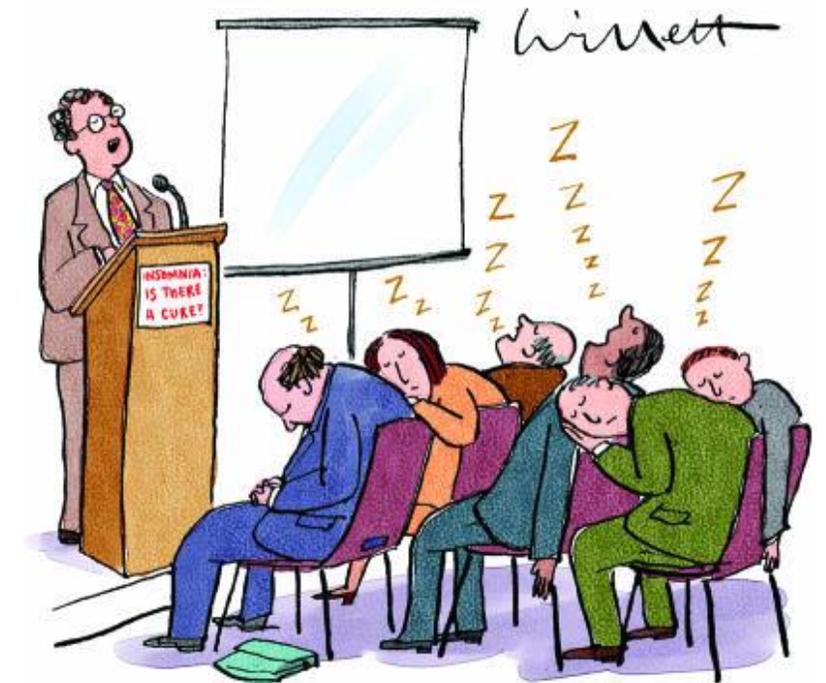


How to present scientific content at its best

Francesco Toschi

ISAPP School

Bad Liebenzell, 23.09.2024



Few disclaimers



- I am not a world-leading expert in presentations
- Conversation is **welcome** (e.g., disagreement)
- This is a very **subjective** topic (but some things are rather objective...)

Why presenting your results?

“Unshared knowledge is like a buried treasure, valuable but useless”

Why presenting your results?

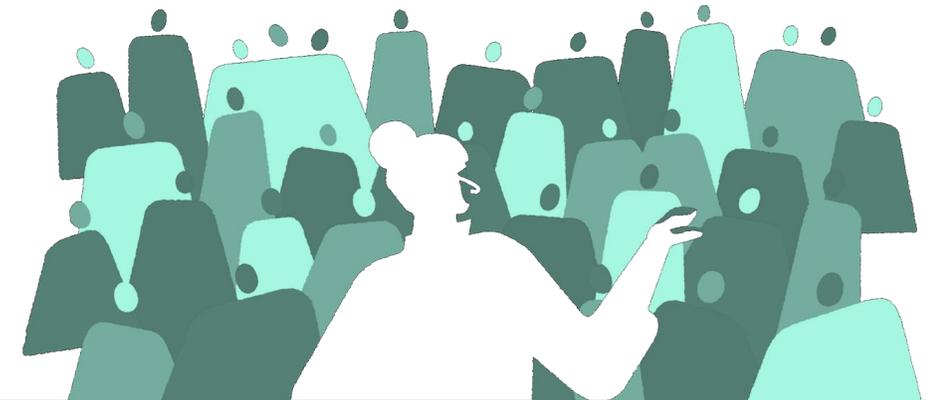
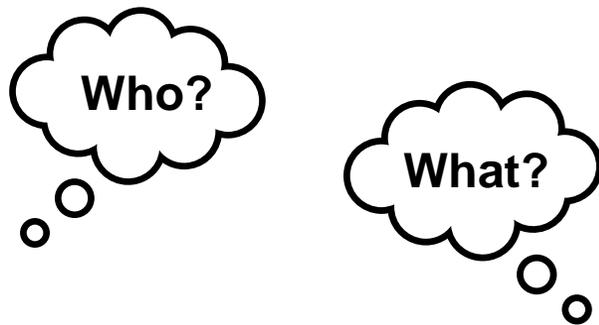
“Unshared knowledge is like a buried treasure, valuable but useless”

- ChatGPT

Think about your audience

Two important questions to ask yourself:

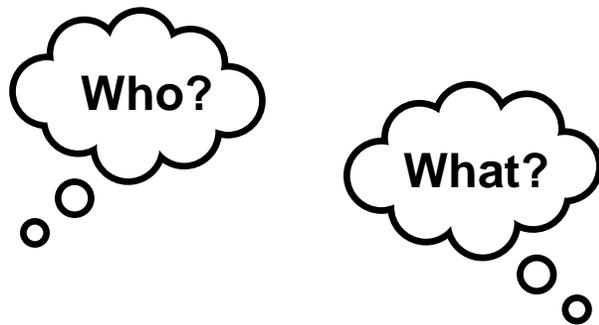
- “who is my **audience**?”
- “what do I want my **audience** to take home?”

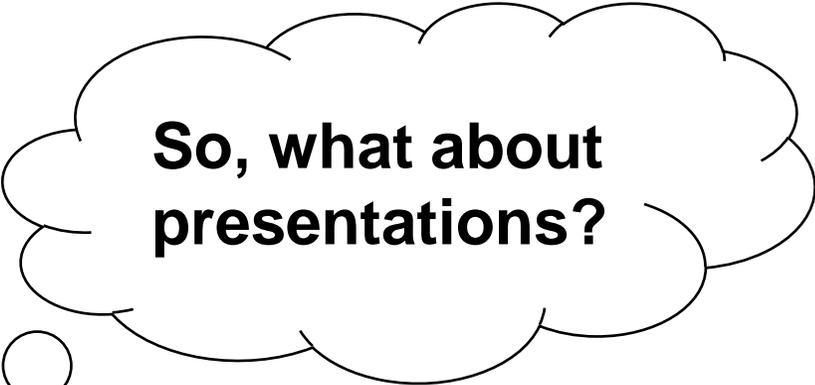


Think about your audience

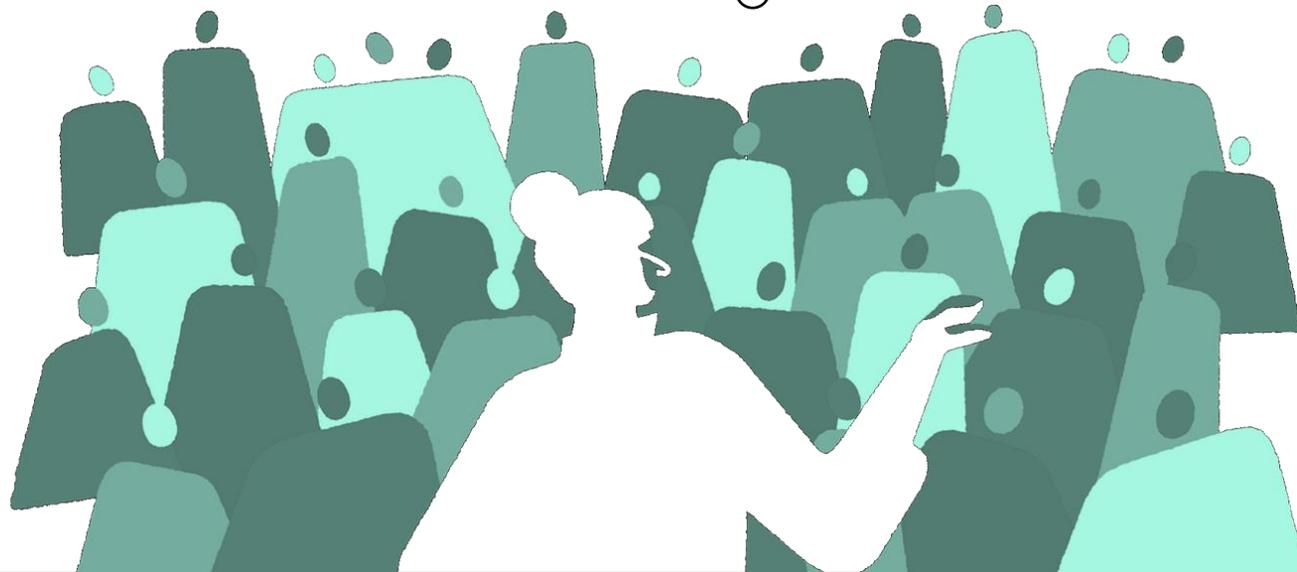
Two important questions to ask yourself:

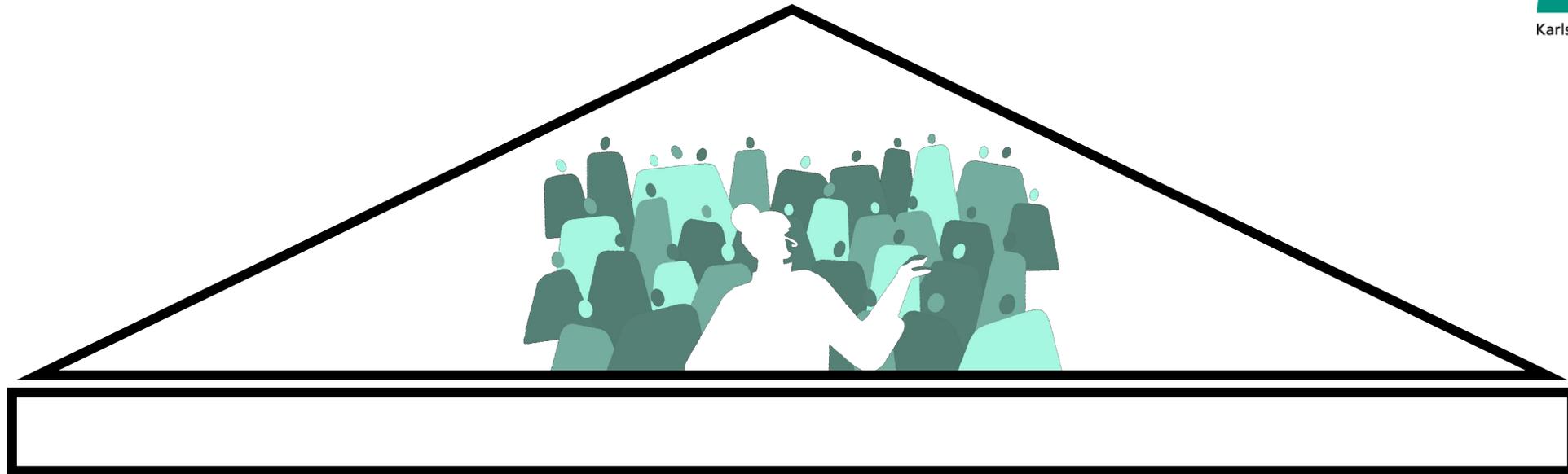
- “who is my **audience**?” → level of details
- “what do I want my **audience** to take home?” → key message



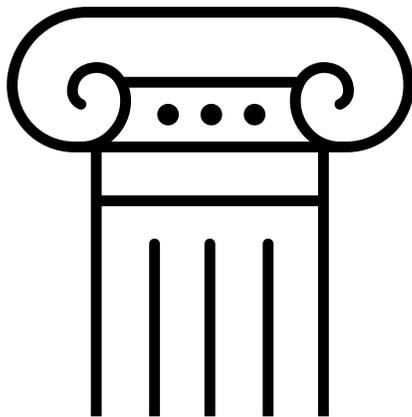


**So, what about
presentations?**

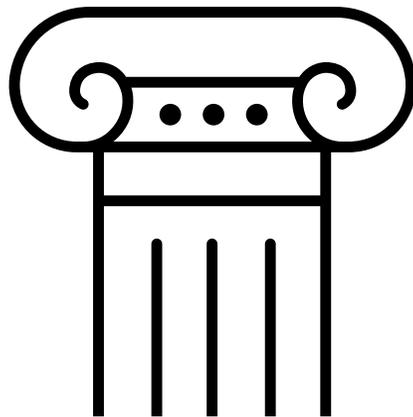




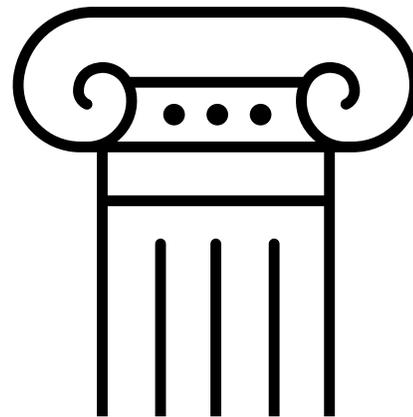
Structure



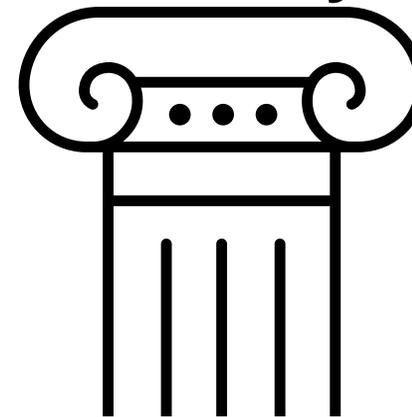
Content

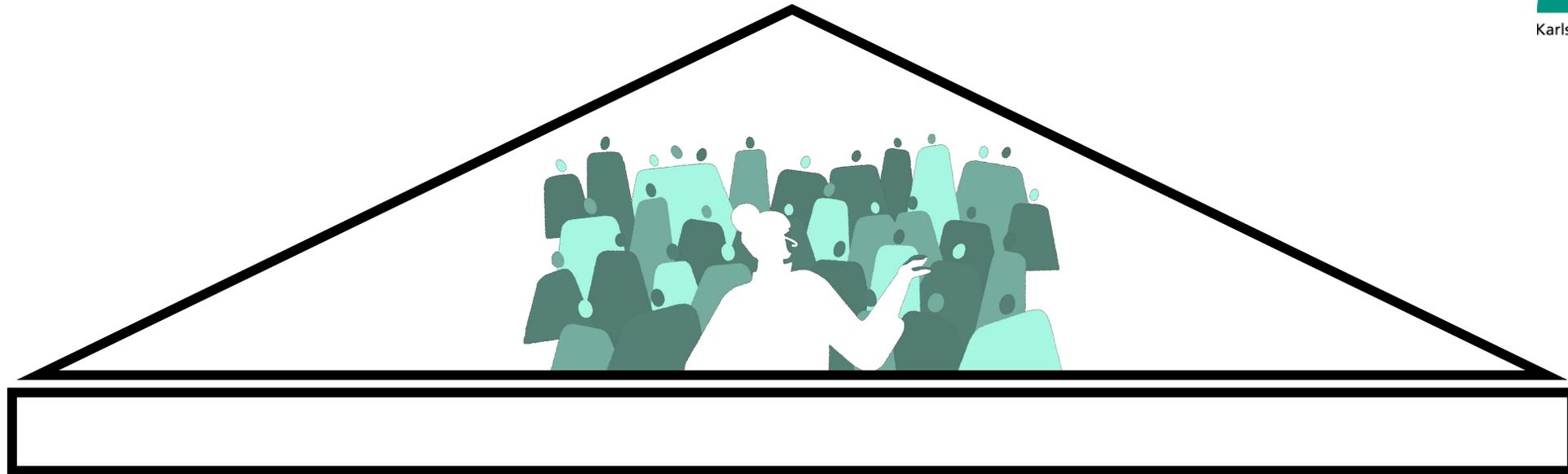


Visual aids

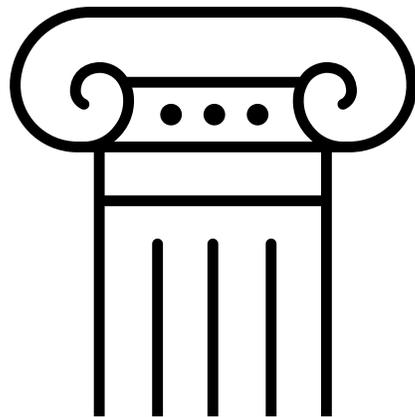


Delivery

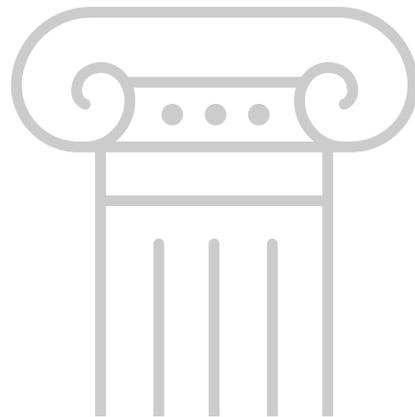




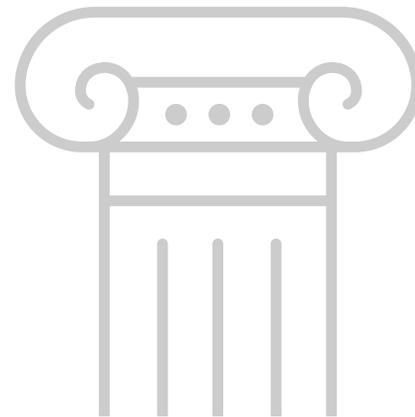
Structure



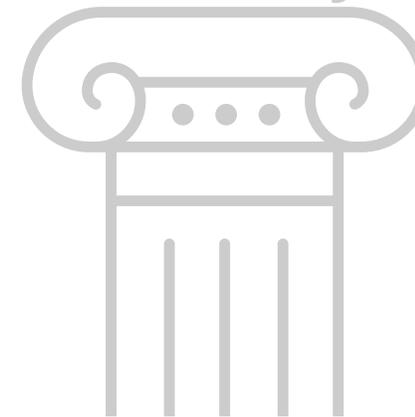
Content



Visual aids



Delivery



Structure of a presentation



Structure of a presentation



- Introduce problem, experiment, method, ...



