

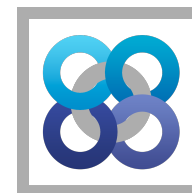
# DO'S and DONT'S about GIVING MATH TALKS

NÚRIA FAGELLA

Learning Week I: September 6-10, 2021  
GRAPES project



UNIVERSITAT DE  
BARCELONA



**BGSM**ath  
BARCELONA GRADUATE SCHOOL OF MATHEMATICS

# CREDITS

All advice has been "borrowed" from several places:

- *Sharing your scientific research*. James Clark (Kings College).
- *Designing effective scientific presentations*. Susan McConnell (Stanford)  
<https://www.youtube.com/watch?v=Hp7ld3Yb9XQ&list=LL&index=1&t=28s>
- *Giving a talk*. Bryna Kra (Northwestern University).
- *Talks are not the same as papers*. Terence Tao (UCLA).
- *The do's and dont's of giving a math talk*. Adam Van Tuyl (Lakehead University)
- *Technically speaking*. NSF project. [http://techspeaking.denison.edu/Technically\\_Speaking/Home.html](http://techspeaking.denison.edu/Technically_Speaking/Home.html)

+ 35 years of attending good (and bad!) talks

# PUBLIC SPEAKING

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We are **not experts** at public speaking, but .....



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We are **not experts** at public speaking, but .....

We are all **EXPERTS** at **LISTENING** to talks!

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How many hours have you spent sitting in rooms listening to talks and lectures????

# Filippov-type Predator Prey Model

## Prey Switching with a Linear Preference Trade-Off\*

**Abstract.** In ecology, *prey switching* refers to a predator's adaptive change of habitat or diet in response to prey abundance. In this paper, we study piecewise-smooth models of predator-prey interactions with a linear trade-off in a predator's prey preference. We consider optimally foraging predators and derive a model for a 1 predator-2 prey interaction with a tilted switching manifold between the two sides of discontinuous vector fields. We show that the 1 predator-2 prey system undergoes a novel adding-sliding-like (center to two-part periodic orbit; "C2PO") bifurcation in which the prey ratio transitions from constant to time-dependent. Farther away from the bifurcation point, the period of the oscillating prey ratio doubles, which suggests a possible cascade to chaos. We compare our model predictions with data on freshwater plankton, and we successfully capture the periodicity in the ratio between the predator's preferred and alternative prey types. Our study suggests that it is useful to investigate prey ratio as a possible indicator of how population dynamics can be influenced by ecosystem diversity.

674

**3.3.4. Period doubling.** We compute a bifurcation diagram for (3.4) by determining the local maxima of the quantity  $p_1/(a_q p_2) > 1$  when  $a_q \rightarrow 0$  and  $b_q \rightarrow q_2$ . The period-1 adding-sliding periodic orbit that emerges when  $a_q < q_2/q_1$  period-doubles as we decrease  $a_q$  from the bifurcation point. As we illustrate in Figure 7 (see Figure 8 for example trajectories and sliding segments of period-2, period-4, and chaotic orbits), this suggests that there is a cascade to chaos as  $a_q \rightarrow 0$ . From a biological perspective,  $a_q \rightarrow 0$  corresponds to the situation in

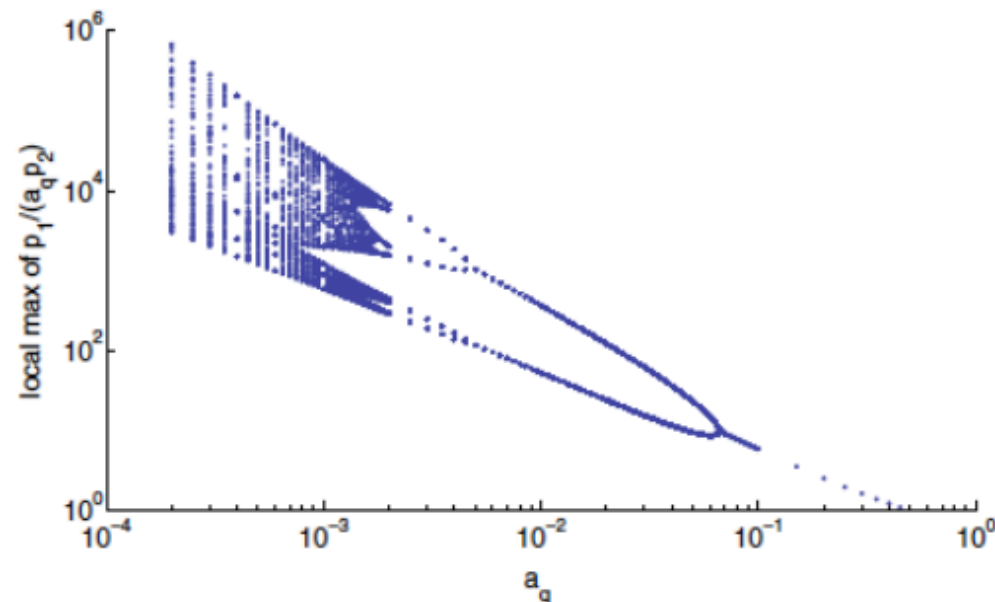


Figure 7. Local maxima of  $p_1/(a_q p_2) > 1$  as  $a_q \rightarrow 0$  for (3.4) with parameter values  $r_1 = 1.3$ ,  $r_2 = 0.26$ ,  $e = 0.25$ ,  $m = 0.14$ , and  $\beta_1 = \beta_2 = 1$ .

