The Art of Giving Talks: Some Thoughts, Advice, and Lessons Learned the Hard Way

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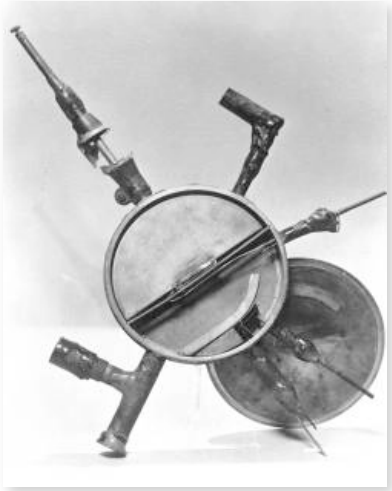
Your mileage may vary!

- This talk may not make you a gifted speaker
- None of the rules that I give you are iron-clad
- You will need to modify these rules to suit your personal speaking style

What is a talk?

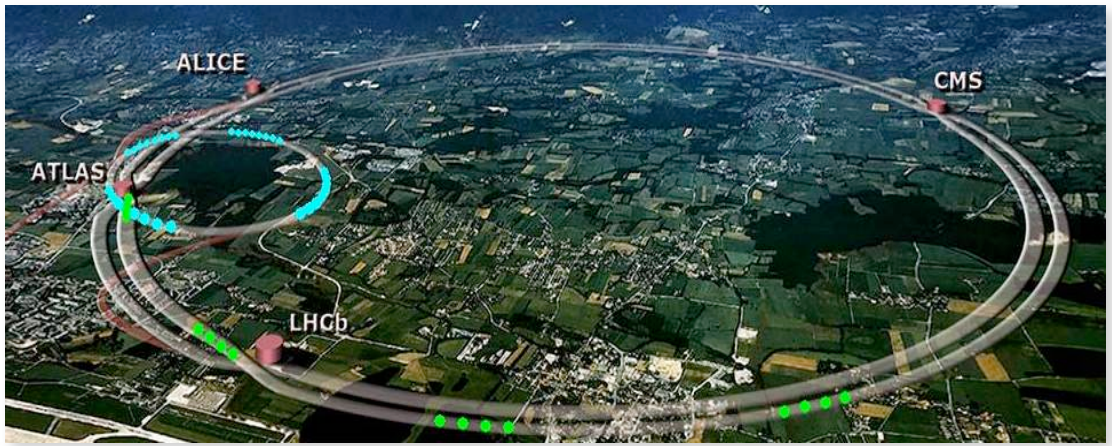
A good talk is
nothing more than
a story

Experiments vs. Computational Science



4.5 inches diameter

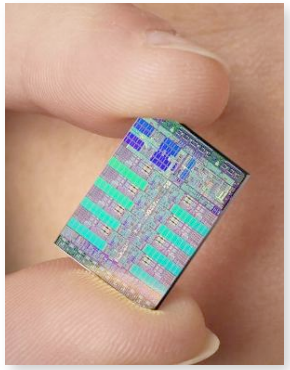
75,000 increase



27 km circumference, $4B US

400 operations/s

500 Million increase



200 Billion operations/s, $400

Some reasons for sharpening your communication skills

1) Probably **the single most important** aspect in job hunting is your interview talk. The interview talk can make or break the interview.
2) Giving talks is expected in many jobs and is a critical factor in job success.
3) If you're heading into academia then you'll be giving talks almost every day!

What types of talks are there?

- Job interview
- Present a new result
  - at a conference
  - a status report for a project
- Argue for/against something

Each of these talks will be different but the basic structure will be the same !

There are three key elements

- The ***message***
  - What is the main idea that you would like to get across to your audience
- The ***audience***
  - Who are the people that you want to give your message to
- The ***connections***
  - How do the pieces of your talk fit together

The Message

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What is your message ?