Suggestion (by B. von Krosigk)

Outline? Only verbally or as built-in feature

Structure of a presentation



- Introduce problem, experiment, method, ...
- What is your goal?
- How do you achieve your goal?
- Problems and solutions



Structure of a presentation



- Introduce problem, experiment, method, ...

- What is your goal?

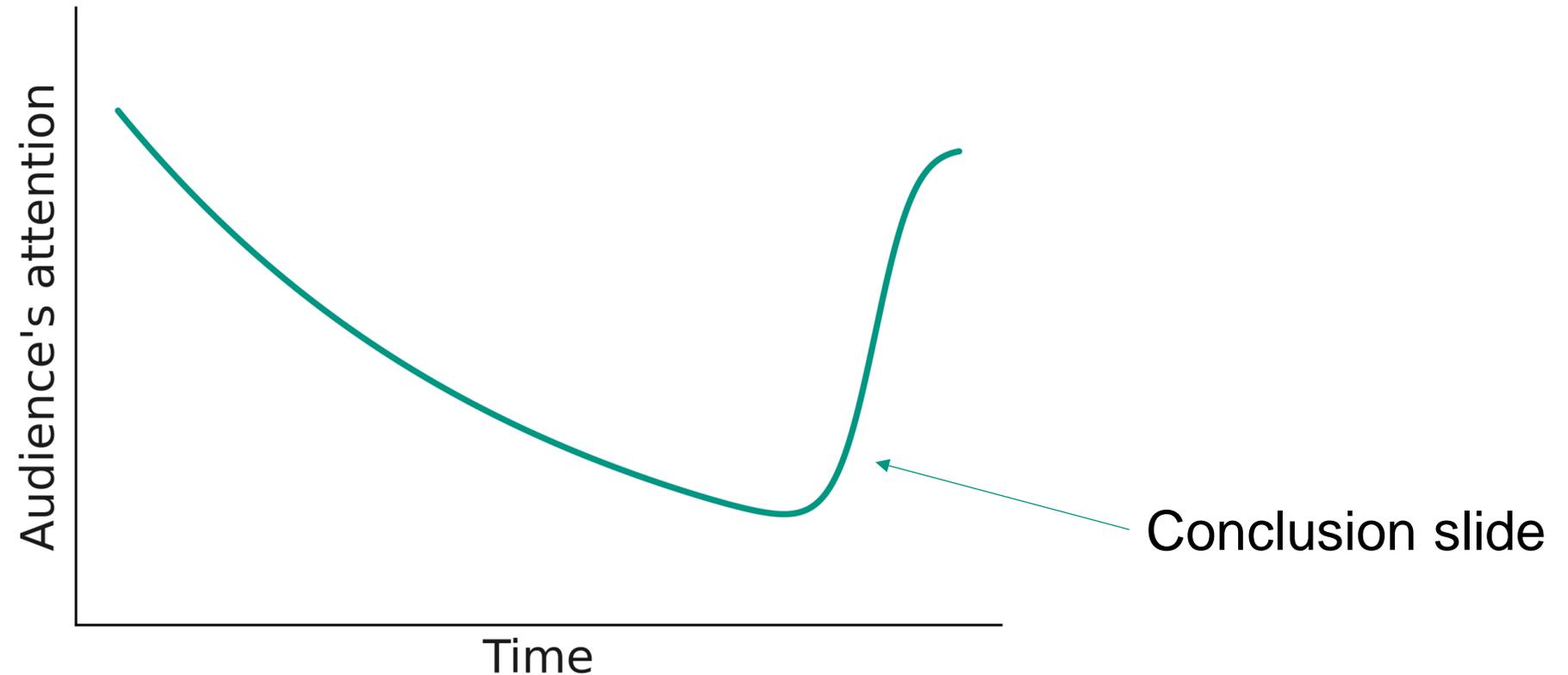
- How do you achieve your goal?

- Problems and solutions

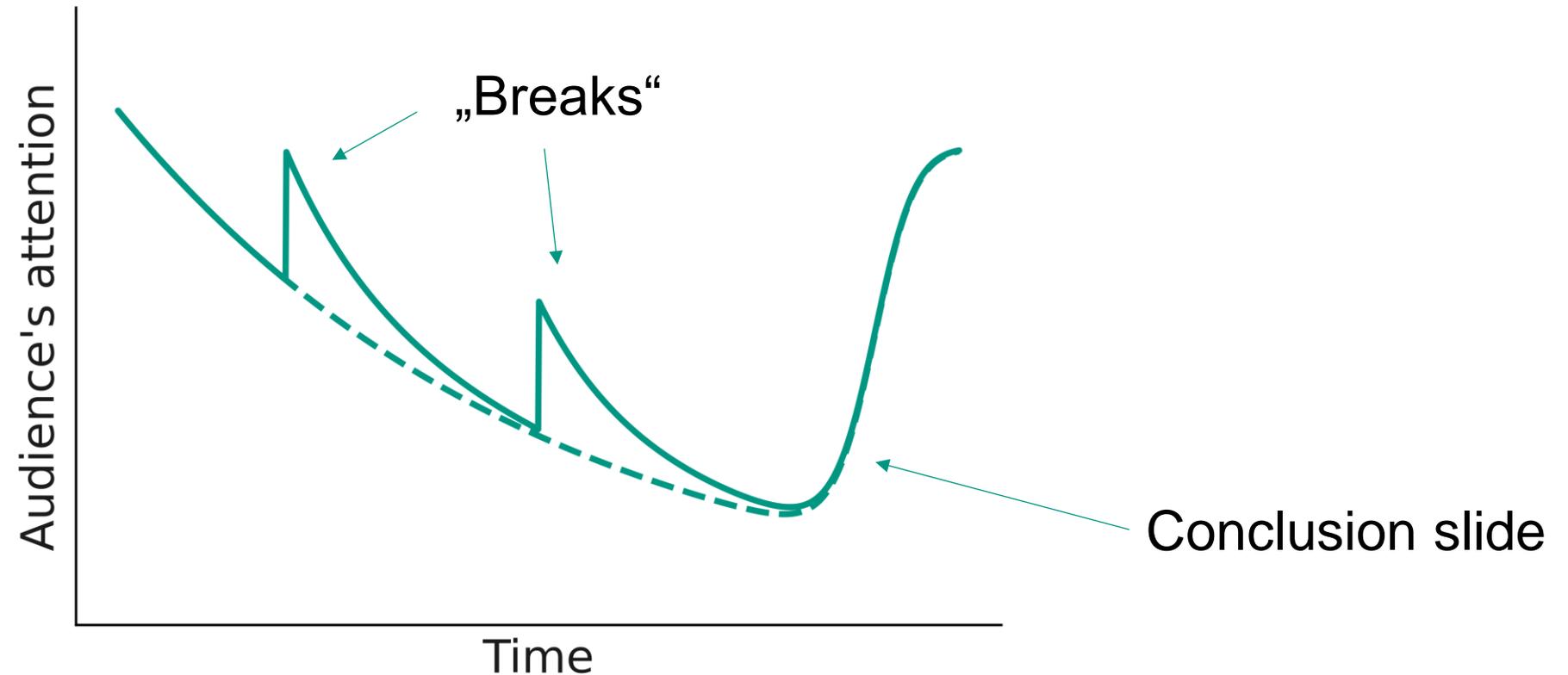
- How your work fits in the big picture

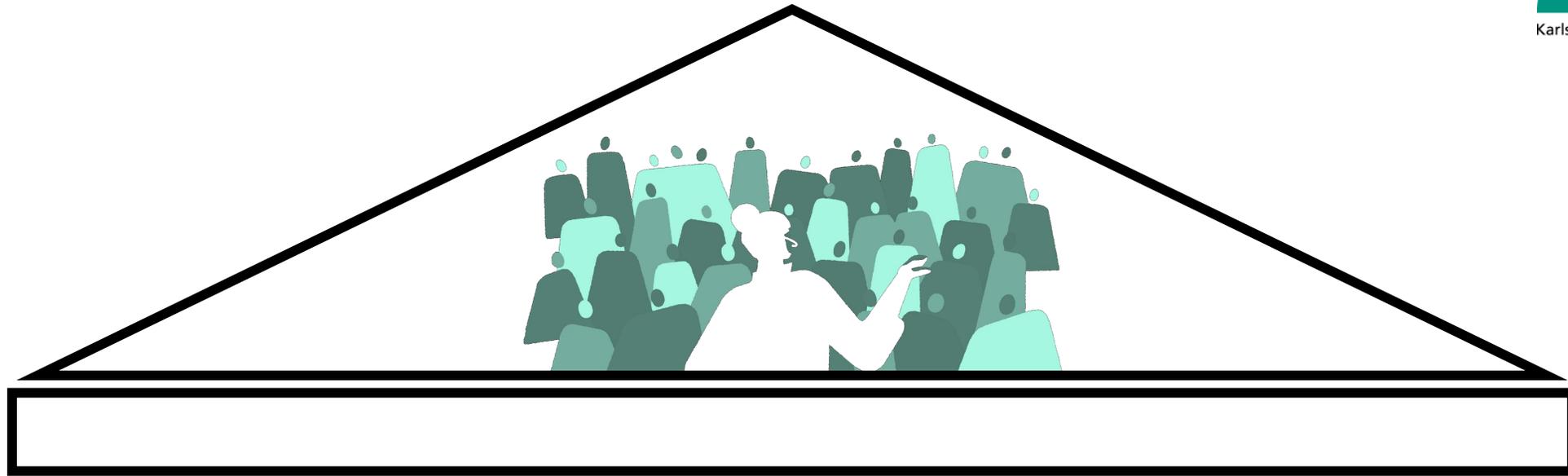


Evolution of the audience's attention (pessimistic)

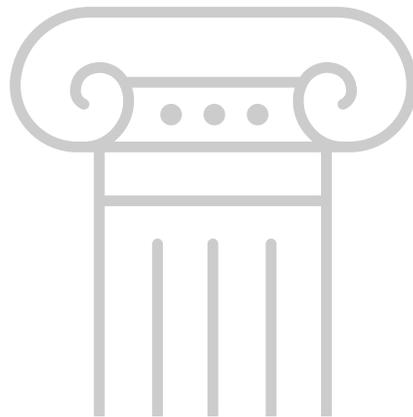


Evolution of the audience's attention (pessimistic)