## PREY SWITCHING WITH LINEAR PREFERENCE

675

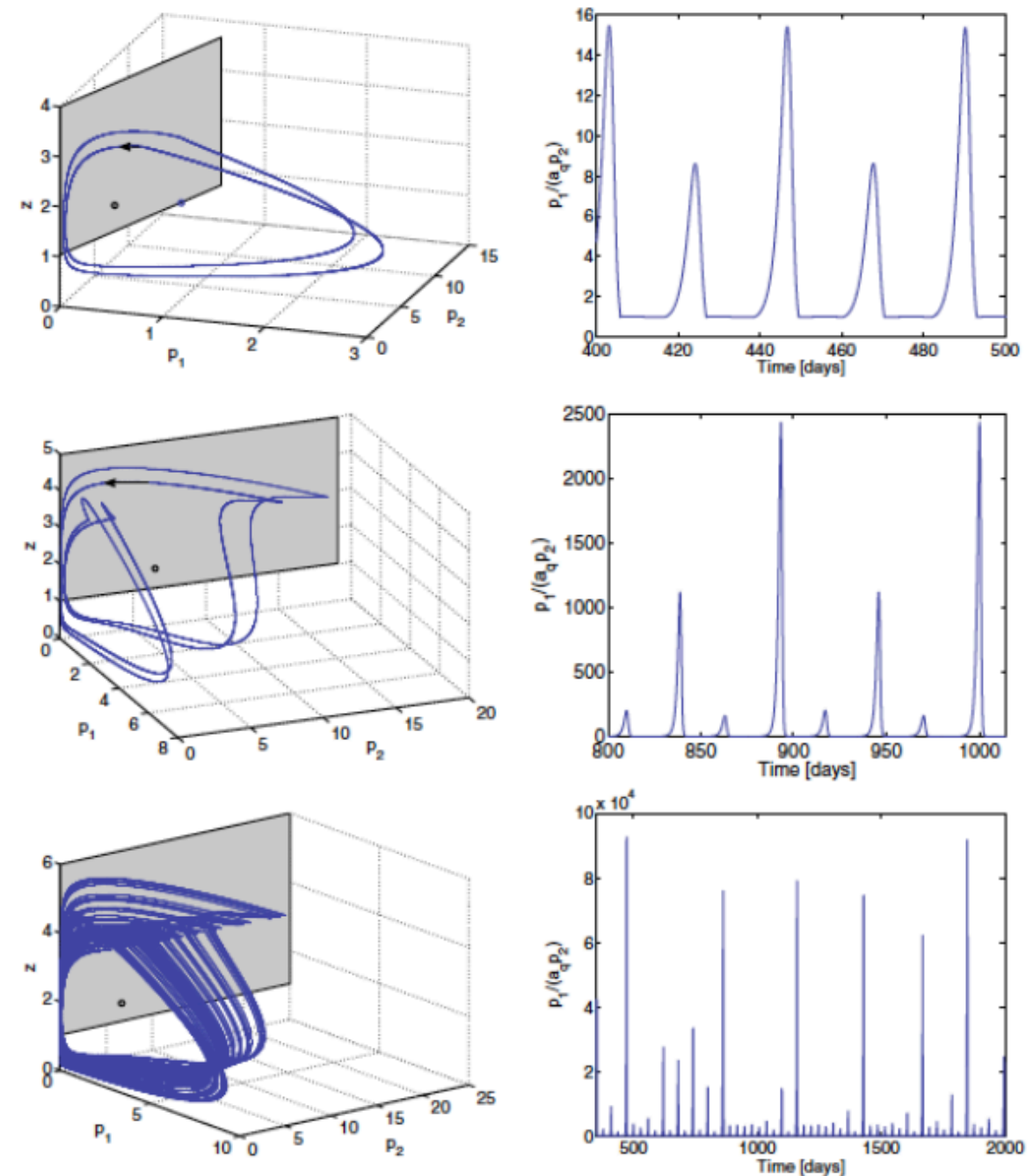


Figure 8. (Left) Example trajectories and (right) scaled prey ratio  $p_1/(a_q p_2)$  of (3.4) with (top)  $a_q = 0.06$ , (middle)  $a_q = 0.0035$ , and (bottom)  $a_q = 0.0005$  for the parameter values  $q_1 = 1$ ,  $q_2 = 0.5$ ,  $r_1 = 1.3$ ,  $r_2 = 0.26$ ,  $e = 0.25$ ,  $m = 0.14$ , and  $\beta_1 = \beta_2 = 1$ .

## 2<sup>nd</sup> averaging (descent method)

new change of variable

$$\begin{aligned}\psi &= (1 + \alpha_0 + \beta_0 \mathcal{H})\theta + (\alpha_1 + \beta_1 \mathcal{H})\partial_\tau^{-1}\theta + (\alpha_2 + \beta_2 \mathcal{H})\partial_\tau^{-2}\theta \\ \theta(\xi, \tau) &= \varphi(y, t) = p(\mathcal{U}_t(x), t)(L_{w'}u)(x, t) \quad (\xi, \tau) = Q(\mathcal{U}_t(x), t)\end{aligned}$$

*Theorem 3:* Assume  $\underline{w} \in H_{\mathfrak{H}}^{m, ee}$ ,  $m \geq 14$ , then consider the linear equation

$$\Lambda(\underline{w}, \varepsilon)u = f$$

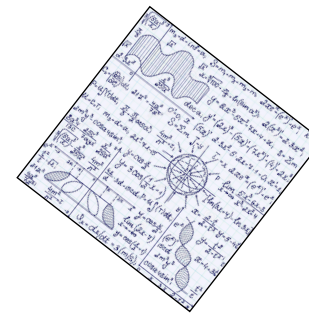
Then  $\psi$  satisfies

$$\partial_\tau^2 \psi - (1 + \beta^{(0)})\mathcal{H}\partial_\xi \psi - \kappa^{(0)}\psi + (b_3 + b_4 \mathcal{H})\partial_\tau^{-2}\psi + \tilde{\mathcal{B}}\psi = g$$

$$\begin{aligned}\beta^{(0)}(\underline{w}, \varepsilon) &= \varepsilon^2/4 + O(\varepsilon^3), \quad \kappa^{(0)}(\underline{w}, \varepsilon) = c_I \varepsilon^4 + O(\varepsilon^5) \text{ const} \\ b_3(\underline{w}, \varepsilon), \quad b_4(\underline{w}, \varepsilon) &= O(\varepsilon^2) \quad C^{m-8} \text{ functions of } (\xi, \tau) \\ c_I &= (1/4)(\text{card}(I) - 1/2) \sum_{q \in I} q^2\end{aligned}$$

$\tilde{\mathcal{B}} = O(\varepsilon)$  is smoothing enough and depends smoothly on  $(\underline{w}, \varepsilon)$

# THREE DIMENSIONS



## WANDERING DOMAINS IN AND OUT

Analysis, Dynamics, Geometry and Probability

On the occasion of Chris Bishop's birthday

Simons Center, March 2-6, 2020.

Núria Fagella

(Joint work with A. Benini, V. Evdoridou, P. Rippon and G. Stallard )

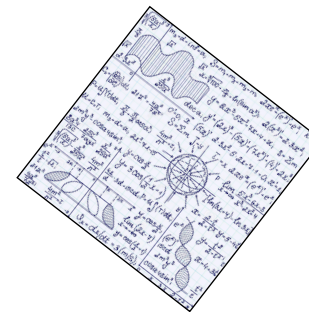
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- **CONTENT**

Plan what to say



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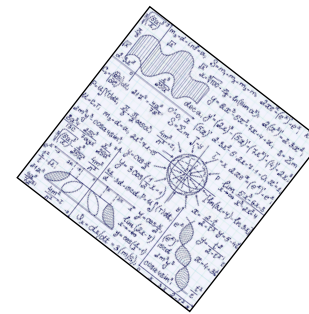
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Plan what to say



- **FORM**

Prepare slides (or bckb!)

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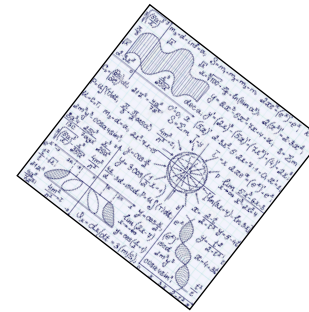




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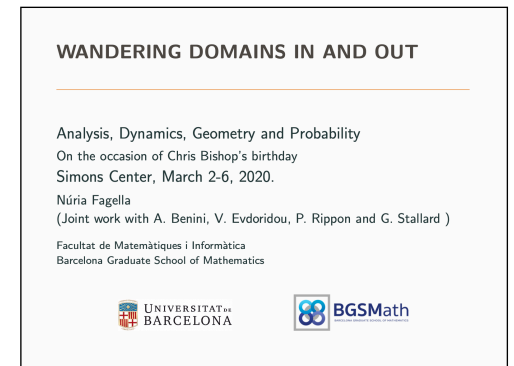
- **CONTENT**

Plan what to say



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- **PERFORMANCE**

Practice your delivery





# CONTENT



*"... I have made this letter longer than usual  
because I lack the time to make it shorter..."*

Blaise Pascal, 1642

# CONTENT



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Prepare with **enough time** in order to:

# CONTENT



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- Organize your material

# CONTENT



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Blaise Pascal, 1642

Prepare with **enough time** in order to:

- Decide what to tell
- Organize your material
- Be concise

***"A talk is not a paper"*** (Terence Tao)

**Don't try to do too much!**

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- Plan what you would like to say.... and **choose 1/3** of it!

