nuclear physicists, neutrino physicists, and so on. In terms of content, this audience probably wants to know how your research fits into, say, high energy physics and they probably want to know some of the details that might stimulate thinking about their own research problems. However, don't abuse this license and over-estimate how much language you and your colleagues in the field share. Think of a graduate student in a related, but different area and pitch the intro of your talk to them. For example, if you are an experimental collider physicist, think about a second year graduate student in the audience who does nuclear theory. How much language do you share?

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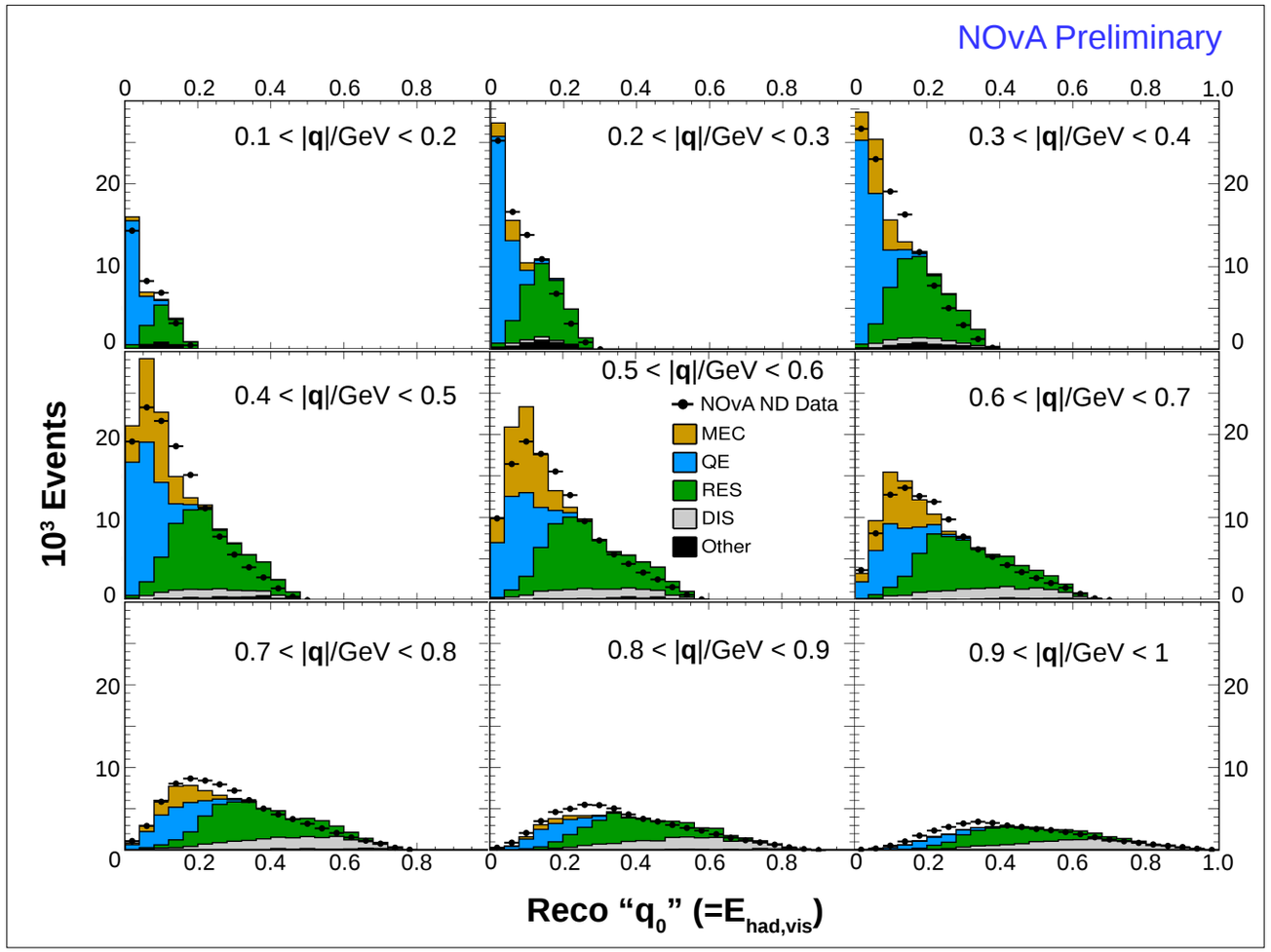
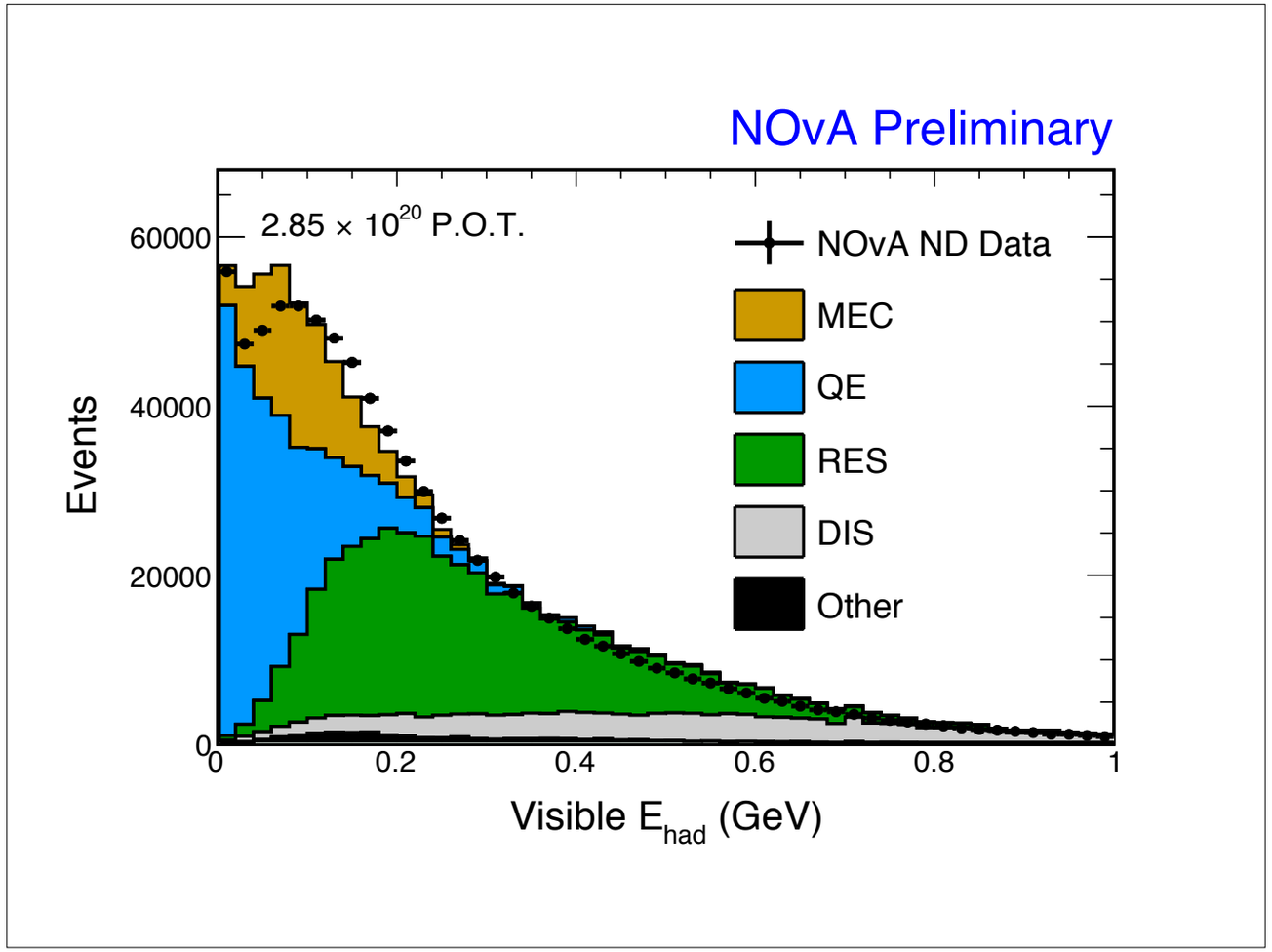
Format: Your audience is in the room, talk to them!