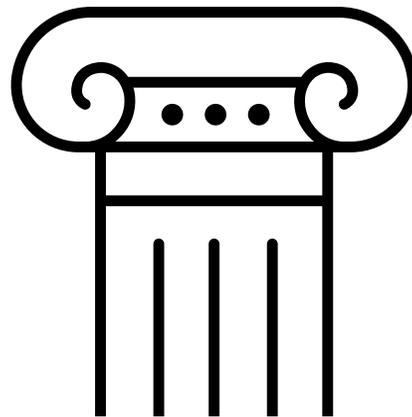




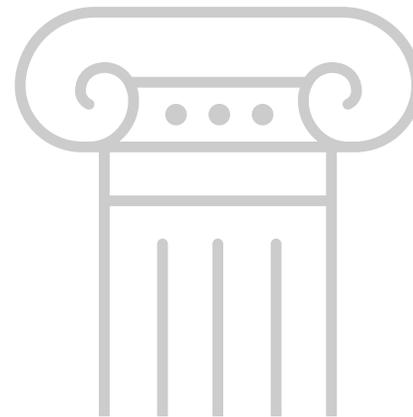
Structure



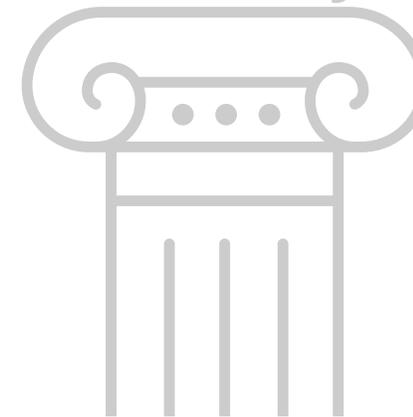
Content



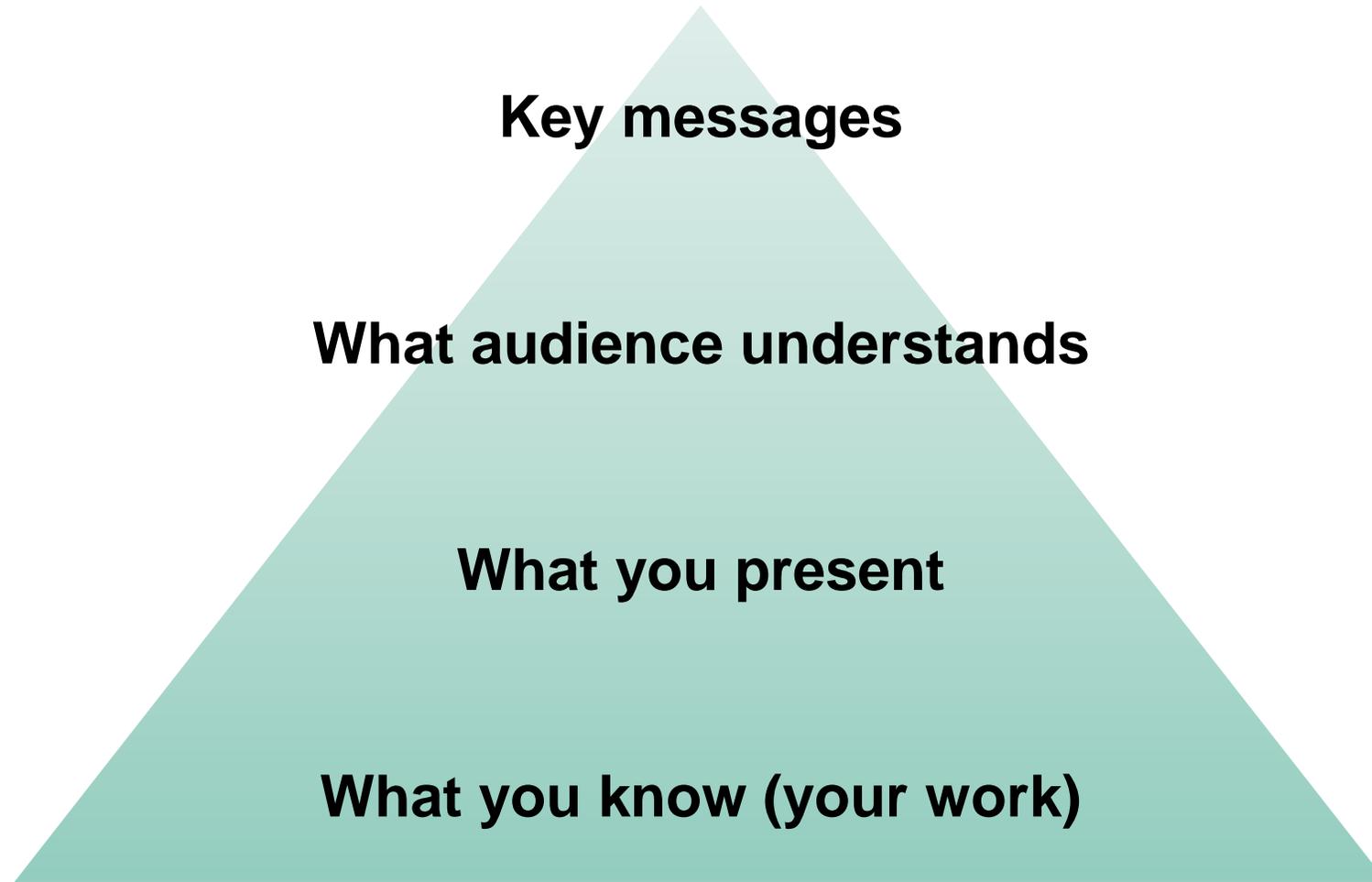
Visual aids



Delivery

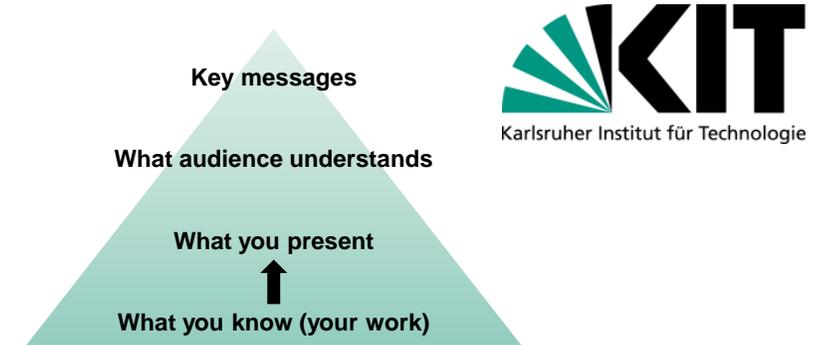


The content pyramid



Climbing the pyramid

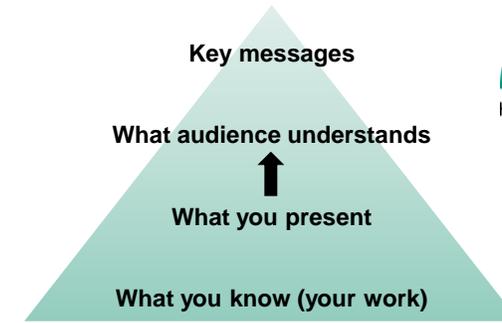
- Do not include everything you know or did



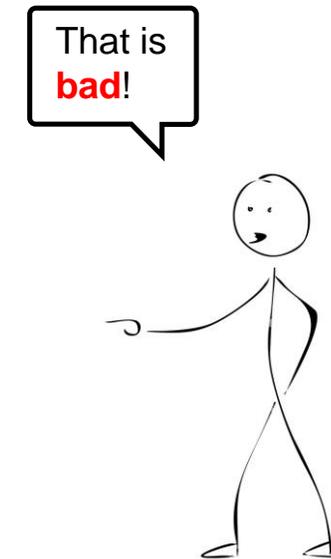
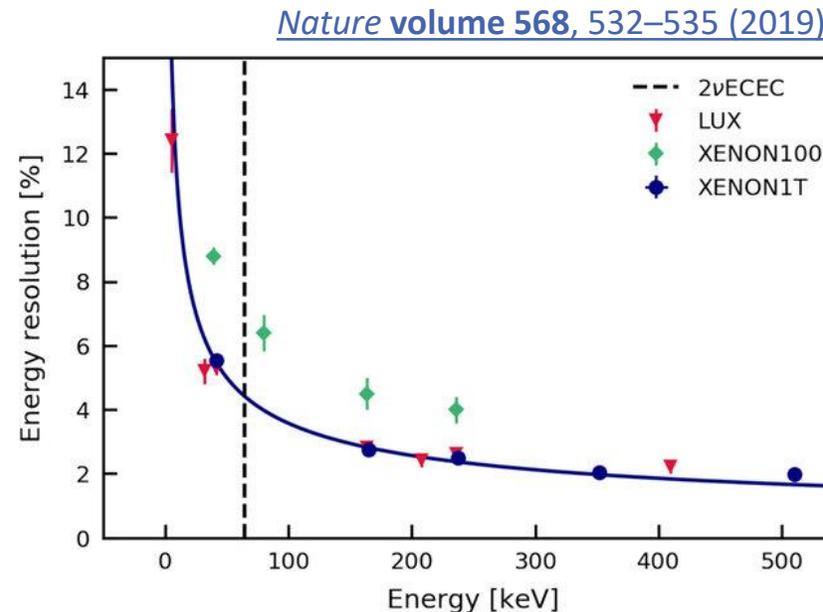
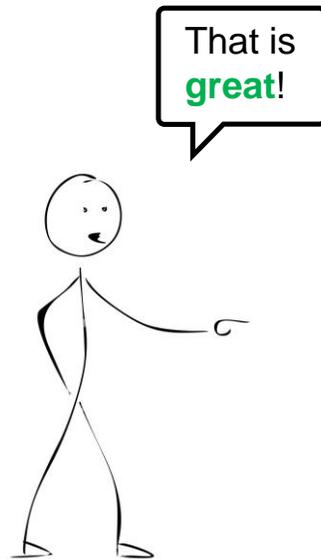
Suggestion

The presentation should look too easy for you!

Climbing the pyramid

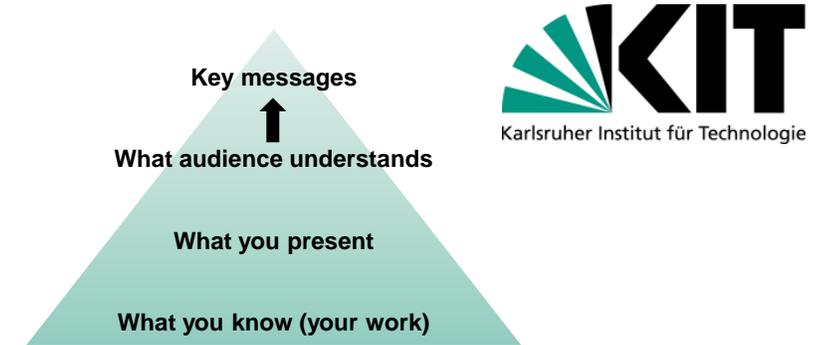


- Do not include everything you know or did
- Do not let the audience interpret your results

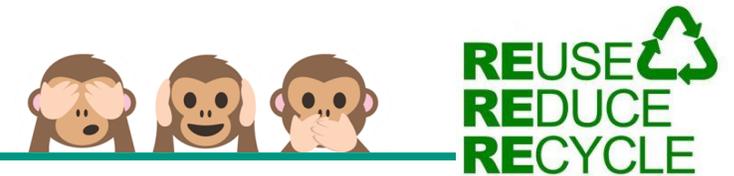


Climbing the pyramid

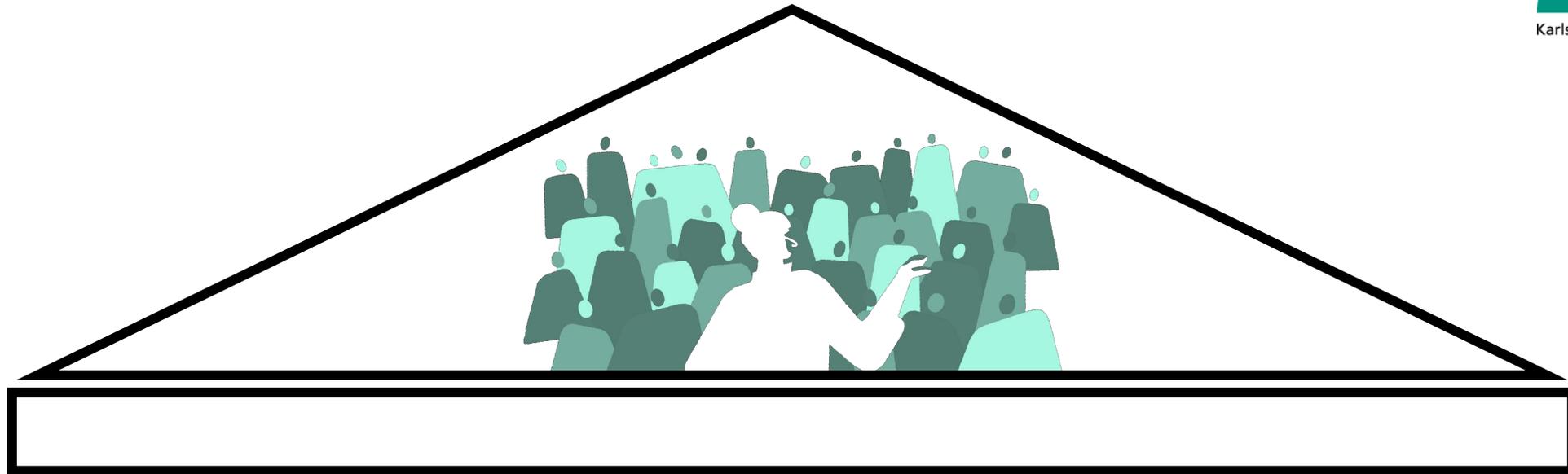
- Do not include everything you know or did
- Do not let the audience interpret your results
- Stress your key messages



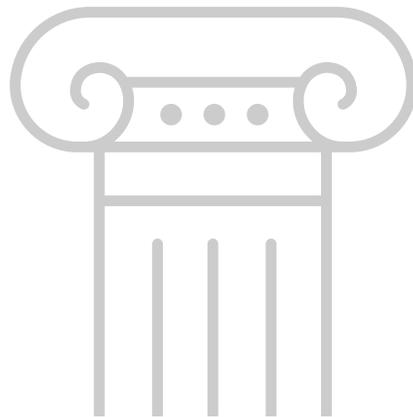
Suggestion



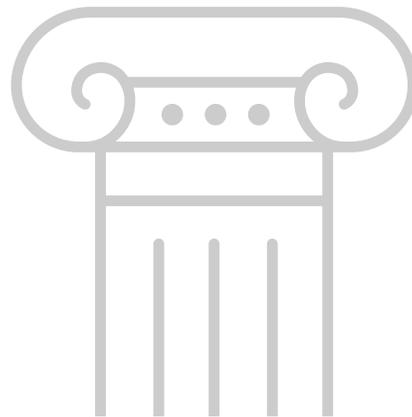
Rule of three: the best way to convey a message is by „dividing“ it into three



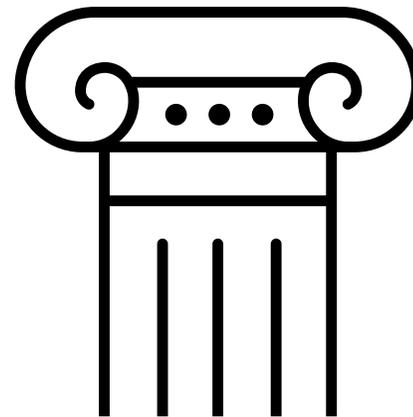
Structure



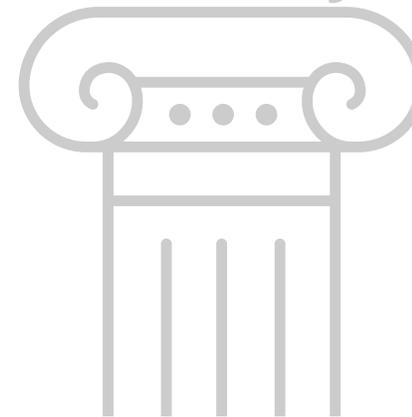
Content



Visual aids



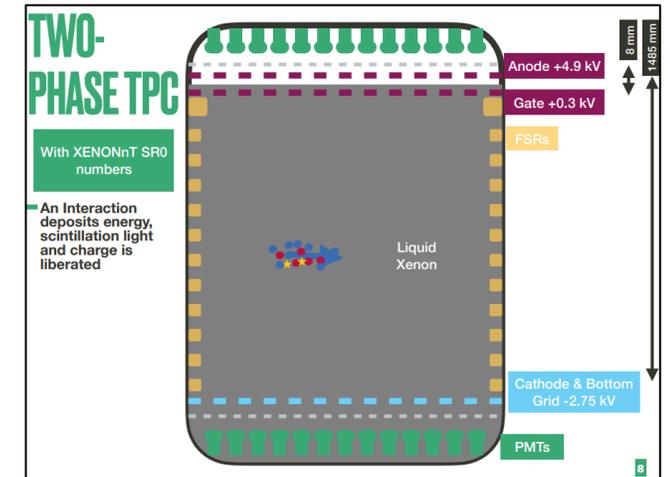
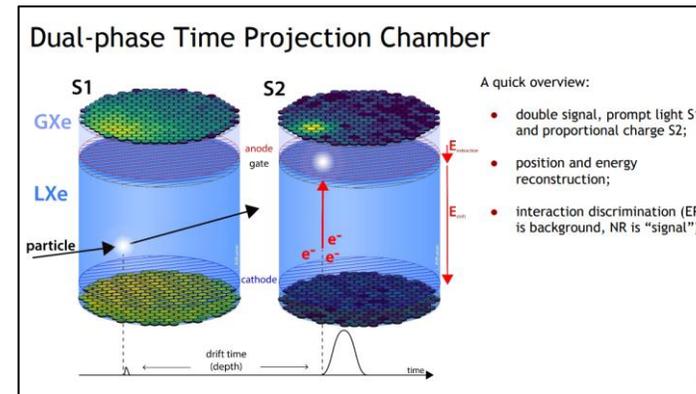
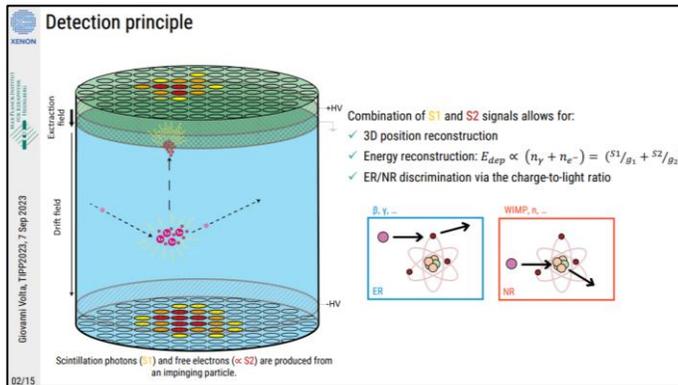
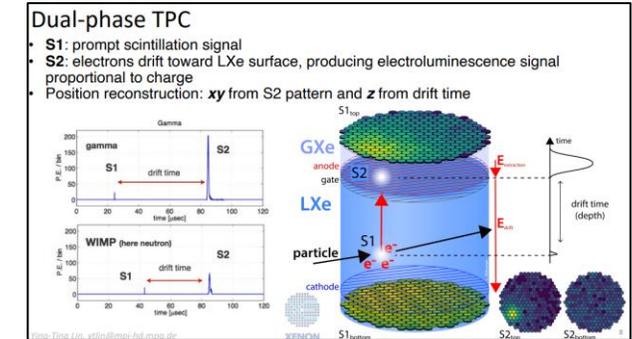
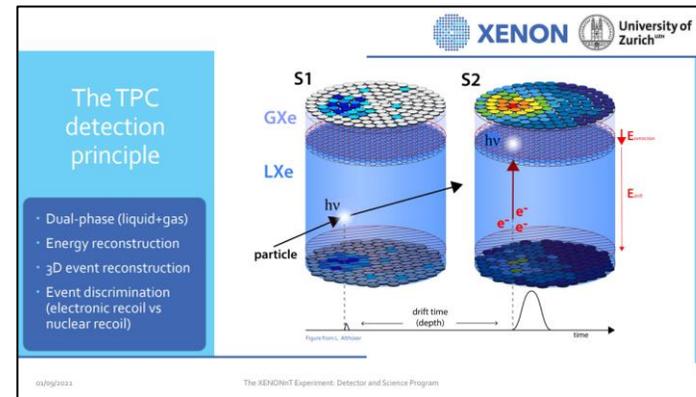
Delivery



Find your own style

Style is personal!

