



**Science
Museum**
of Minnesota®

How to Tell Your Parents About Your Groundwater Problem: Simplification and Storytelling

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*St. Croix Watershed Research Station,
Science Museum of Minnesota*



Who is the SCWRS?



- ✚ ...the environmental research department of the Science Museum of Minnesota
- ✚ ...a private, non-profit lab, built with private funds
- ✚ ...a small team of independent-minded scientists



✚ ***...dedicated to doing the science that makes our rivers and lakes clean***

and aquifers!!

IMRADS

❖ Formal scientific papers & reports:

- ❖ Passionless
- ❖ 1665 Philo
Royal Soc
- ❖ Comprehe
- ❖ Scoured c

❖ ***Fact sheet*** ***audience***





Typical science communication

☼ Formality is carried forward into our presentations

☒ Tell 'em what you're gonna tell 'em

☒ Tell 'em

- We did this
- And we did that
- And we did this other thing
- And we found this
- And our results are preliminary (so don't criticize me!)
- And we think this
- And more work needs to be done

☒ Tell 'em what you told 'em



**“AAA...” structure is pretty bland,
*and we've all done it.***

Formality is a security blanket

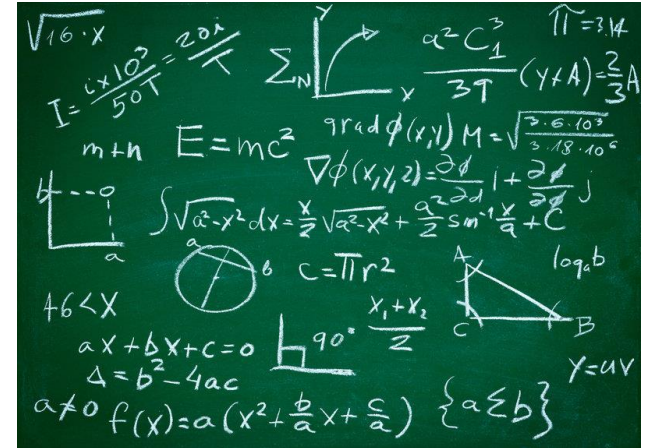


We keep it a secret,
exclusive club...

...that hands down
pronouncements
from on high...

...so if you don't understand my project, that
makes me smarter than you by comparison...

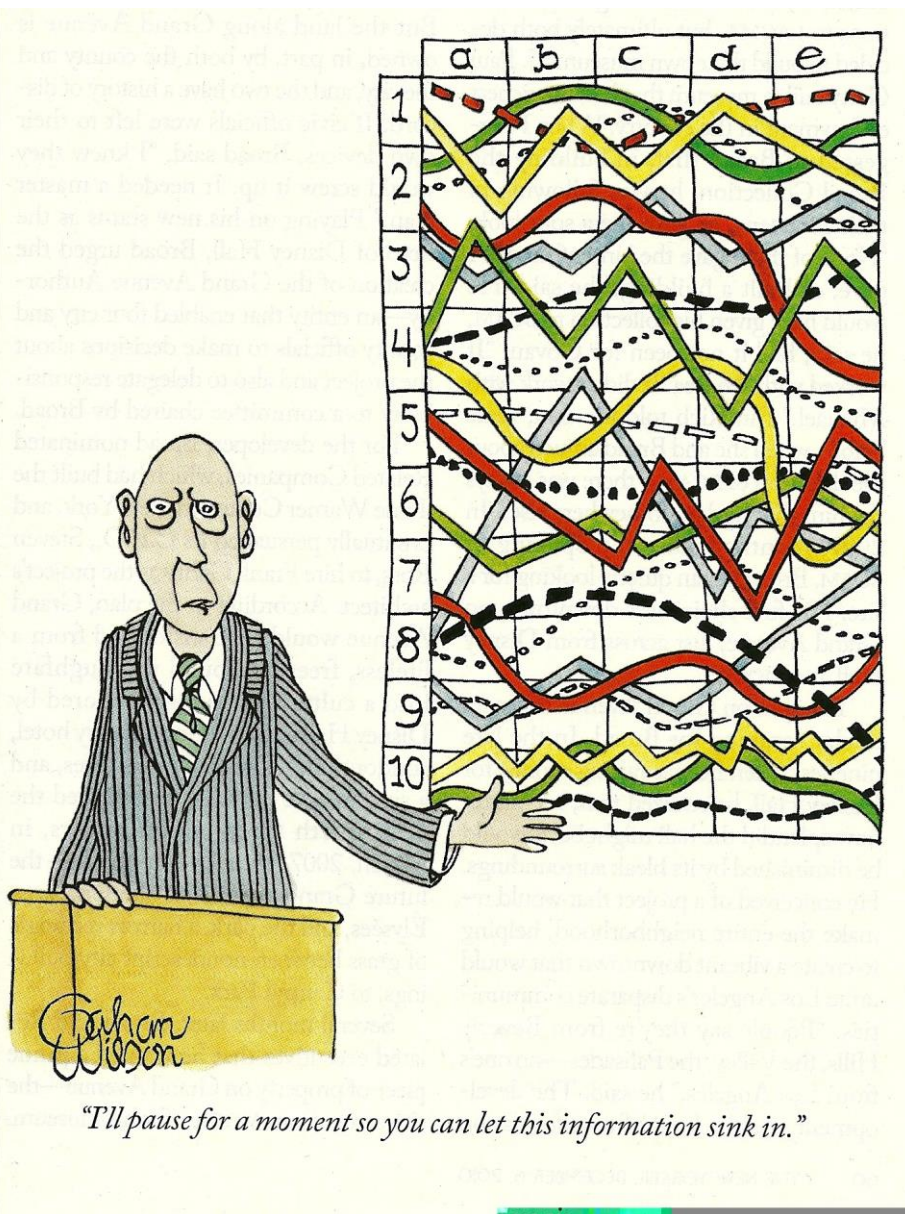
...with arcane methods only
really smart people can
understand...