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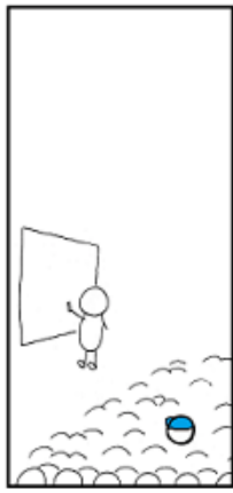
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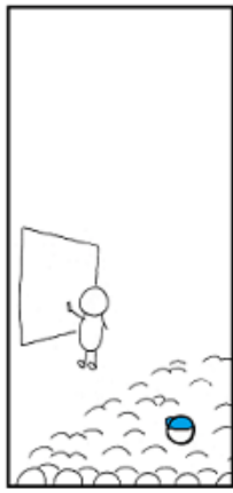
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**Less is more!**



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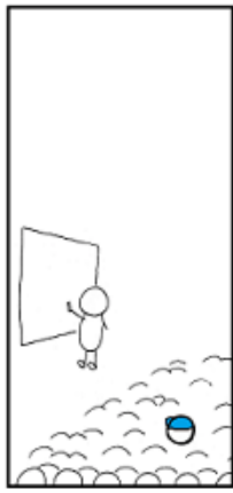
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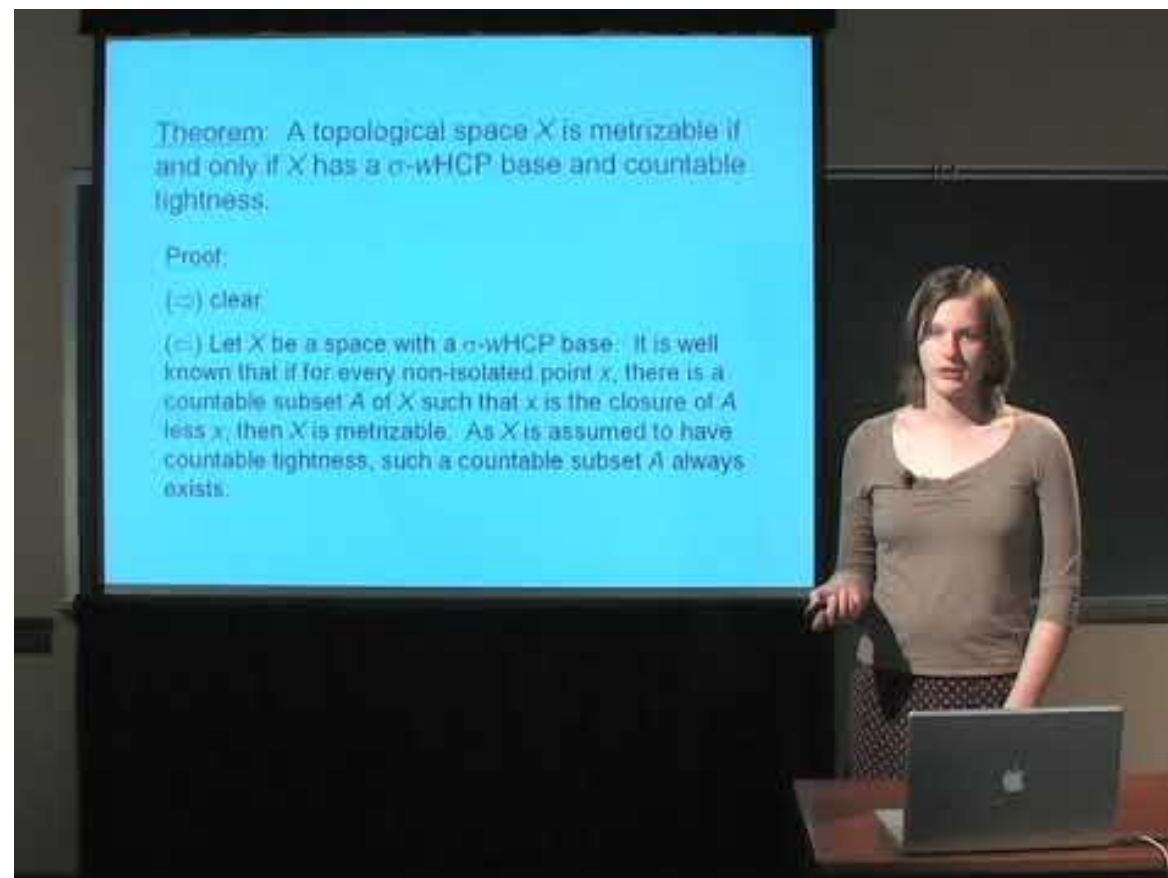
- You are the expert.  
Don't overestimate what the audience knows about your subject.

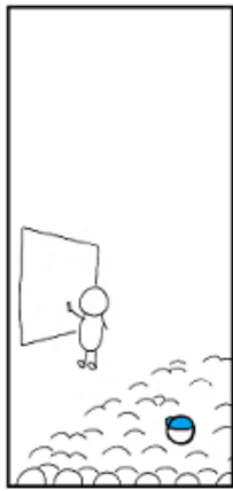


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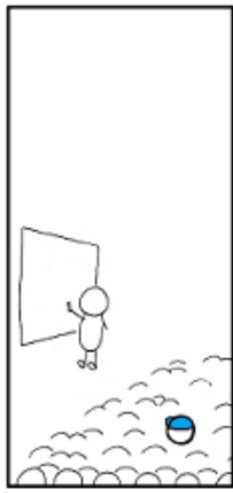




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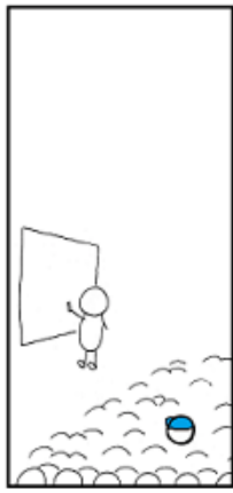
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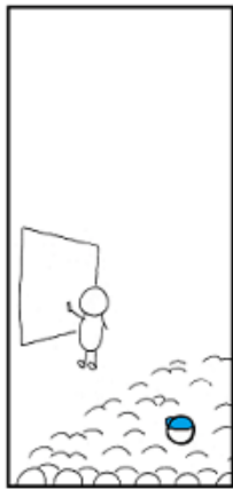


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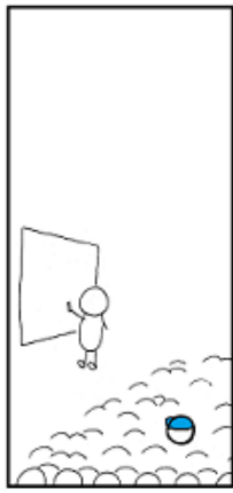




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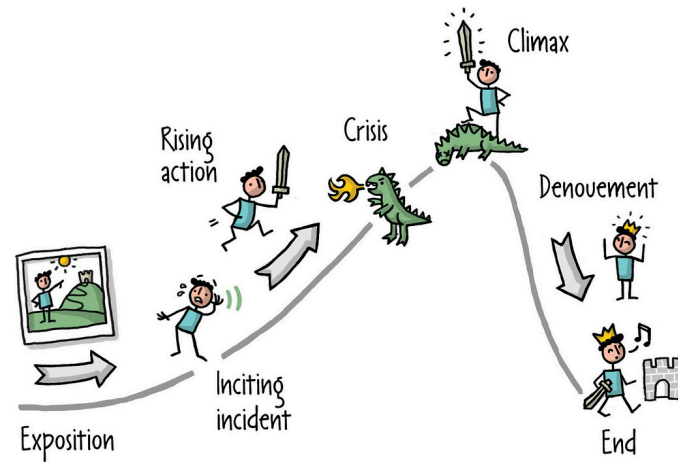
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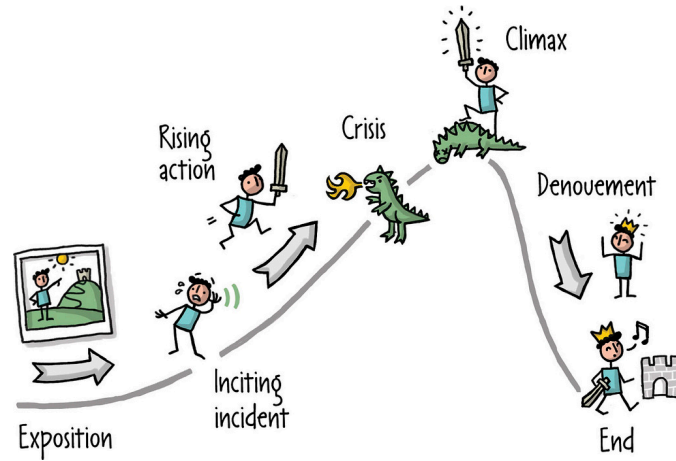
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- **Layer** your talk: give (1) something for everyone (2) for your peers (3) for the experts.