(with possible constraints)



How much text on a slide?

Using too much text in slides is detrimental to effective communication for several reasons. First, it distracts the audience from the speaker. When a slide is filled with text, people naturally start reading it, diverting their attention away from what the presenter is saying. The audience ends up trying to read and listen at the same time, which leads to cognitive overload and results in them missing key points from both the slide and the spoken presentation. Furthermore, long blocks of text are visually overwhelming and can make the slide look cluttered and unprofessional. Slides are intended to enhance the spoken word, not replace it. Overloading them with text reduces the clarity and focus that should be present in a visual aid. Moreover, too much text leads to ineffective communication because the audience cannot retain large amounts of written information presented in such a short time. Presentations are often fast-paced, and expecting viewers to absorb detailed paragraphs in a few seconds creates frustration and disengagement. This often leads to the audience simply tuning out, as they feel they cannot keep up with the pace of reading while listening. Additionally, too much text reduces the impact of key messages. The most important points become lost in a sea of words, making it harder for the audience to distinguish the core takeaways. A well-designed slide should highlight the essential elements of the presentation, providing visual cues that reinforce what the speaker is explaining. Overly text-heavy slides also diminish opportunities for dynamic storytelling and interaction. Instead of engaging with the presenter and the flow of the narrative, the audience becomes passive readers, which can reduce the overall energy and connection in the room. Finally, from a design perspective, large chunks of text create a less aesthetically pleasing experience. Slides with minimal, clear content tend to be more visually striking and memorable. In contrast, text-heavy slides are often difficult to read due to small fonts or too much information crammed into a single space. This can also lead to poor readability, particularly for those in the back of the room or watching on smaller screens. In essence, the primary purpose of slides is to support and emphasize the speaker's points, not to deliver the entire presentation in written form. When slides are overloaded with text, they undermine this goal, turning a dynamic, engaging medium into a dense, uninviting wall of information.

A presentation is not a paper...

Too much text is

- **distracting**, it divides the audience's attention
- **confusing**, it hides the important information
- **busy**, it looks cluttered

...but it can be reference material

Overview

Scientific Program

Call for Abstracts

Timetable

Poster session

Contact

✉ info-idm2024-loc@lists.i...

Timetable

Mon 08/07
Tue 09/07
Wed 10/07
Thu 11/07
Fri 12/07
All days

Print
PDF
Full screen
Detailed view
Filter

Concert: I Solisti Aquilani
Parallel 1
Parallel 2
Parallel 3
see more...

09:00	Illuminating the Dark Universe with Euclid <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Andrea Cimatti</i> 09:00 - 09:30
	Theoretical framework for Dark Matter Axions <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Luca Di Lu...</i> 09:30 - 10:00
10:00	Experimental search of Dark Matter Axions <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Julia Vo...</i> 10:00 - 10:30
	Coffee break <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	10:30 - 11:00
11:00	Axion constraints from astrophysical observations <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Manuel Me...</i> 11:00 - 11:30
	Primordial black holes or else? <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Paolo P...</i> 11:30 - 12:00
12:00	Dark stars <i>Palazzo dell'Emiciclo, Sala Ipogea</i>	<i>Christoforos Kou...</i> 12:00 - 12:30

- Stick to bullet points
- Condense information
- Use sketches and plots
- Back-up slides for details

Same for equations

The lagrangian of the Standard Model is

$$\begin{aligned}
\mathcal{L}_{SM} = & -\frac{1}{2}\partial_\nu g_\mu^a \partial_\nu g_\mu^a - g_s f^{abc} \partial_\mu g_\nu^a g_\mu^b g_\nu^c - \frac{1}{4}g_s^2 f^{abc} f^{ade} g_\mu^a g_\nu^b g_\mu^c g_\nu^d - \partial_\nu W_\mu^+ \partial_\nu W_\mu^- \\
& M^2 W_\mu^+ W_\mu^- - \frac{1}{2}\partial_\nu Z_\mu^0 \partial_\nu Z_\mu^0 - \frac{1}{2c_w^2} M^2 Z_\mu^0 Z_\mu^0 - \frac{1}{2}\partial_\mu A_\nu \partial_\mu A_\nu - igc_w (\partial_\nu Z_\mu^0 (W_\mu^+ W_\nu^- - \\
& W_\mu^- W_\nu^+) - Z_\nu^0 (W_\mu^+ \partial_\mu W_\nu^- - W_\mu^- \partial_\mu W_\nu^+) + Z_\nu^0 (W_\nu^+ \partial_\nu W_\mu^- - W_\nu^- \partial_\nu W_\mu^+)) - \\
& ig s_w (\partial_\nu A_\mu (W_\mu^+ W_\nu^- - W_\nu^+ W_\mu^-) - A_\nu (W_\mu^+ \partial_\mu W_\nu^- - W_\mu^- \partial_\mu W_\nu^+) + A_\mu (W_\nu^+ \partial_\nu W_\mu^- - \\
& W_\nu^- \partial_\nu W_\mu^+)) - \frac{1}{2}g^2 W_\mu^+ W_\nu^- W_\nu^+ W_\mu^- + \frac{1}{2}g^2 W_\mu^+ W_\nu^- W_\mu^- W_\nu^+ + g^2 c_w^2 (Z_\mu^0 W_\nu^+ Z_\nu^0 W_\mu^- - \\
& Z_\mu^0 Z_\nu^0 W_\nu^+ W_\mu^-) + g^2 s_w^2 (A_\mu W_\nu^+ A_\nu W_\mu^- - A_\mu A_\nu W_\nu^+ W_\mu^-) + g^2 s_w c_w (A_\mu Z_\nu^0 (W_\mu^+ W_\nu^- - \\
& W_\nu^+ W_\mu^-) - 2A_\mu Z_\mu^0 W_\nu^-) - \frac{1}{2}\partial_\mu H \partial_\mu H - 2M^2 \alpha_h H^2 - \partial_\mu \phi^+ \partial_\mu \phi^- - \frac{1}{2}\partial_\mu \phi^0 \partial_\mu \phi^0 - \\
& \beta_h \left(\frac{2M^2}{g^2} + \frac{2M}{g} H + \frac{1}{2}(H^2 + \phi^0 \phi^0 + 2\phi^+ \phi^-) \right) + \frac{2M^2}{g^2} \alpha_h - \\
& \frac{g\alpha_h M}{8} (H^4 + H\phi^0 \phi^0 + 2H\phi^+ \phi^-) - \\
& \frac{1}{8}g^2 \alpha_h (H^4 + (\phi^+ \phi^-)^2 + 4(\phi^0)^2 \phi^+ \phi^- + 4H^2 \phi^+ \phi^- + 2(\phi^0)^2 H^2) - \\
& g M W_\mu^+ W_\mu^- H - \frac{1}{2}g \frac{M}{c_w} Z_\mu^0 Z_\mu^0 H - \\
& \frac{1}{2}ig (W_\mu^+ (\phi^0 \partial_\mu \phi^- - \phi^- \partial_\mu \phi^0) - W_\mu^- (\phi^0 \partial_\mu \phi^+ - \phi^+ \partial_\mu \phi^0)) + \\
& \frac{1}{2}g (W_\mu^+ (H \partial_\mu \phi^- - \phi^- \partial_\mu H) + W_\mu^- (H \partial_\mu \phi^+ - \phi^+ \partial_\mu H)) + \frac{1}{2}g \frac{1}{c_w} (Z_\mu^0 (H \partial_\mu \phi^0 - \phi^0 \partial_\mu H) + \\
& M (\frac{1}{c_w} Z_\mu^0 \partial_\mu \phi^0 + W_\mu^+ \partial_\mu \phi^- + W_\mu^- \partial_\mu \phi^+)) - ig \frac{s_w^2}{c_w} M Z_\mu^0 (W_\mu^+ \phi^- - W_\mu^- \phi^+) + ig s_w M A_\mu (W_\mu^+ \phi^- - \\
& W_\mu^- \phi^+) - ig \frac{1-2c_w^2}{2c_w} Z_\mu^0 (\phi^+ \partial_\mu \phi^- - \phi^- \partial_\mu \phi^+) + ig s_w A_\mu (\phi^+ \partial_\mu \phi^- - \phi^- \partial_\mu \phi^+) - \\
& \frac{1}{4}g^2 W_\mu^+ W_\mu^- (H^2 + (\phi^0)^2 + 2\phi^+ \phi^-) - \frac{1}{8}g^2 \frac{1}{c_w} Z_\mu^0 Z_\mu^0 (H^2 + (\phi^0)^2 + 2(\phi^0)^2 \phi^+ \phi^-) - \\
& \frac{1}{2}g^2 \frac{s_w^2}{c_w} Z_\mu^0 \phi^0 (W_\mu^+ \phi^- + W_\mu^- \phi^+) - \frac{1}{2}ig^2 \frac{s_w}{c_w} Z_\mu^0 H (W_\mu^+ \phi^- - W_\mu^- \phi^+) + \frac{1}{2}g^2 s_w A_\mu \phi^0 (W_\mu^+ \phi^- + \\
& W_\mu^- \phi^+) + \frac{1}{2}ig^2 s_w A_\mu H (W_\mu^+ \phi^- - W_\mu^- \phi^+) - g^2 \frac{s_w}{c_w} (2c_w^2 - 1) Z_\mu^0 A_\mu \phi^+ \phi^- - \\
& g^2 s_w^2 A_\mu A_\mu \phi^+ \phi^- + \frac{1}{2}ig_s \lambda_{ij}^c (\bar{q}_i^c \gamma^\mu q_j^c) g_\mu^a - \bar{e}^\lambda (\gamma^\mu + m_e^\lambda) e^\lambda - \bar{\nu}^\lambda (\gamma^\mu + m_\nu^\lambda) \nu^\lambda - \bar{u}_j^c (\gamma^\mu + \\
& m_u^\lambda) u_j^c - \bar{d}_j^c (\gamma^\mu + m_d^c) d_j^c + ig s_w A_\mu (-\bar{e}^\lambda \gamma^\mu e^\lambda) + \frac{2}{3}(\bar{u}_j^c \gamma^\mu u_j^c) - \frac{1}{3}(\bar{d}_j^c \gamma^\mu d_j^c) + \\
& \frac{ig}{4c_w} Z_\mu^0 \{(\bar{\nu}^\lambda \gamma^\mu (1 + \gamma^5) \nu^\lambda) + (\bar{e}^\lambda \gamma^\mu (4s_w^2 - 1 - \gamma^5) e^\lambda) + (\bar{d}_j^c \gamma^\mu (\frac{2}{3}s_w^2 - 1 - \gamma^5) d_j^c) + \\
& (\bar{u}_j^c \gamma^\mu (1 - \frac{2}{3}s_w^2 + \gamma^5) u_j^c)\} + \frac{ig}{2\sqrt{2}} W_\mu^+ ((\bar{\nu}^\lambda \gamma^\mu (1 + \gamma^5) U^{lep}_{\lambda\kappa} e^\kappa) + (\bar{u}_j^c \gamma^\mu (1 + \gamma^5) C_{\lambda\kappa} d_j^c)) + \\
& \frac{ig}{2\sqrt{2}} W_\mu^- ((\bar{e}^\kappa U^{lep}_{\kappa\lambda}^\dagger \gamma^\mu (1 + \gamma^5) \nu^\lambda) + (\bar{d}_j^c C_{\kappa\lambda}^\dagger \gamma^\mu (1 + \gamma^5) u_j^c)) + \\
& \frac{ig}{2M\sqrt{2}} \phi^+ (-m_e^\kappa (\bar{\nu}^\lambda U^{lep}_{\lambda\kappa} (1 - \gamma^5) e^\kappa) + m_\nu^\lambda (\bar{\nu}^\lambda U^{lep}_{\lambda\kappa} (1 + \gamma^5) e^\kappa) + \\
& \frac{ig}{2M\sqrt{2}} \phi^- (m_e^\lambda (\bar{e}^\lambda U^{lep}_{\lambda\kappa}^\dagger (1 + \gamma^5) \nu^\kappa) - m_\nu^\kappa (\bar{e}^\lambda U^{lep}_{\lambda\kappa}^\dagger (1 - \gamma^5) \nu^\kappa) - \frac{g}{2} \frac{m_\lambda}{M} H (\bar{\nu}^\lambda \nu^\lambda) - \\
& \frac{g}{2} \frac{m_\lambda}{M} H (\bar{e}^\lambda e^\lambda) + \frac{ig}{2} \frac{m_\lambda}{M} \phi^0 (\bar{\nu}^\lambda \gamma^5 \nu^\lambda) - \frac{ig}{2} \frac{m_\lambda}{M} \phi^0 (\bar{e}^\lambda \gamma^5 e^\lambda) - \frac{1}{4} \bar{\nu}_\lambda M_{\lambda\kappa}^R (1 - \gamma_5) \bar{\nu}_\kappa - \\
& \frac{1}{4} \bar{\nu}_\lambda M_{\lambda\kappa}^R (1 - \gamma_5) \bar{\nu}_\kappa + \frac{ig}{2M\sqrt{2}} \phi^+ (-m_d^c (\bar{u}_j^c C_{\lambda\kappa} (1 - \gamma^5) d_j^c) + m_u^c (\bar{u}_j^c C_{\lambda\kappa} (1 + \gamma^5) d_j^c) + \\
& \frac{ig}{2M\sqrt{2}} \phi^- (m_d^c (\bar{d}_j^c C_{\lambda\kappa}^\dagger (1 + \gamma^5) u_j^c) - m_u^c (\bar{d}_j^c C_{\lambda\kappa}^\dagger (1 - \gamma^5) u_j^c) - \frac{g}{2} \frac{m_\lambda}{M} H (\bar{u}_j^c u_j^c) - \\
& \frac{g}{2} \frac{m_\lambda}{M} H (\bar{d}_j^c d_j^c) + \frac{ig}{2} \frac{m_\lambda}{M} \phi^0 (\bar{u}_j^c \gamma^5 u_j^c) - \frac{ig}{2} \frac{m_\lambda}{M} \phi^0 (\bar{d}_j^c \gamma^5 d_j^c) + \bar{G}^a \partial^2 G^a + g_s f^{abc} \partial_\mu \bar{G}^a G^b g_\mu^c + \\
& X^+ (\partial^2 - M^2) X^+ + X^- (\partial^2 - M^2) X^- + X^0 (\partial^2 - \frac{M^2}{c_w^2}) X^0 + Y \partial^2 Y + igc_w W_\mu^+ (\partial_\mu X^0 X^- - \\
& \partial_\mu X^+ X^0) + ig s_w W_\mu^+ (\partial_\mu Y X^- - \partial_\mu X^+ Y) + igc_w W_\mu^- (\partial_\mu X^- X^0 - \\
& \partial_\mu X^0 X^+) + ig s_w W_\mu^- (\partial_\mu X^- Y - \partial_\mu Y X^+) + igc_w Z_\mu^0 (\partial_\mu X^+ X^- - \\
& \partial_\mu X^- X^0) + ig s_w A_\mu (\partial_\mu X^+ X^- - \\
& \partial_\mu X^- X^0) - \frac{1}{2}gM (\bar{X}^+ X^+ H + \bar{X}^- X^- H + \frac{1}{c_w} \bar{X}^0 X^0 H) + \frac{1-2c_w^2}{2c_w} igM (\bar{X}^+ X^0 \phi^+ - \bar{X}^- X^0 \phi^-) + \\
& \frac{1}{2c_w} igM (\bar{X}^0 X^- \phi^+ - \bar{X}^0 X^+ \phi^-) + igM s_w (\bar{X}^0 X^- \phi^+ - \bar{X}^0 X^+ \phi^-) + \\
& \frac{1}{2}igM (\bar{X}^+ X^+ \phi^0 - \bar{X}^- X^- \phi^0) .
\end{aligned}$$