- You should be able to answer the question:
  - ***What's your point?***
- The message should be short
  - Summarize in 2-3 sentences.
  - Should be understandable at a high level
- Short talks (15 minutes or less) should have only one message

Most common mistake in a talk is not having a clear message

Everything in your talk should support your message

- Start with the message and work backwards in developing your talk

- It's incredibly easy to fall into the trap of thinking that
  - _____ is just too interesting to let the audience miss

- If you're not sure, ask yourself once again
  - ***What's your point?***

The Audience

You need to tune the talk to the audience

- You need to be able to answer the question
  - **Why should I (the audience) care**?
- Find out what the makeup of the audience will be and why they are there
- Emphasize or de-emphasize parts of your argument to suit the audience – respect your audience

Second most common mistake is using the same talk for all audiences

The Connections

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Structuring your talk

- It's not enough to lay out the key elements – you need to show how the elements fit together
- Walk the audience through your key points and show them how they are related
- Most talks suffer from too many (insignificant) details and not enough overview - a *talk is not a paper*

Third most common mistake is to give details rather than showing the connections – determine the significant details!

Some Tips and Tricks

Lessons Learned the Hard Way

Essential elements in a talk

- Why is this problem important?
  - Why should I care?
- What was the outcome/product/….
  - Is there a tangible result?
- What was *your* contribution?
  - Use words like, *"This is my main result"*

Keep your main points simple

- Most people/societies/cultures have a hard time dealing with more than 3 ideas at one time
- Remember that for a large part of your audience the material is new
- Paraphrase the main points in several ways - please **do not** read the bullets verbatim

Give specific examples where possible

- Examples can be used to clarify a given point
- Examples can create a big impact
- Examples, especially visual ones are better than written examples