In terms of format, your audience is again likely just the people in the room so your slides do not need to speak for themselves. Avoid lots of text and encourage the audience to listen to you.



This audience probably wants and expects to see some details so choose which aspects of your topic you want to explore. However, take care to explain what is being plotted and what it means. Take a moment to explain mathematical symbols in words and pictures. For example, neutrino physicists often plot event distributions as a function of momentum transfer q and just assume that everyone in the audience knows what that means.



Don’t assume. Bring your audience along using words (“the amount of momentum transferred from the neutrino to the nucleus”), and a picture (“here at low q the neutrino is glancing off the nucleus, over here you tend to blow the nucleus apart”).

Colloquium **~~Seminar~~** Research plan

"Job Talk Seminar"

Audience*: Theorists and experimentalists drawn from your subfield and related subfields

Content*: Place your work in the context of your subfield as a whole. Provide some detail you think the audience will find interesting.

Language*: Use language shared by experimentalists and theorists from your subfield that a beginning graduate student can understand.

Format: Your audience is in the room, talk to them!

One word of caution: A “job talk” seminar and a “seminar seminar” are close but not quite the same. In a “job talk” seminar you are likely to draw faculty broadly from the department as all faculty have a stake in who gets hired for the position. This makes the “job talk seminar” somewhere between a “seminar seminar” and a “colloquium”. For the job talk make sure to spend at least some time on the broader context and addressing this broader audience.

Colloquium Seminar **Research plan**

Similar in most respects to the “job talk seminar” but you should address some specific questions:

- What are the important questions in your field?
- Which ones are you interested in and why?
- Why are these the important ones?
- How will your future research address these?
- What science do you expect to deliver in 3 years? 6 years?
- What do you expect your group to look like?
- What resources do you need? Which of them exist at the university / lab? Which will you need to bring in?