Same for equations

The lagrangian of the Standard Model is

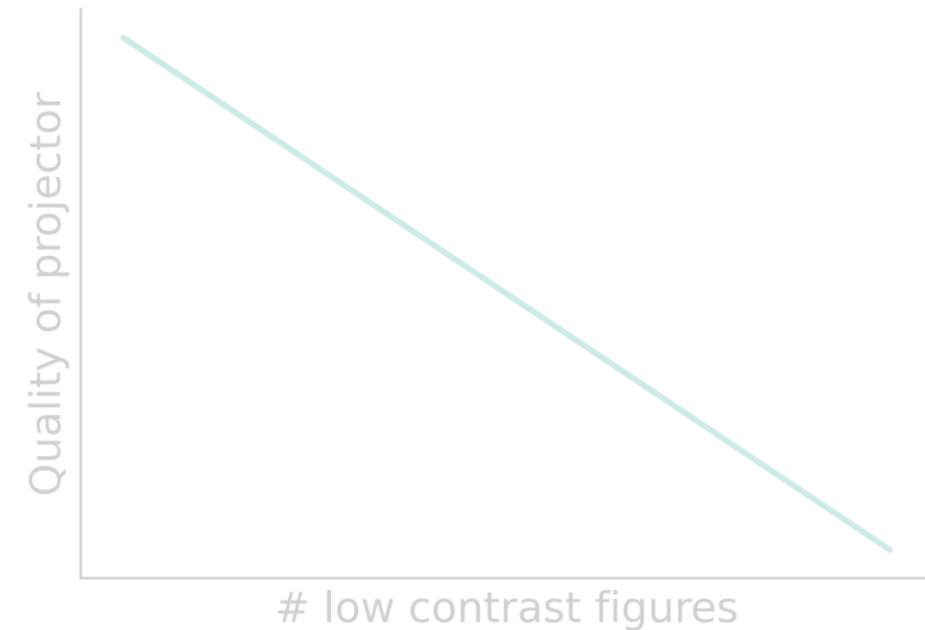
$$\begin{aligned}\mathcal{L}_{\text{SM}} = & -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} && \text{Gauge fields' dynamics} \\ & +i\bar{\psi}\gamma^\mu D_\mu\psi + \text{h.c.} && \text{Fermions' interactions and kinematics} \\ & +\bar{\psi}_i y_{ij}\psi_j\phi + \text{h.c.} && \text{Yukawa coupling} \\ & +|D_\mu\phi|^2 - V(\phi) && \text{Higgs field's dynamics}\end{aligned}$$

Contrast is important

Golden rule: **never** trust the projector!

Suggestion

- PowerPoint has a built-in contrast checker
- Google is your friend ([contrast checker](#))

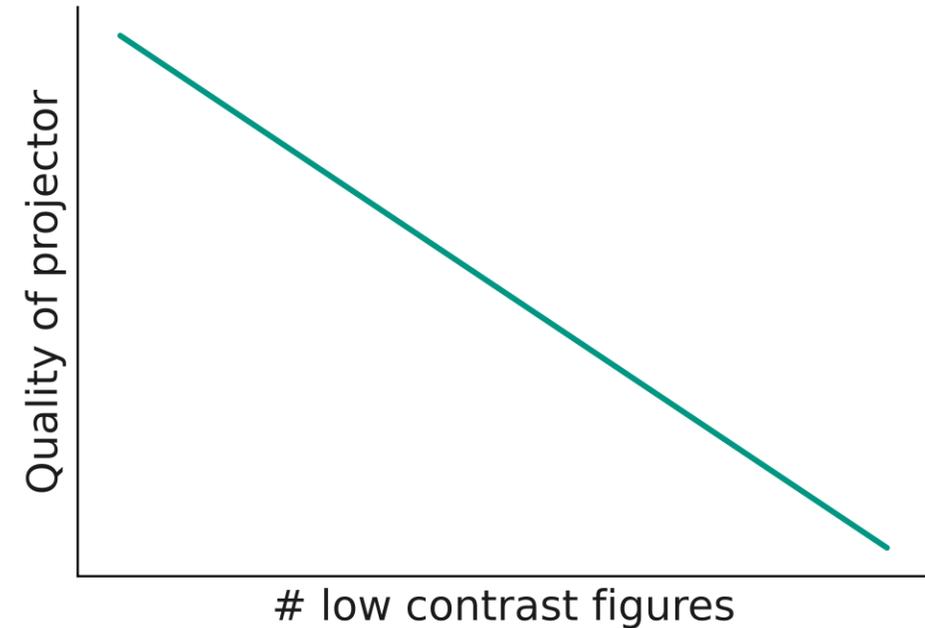


Contrast is important

Golden rule: **never** trust the projector!

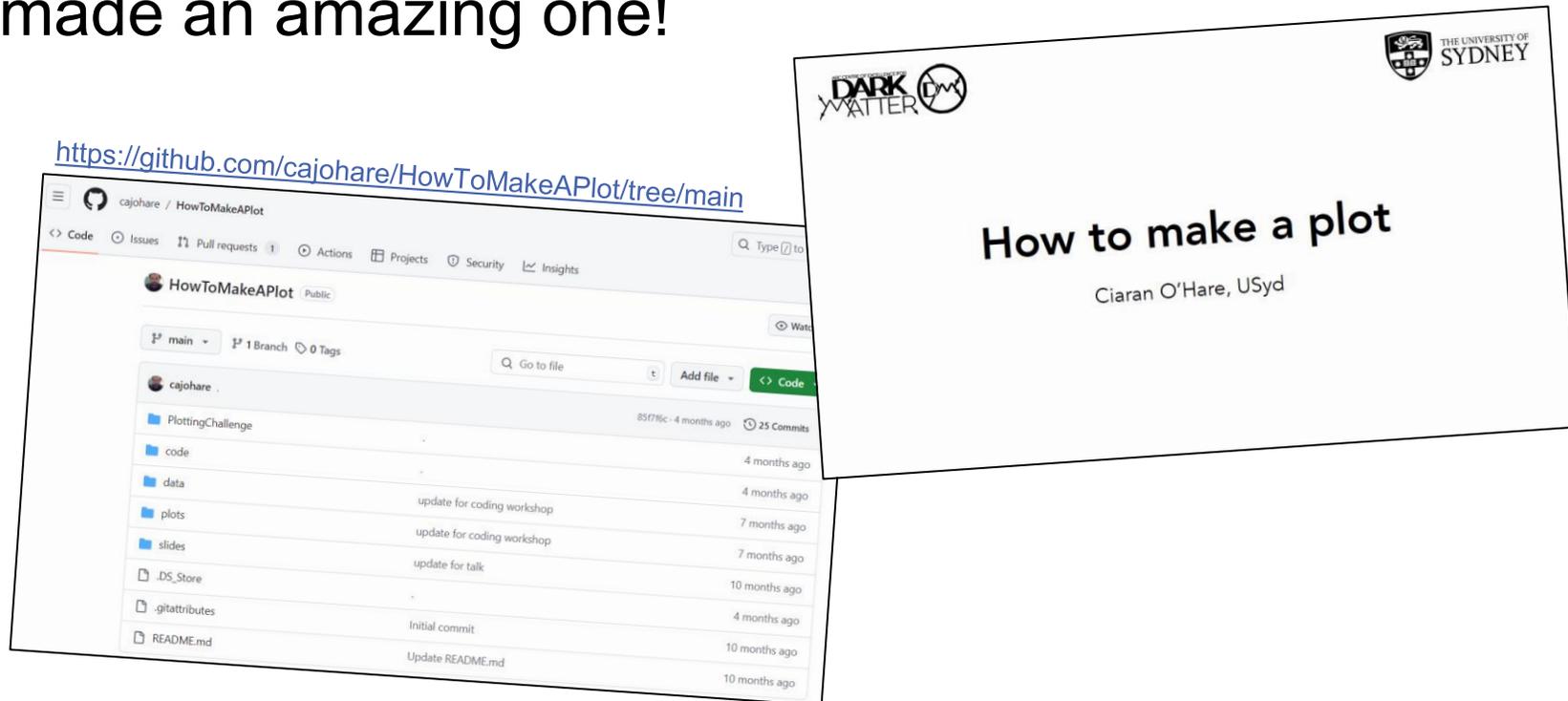
Suggestion

- PowerPoint has a built-in contrast checker
- Google is your friend ([contrast checker](#))



Plots

This topic would require its own presentation:
Ciaran O'Hare made an amazing one!

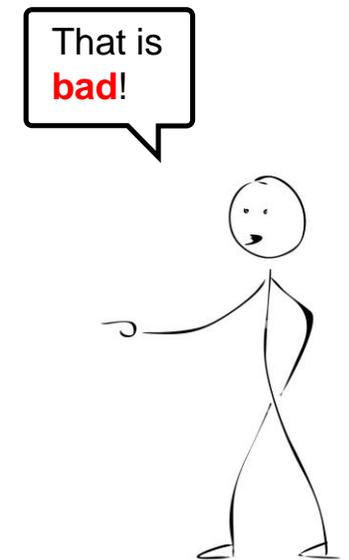
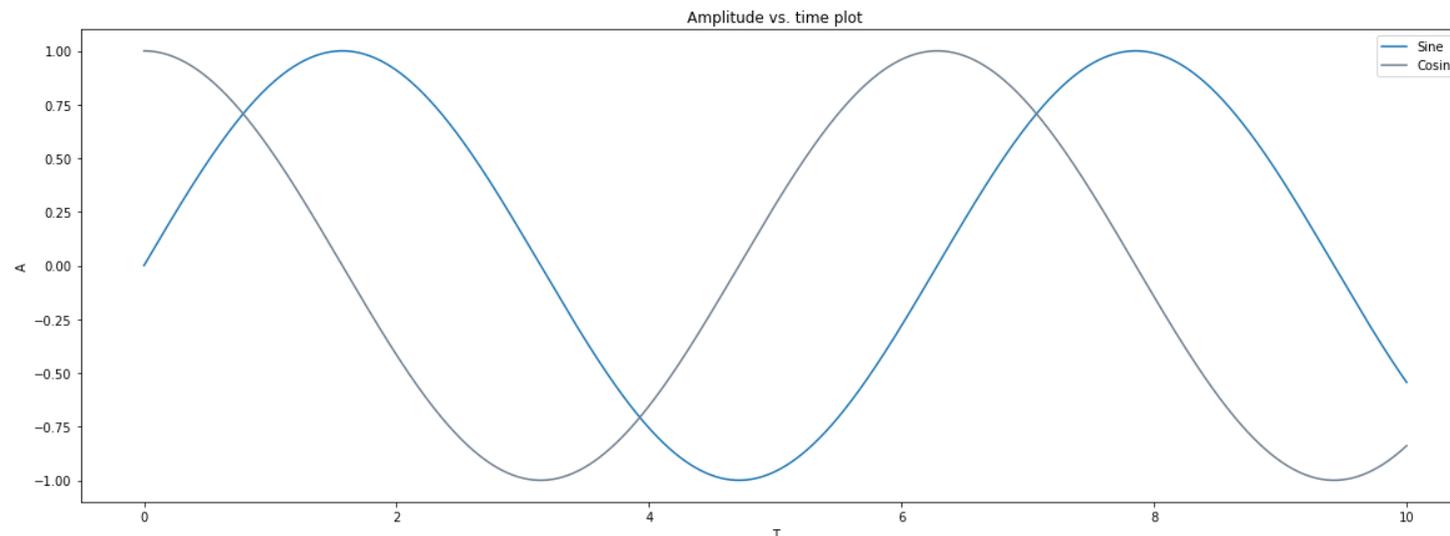


Plots: few general remarks

- Results are conveyed through plots: **spend time on them**
- Plots should be **simple**, but not basic
- Always have a **money plot** in your presentation
- When you show a plot, **explain it**

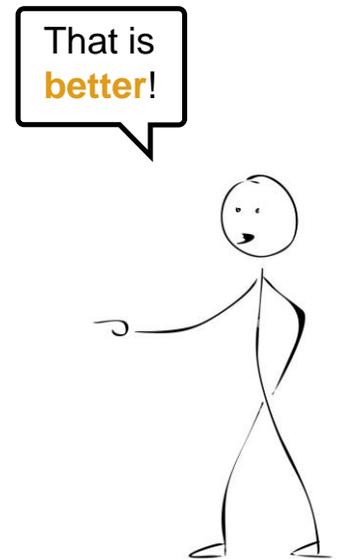
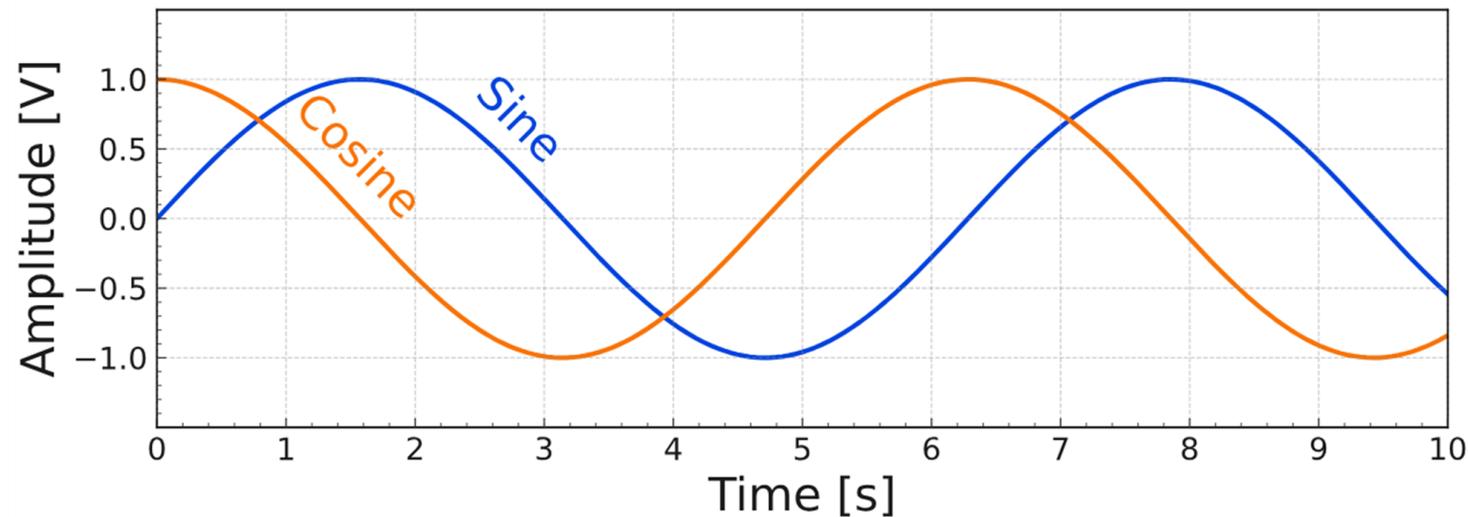
Plots: the „non-negotiables“