...and I can make sure you don't understand,
by giving a bad presentation!



Show lots of graphs (labels are optional)



"As the data clearly show..."

"Is there anyone who doesn't think this is clear?"

Science is too pretentious darned stuffy

- ✚ Formality is fine for written publications
 - ✚ ...although I can't always help myself
- ✚ But presentations are for speaking, face to face, with an audience -- your friends and colleagues.





It's too hard to explain...

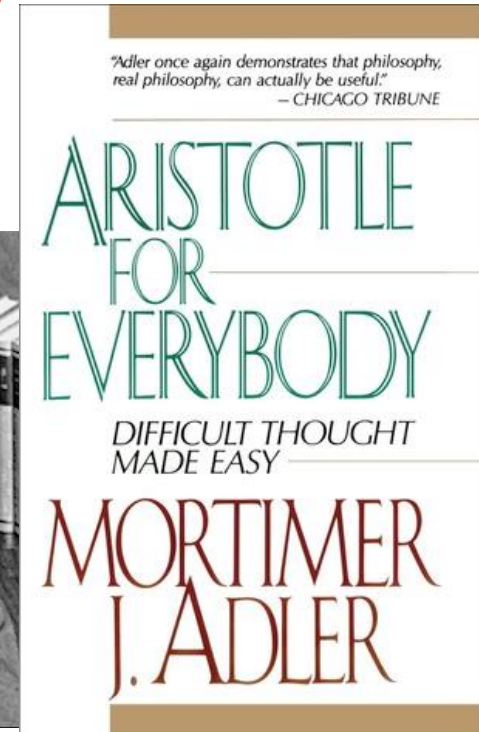
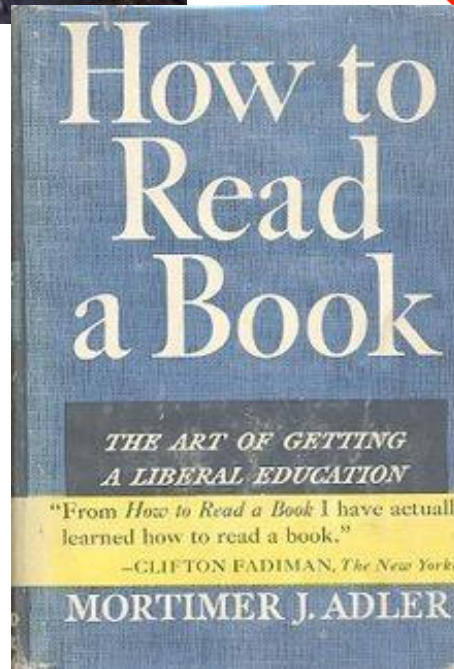


"I really understand this stuff – but I just don't know how to explain it, especially to the public."



"The person who says he knows what he thinks but cannot express it usually does not know what he thinks."

-- Mortimer Adler



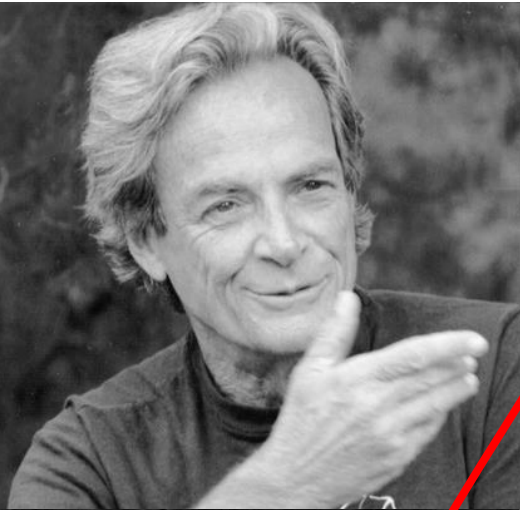
How do you gain understanding?

Feynmann's Method for Understanding

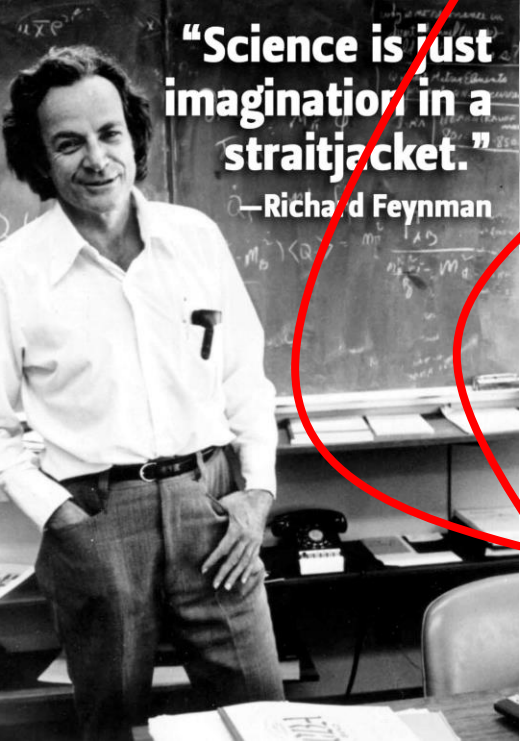
- ✚ Identify a topic to understand
 - ✚ Groundwater recharge, e.g.
- ✚ Pretend to explain it in simple terms to a new student, or to your kindly but non-technical parents
- ✚ Identify the sticking points and repair them
 - ✚ Return to references and text books as needed
- ✚ Organize & simplify the explanation with analogy and humor