The third type of talk you might be asked to give is a research plan. Here the audience is similar to the “job talk seminar”. Do spend a little time at the start to provide some context for your research; don’t repeat your seminar, but don’t assume that everyone has seen it. The research plan should be forward looking and answer some specific questions: What questions are you most interested in? Why are they the important ones? How big a group are you imagining? What science can you deliver in 3 years? 6 years? What are the funding opportunities? What resources do you need? How many of them exist at the university? How many will you have to bring in?

[redacted]

Story first

Once you know who you will be talking to you can think about what topics and stories that audience will find interesting, compelling, and relevant. You are now ready to start writing your talk.

Story first

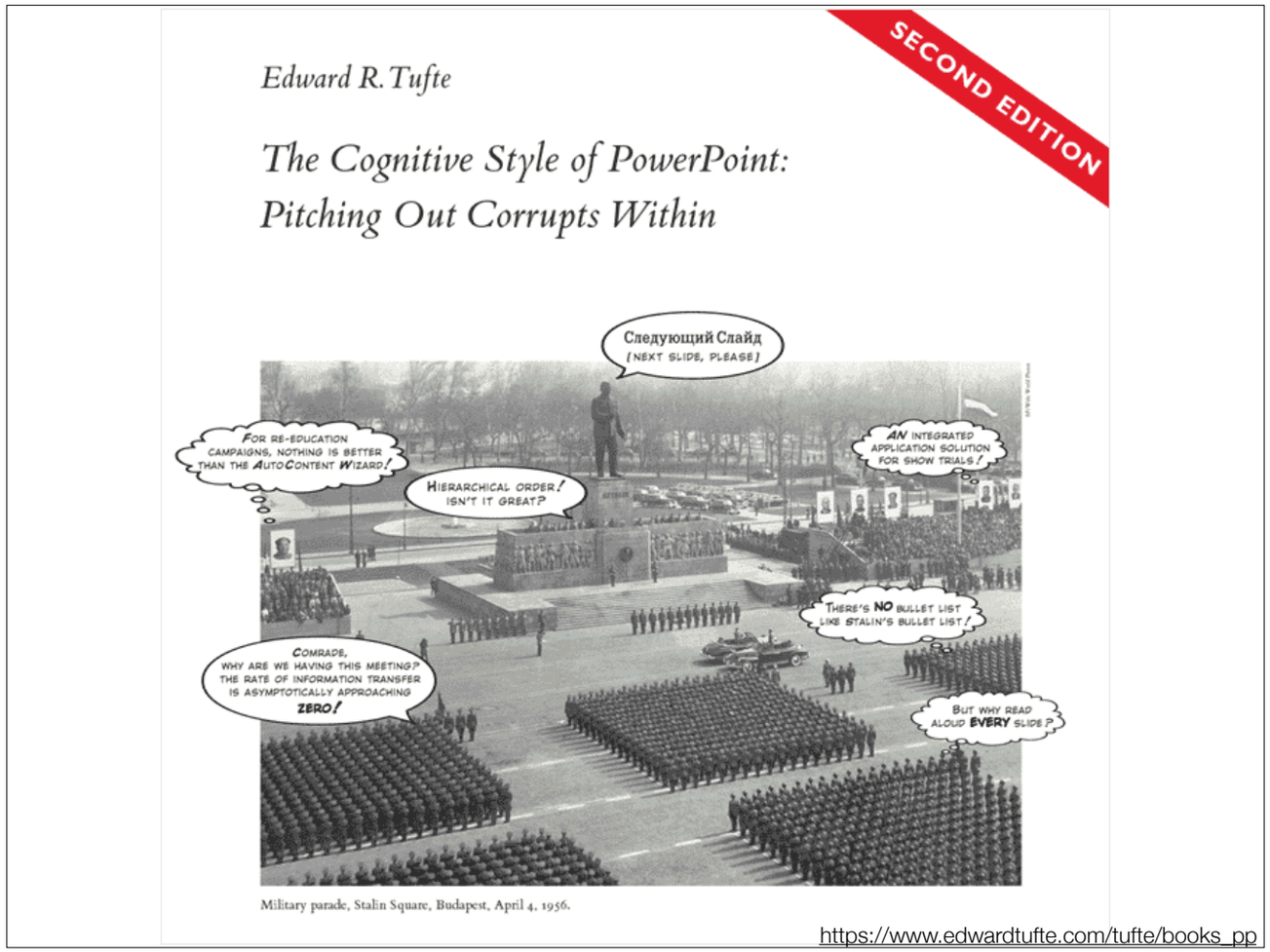
What ~three things do I want people to remember after my talk?

Usually I start this process by thinking about what message I want to deliver to the audience. If people remember only ~three things from my talk what do I want them to be? Once I can answer those questions I'm ready to start putting the talk together by fleshing each message out.