- Careful with use of **colors** (contrast, colorblind-friendly)
- **Font size** should be comparable to slide font size
- Be mindful about **file size** (< 1 MB), but still use vector graphics

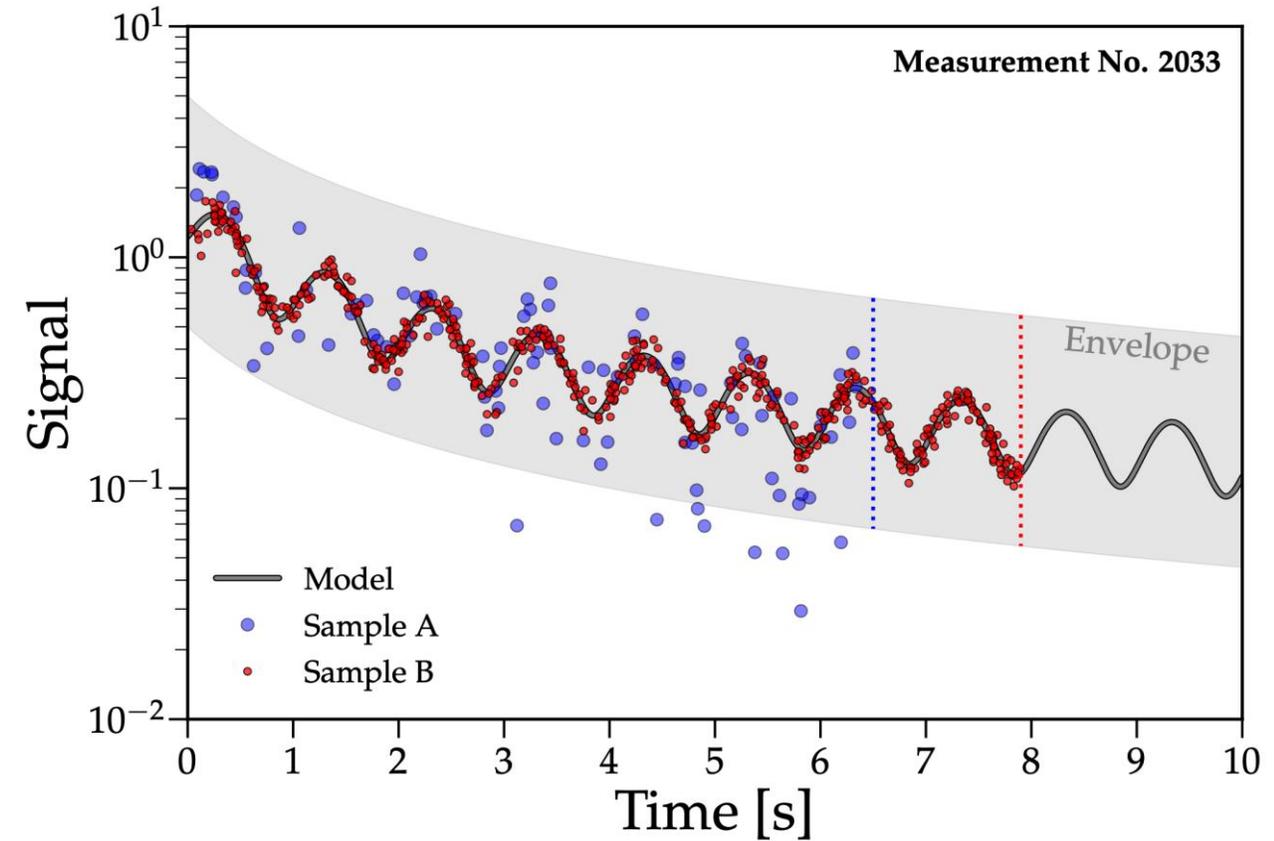
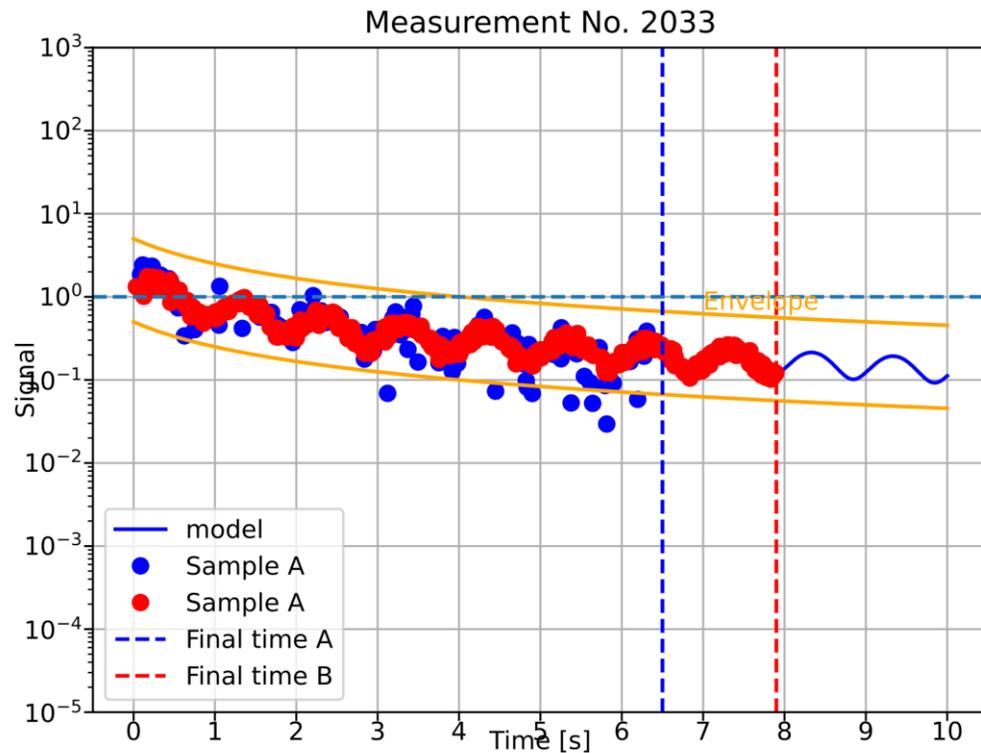


Plots: the „non-negotiables“

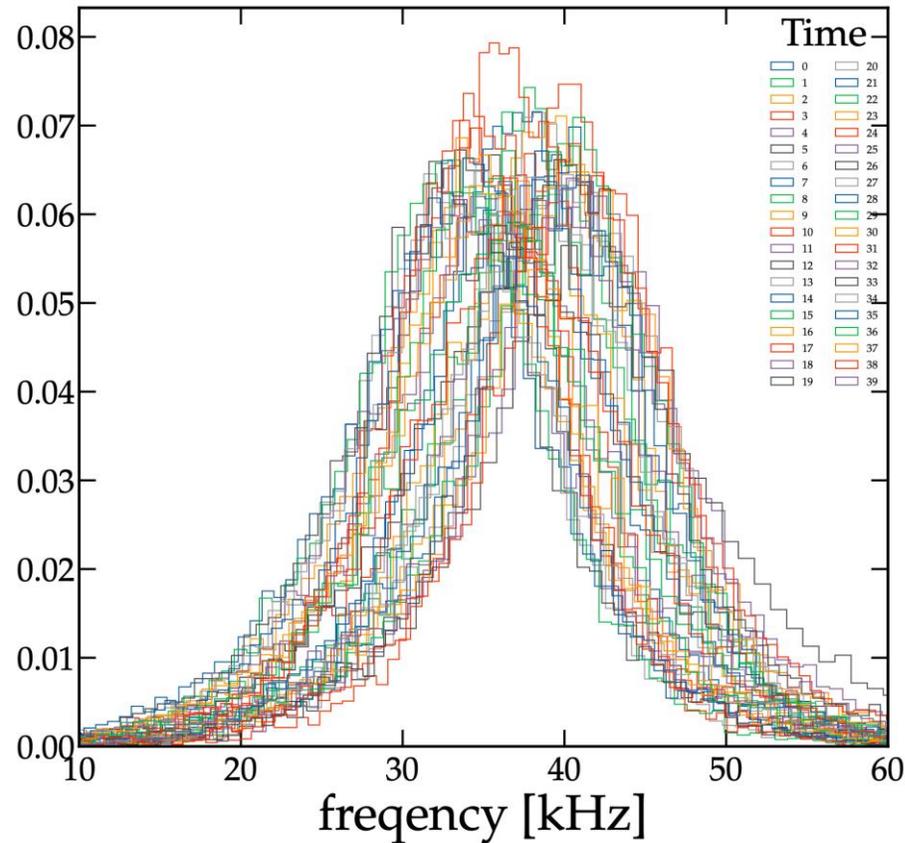
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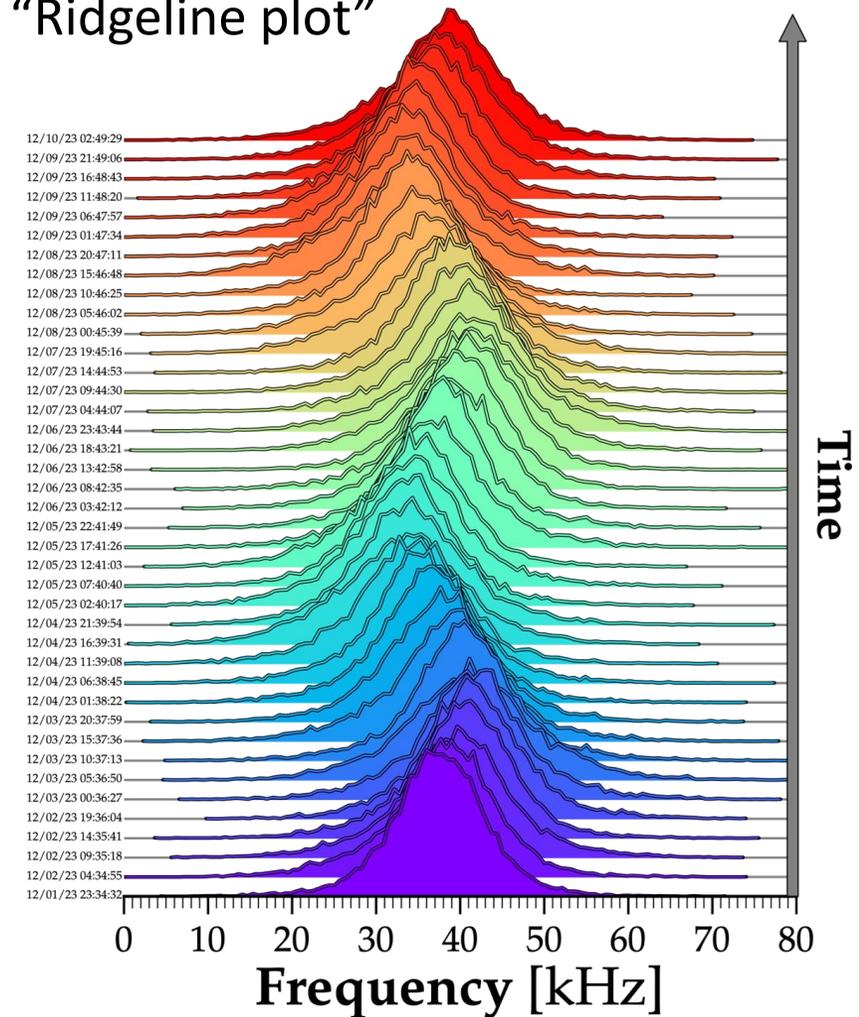
Plots: some other examples (from O'Hare)



Plots: some other examples (from O'Hare)

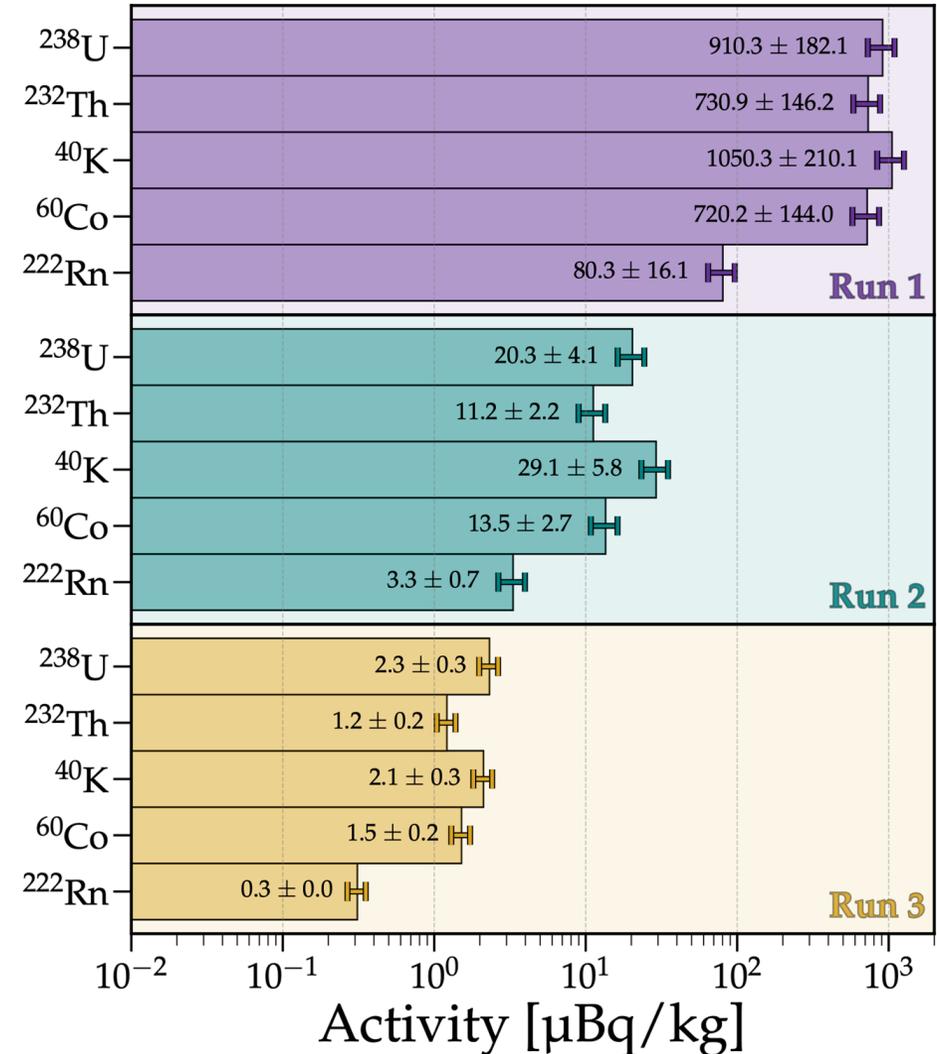


"Ridgeline plot"