**Understanding and communication
are tightly linked**

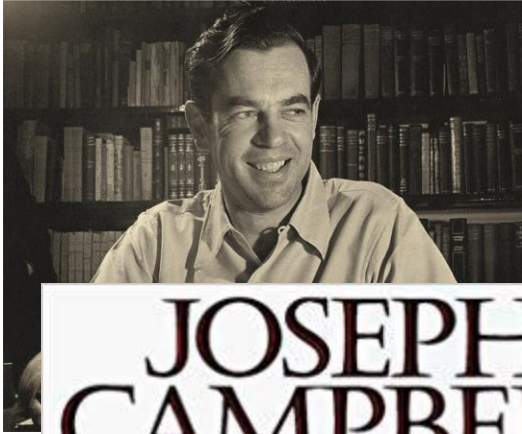
**These key points can be done by Story
*BUT: How do you tell a story?***



**"Science is just
imagination in a
straitjacket."
—Richard Feynman**



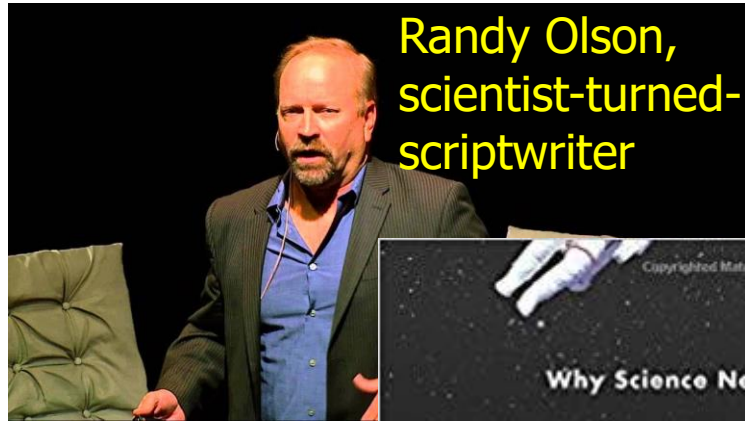
What is “story” (= narrative)?



JOSEPH
CAMPBELL



THE HERO
WITH A
THOUSAND
FACES

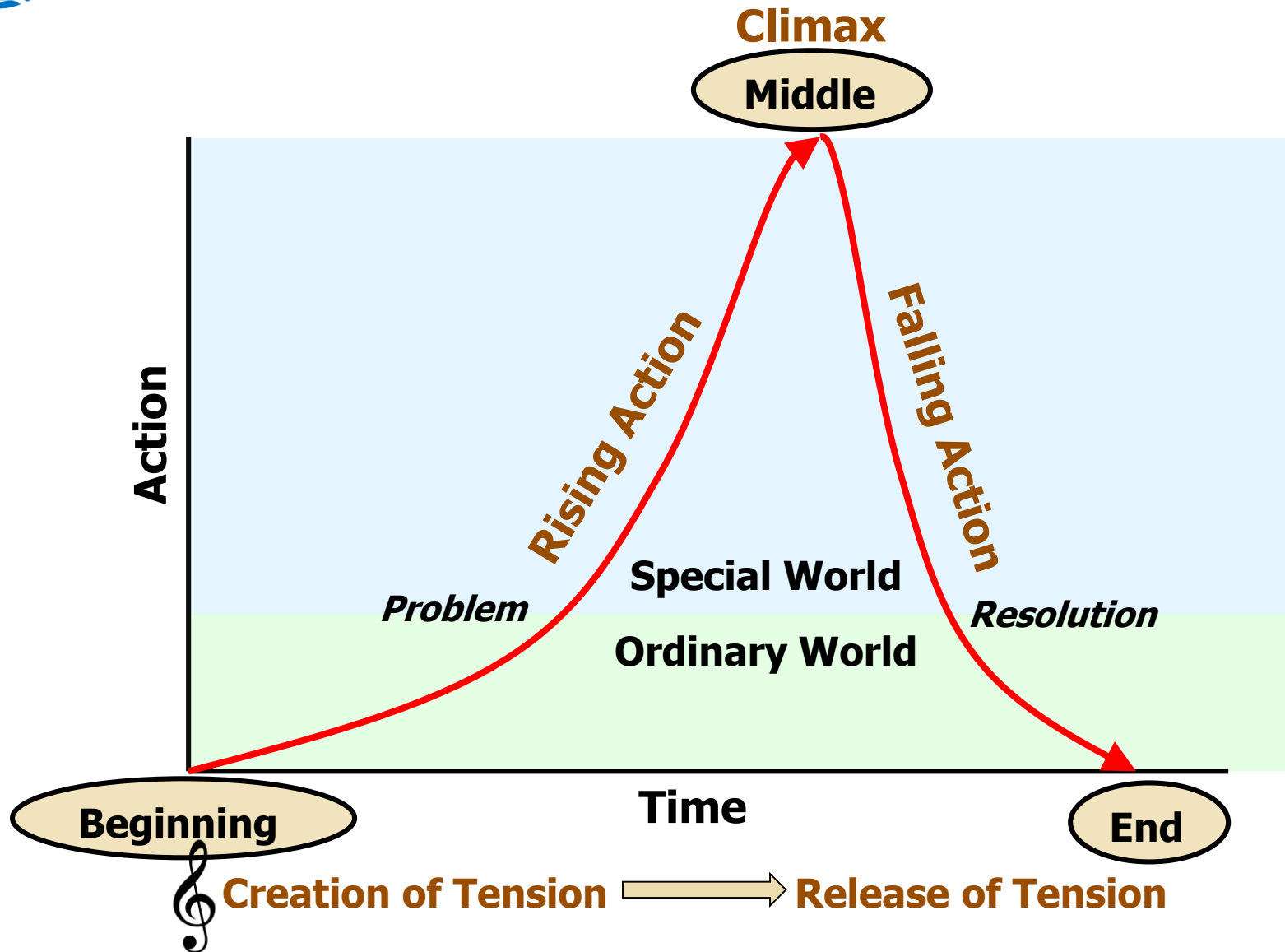


Randy Olson,
scientist-turned-
scriptwriter





Universal Narrative Structure



Is there anyone who doesn't think this is clear??