Story first

Start with words, not visuals

As you begin writing, I urge you to not start immediately with the slideware. For important talks, I approach them as writing projects and begin constructing my story as an outline and words. I think this has several advantages. First, the writing is an excellent opportunity to make a first practice pass at how you are going to explain things and help you choose the right words when you are giving the talk. Having worked out the best way to explain a complex topic on paper, you'll be that much better prepared to explain it in a talk. Second, I find it easier to manipulate ideas and topics in writing than I do in slideware. Have I set this topic up well enough or do I need to lay more ground work in the introduction? Does this story fit inside the time I have? Too much, too little?



https://www.edwardtufte.com/tufte/books_pp

Third, I find that by focusing on my story rather than my slides first I avoid many of the pitfalls of slideware presentations: An over-abundance of distracting visuals, slides cluttered with plots that end up communicating very little, low information density bullet points, and a tendency to “sell” rather than “teach”.

Powerpoint is easy for presenter, hard for audience

"The traditional kind of corporate meeting starts with a presentation. Somebody gets up in front of the room and presents with a powerpoint presentation, some type of slide show. In our view you get very little information, you get bullet points. This is easy for the presenter, but difficult for the audience. And so instead, all of our meetings are structured around a 6 page narrative memo."

Jeff Bezos, Amazon.com

All meetings are structured around a 6 page memo

"When you have to write your ideas out in complete sentences, complete paragraphs it forces a deeper clarity."

Finally, taking an approach of "what's my story" instead of "I need 40 slides" prepares you to master your material in a way a copy-and-paste from some slides you saw somewhere does not. If you've worked out your story and practiced it, you will not need to "put your notes on the slide" which is a common slideware crutch used by speakers that can make for crushingly boring talks. You'll be better prepared to engage your audience.

Once I have my story worked out, then I start assembling the visuals I'll want to support my story in slideware.

Mechanics of the talk

Think of talk as three 15 minute units

Don’t go over time!

Face the audience and make eye contact

Make purposeful movements

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Make purposeful movements

As you build your talk think of your pace. People can only focus for 15 to 20 minutes at a stretch. So, in a 50 minute talk, think of building it in about three units and maybe pause between each unit to take questions on the topics so far. This gives people a chance to reflect on what they’ve heard, relax a little, and then prepare for the next unit. Think carefully about time.

Mechanics of the talk

Think of talk as three 15 minute units

Don’t go over time!

Face the audience and make eye contact

Make purposeful movements

Do not go over 50 minutes for a one hour talk. People have meetings to go to, kids to pick up, etc. etc. If you think you are likely to go over time, think in advance about a “unit” of your talk that you can skip.

Mechanics of the talk

Think of talk as three 15 minute units

Don’t go over time!

Face the audience and make eye contact

Make purposeful movements

When you give the talk try to face the audience as much as possible. Divide the room up into 6 zones and periodically make eye contact with a person in each of the zones.

Mechanics of the talk

Think of talk as three 15 minute units

Don’t go over time!

Face the audience and make eye contact

Make purposeful movements

Don’t make lots of unnecessary movement, but do move when you have an important point to make or want to shift topics. Limit your use of the laser pointer. Stand close to the screen so you aren’t blocking the view of members of your audience.

