Class 2: Designing technical presentations

Instructor: Michael Szell
Sep 3, 2019
Today you will learn how to design scientific presentations

Good and bad examples of technical presentations

Structural design of presentations

Slide design
Today you will NOT learn

How to deliver a presentation:

Will be done by Helle in class 5 on Sep 24.
The Higgs Boson validates the Standard Model of Physics

Finding the Higgs Boson was the most important goal of particle physics for decades

The Higgs Boson is what gives mass to particles
Finding the Higgs Boson was the most important goal of particle physics for decades

It was proposed by Peter Higgs and other physicists in 1964!

Because of its significance some media called it "God Particle"

https://en.wikipedia.org/wiki/Higgs_boson
When CERN discovered a new boson, it lead to extreme media hype and ultimately to a Nobel Prize for Higgs.

The LHC costed 13,500,000,000 EUR

https://arxiv.org/abs/1603.00886
Let's look at how CERN announced its monumental discovery
We present updated results on SM Higgs searches based on the data recorded in 2011 at $\sqrt{s}=7$ TeV ($\sim 4.9$ fb$^{-1}$) and 2012 at $\sqrt{s}=8$ TeV ($\sim 5.9$ fb$^{-1}$)

Results are preliminary:
- 2012 data recorded until 2 weeks ago
- harsher conditions in 2012 due to $\sim x2$ larger event pile-up
- new, improved analyses deployed for the first time

$H \rightarrow \gamma\gamma$ and $H \rightarrow 4l$: high-sensitivity at low-$m_H$; high mass-resolution; pile-up robust
- analyses improved to increase sensitivity → new results from 2011 data
- all the data recorded so far in 2012 have been analyzed
→ results are presented here for the first time

Other low-mass channels: $H \rightarrow WW^{(*)} \rightarrow lvlv$, $H \rightarrow tt\ell\ell$, $W/ZH \rightarrow W/Z bb$:
- $E_{T}^{miss}$ in final state → less robust to pile-up
- worse mass resolution, no signal “peak” in some cases
- complex mixture of backgrounds
→ understanding of the detector performance and backgrounds in 2012 well advanced, but results not yet mature enough to be presented today
→ 2011 results used here for these channels for the overall combination

ATLAS: Status of SM Higgs searches, 4/7/2012

Efficiency of inclusive electron trigger ($E_T$ thresholds as low as 24) as a function of “pile-up”

Many improvements in $E_T^{miss}$ trigger:
- e.g. pile-up suppression,
- L2 fast front-end board sums instead of L1 only
- same threshold as in 2011, sharper turn-on curve

From $Z \rightarrow ee$ events

After 32 more slides with similar details...
The big result is presented on slide 44.

The big result is summarized on slide 51

We have presented preliminary results on searches for a SM Higgs boson using the full data sample recorded so far for $H \to \gamma \gamma$ and $H \to 4l$ ($\sqrt{s}=7, 8$ TeV, $\sim 10.7$ fb$^{-1}$) and the 2011 data ($\sqrt{s}=7$ TeV, $\sim 4.9$ fb$^{-1}$) for the other channels.

Impressive accomplishment of the experiment in all its components: first results with full 2012 dataset were available less than one week from "end of data-taking", with a fraction of good-quality data used for physics of ~ 90% of the delivered luminosity.

We have looked for a SM Higgs over the mass region 110-600 GeV in 12 channels.

We have excluded at 99% CL the full region up to 523 GeV except $121.8 < m_H < 130.7$ GeV.

We observe an excess of events at $m_H \sim 126.5$ GeV with local significance $5.0 \sigma$.

- The excess is driven by the two high mass resolution channels:
  - $H \to \gamma \gamma$ (4.5 $\sigma$) and $H \to ZZ^* \to 4l$ (3.4 $\sigma$)
- Expected significance from a SM Higgs: 4.6 $\sigma$
- Fitted signal strength: $1.2 \pm 0.3$ of the SM expectation

If it is the SM Higgs, it's very kind of it to be at that mass accessible at LHC in $\gamma \gamma$, $ZZ^* \to 4l$, $WW^* \to lv$, $bb$, $\tau \tau$.

ATLAS: Status of SM Higgs searches, 4/7/2012

EXERCISE: What is wrong with this presentation?

Form groups of 4.

5 min: Discuss in group:
1) What are the biggest issues?
2) What is the reason for these issues?

5 min: Discuss with whole class
EXERCISE: What is wrong with this presentation?

What went wrong in the communication situation?