Examples: *The Odyssey*

**Hang out
with Calypso**



**Avoid Scylla
& Charybdis**



**Escape from
a cyclops**



Set sail for home

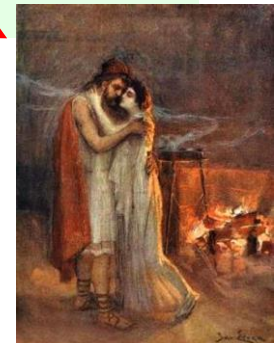


**Kill all the
suitors**



Trojan War ends

**Re-connect
with
Penelope**



Examples: Wizard of Oz

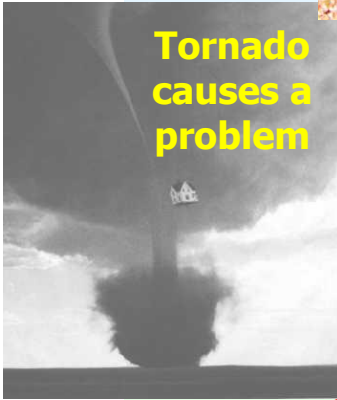
**They land
in Oz**



**They kill
the witch**



**Tornado
causes a
problem**



**Dorothy
clicks her
heels to
go home**



**Dorothy &
Toto in
Kansas**

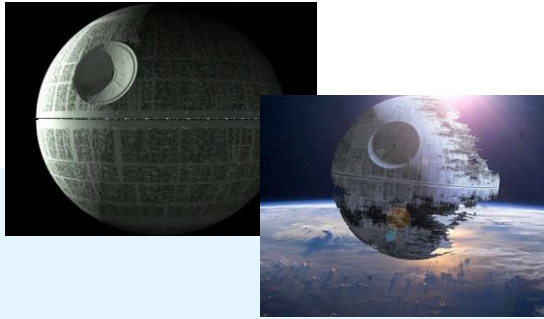


**Dorothy &
Toto back
in Kansas**

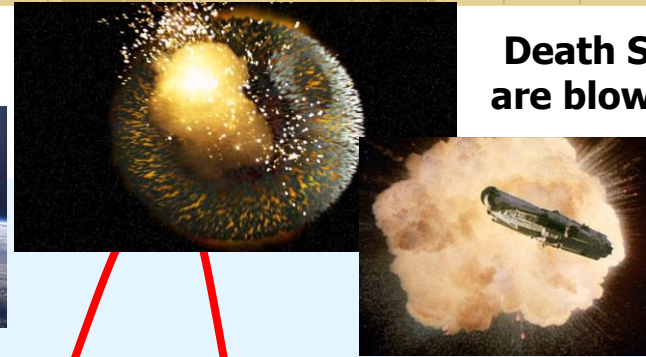


Examples: *Star Wars* trilogy