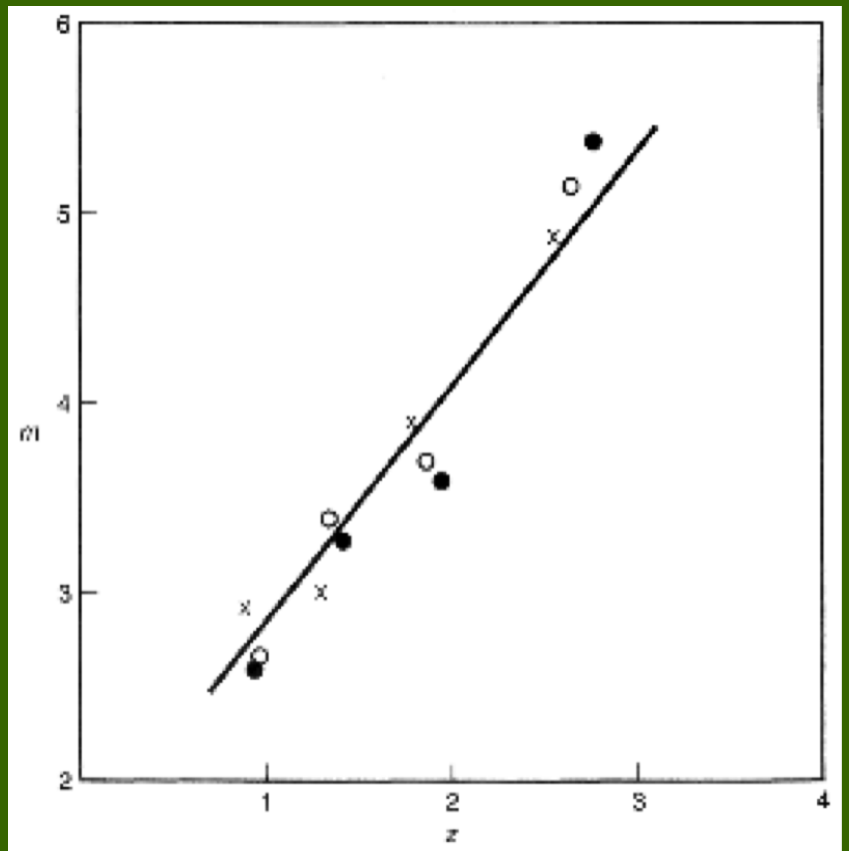
Some Examples

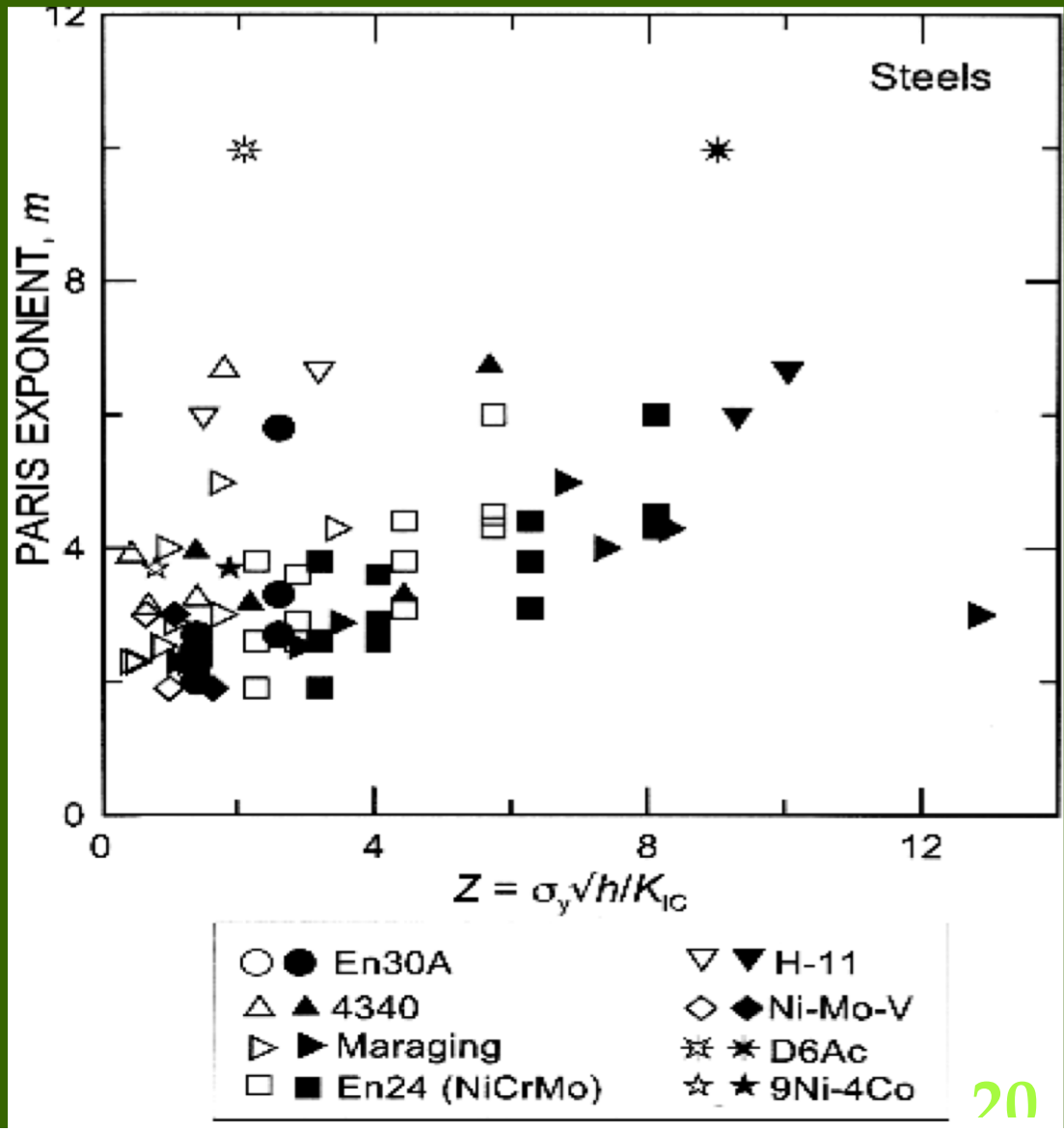
This means (!) that the parameters of the Paris Law

$$\frac{d\ell}{dn} = A(\Delta N)^m$$

are not the material properties: they depend on the specimen size h, because

$$Z = (\sigma_Y h^{1/2})/K_{IC}.$$





Eigenvalues/vectors found numerically (new result)