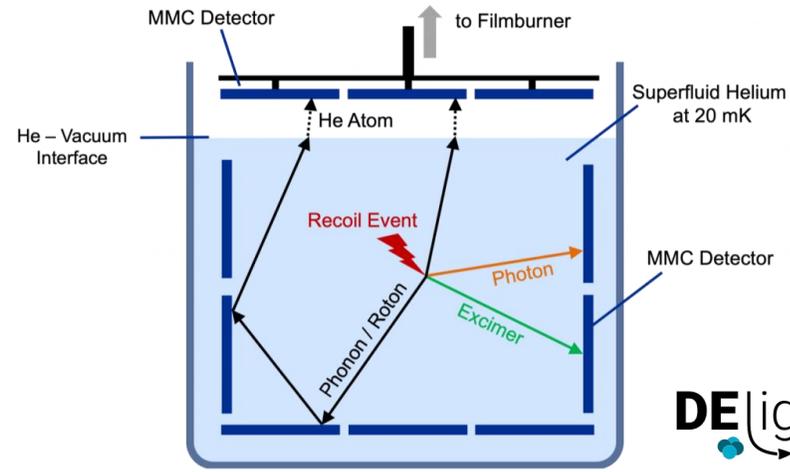
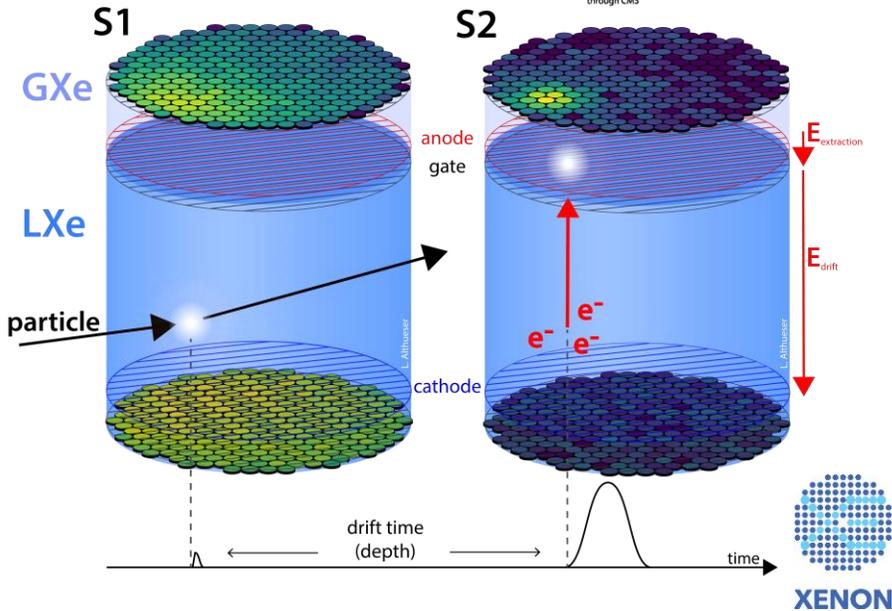
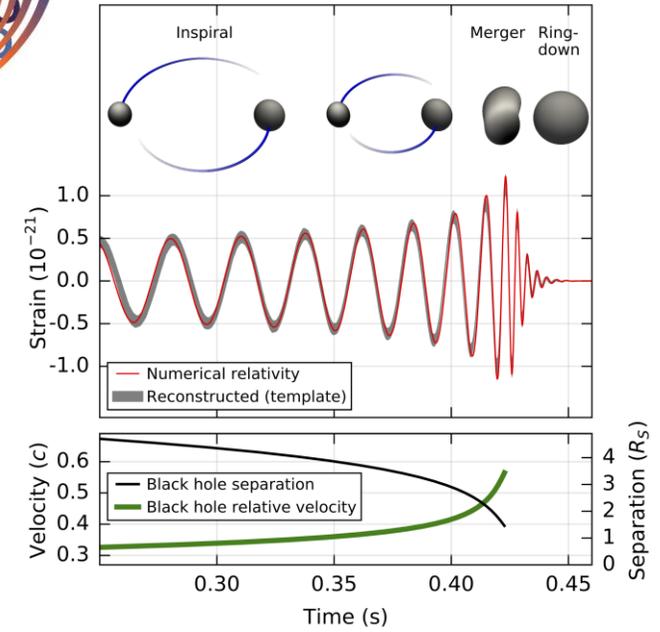
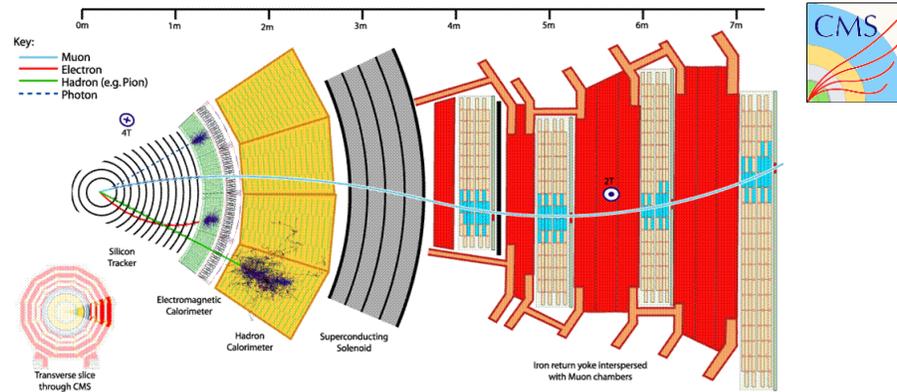


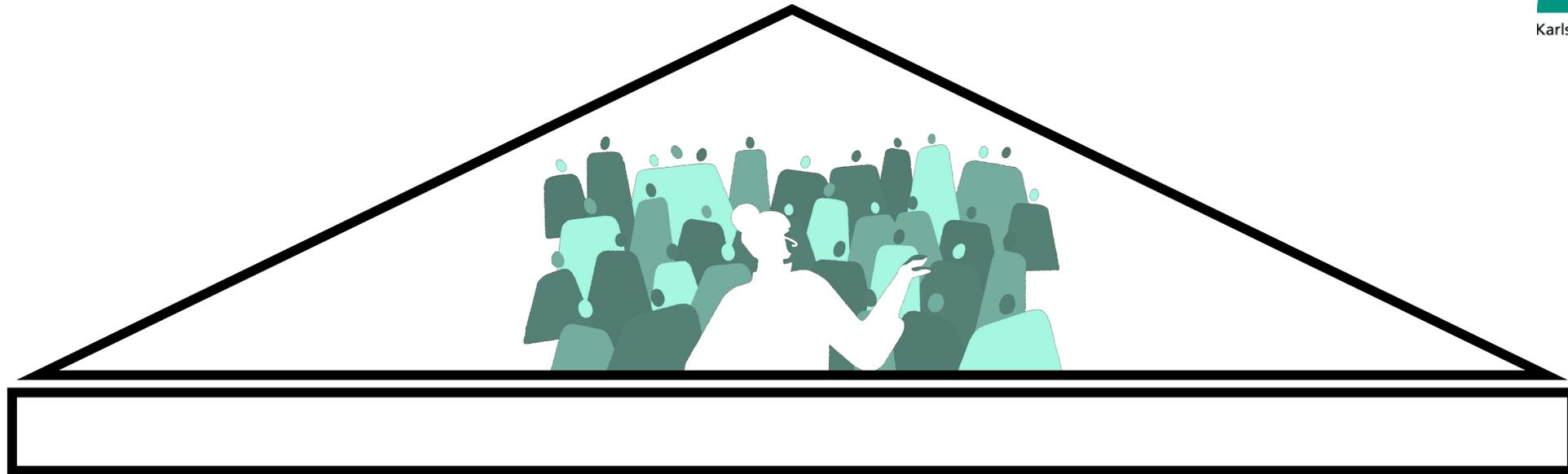
Plots: some other examples (from O'Hare)

	^{238}U ($\mu\text{Bq/kg}$)	^{232}Th ($\mu\text{Bq/kg}$)	^{40}K ($\mu\text{Bq/kg}$)	^{60}Co ($\mu\text{Bq/kg}$)	^{222}Rn ($\mu\text{Bq/kg}$)
Run 1	910.3 ± 182.1	730.9 ± 146.2	1050.3 ± 210.1	720.2 ± 144.0	80.3 ± 16.1
Run 2	20.3 ± 4.1	11.2 ± 2.2	29.1 ± 5.8	13.5 ± 2.7	3.3 ± 0.7
Run 3	2.3 ± 0.3	1.2 ± 0.2	2.1 ± 0.3	1.5 ± 0.2	0.3 ± 0.0

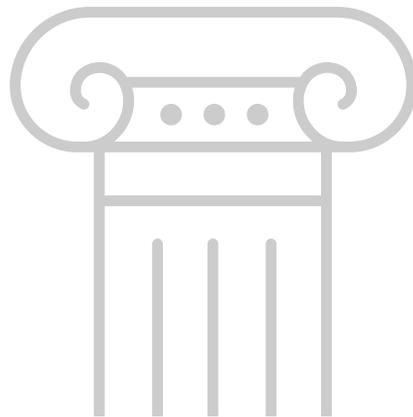


A picture is worth a thousand words

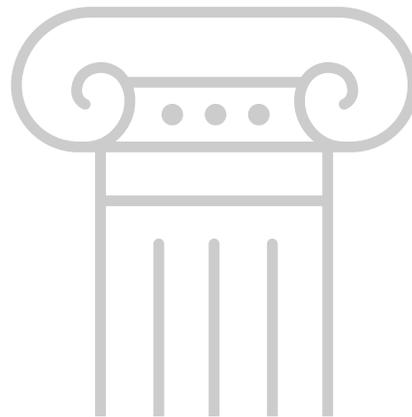




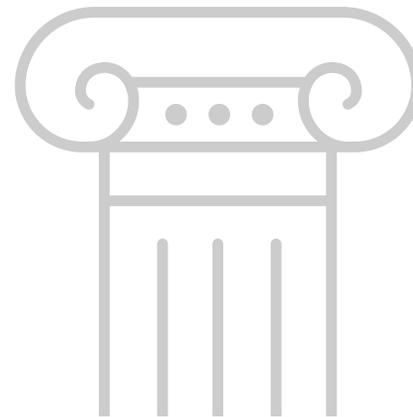
Structure



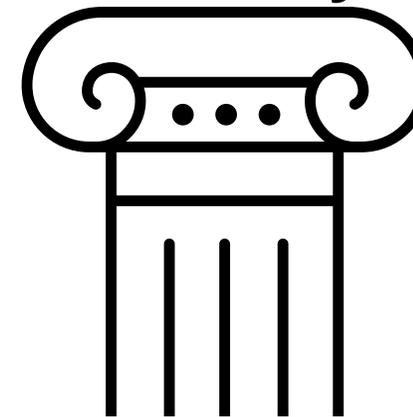
Content



Visual aids



Delivery



Delivery

- **Rehearse**, rehearse, rehearse
- You are talking to your audience, not to your slides
- Not only what you say, but also **how** you say it

Suggestion

Anxiety is normal: memorizing the beginning of your presentation might help



My personal experience

- First rehearsal is always $\sim 2x$ longer than it should
- Keep eye contact with few people, but scan the room for general feedback
- Moving helps reducing the anxiety
- Be careful with laser pointer...



Question time

When asked

- Reformulate the question
- Be concise
- Don't be afraid of „I don't know“



Question time

When asked

- Reformulate the question
- Be concise
- Don't be afraid of „I don't know“



When asking

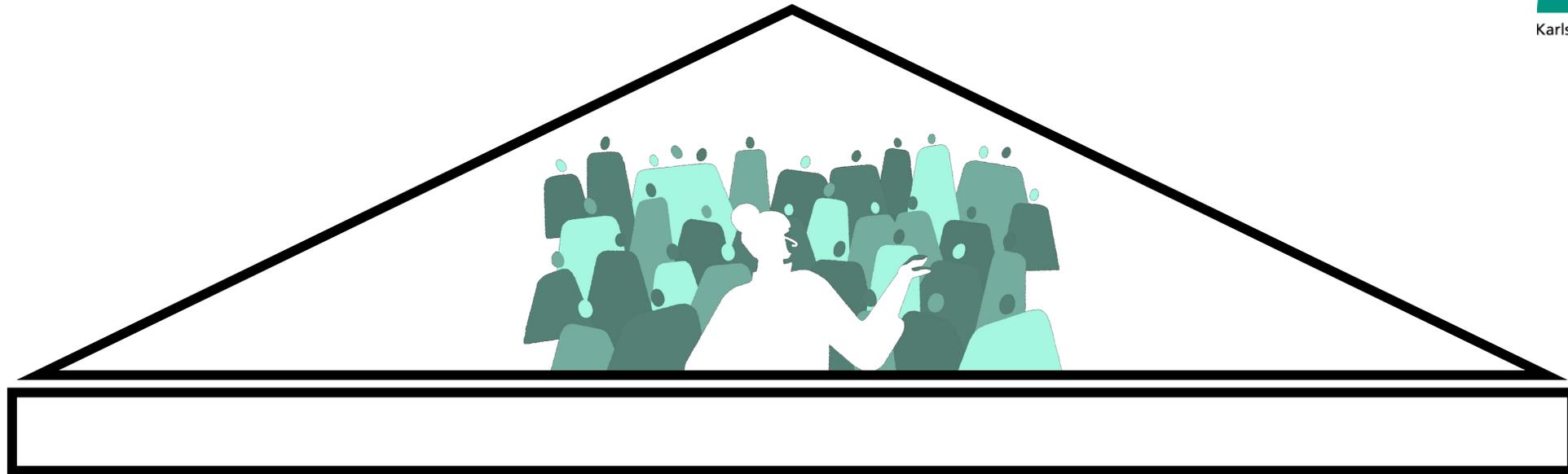
- Don't be afraid of asking
- Be concise
- Don't start arguments



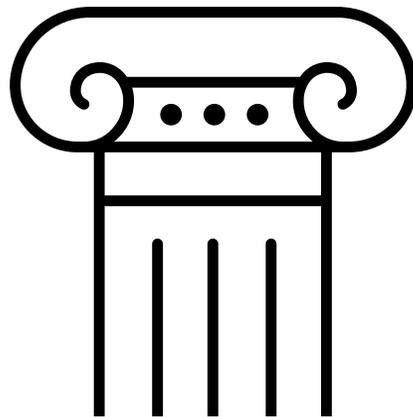
But so, what can you do concretely?