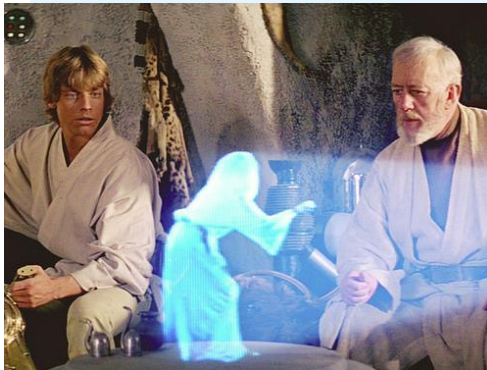
**Death Stars
are built**



**Death Stars
are blown up**



**Obi Wan and
a needy
Princess Leia
enlist Luke**



**Han saves Luke from that
creepy thing with his sister**



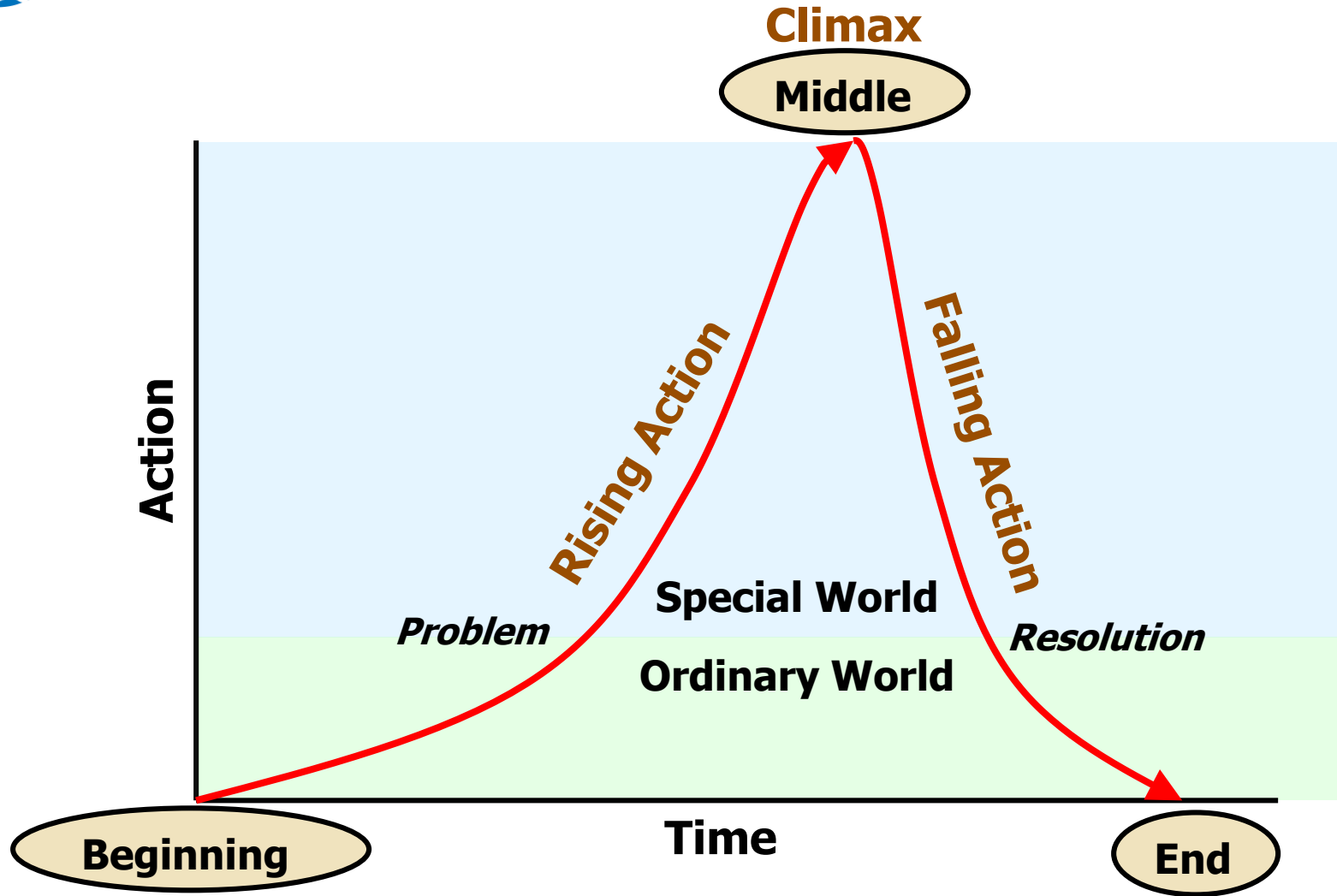
**C3PO & R2D2
settle down
together...**

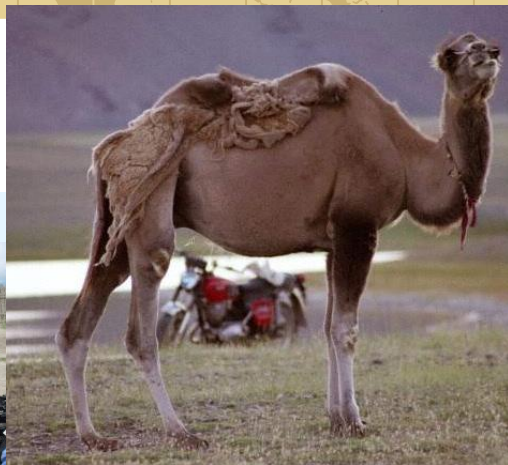
**...and raise
ewoks on their
fur farm**





How do we fit science into this structure?





Launch

Special World

Ordinary World

Beginning

End





Science Story 1: Fieldwork / Expedition



Fieldwork

- ▣ Methods
- ▣ Problems?
- ▣ Unexpected events?