# CONTENT

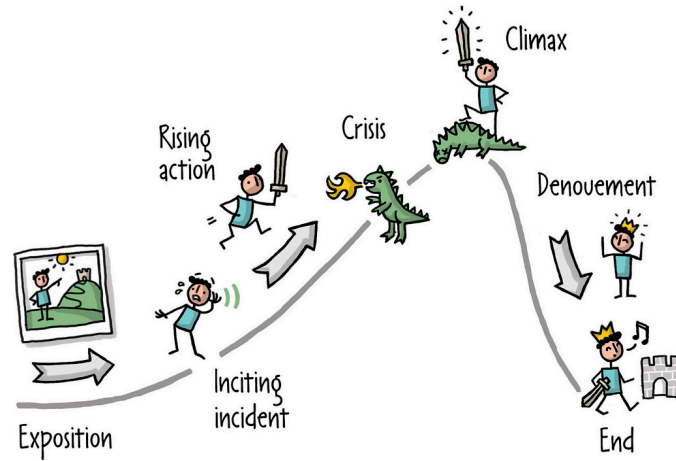
**Tell a story - structure your talk**



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## Tell a story - structure your talk

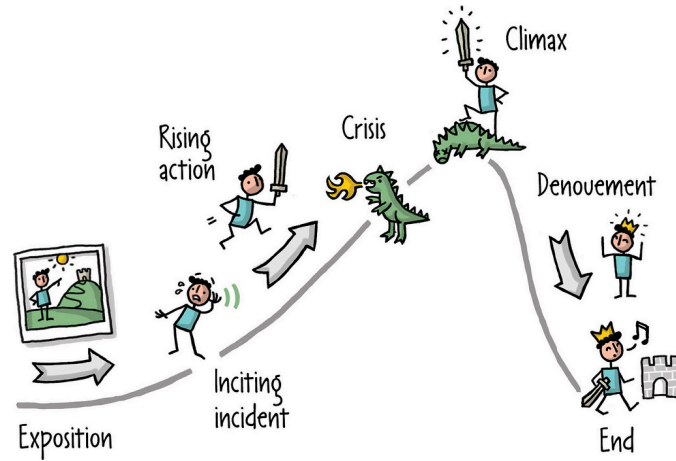
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# CONTENT

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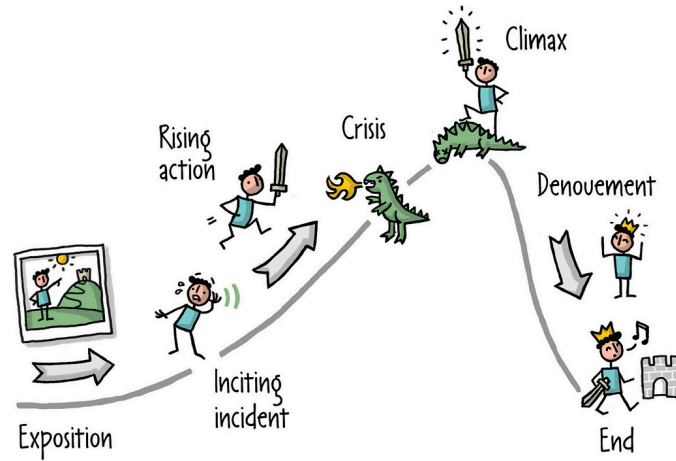


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*The craft of Scientific Presentations*  
(Michael Alley)



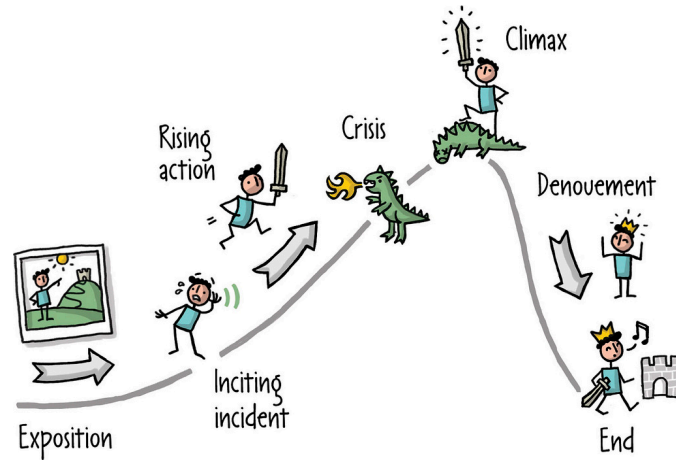
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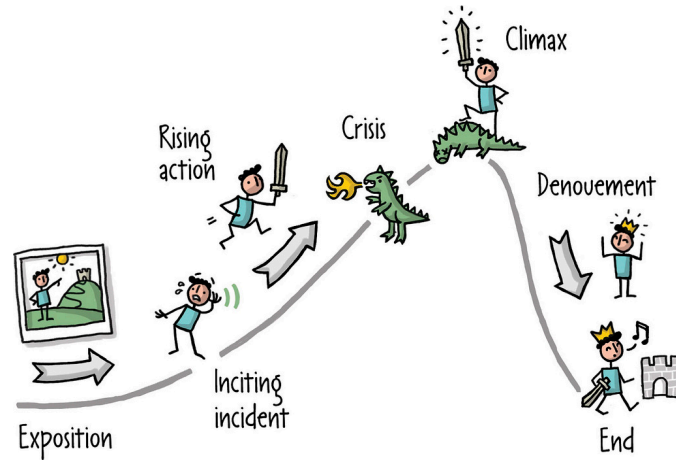
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**start broad**

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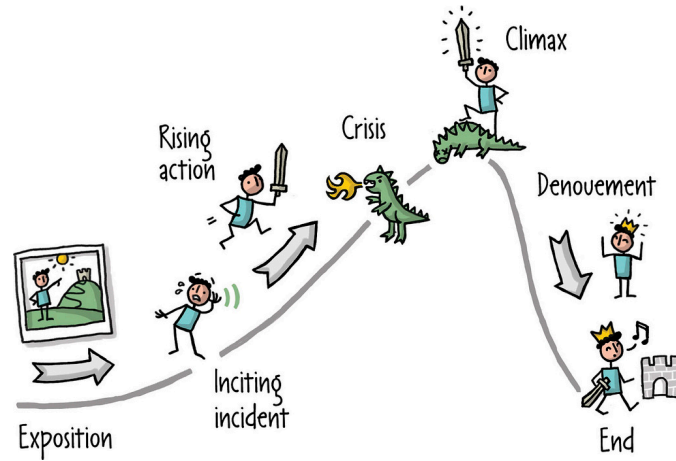
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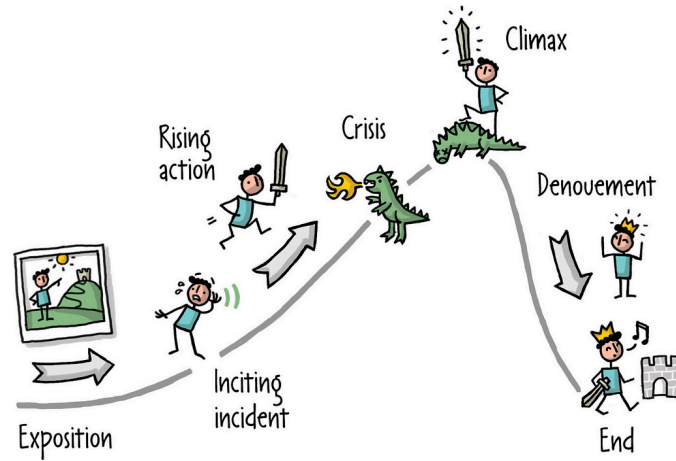