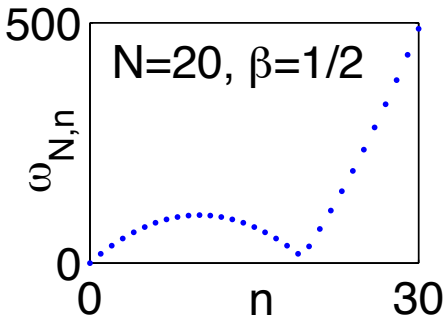
$$\hat{B}\hat{A}\hat{z} = \omega\hat{z}, \qquad \hat{A}_{kl} = |k|\delta_{kl} - \hat{u}_{k-l}, \qquad \hat{B}_{kl} = k\delta_{kl}.$$

$$v_t = Hv_{xx} - (uv)_x = iBAv$$
$$A = H\partial_x - u, \quad B = -i\partial_x$$
$$v(x,t) = \mathrm{Re}\{Cz(x)e^{i\omega t}\}$$

$$\hat{u}_k = \begin{cases} N\alpha, & k = 0, \\ 2N\beta^{k/N}, & k \in N\mathbb{Z},\ k > 0, \\ 2N\bar{\beta}^{|k|/N}, & k \in N\mathbb{Z},\ k < 0, \\ 0 & \text{otherwise.} \end{cases}$$

$$\omega_{N,n} = \begin{cases} -\omega_{N,-n} & n < 0, \\ 0 & n = 0, \\ (n)(N-n) & 1 \le n \le N-1, \\ (n+1-N)\big(n+1+N(1-\alpha)\big) & n \ge N. \end{cases}$$

$$\alpha = \frac{1-3|\beta|^2}{1-|\beta|^2}, \qquad |\beta|^2 = \frac{1-\alpha}{3-\alpha}$$



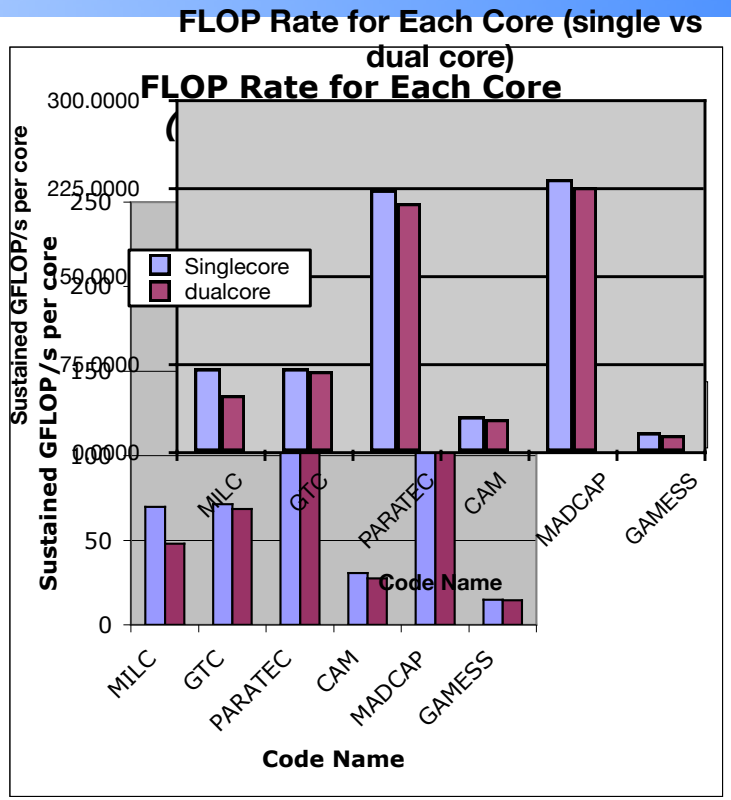
N \ n	1	2	3	4	5	6	⋯
1	$\omega_{1,1}$	$\omega_{1,2}$	$\omega_{1,3}$	$\omega_{1,4}$	$\omega_{1,5}$	$\omega_{1,6}$	⋯
2	$\omega_{2,1}$	$\omega_{2,2}$	$\omega_{2,3}$	$\omega_{2,4}$	$\omega_{2,5}$	$\omega_{2,6}$	⋯
3	$\omega_{3,1}$	$\omega_{3,2}$	$\omega_{3,3}$	$\omega_{3,4}$	$\omega_{3,5}$	$\omega_{3,6}$	⋯
4	$\omega_{4,1}$	$\omega_{4,2}$	$\omega_{4,3}$	$\omega_{4,4}$	$\omega_{4,5}$	$\omega_{4,6}$	⋯
5	$\omega_{5,1}$	$\omega_{5,2}$	$\omega_{5,3}$	$\omega_{5,4}$	$\omega_{5,5}$	$\omega_{5,6}$	⋯
6	$\omega_{6,1}$	$\omega_{6,2}$	$\omega_{6,3}$	$\omega_{6,4}$	$\omega_{6,5}$	$\omega_{6,6}$	⋯