Launch

Special World

Ordinary World



Background / Problem statement

- ▣ Prep for field

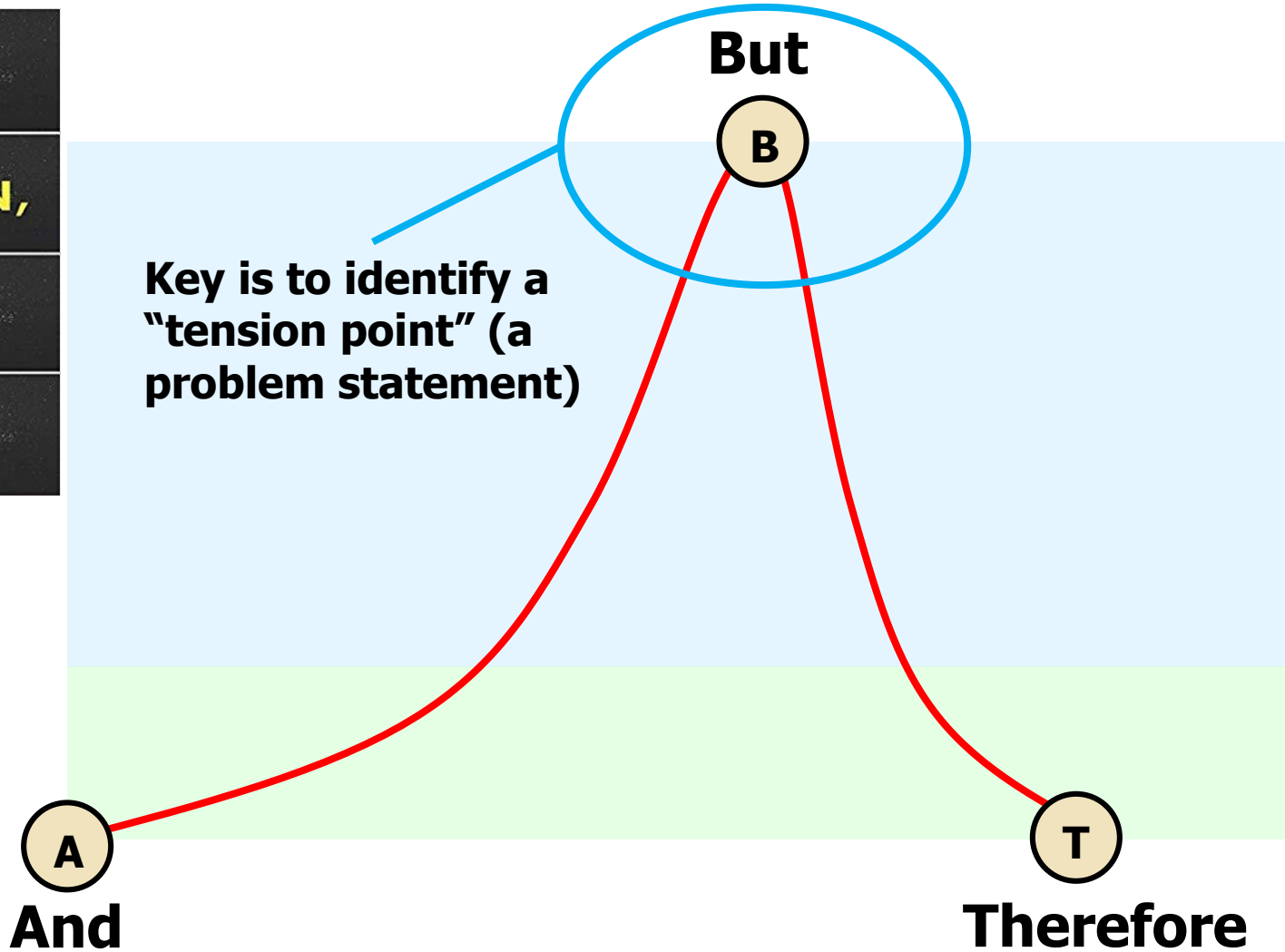


Back in the lab

- ▣ Results
- ▣ Summary / Conclusions
- ▣ Next steps

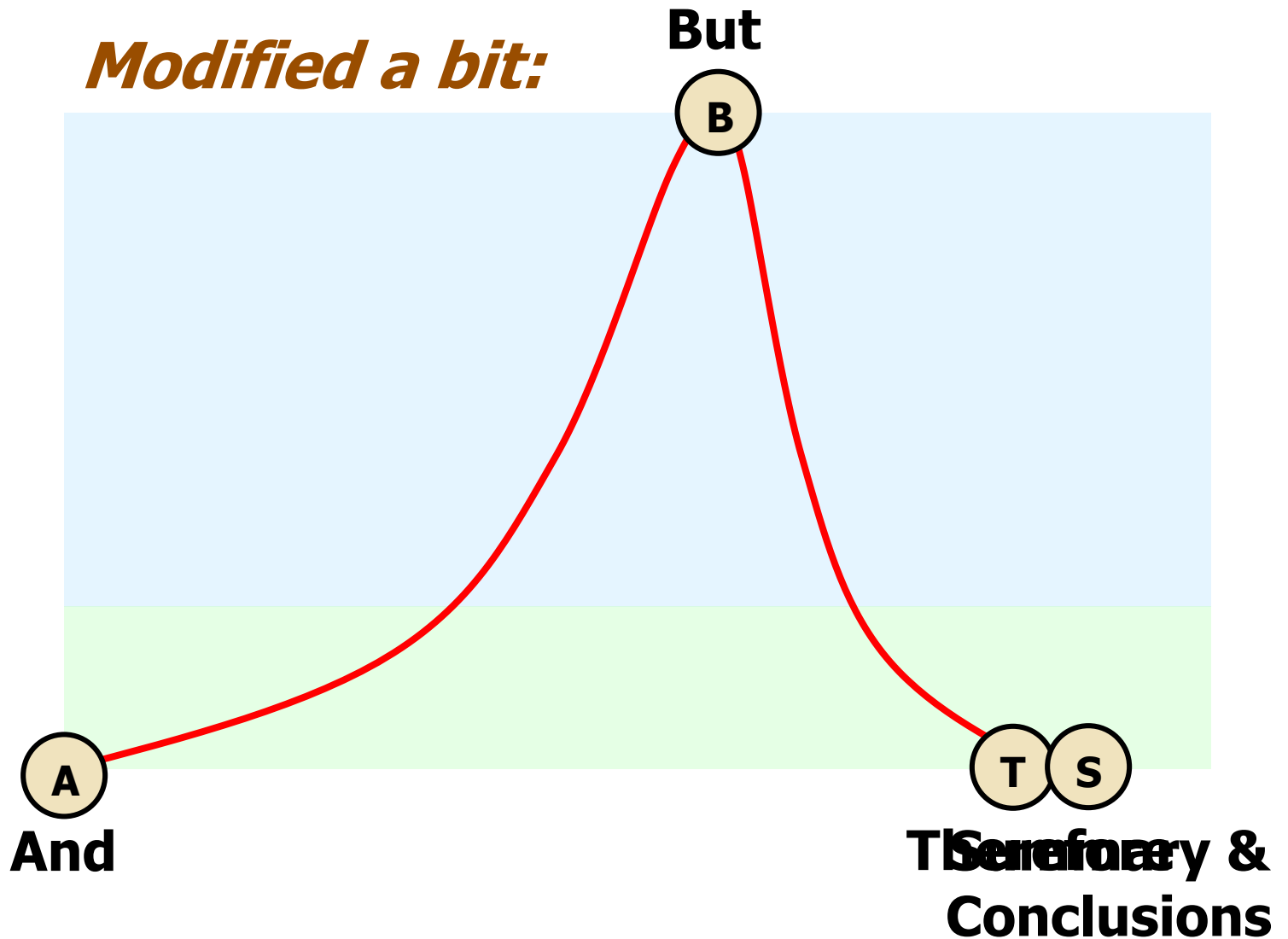


Science Story 2: Olson's "ABT"