start broad

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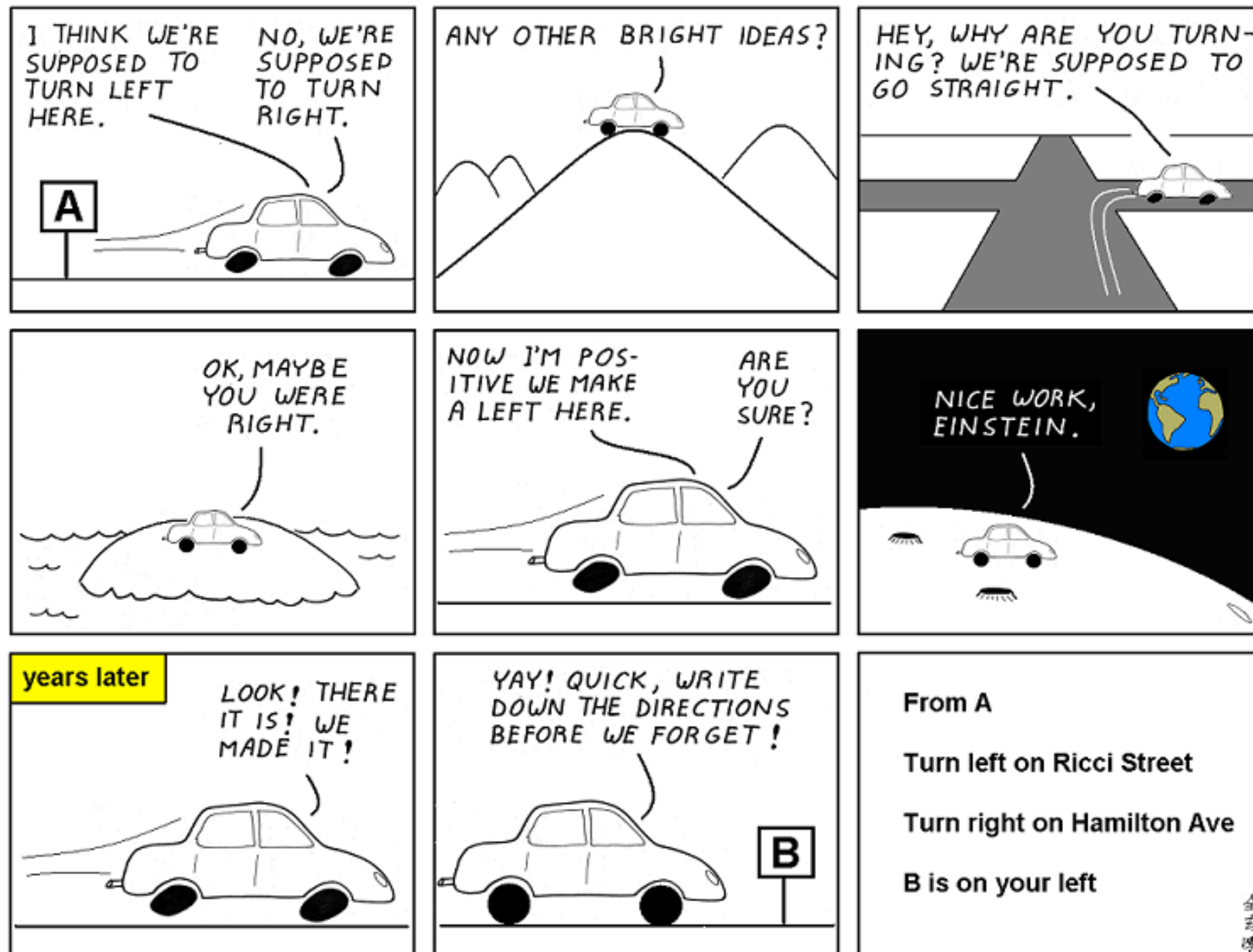
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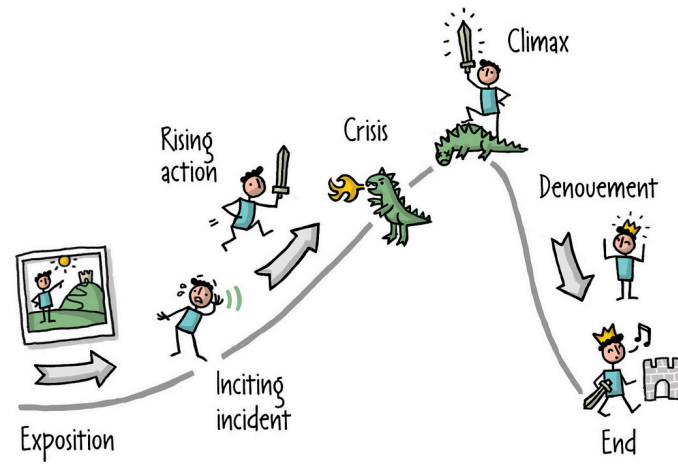
end broad

- You might explain **how** you came up with the proofs.  
**Failed ideas** might be interesting!

## Obvious

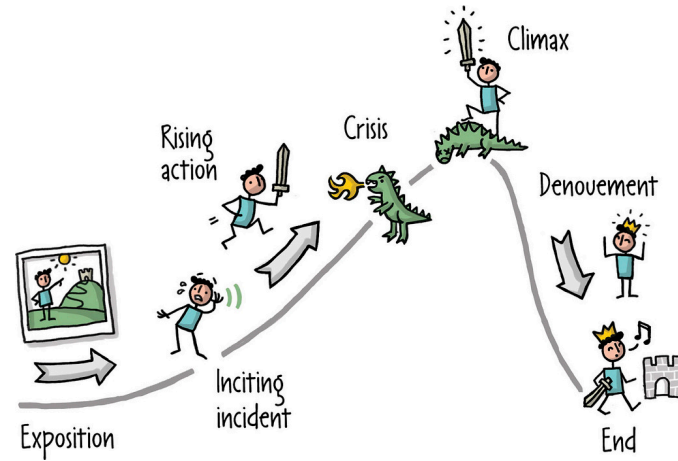


This is how most mathematical proofs are written.



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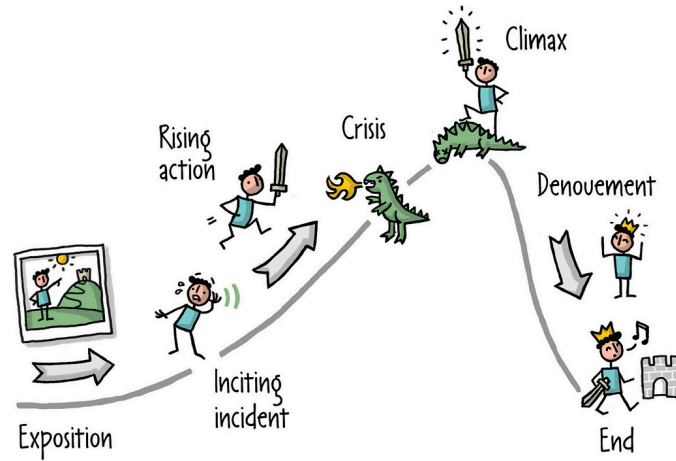
Give proper credit



# CONTENT

## Give proper credit

- Make it clear which results are **yours** and which are not



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- Make it clear which results are **yours** and which are not
- Be assertive - **not negative**.

# FORMAT



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- 1 hour talks ideal on blackboard but....hard to do.

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Themes:

Implications for pp-partitions of haplotype matrices.