3 min: Fill in the table.
<table>
<thead>
<tr>
<th></th>
<th>WHO</th>
<th>WHAT</th>
<th>WHOM</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>How it was imagined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What happened</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Main mistake: The audience is ignored!

Who is the audience?

Experts (scientists) and non-experts (science journalists + public)
Ignoring the audience leads to a chain of problems

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>WHOM</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>How it was imagined</td>
<td>To inform colleagues</td>
<td>Technical presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What happened</td>
<td>To inform colleagues</td>
<td>Technical presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How should it have happened?</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>WHO</td>
<td>WHAT</td>
<td>WHOM</td>
<td>WHY</td>
<td>HOW</td>
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</tr>
<tr>
<td>How it was imagined</td>
<td>[Image of character]</td>
<td>[Image of character]</td>
<td>To inform colleagues</td>
<td>Technical presentation</td>
</tr>
<tr>
<td>What happened</td>
<td>[Image of character]</td>
<td>[Image of character]</td>
<td>To inform colleagues</td>
<td>Technical presentation</td>
</tr>
<tr>
<td>How should it have happened?</td>
<td>[Image of character]</td>
<td>[Image of character]</td>
<td>To inform the public</td>
<td>Non-technical presentation</td>
</tr>
</tbody>
</table>
Structural design of presentations
To excel in your presentations, you need content, passion, and a good sense of your audience.
Both content and passion are necessary

Passion but no content

Content but no passion
Both content and passion are necessary

Carl Sagan effect:
Mistaking passionate communication with lack of content
When presenting, you must seize upon the advantages of presentations and downplay the disadvantages.

Advantages?  Disadvantages?
When presenting, you must seize upon the advantages of presentations and downplay the disadvantages.

Advantages

• Chance to answer questions

• Chance to read expressions

• Chance to emphasize key points

• Ability to use visual aids

• Assurance that audience has witnessed the content

Disadvantages

• One chance to talk, one chance to hear

• Difficult for audience to look up background information

• Audience restricted by pace of speaker

• Success dependent on delivery

• Difficult assembling speaker and audience
When preparing a presentation, what are the important questions to ask about the audience?
When preparing a presentation, what are the important questions to ask about the audience?

Audience

What do they know?
When preparing a presentation, what are the important questions to ask about the audience?

- What do they know?
- Why will they be interested?
When preparing a presentation, what are the important questions to ask about the audience?

Audience

What do they know?

Why will they be interested?

What do I want to achieve?
Inform, persuade, inspire?
DISCUSSION: Why are these slides not persuasive?

Temperature Concern on SRM Joints

27 Jan 1986
There is a culture of ineffective technical presentations. Why?
We imitate and follow social norms

What if the norm is bad?
Slides are an aid, NOT the main content
Not everything in a presentation needs slides
A digital acquisition system has to sample at a rate fast enough to retain the shape of the analog signal.
Hefner developed a dynamic electro-thermal model for IGBTs from of the
temperature-dependent IGBT silicon chip, packages and heat sinks. The temperature-
dependent IGBT electrical model describes the instantaneous electrical behavior in
terms of the instantaneous temperature of the IGBT silicon chip surface. The
instantaneous power dissipated in the IGBT is calculated using the electrical model
and determines the instantaneous heat rate that is applied to the surface of the silicon
chip thermal model. Hefner incorporated this methodology into the SABER circuit
simulator.

Adams, Joshi and Blackburn considered thermal interactions between the heat
sources, substrate, and encloses walls as affected by the thermal conductance of the
walls and substrate with the intent of determining which physical effects and level of
detail are necessary to accurately predict thermal behavior of discretely heated
enclosures.

Chen, Wu and Boroveich are modeling of thermal and electrical behavior using
several commercial softwares (I-DEAS, Maxwell, Flotherm and Saber) and 3-D,
 transient approaches.
Our research question is whether the dunlins of Iceland and the Baltic Sea are different subspecies.
Presentation software defaults are bad
I need you to: Break The Cycle
To excel in your scientific presentation, you guide your audience up the mountain of your work.
Many good presentations have an hourglass structure.

Big picture | Details | Big picture

Beginning | Middle | Ending
You must define a fitting scope and depth.
The area is determined by the speaking time:

- 20 min
- 5 min
- unknown
What are the common mistakes with scope and depth?
What are the common mistakes with scope and depth?

too broad scope

too narrow depth
What are the common mistakes with scope and depth?

Problem 1: Trying to cover too much
Problem 2: Talking too much about your struggles

too broad scope

too narrow depth
The success of a presentation is measured by how well you have communicated new insights.
What are the common mistakes with scope and depth?