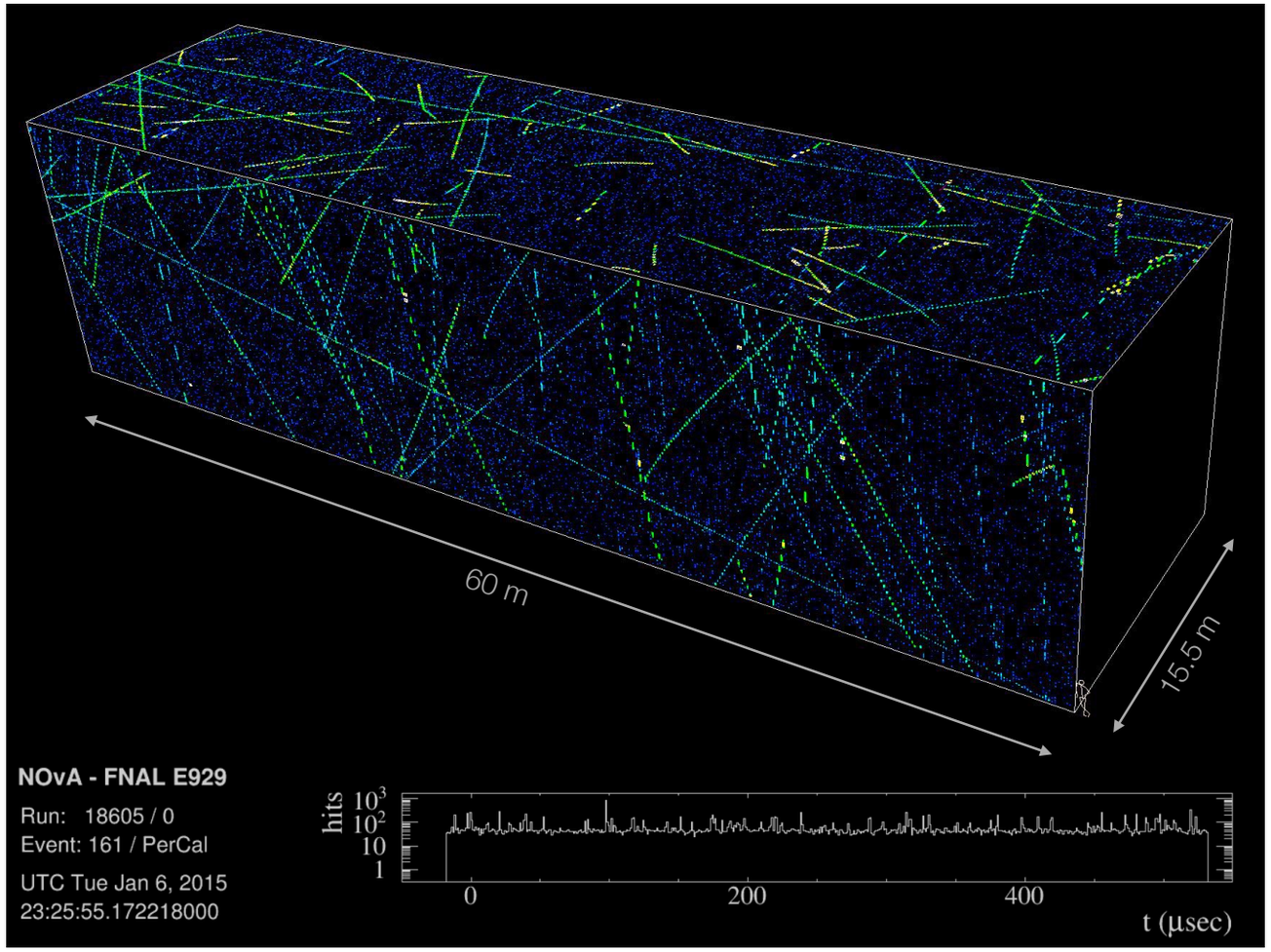
Showing your passion

During the talk you want to communicate your passion for the science. I think a lot of people get this advice but don’t know what to do with it and it sometimes goes wrong. This can lead to some of my personal pet-peeves.

Showing your passion

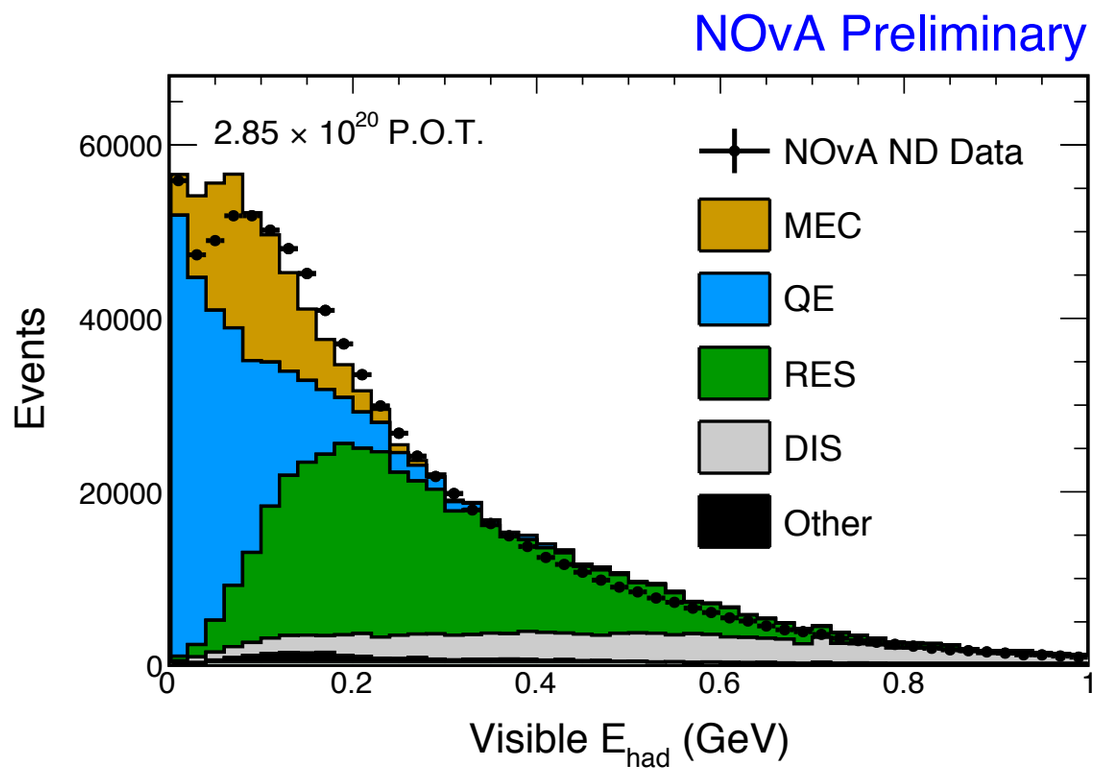
We exclude maximal mixing at 2.4σ!

Like exclamation points. There's almost no reason to use an exclamation point in a scientific presentation, or worse, a scientific proposal. I personally also get suspicious of talks that are trying so hard to "show passion" that I start to feel like the speaker is trying to sell me something.