Corollary

If  $\chi_{pp}(M) = 2$  for a haplotype matrix  $M$ , we can find an optimal pp-partition in polynomial time.

Corollary

Computing  $\chi_{pp}$  for haplotype matrices is

- NP-hard,
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### BUILDING BLOCKS

#### ► Pedersen Commitment [Ped91]

- **Setup:** Let  $G = \langle P \rangle$  be a group of prime order  $q$ . Select  $Q \leftarrow G$ . Set  $pk \leftarrow (P, Q)$ .
- **Commit( $m$ ):** To commit to a message  $m \in \mathbb{Z}_q$ , select  $r \leftarrow \mathbb{Z}_q$ , and set  $C \leftarrow [m]P + [r]Q$ .
- **Opening:** to open a commitment  $C$  just reveal  $m$  and  $r$ , the correctness can be checked by verifying that  $C = [m]P + [r]Q$ .
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Jaumard, Hartman, Nierhoff, Sharan, Tsuru, T. Block Partitioning and Perfect Phylogenesis WABI 2006 12 / 21

BLIND SIGNATURES SECURITY MODEL RELATED WORK OUR CONSTRUCTION EFFICIENCY COMPARISON OPEN PROBLEMS

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Efficient Two-Move Blind Signatures ... 12 / 14

**Focus:**  
**A MINIMALIST BEAMER THEME**

SUBTITLE

AUTHOR 1  
AUTHOR 2  
INSTITUTE NAME  
INSTITUTE ADDRESS  
DD MM YYYY

FOCUS



# Text on slides

Keep it **BIG**, **SIMPLE** and **CLEAR**

## BIG



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- Must be read **from the back**
- Use **fonts > 28pt** (30, 32, 34, 36, 40, 46, 50)
- There is no point in adding little comments like this if nobody can read them....





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- Don't put too many elements in one slide

# Going back to the example....

## Filippov-type Predator Prey Model

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### Prey Switching with a Linear Preference Trade-Off\*

**Abstract.** In ecology, *prey switching* refers to a predator's adaptive change of habitat or diet in response to prey abundance. In this paper, we study piecewise-smooth models of predator-prey interactions with a linear trade-off in a predator's prey preference. We consider optimally foraging predators and derive a model for a 1 predator-2 prey interaction with a tilted switching manifold between the two sides of discontinuous vector fields. We show that the 1 predator-2 prey system undergoes a novel adding-sliding-like (center to two-part periodic orbit; "C2PO") bifurcation in which the prey ratio transitions from constant to time-dependent. Farther away from the bifurcation point, the period of the oscillating prey ratio doubles, which suggests a possible cascade to chaos. We compare our model predictions with data on freshwater plankton, and we successfully capture the periodicity in the ratio between the predator's preferred and alternative prey types. Our study suggests that it is useful to investigate prey ratio as a possible indicator of how population dynamics can be influenced by ecosystem diversity.

674

**3.3.4. Period doubling.** We compute a bifurcation diagram for (3.4) by determining the local maxima of the quantity  $p_1/(a_q p_2) > 1$  when  $a_q \rightarrow 0$  and  $b_q \rightarrow q_2$ . The period-1 adding-sliding periodic orbit that emerges when  $a_q < q_2/q_1$  period-doubles as we decrease  $a_q$  from the bifurcation point. As we illustrate in Figure 7 (see Figure 8 for example trajectories and sliding segments of period-2, period-4, and chaotic orbits), this suggests that there is a cascade to chaos as  $a_q \rightarrow 0$ . From a biological perspective,  $a_q \rightarrow 0$  corresponds to the situation in

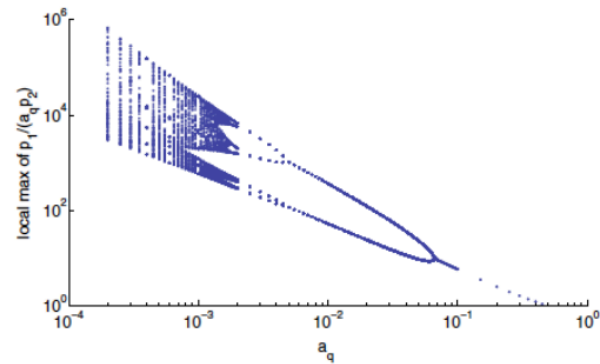


Figure 7. Local maxima of  $p_1/(a_q p_2) > 1$  as  $a_q \rightarrow 0$  for (3.4) with parameter values  $r_1 = 1.3$ ,  $r_2 = 0.26$ ,  $e = 0.25$ ,  $m = 0.14$ , and  $\beta_1 = \beta_2 = 1$ .

### PREY SWITCHING WITH LINEAR PREFERENCE

675

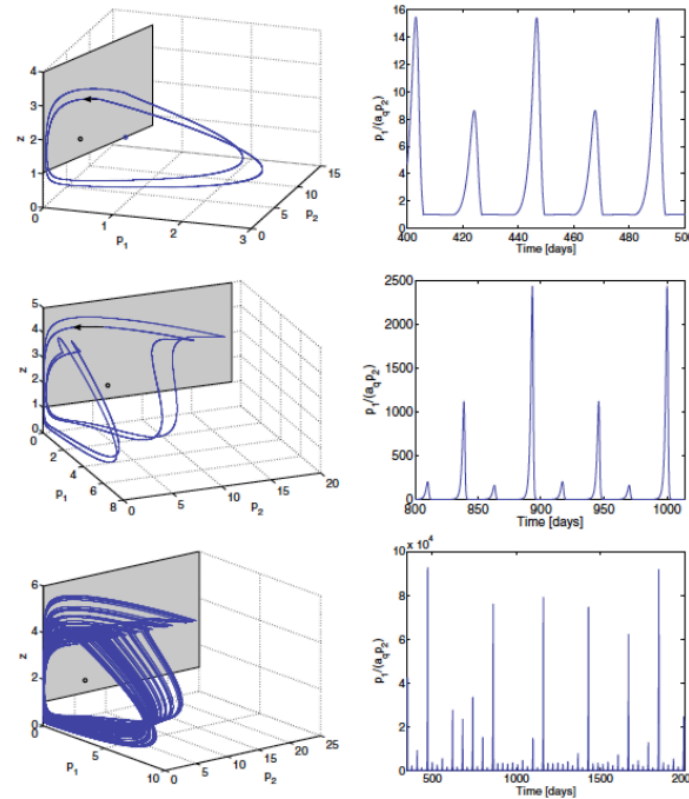


Figure 8. (Left) Example trajectories and (right) scaled prey ratio  $p_1/(a_q p_2)$  of (3.4) with (top)  $a_q = 0.06$ , (middle)  $a_q = 0.0035$ , and (bottom)  $a_q = 0.0005$  for the parameter values  $q_1 = 1$ ,  $q_2 = 0.5$ ,  $r_1 = 1.3$ ,  $r_2 = 0.26$ ,  $e = 0.25$ ,  $m = 0.14$ , and  $\beta_1 = \beta_2 = 1$ .