Science Story 2: Olson's "ABT"



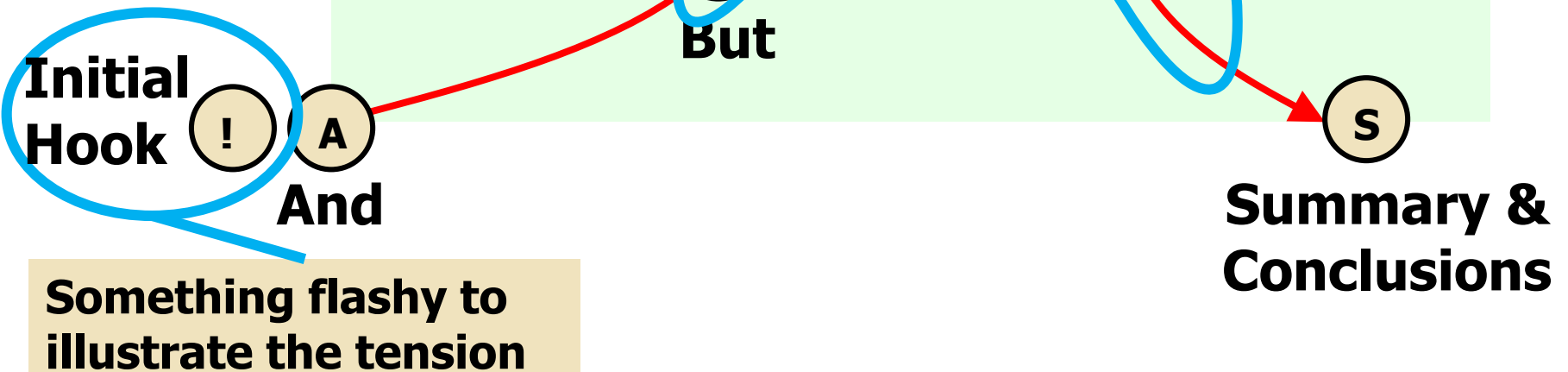


Science Story 2: Olson's "ABT"

Modified a bit:

Challenge is to identify "tension points" and develop them in a way that does not feel contrived

This part of the story should be relatively easy



Example tension points in science

❖ Problem statement

❖ ***How can we solve this problem?***

❖ Multiple working hypotheses

❖ T.C. Chamberlin: 1890 Method of MWH

- The Literature offers several hypotheses
- You may add several more

❖ ***Which hypothesis will "win"?***

- One may be favored – but there is always uncertainty

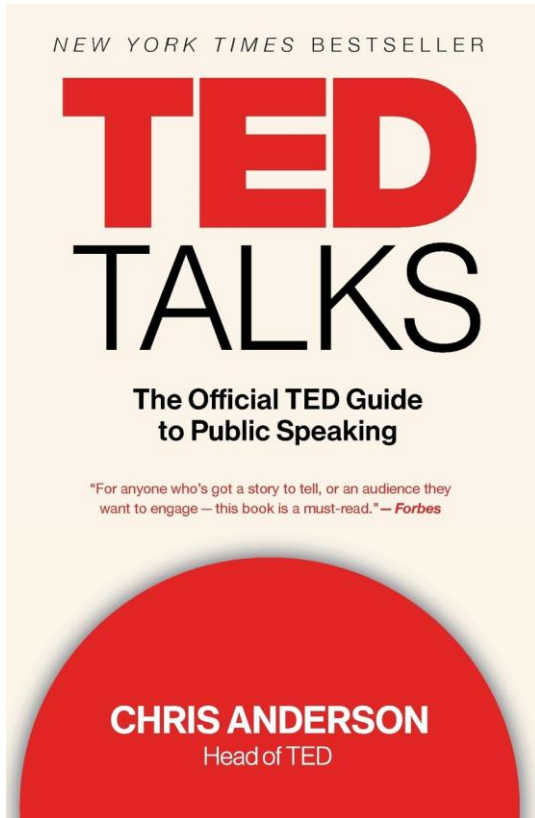
❖ Methodological problems & concerns

❖ ***We followed the recipe, but the results were ~~stupid~~ clearly unreliable. We were in a pickle – what did we do?***

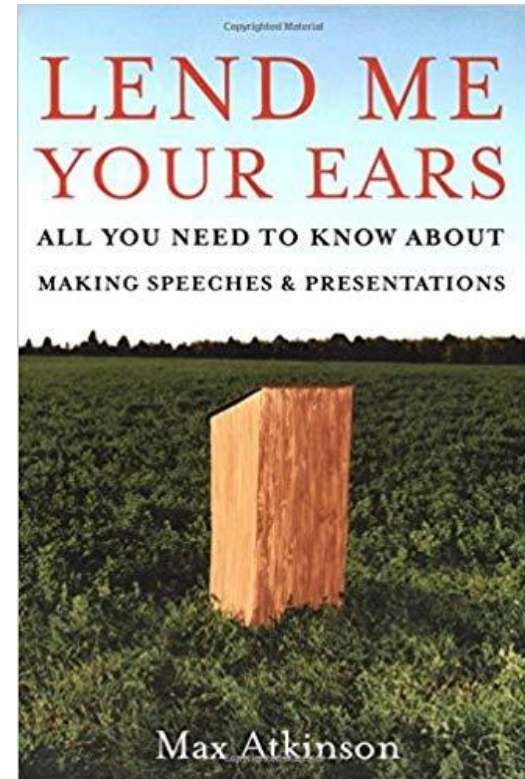
- Your audience will empathize and identify with you