- Spend time on your presentations
- Practice whenever you can
- Learn from others
- Try new things

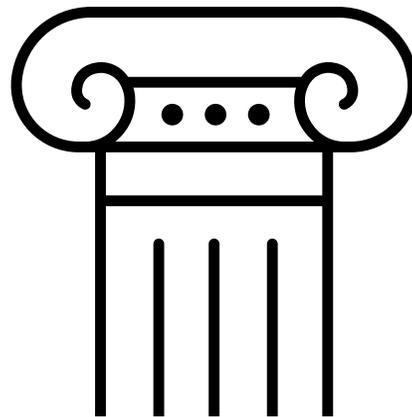




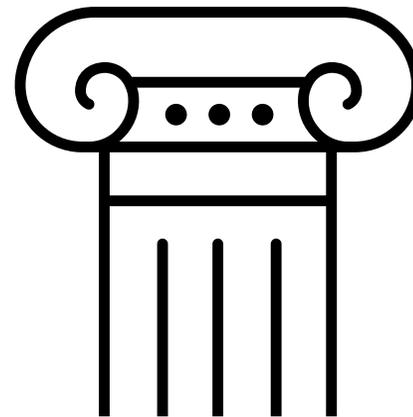
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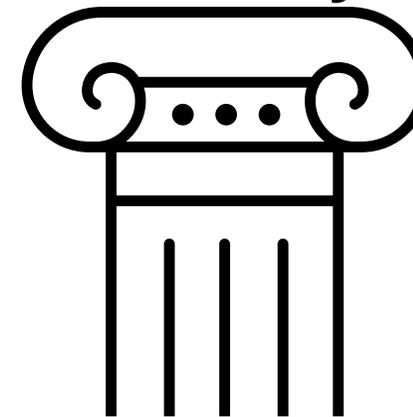
Content



Visual aids

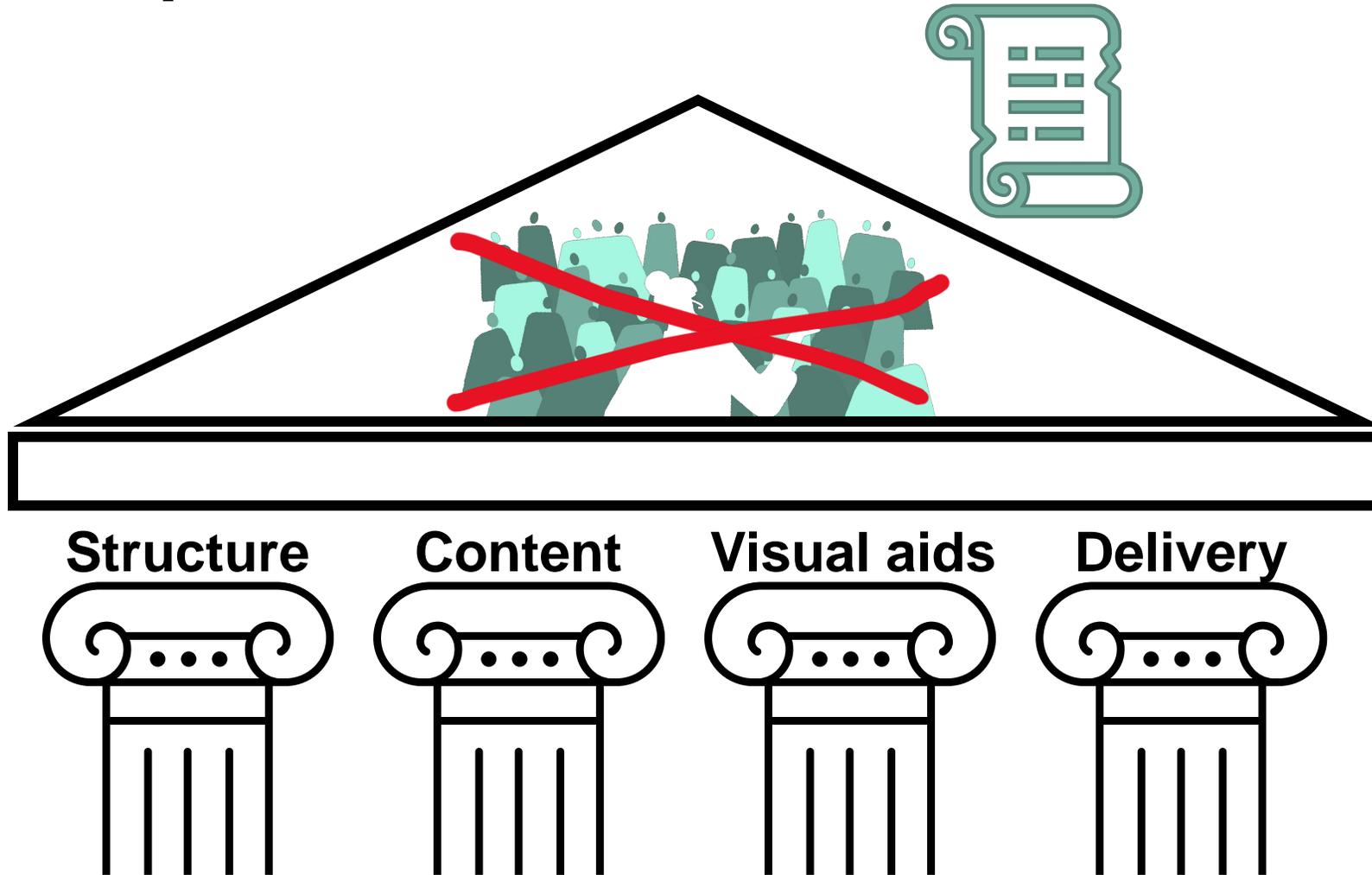


Delivery



What about posters?

What about posters?



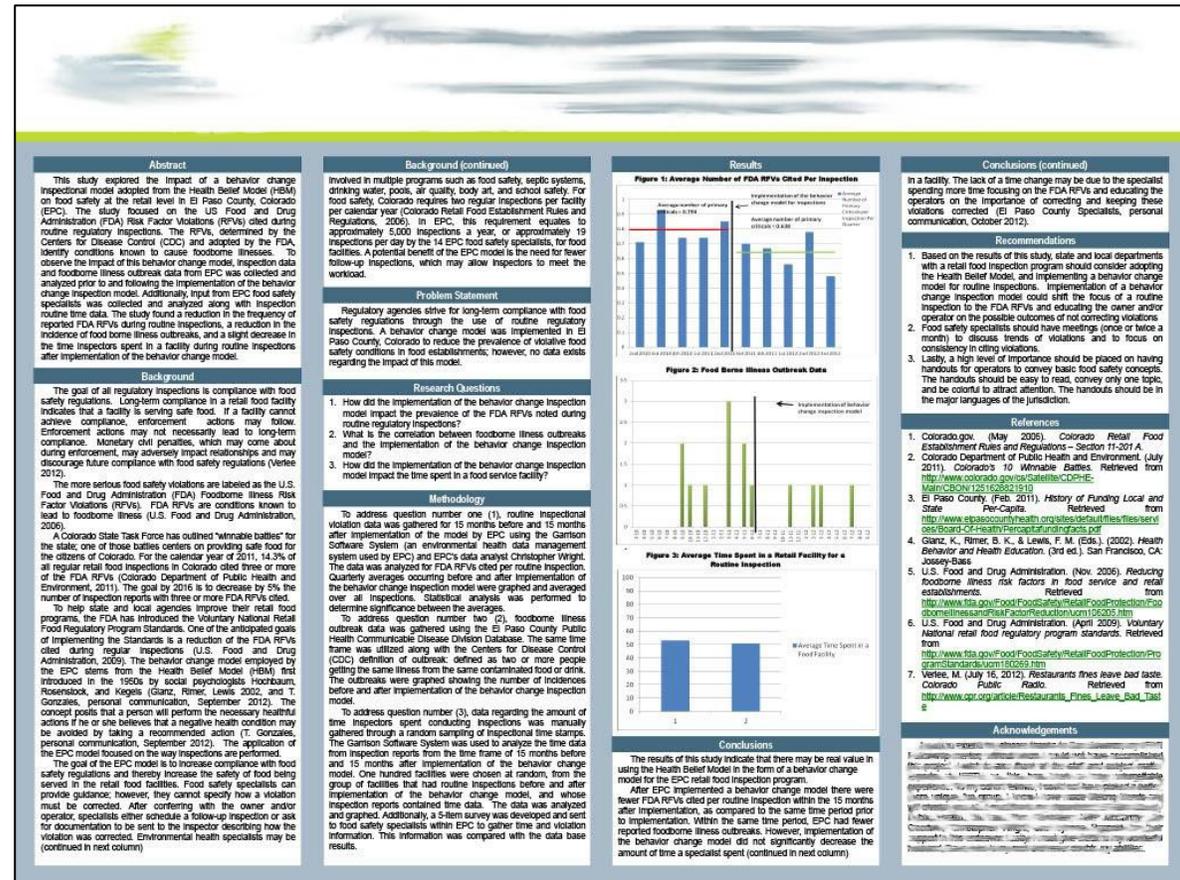
A poster is NOT an A0 paper

■ A poster is a visual abstract

■ Avoid wall of text

■ Readable from ~2/3 m

■ Stand next to it



Same message, different style

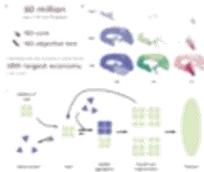
Novel Analytical Methods for Capture and Screening of Transient Oligomeric Species Responsible for Neurodegeneration

Dr. BrightCarbon

From increasingly aging populations, the economic, social and societal burdens of neurodegenerative diseases are set to intensify. At the heart of neurodegeneration sits toxic oligomeric proteins whose formation through seeded aggregation is statistically more likely as age increases. The nature of their formation brings a significant barrier to their detection, since families being of exponentially low concentrations in a typical patient sample, they are transient and dynamic. Single-molecule methods, particularly nanopore sensing, are an appropriate tool to apply to protein oligomer detection due to the stochastic sensing mechanism. Protein detection using nanopores is improved by employing DNA carriers, armed with molecular beacons tuned to bind specifically to the target analyte. Herein, we show the first steps for developing such a sensing device. Specifically, synchronized detection of an oligo analyte, expression and aggregation of a protein, and testing of an in-synthetic targeting molecular beacon.

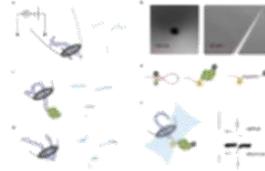
Neurodegenerative Disease

Neurodegeneration is the progressive atrophy and loss of function of neurons that leads to a range of downstream effects such as personality changes, memory loss and movement disorders. Alzheimer's Disease (AD) and Parkinson's Disease (PD) are by far the most common neurodegenerative diseases, with a global prevalence of 30 million and 8.5 million respectively (Figure 1a).¹ Indeed, this translates to 5.9% of the population over 60 years of age having AD, and 5.2% having PD. Moreover, neurodegenerative diseases are incurable and untreatable. The drug industry is used to treat PD by replacing dopamine lost through death of dopaminergic neurons, however, it has no effect on the progression of the disease. It only postpones the symptoms temporarily.^{2,3} Neurodegenerative diseases, societal and emotional burden, the number of people aged over 60 is expected to double in the next 40 years.⁴ Furthermore, a large proportion of these cases will be in developing countries, where access to the necessary care facilities is more difficult. Hence, research developments in neurodegeneration are both timely and crucial.



Nanopore Sensing

Nanopore sensing is a label-free method of single-molecule detection based on the transport of an analyte (a piece of dsDNA) in electrostatic solution between two chambers, via a hole of nanometric dimensions. Application of voltage to the analyte solution triggers passage of ions through the pore, and perturbations of ionic current flow (measured pulses) indicate the translocation of a single analyte molecule through the pore (Figure 2a). Further analysis of the properties of the translocation readout reveals information on the nature of the molecule through dwell time, peak current and area. Nanopore sensing is a stochastic process, so many single-molecule events must be recorded and averaged together to build meaningful statistics. Single-based sensors are inherently low cost and rapid to produce. The detection of disease biomarkers or pathological factors is a particularly favorable use of nanopore technology. Initial work by Liu et al. demonstrated the simultaneous selective detection of three proteins in human serum, by introducing a DNA-based carrier functionalized with oligonucleotide aptamers tuned to the target proteins (Figure 2b).⁵ Not only did this open the door to detection of biologically relevant biomolecules in complex media, the authors also developed the basis of detecting proteins in nanopores.



Results

To demonstrate the sensing mechanism, Figure 3b shows a typical trace for 300 pM 10 kbp DNA in a nanopore, with a 100 ms time scale. Each pulse from the baseline represents a single DNA molecule exiting the nanopore. From visual inspection of the trace, one can conclude that near identical molecules can lead to diverse different readout signals. This is caused by the binding effect at secondary positions, which is reinforced by the heterogeneity in Figure 3c - while dwell time and peak amplitude both have secondary populations, charge has only one. Typically, the charge is a measure of the molecule's length from the nanopore during a translocation and is controlled by the charge of the molecule passing through.⁶ Hence, charge is a useful parameter to discriminate between different analytes or conformations of the same analyte.⁶ In the shape of the distributions are tighter when analyzed together: the major population for dwell time is for longer times, which compensates for the major population for amplitude being lower currents. The combination of width and height to give area leads to a uniform population with a single component.



Conclusion

Encouraging work has been presented thus far. The synthesized platform, though technically difficult, shows significant promise. As described above, a widget has been designed to prevent misalignment due to drift, and a new batch of Y2FD-4 has been produced to prevent potential sample degradation. These steps, along with improved techniques through practice, should see a dramatic increase in the synchronization percentage in the 10 kbp-Y2FD-4 experiments.

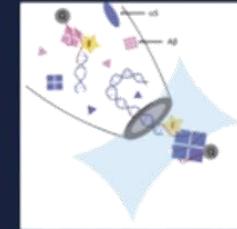


References
 1. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 2. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 3. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 4. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 5. Liu, Y., et al. *Nature Nanotechnology*, 2014, 9, 100-105.
 6. BrightCarbon, *Single-molecule two-point detection*, 2023.

Revolutionising the Study of Neurodegenerative Disease

Dr. BrightCarbon

Single-molecule two-point detection shows the potential to change the way we think about Parkinson's and Alzheimer's Disease



1. Introduction

- Neurodegenerative diseases are caused by abnormal aggregation of proteins such as Aβ and αSyn in the brain.
- Aggregated proteins become toxic and start destroying neurons.

2. Methods

- Aggregated proteins are transient, so are best detected using single-molecule methods.
- Nanopore current and conformational fluorescence are used in tandem to produce synchronized signals (Fig 1).

3. Results

- Using a molecular beacon carrier with a matching target sequence we show synchronized detection is possible (Fig 2).

4. Discussion

- Further validity testing is required to confirm if the method works in clinical samples.
- We taken a major step towards proving the viability of this sensing mechanism.

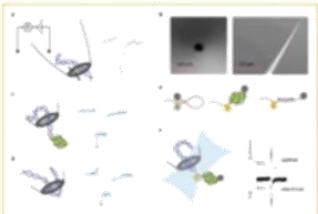


Figure 1. (a, b) Nanopore sensing setup; (c, d) Nanopore sensing with a DNA carrier; (e, f) Nanopore sensing with a molecular beacon carrier for synchronized detection.

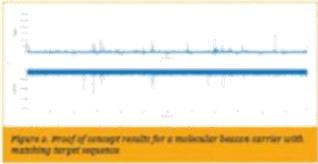


Figure 2. Proof of concept results for a molecular beacon carrier with matching target sequence.

References
 1. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 2. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 3. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 4. World Health Organization, *World Health Statistics Quarterly*, 2017, 70, 103-114.
 5. Liu, Y., et al. *Nature Nanotechnology*, 2014, 9, 100-105.
 6. BrightCarbon, *Single-molecule two-point detection*, 2023.

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From BrightCarbon

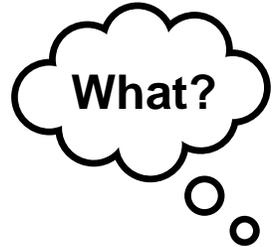
Thank you for your attention!

Thank you for attention!

Summary



Know your audience and adjust for it



Keep in mind what your key messages are

Spend time on how you present your work



Summary



Know your audience and adjust for it



Keep in mind what your key messages are



Spend time on how you present your work



Some references

„[How to give scientific presentations](#)“

Christoph Grab, ETH PhD seminar 2011, Zürich

„[Designing Effective Science Presentations](#)“

Society for Neuroscience

„[How to create beautiful and effective academic posters in PowerPoint](#)“,

Emily Pinch, brightcarbon.com