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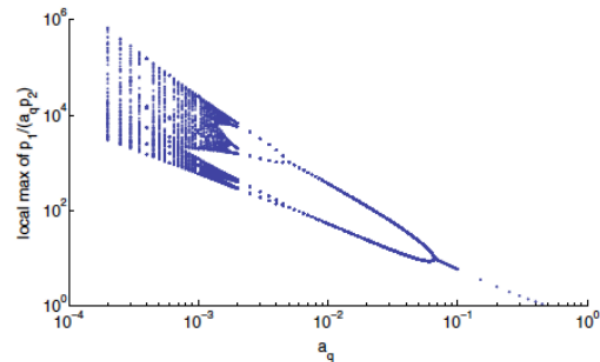


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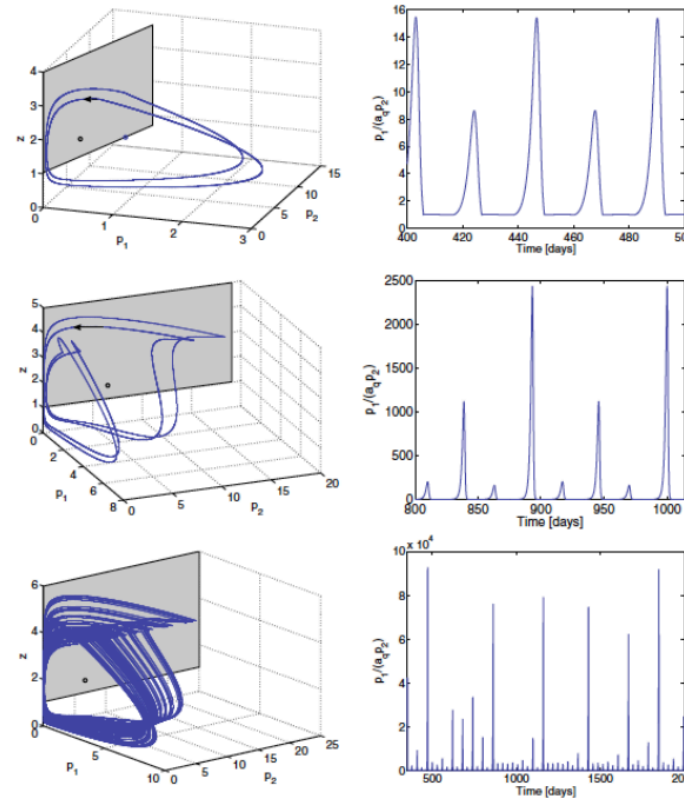


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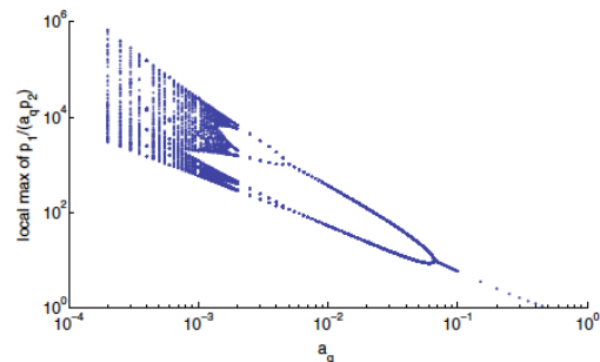


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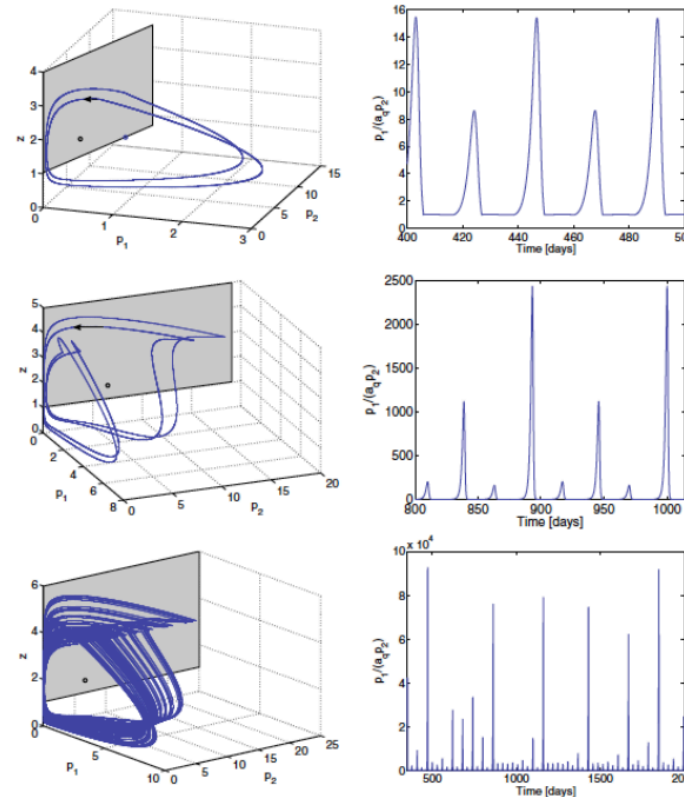


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*"I know there is a lot of information but I only want you to look at this piece here ...."*

If you are not going to take the time to talk about it, leave it out!!



# Text on slides

Keep it BIG, SIMPLE and CLEAR

## CLEAR



# Text on slides

Keep it **BIG**, **SIMPLE** and **CLEAR**

**CLEAR**

- Use **clean fonts**: Arial or Helvetica



# Text on slides

Keep it **BIG**, **SIMPLE** and **CLEAR**

## CLEAR

- Use **clean fonts**: Arial or Helvetica
- Don't *míx* **different** FONTS



# Text on slides

Keep it **BIG**, **SIMPLE** and **CLEAR**

## CLEAR

- Use **clean fonts**: Arial or Helvetica
- Don't *míx* **different** FONTS
- *No scripted fonts - hard to read!*



# Text on slides

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## CLEAR

- Use **clean fonts**: Arial or Helvetica
- Don't *míx* **different** FONTS
- *No scripted fonts - hard to read!*
- **Simple background** - single color or gradient



# Text on slides

Keep it **BIG**, **SIMPLE** and **CLEAR**

## CLEAR

- Use **clean fonts**: Arial or Helvetica
- Don't *míx* **different** FONTS
- *No scripted fonts - hard to read!*
- **Simple background** - single color or gradient
- Don't overuse fancy animations



Too many **animations** are **distracting** and do not help you to get your point across



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# COLORS and EFFECTS

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- YOU might love this color, but think of the audience

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  - Others just look awful!

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- YOU might love this color, but think of the audience
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- **Shadows and reflections rarely work**

# COLORS and EFFECTS

- YOU might love this color, but think of the audience
  - Some colors are hard to read
  - Others just look awful!
- **Shadows and reflections rarely work**
- Use traditional color schemes:
  - Dark on white
  - Yellow/white on dark





# What about graphics?



# What about graphics?

- Audience is **visually oriented** so **DO add images** (1 pict > 50 words!)



# What about graphics?

- Audience is **visually oriented** so **DO add images** (1 pict > 50 words!)
- BUT



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- Audience is **visually oriented** so **DO add images** (1 pict > 50 words!)
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- Audience is **visually oriented** so **DO add images** (1 pict > 50 words!)
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  - **Explain every** graphic that you show

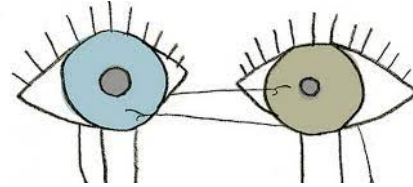


# What about graphics?

- Audience is **visually oriented** so **DO add images** (1 pict > 50 words!)
- BUT
  - **Show just** the graphics that you plan to explain
  - **Explain every** graphic that you show
- Use **quality graphics**: Don't cut and paste from papers! Make your own if possible.