Problem 1: Too many details
Problem 2: Laundry lists, lack of guidance
Many good presentations have an hourglass structure
Accompany your facts with guidance

"This could sound obvious to you, but is an important concept to build on:"
Easy fact

"This is the IMPORTANT INSIGHT of this work:"
Important insight
"Look how beautiful it is. Nobody knew before."

"This is a minor detail but interesting for the mathematicians:"
Detail
Where do you need transitions?
You need transitions between sections
When you end, reconnect to the beginning
Good speakers make a transition between each slide
Example presentation
To prepare my presentation I analyzed the situation

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>WHOM</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Scientist</td>
<td>Data visualization project on transport justice</td>
<td>3rd year DS BSc students</td>
<td>Teach good presentations Inspire you about the topic</td>
<td>7 min presentation (non-technical)</td>
</tr>
<tr>
<td>Tech Comm teacher</td>
<td></td>
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</tr>
</tbody>
</table>
Revealing wasted urban space through data visualization

Michael Szell
Computer Science Dept

Sep 3, 2019
Space is not distributed in a fair way between different modes of transport.
Most space is for cars, but most people use bikes
Can we use data science and visualization to learn more?
What a lovely *green*..
What a **lovely green..** MONSTER

800m x 500m
We visualized ALL parking spaces with polygon packing
There are huge differences between car and bike parking
There are huge differences between car and bike parking.
Our project **What the Street!?** covers 23 world cities

Open-sourced at https://github.com/moovel/lab-what-the-street
Why is there so much car parking?

Is it necessary?
Cars are used 36 minutes per day
Cars are not used 1404 minutes per day
Cars are used 36 minutes per day
Cars are not used 1404 minutes per day

A typical snapshot of Copenhagen

5,500 cars moving
250,000 cars parked
We are wasting space worth 6,000 playgrounds!

A typical snapshot of Copenhagen

5,500 cars moving

250,000 cars parked

2.5 \times 6,000 = 250,000

6,000 Playgrounds
The Mobility Space Report: What the Street!

Who owns Copenhagen?

City space is limited! What do you think, how much space is allocated to the different ways of moving through the city?

<table>
<thead>
<tr>
<th>Cars</th>
<th>Rails</th>
<th>Bikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Take your best guess by adjusting the sliders.
How can we get back all the space?
10% of self-driving cars can deliver same mobility

Self-driving, shared cars sound nice but are NOT the ultimate solution.
You can't beat math:
Simple geometry tells us cars will ALWAYS be inefficient.
Pioneering cities have started to remove parking. Let us push for more to save our cities and the planet!

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EXERCISE: Analyze the talk's structure

Form groups of 4.

10 min: Analyze in group

1) Content, passion, audience
2) Hourglass, sections and transitions
3) Scope and depth
4) Purpose fulfilled?

5 min: Discuss with whole class
10 min break
Slide design
DISCUSSION: Analyze the talk's slides

How are the slides different than in a "typical" research talk?
The beginning should answer what the presentation is about without leaving the audience behind.
The beginning should answer what the presentation is about without leaving the audience behind.

Determining Whether Atmospheric Mercury Goes into Surface Snow after a Depletion Event

Katrine Aspmo  
Torunn Berg  
Norwegian Institute for Air Research

Grethe Wibetoe  
University of Oslo, Dept. of Chemistry

June 16, 2004
A common error in the mapping of technical talks is to show a list that is not memorable.
A common error in the mapping of technical talks is to show a list that is not memorable.

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
The assertion-evidence structure consists of a message headline supported by visual evidence.

The way a dog sniffs does not contaminate the vapor stream from the scent source.

[Settles et al., 2002]
The assertion-evidence structure consists of a message headline supported by visual evidence.

Xenon headlights illuminate signs better than halogen headlights do.
The assertion-evidence structure consists of a message headline supported by visual evidence.