=

N \ n	1	2	3	4	5	6	⋯
1	*	*	*	*	*	*	⋯
2	1	*	*	*	*	*	⋯
3	2	2	*	*	*	*	⋯
4	3	4	3	*	*	*	⋯
5	4	6	6	4	*	*	⋯
6	5	8	9	8	5	*	⋯

Will Multicore Slam Against the Memory Wall?

- **Memory Bandwidth Starvation**
  - *"Multicore puts us on the wrong side of the memory wall. Will CMP ultimately be asphyxiated by the memory wall?"* Thomas Sterling
  - Memory wall is NOT a problem that is caused by multicore (*memory wall coined in 1994*).



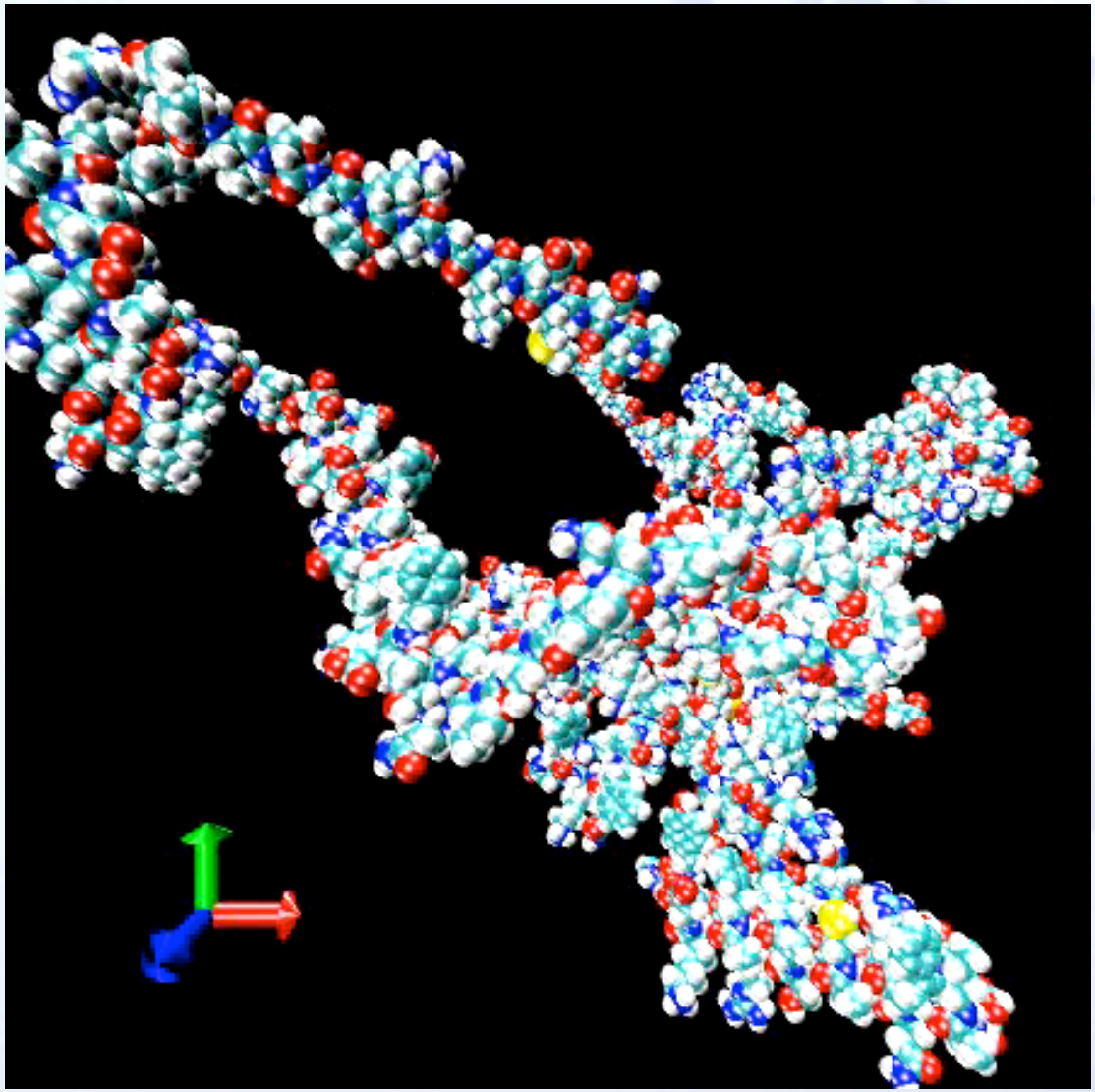
- **What about latency (other part of memory wall)**
  - Effective use of bandwidth is progressively inhibited by poor latency tolerance of modern microprocessor cores *(memory mud rather than memory wall)*
  - Stalled clock rates actually halt growing gap of memory latency / operation
  - bandwidth is the dependent variable for mem wall
- **Memory bandwidth is a commodity (price sweet spot based on volume)**
  - With current technology, we could put 8x more bandwidth onto chips then we currently do! *. . . GPUs and Cicso Metro already do this! (IBM Power6 provides 30x IA64 memory bandwidth)*
  - *Historically communication bandwidth scales 4x faster than Moore's Law!*
  - **So why don't we do it?** . . . b*ecause it is ineffective for current processor cores*
  - *Cell/Software controlled memory can use bandwidth more effectively*