So, how then, to show you're passionate about the topic you are discussing? My advice is to find room in the talk to highlight one or two topics that you are personally connected to and find kind of mind blowing. Give yourself the license to say in a completely non-scientific way "isn't that cool?". Maybe there was an unexpected problem which you solved in a way that's clever? My guess is that if you are making eye contact with your audience, and not reciting bullets off the screen and are genuinely kind of jazzed to be doing physics, it will come across.

Showing your passion



Teach: "You can get this"

I think my other piece of advice on this topic of "showing passion" is related to my comments above about content. If you take the time to explain what a plot means and why it's interesting, you're communicating to the audience "you can get this!". If you flash a million plots you are communicating "there's too much, give up now!". I think most faculty would want the first person in their classrooms.

[redacted]

Taking questions

Relax, listen to the questions

Prepare to avoid being blind-sided

Don’t fake it

Don’t engage with hostile questioners

Hopefully when you are done, there will be questions.

Taking questions

Relax, listen to the questions

Prepare to avoid being blind-sided

Don’t fake it

Don’t engage with hostile questioners

An obvious point, but also one of the things I see go wrong very often is that you have to listen to the question. Take a breath, don’t interrupt and then think about what the person just said. If you don’t understand, ask for clarification. Often I see people who are nervous answer a question they expected to get rather than a question that was actually asked because their expectations and nerves overrode their listening. Breathing is a great way to fight nerves.

Taking questions

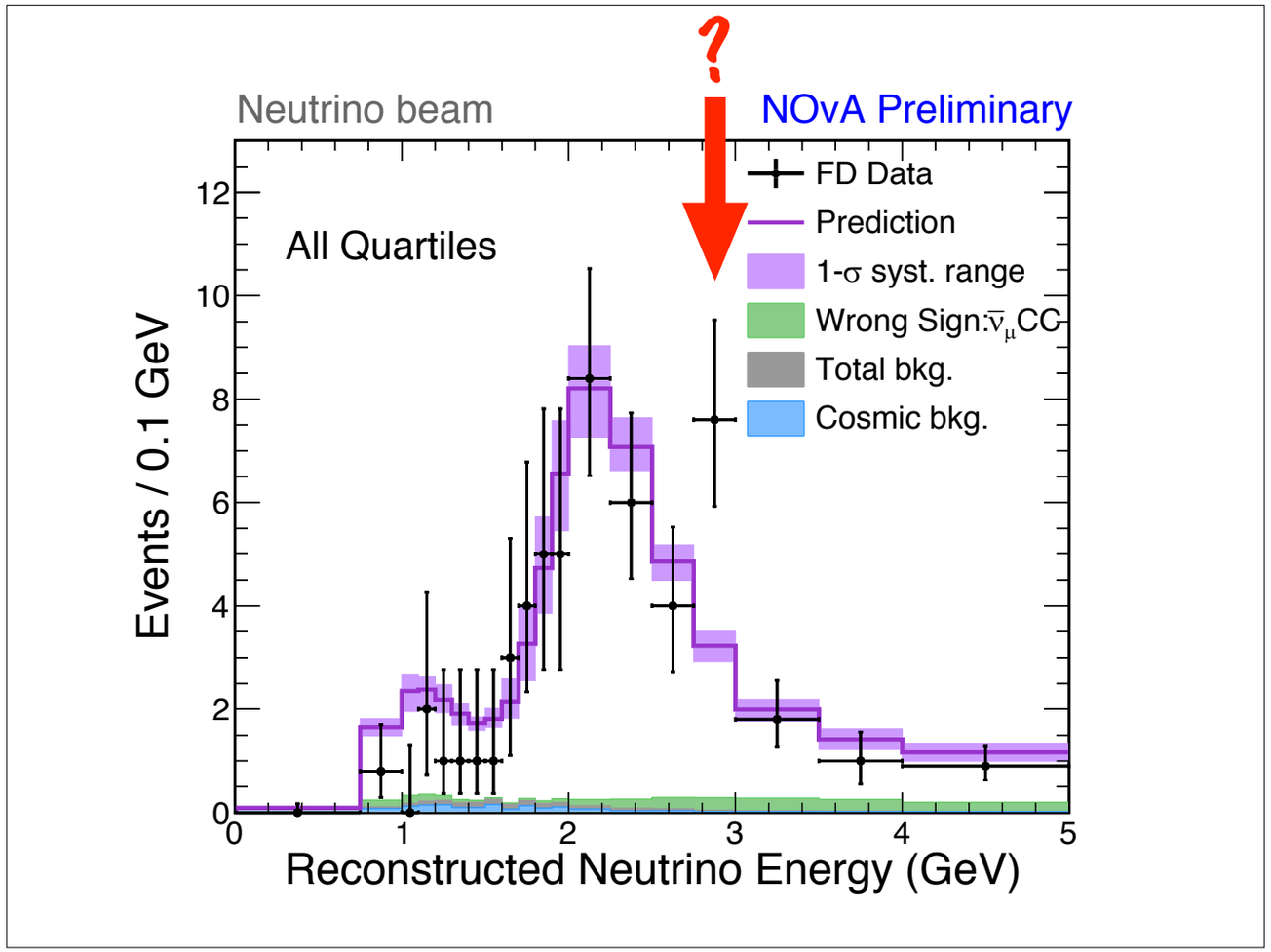
Relax, listen to the questions

Prepare to avoid being blind-sided

Don’t fake it

Don’t engage with hostile questioners

Of course, you are worried about getting asked something you don’t know. No on wants to get blindsided. There’s nothing for that except preparation. I claim that if you follow the “story first” approach to the talk you will naturally be better prepared for questions than if you focused instead on just the visuals of your slides.