*Word slides are
for wimps.*



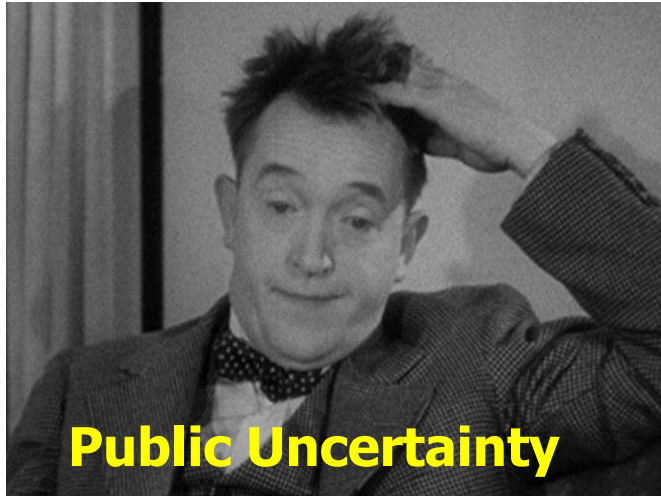
- ✚ **“Chalk and Talk”**
- ✚ Rhetorical devices:
 - ✚ Contrasts; analogies; rule of threes



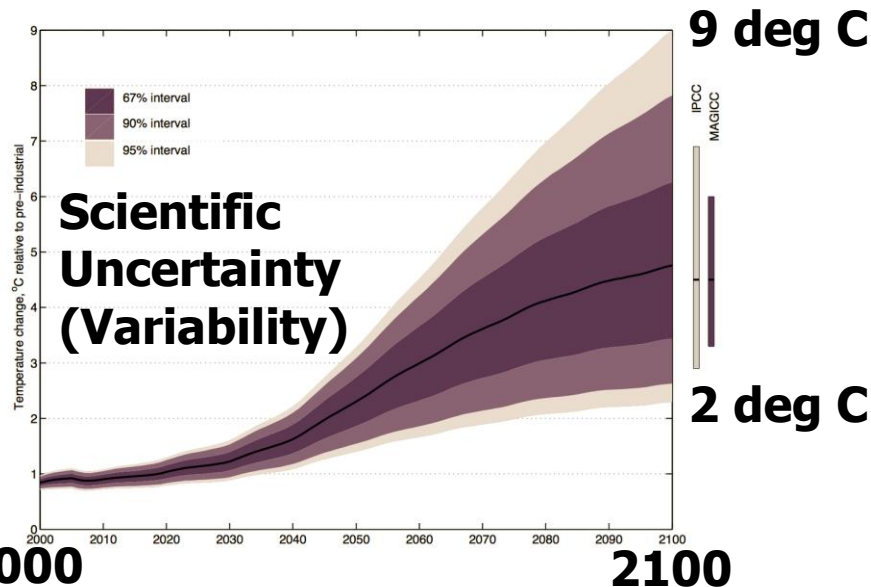
- ✚ Start with a curiosity; find a solution to the riddle; present it artfully
- ✚ “Throughline” = thread of the story

- ✚ **Practical advice about speaking in front of people**

Uncertainty -> Precision of our Knowledge



**Uncertainty
= *Ignorance***



Scientist



**Uncertainty ->
*Precision of our
Knowledge***



Dealing with Citizen Doubters of Science

"A landmark contribution to humanity's understanding of itself."
—The New York Times Book Review

THE RIGHTEOUS MIND

WHY GOOD
PEOPLE ARE DIVIDED
BY POLITICS AND
RELIGION

...AND SCIENCE!

JONATHAN
HAIDT



- ✚ "The mind is divided, like a rider (reason) on an elephant (emotion), and the rider's job is to serve the elephant."
 - ✚ ***To change someone's mind, you must talk to his elephant (emotions)***
- ✚ Emotions are driven by components of your Moral Foundation
 - ✚ Care / Harm
 - ✚ Fairness / Cheating
 - ✚ Loyalty / Betrayal
 - ✚ Authority / Subversion
 - ✚ Sanctity / Degradation
 - ✚ Liberty / Oppression
- ✚ We are 90% selfish primates, and ***10% good citizens who want to be part of something larger and nobler than ourselves.***



Dealing with Citizen Doubters of Science

- ⊕ Accept responsibility; do not lay blame
 - ⊕ **Blaming people for the unintended consequences of their actions creates enormous pushback & vicious backlash**
 - Automobile owners and global warming
 - Agriculture and water quality
 - ⊕ **Facts alone will not change minds**
 - *You must talk to the elephant!*
- ⊕ Encourage the 10% good citizen in each individual by appealing to the six moral foundations that drive emotion:
 - ⊕ We're all responsible, together.
 - ⊕ It's not ***Fair*** for us to pollute our shared environment
 - ⊕ By doing so, we're violating the ***Sanctity*** of nature and the ***Authority*** of our democratic government
 - ⊕ And ***Harming*** the land and ***Betraying*** our forefathers who left the land to us and our children
 - ⊕ Thereby infringing on their ***Liberty***



Summary: Tidying Things Up

- ✿ Create your science story using ABT structure
 - ✦ ABT = And --> But (tension) --> Therefore (resolution)
 - ✦ Seek out natural tension points
 - Competition among multiple working hypotheses
 - Excitement in the field or Problems with methods
- ✿ Simplify your story
 - ✦ Pretend you're explaining it to your parents or a new student
 - Understanding = ability to explain
 - ✦ Use analogy and humor
- ✿ Uncertainty -> Precision of our Knowledge
- ✿ To change someone's mind, talk to his elephant to encourage his nobler self



Questions?