Multicore will make it easier to assess need for more bandwidth

Drug Design (Take 1)

- Drug design can be formulated as an **energy minimization problem.**
- A single new drug may cost between $800 million and $1.8 billion to develop from start to finish.
- The design process typically takes **over 10 years** due to the large number of trial drugs that need to be considered.
- There are various energy functions used to describe the molecules involved.
- There are thousands of parameters because the size of the drugs is large.
- Are all these details necessary, what's his point?
- Due to physical constraints the optimization problem contains numerous nonlinear constraints.
- It can be shown that there are thousands of local minima which makes it difficult for most optimization methods.
- Thank goodness for email, so I don't have to listen to all of this.
- We are working on special optimization methods to solve this minimization problem.
- By using visualization techniques we can speed up the optimization methods.
- The end result is that we can speed up the discovery process possibly savings ***hundreds of millions of dollars*** and thousands of lives.

Drug Design (Take 2)



- A single new drug may cost over $800 million to develop and the design process typically takes over 10 years.
- Computer simulations can be used to predict new drugs
- Total simulation took approximately 32 hours on a desktop computer

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Question & Answer Period

Handling questions

- Anticipate and prepare for the obvious questions
- First make sure you understand the question
- Try to answer all questions, but some questions can/should be deferred.

Don't Panic !

Top 10

1) Have a clear message you want to deliver
2) Prepare for your audience
3) Tie the pieces together into a story
4) Only use material that supports your message
5) Avoid unnecessary details
6) Use (visual) examples to clarify your points
7) State the importance of your problem
8) Present your contribution
9) Prepare for questions
10) Practice, practice, practice

Sample 30 minute talk

- **Set the stage** (5-10 minutes)
  - Tell the audience what the main issues are
  - Lay out your problem/issue
  - Describe why it's important!
- **What happened** (10-15 minutes)
  - How was the problem resolved
  - Only need the key ideas here (significant details)
  - Don't necessarily need chronological order
- **Summarize** (5 minutes)
- **Questions?** (5 minutes)

You should be prepared to adjust in real-time

Questions?