There are other things you can do. When you talk is nearly done, go through it with a skeptical eye. Is the shape of that distribution weird? What's that spike over there? Is that language really the most precise? This should prepare you for many things. Another form of preparation is to be "up" on your field.

Taking questions

Cornell University

We gratefully acknowledge support from the Simons Foundation and member institutions.

arXiv.org > hep-ex

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High Energy Physics – Experiment

Authors and titles for recent submissions

- Thu, 13 Jun 2019
- Tue, 11 Jun 2019
- Mon, 10 Jun 2019
- Fri, 7 Jun 2019
- Thu, 6 Jun 2019

[total of 54 entries: **1-25** | 26-50 | 51-54]
[showing 25 entries per page: fewer | more | all]

Thu, 13 Jun 2019

[1] arXiv:1906.05056 [pdf, other]
ATLAS Measurements of CP Violation and Rare Decays in Beauty Mesons
Wolfgang Walkowiak (On behalf of the ATLAS Collaboration)
Comments: 6 pages, 10 figures, Proceedings of the 2019 Conference on Flavor Physics and CP Violation (FPCP2019)
Subjects: **High Energy Physics – Experiment (hep-ex)**

[2] arXiv:1906.04963 [pdf, other]
Measurements of particle spectra in diffractive proton-proton collisions with the STAR detector at RHIC
Lukasz Fulek
Subjects: **High Energy Physics – Experiment (hep-ex)**; Nuclear Experiment (nucl-ex)

[3] arXiv:1906.04907 [pdf, other]
First measurement of neutrino oscillation parameters using neutrinos and antineutrinos by NOvA

Read the arXiv abstracts; people in your audience may have seen something and be curious about how it might be related.

Taking questions

Relax, listen to the questions

Prepare to avoid being blind-sided

Don’t fake it

Don’t engage with hostile questioners

Ultimately, if you don’t know the answer to a question, however, don’t try to fake it. Say “I’ll try to find an answer to that” and then do actually follow up.

Taking questions

Relax, listen to the questions

Prepare to avoid being blind-sided

Don’t fake it

Don’t engage with hostile questioners

Finally, you might get hostile questions. These might take the form of someone who is using the Q&A time to advance some of their own work. Usually this requires no comment from you other than “Thank you”. Sometimes you can deflect the question by framing the debate for the audience. Something like “This is a long standing debate, they say X, we think we’ve shown Y, I doubt we’ll be able to resolve it here”. Avoid engaging in the debate then-and-there. Once someone has stood up to make their point, they are not going to be convinced by anything you say.

[redacted]

Practice and performance

Practice

Attend talks. Think about them critically.

Be physically prepared

Give the talk you want to give

Practice and performance

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Attend talks. Think about them critically.

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Give the talk you want to give

Finally, find time to practice. In front of your collaborators, into a voice message on your phone, in your head as you read what you've prepared.

Practice and performance

Practice

Attend talks. Think about them critically.

Be physically prepared

Give the talk you want to give

There are other forms of practice too even when you're not talking. Go to seminars and colloquia. When they are good, ask yourself what appealed to you. When they are bad try to identify specifically why. When the talk is done, try to write down three things you learned from the talk. If you can't do it, why not?

Practice and performance

Practice

Attend talks. Think about them critically.

Be physically prepared

Give the talk you want to give

On the day of the talk make sure that you are rested, fed, and hydrated. This isn't as easy as it sounds. You'll be travelling, so getting a good night's sleep will be hard. You'll be talking to people all day, so your mouth will be dry and tired. Do your best to pace yourself and take care of yourself heading into the talk.