Space is not distributed in a fair way between different modes of transport.
Change defaults: Bulleted lists lack logical connections
Change defaults: Bulleted lists lack logical connections
Change defaults: Set up master slides

Page title

Title Text

Subtitle text

IT UNIVERSITY OF COPENHAGEN
Change defaults: Use readable font consistently
(PRIMARY CONCERNS -

FIELD JOINT - HIGHEST CONCERN

- EROSION PENETRATION OF PRIMARY SEAL REQUIRES RELIABLE SECONDARY SEAL FOR PRESSURE INTEGRITY
  - IGNITION TRANSIENT - (0-600 MS)
    - (0-170 MS) HIGH PROBABILITY OF RELIABLE SECONDARY SEAL
    - (170-330 MS) REDUCED PROBABILITY OF RELIABLE SECONDARY SEAL
    - (330-600 MS) HIGH PROBABILITY OF NO SECONDARY SEAL CAPABILITY
  - STEADY STATE - (600 MS - 2 MINUTES)
    - IF EROSION PENETRATES PRIMARY O-RING SEAL - HIGH PROBABILITY OF NO SECONDARY SEAL CAPABILITY
      - BENCH TESTING SHOWED O-RING NOT CAPABLE OF MAINTAINING CONTACT WITH METAL PARTS GAP OPERATING TO MEOP
      - BENCH TESTING SHOWED CAPABILITY TO MAINTAIN O-RING CONTACT DURING INITIAL PHASE (0 - 170 MS) OF TRANSIENT
Maximize signal-to-noise and slow down with graphs

We developed the mobility triangle. It shows the arrogance of space with 2 data points.
Gravitation and hydrostatic pressure

\[ m = \rho V = \rho \delta^2 h \]

- \[ F_g = mg \sin \psi \]
- \[ F_{ph} = mg \sin \psi_s \]
- \[ F_{g,ph} = mg(\sin \psi + \sin \psi_s) \]
Gravitation and hydrostatic pressure

\[ m = \rho V = \rho \delta^2 h \]

- \[ F_g = mg \sin \psi \]
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- \[ F_{g,ph} = mg(\sin \psi + \sin \psi_s) \]
Gravitation and hydrostatic pressure

\[ m = \rho V = \rho \delta^2 h \]

- \[ F_g = mg \sin \psi \]
- \[ F_{ph} = mg \sin \psi \]
- \[ F_{\phi h} = mg(\sin \psi + \sin \psi_s) \]
Tsunamis cause devastating destruction, especially to sparsely vegetated areas.

*2004 Indian Ocean Tsunami: Gleebruk Village, Sri Lanka*

**Before:**

**After:**
Tsunamis cause devastating destruction, especially to sparsely vegetated areas.

2004 Indian Ocean Tsunami: Gleebruk Village, Sri Lanka

Before: | After:
--- | ---

Tsunamis cause devastating destruction, especially to sparsely vegetated areas

2004 Indian Ocean Tsunami: Gleebruk Village, Sri Lanka

Before | After
--- | ---
Sparse | Sparse
Final slides should emphasize the main takeaway

Thank you!

Questions?
In summary, high concentrations of acetic acid help protect steel from corrosion.

- Adsorbed HOAc allows the growth of siderite.
- A thick siderite layer protects the steel from corrosion.
Final slides can give a call for action

Pioneering cities have started to remove parking. Let us push for more to save our cities and the planet!

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Presentations for different purposes
When informing, be logical and straightforward

Tell them what you are going to tell them,
tell them,
and tell them what you told them.

https://en.wikipedia.org/wiki/Aristotle
When persuading, audience bias has to be considered.

With an antagonistic audience, building credibility is most important.
When inspiring or entertaining, passion & delivery is key
When teaching, present first evidence, then assertion.

How could you improve these slides?

Tsunamis cause devastating destruction, especially to sparsely vegetated areas.

2004 Indian Ocean Tsunami: Gleebruk Village, Sri Lanka

Before: [Image of before Tsunami impact]

After: [Image of after Tsunami impact]
Preparing presentations
Before opening your computer, decide the story of your talk
Preparing today's 3.5-hour lecture took me 20+ hours

... and I did not practice much
EXERCISE: Improve your own presentation

10 min: Start improving your slides following the checklist

Form groups of 2.
5 min: Apply checklist to your partner's slides
5+5 min: Get+give feedback

Open: Continue improving until the whole checklist is satisfied
Mandatory assignment 1: Slides

Consider your own research topic (for example, first or second year project). Using this topic, create and hand in a deck of 5-12 slides in pdf format for a 6 minute presentation targeted towards informing a general audience. It should follow the assertion-evidence format and include images. Use the checklist to ensure quality slides.

Suggested starting point: the slides from an existing previous presentation like the ones you gave during your first/second year project exams. In a later class you will be expected to present.

Hand-in of this assignment is required for taking the final exam. Hand-in after the due date is not possible.

checklistslides.xlsx

Due date: Friday, 20 September 2019, 23:59
Today you learned

Presentations are much more than a list of facts

Slide design is important to not lose your audience

Know your audience!
Sources and further materials for today's class

https://www.craftofscientificpresentations.com