Get a good night's sleep

Table 6 Equating the effects of sleep deprivation and alcohol consumption

>0.08 BAC = legally drunk

	Hours (decimal) of wakefulness equivalent to BAC concentrations					
	BAC 0.05%			*BAC 0.1%*		
Test and measure	*Mean*	*95% CI*	*%**	*Mean*	*95% CI*	*%**
Reaction time task:						
Speed (ms)	18.04	17.12 to 18.96	76	18.71	17.56 to 19.86	64
Accuracy (misses)	17.31	16.51 to 18.11	42	17.74	16.51 to 18.97	45
Dual task:						
Speed (ms)	17.73	16.75 to 18.71	84	19.65	18.58 to 20.77	67
Hand-eye coordination (level of difficulty)	18.43	17.41 to 19.45	79	19.42	18.40 to 20.44	58
Tracking task:						
Hand-eye coordination (level of difficulty)	18.25	17.37 to 19.13	74	19.01	18.91 to 19.97	61
Mackworth clock vigilance:						
Speed (ms)	17.08	16.20 to 17.96	82	18.10	16.85 to 19.35	58
Accuracy (misses)	17.64	16.72 to 18.56	68	18.80	17.93 to 19.67	76
Symbol digit task:						
Speed (ms)	18.55	17.43 to 19.67	50	18.91	17.92 to 19.90	48
Speed (symbols inspected (n))	18.52	17.46 to 19.58	57	18.64	17.65 to 19.63	79
Accuracy (correct (%))	16.91	15.72 to 18.10	41	18.39	17.01 to 19.77	42
Spatial memory task:						
Accuracy (length of recalled sequence)	18.05	17.09 to 19.01	86	17.88	16.92 to 18.84	64

~18 hours w/o sleep

*Numerator=number of subjects contributing data; denominator=number of subjects whose range of BAC incorporated 0.05% (n=37 or 38) or 0.1% (n=33).

Amount of sleep deprivation required to produce performance decrements equivalent to varying concentrations of blood alcohol (BAC), and the time of day at which the equivalence occurred in this study.

Practice and performance

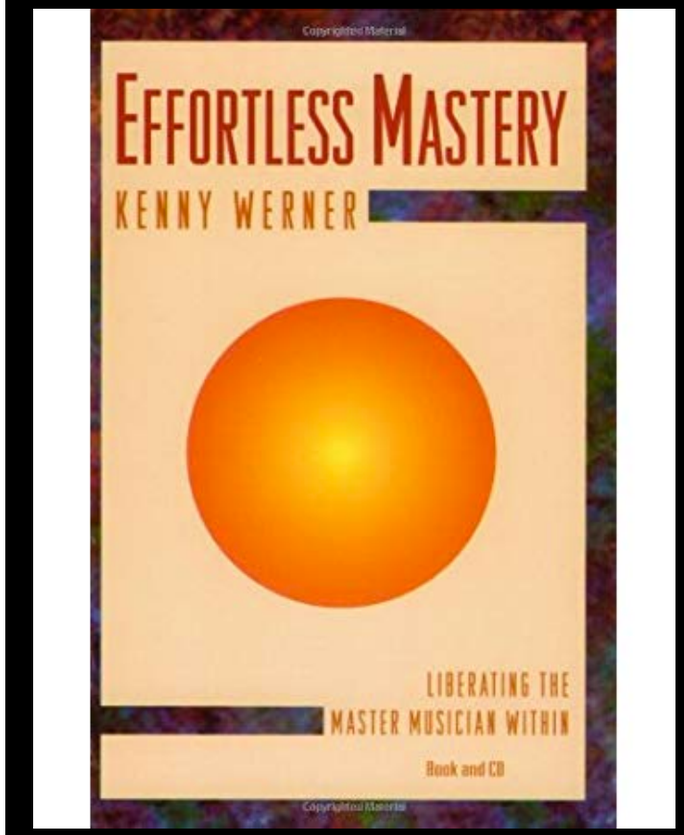
Practice

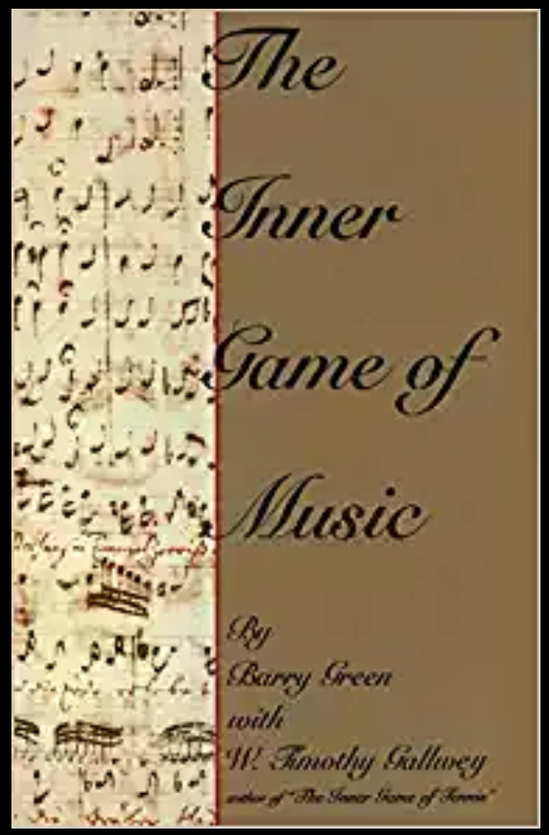
Attend talks. Think about them critically.

Be physically prepared

Give the talk you want to give

And finally, when the talk comes, turn off all the voices in your head that said “do this!”, “don’t do that!”, “That slide is confusing!”.





Those are practice voices which helped you focus on what to improve on but once the talk comes they've outlived their usefulness. Turn them off. You're ready. Listen to the voice that says, "I'm ready. This is going to be fun."

Know your audience

Story first

Give the talk you want to give