# And finally .... DELIVERY TIME

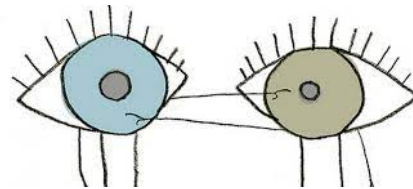
Be interesting



# And finally .... DELIVERY TIME

## Be interesting

- Maintain eye contact

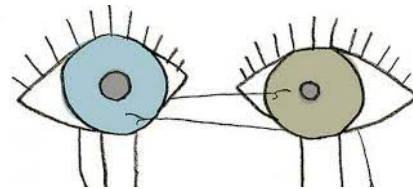




# And finally .... DELIVERY TIME

## Be interesting

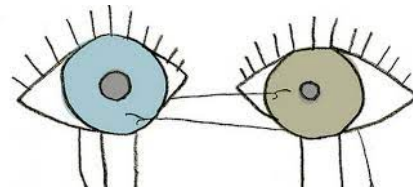
- Maintain eye contact
- Show excitement



# And finally .... DELIVERY TIME

## Be interesting

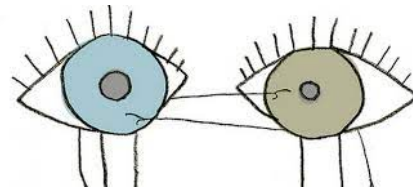
- Maintain eye contact
- Show excitement
- Voice intelligibility



# And finally .... DELIVERY TIME

## Be interesting

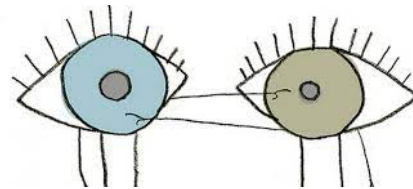
- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume



# And finally .... DELIVERY TIME

## Be interesting

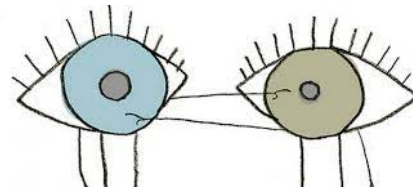
- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume
  - Articulation



# And finally .... DELIVERY TIME

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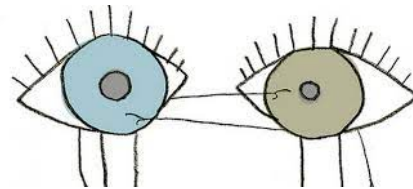
- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume
  - Articulation
  - Pronunciation



# And finally .... DELIVERY TIME

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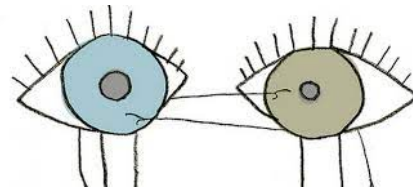
- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume
  - Articulation
  - Pronunciation
  - Pauses



# And finally .... DELIVERY TIME

## Be interesting

- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume
  - Articulation
  - Pronunciation
  - Pauses
  - Don't overuse expressions

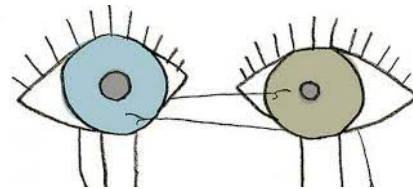




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## Be interesting

- Maintain eye contact
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- Voice intelligibility
  - Pitch and volume
  - Articulation
  - Pronunciation
  - Pauses
  - Don't overuse expressions
  - Watch your grammar

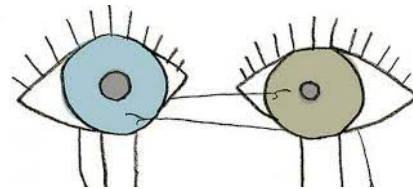




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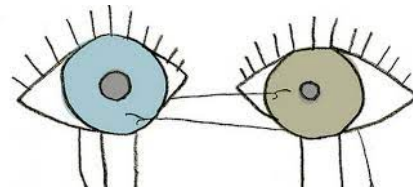


- **Don't read** your slides.  
Glance at them, but **look at the audience.**

# And finally .... DELIVERY TIME

## Be interesting

- Maintain eye contact
- Show excitement
- Voice intelligibility
  - Pitch and volume
  - Articulation
  - Pronunciation
  - Pauses
  - Don't overuse expressions
  - Watch your grammar



- **Don't read** your slides.  
Glance at them, but **look at the audience.**
- Be assertive

# DELIVERY

Be the focus



# DELIVERY

## Be the focus

- Be near the screen



# DELIVERY

## Be the focus

- Be near the screen
- Move around!





# DELIVERY

## Be the focus

- Be near the screen
- Move around!
- Use body language



# DELIVERY

## Be the focus

- Be near the screen
- Move around!
- Use body language
- Smile! Keep the audience awake.



# And the real trick is ....

# PRACTICE!





# And the real trick is ....

## PRACTICE!

- **Theater,** no improvisation.



# And the real trick is ....

## PRACTICE!

- **Theater,** no improvisation.
- Practice and practice



# And the real trick is ....

## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom



# And the real trick is ....

## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom
  - Out loud



# And the real trick is ....

## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom
  - Out loud
  - Mirror



# And the real trick is ....

## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom
  - Out loud
  - Mirror
  - **Record** yourself



# And the real trick is ....

## PRACTICE!

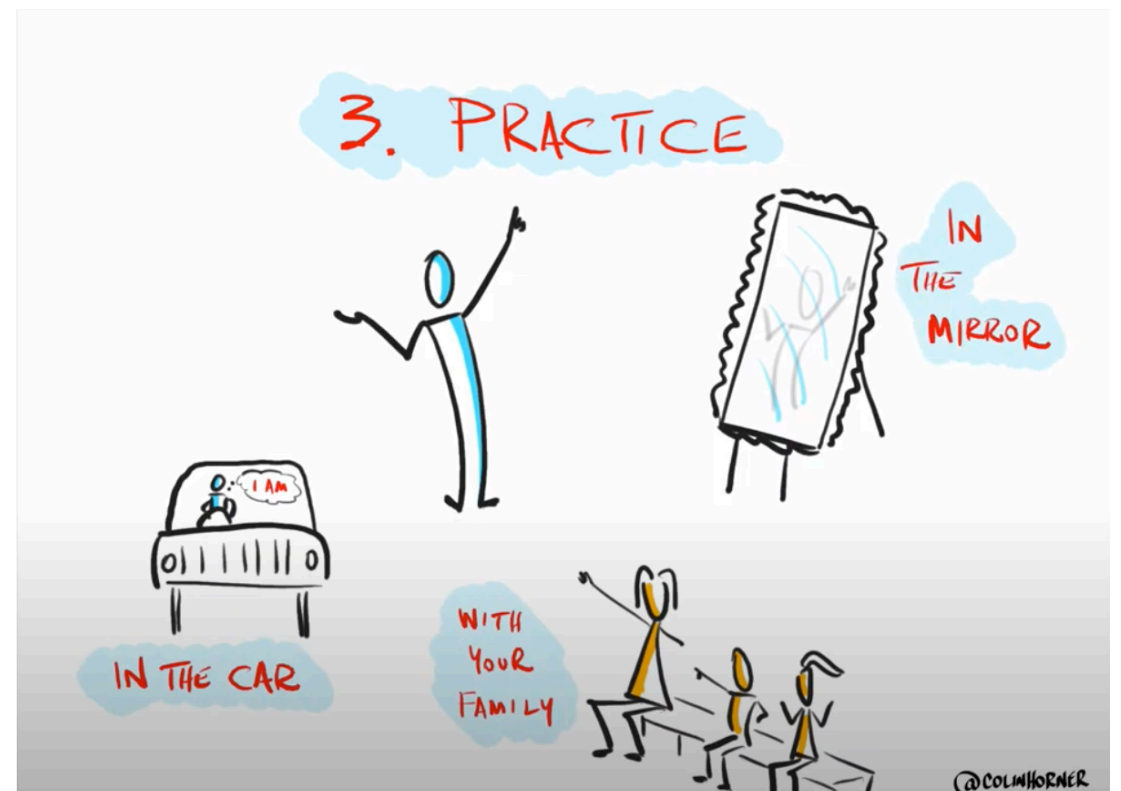
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- Practice and practice
  - Top to bottom
  - Out loud
  - Mirror
  - **Record** yourself
  - Find an **audience**



# And the real trick is ....

## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom
  - Out loud
  - Mirror
  - **Record** yourself
  - Find an **audience**
  - Memorize the first sentences





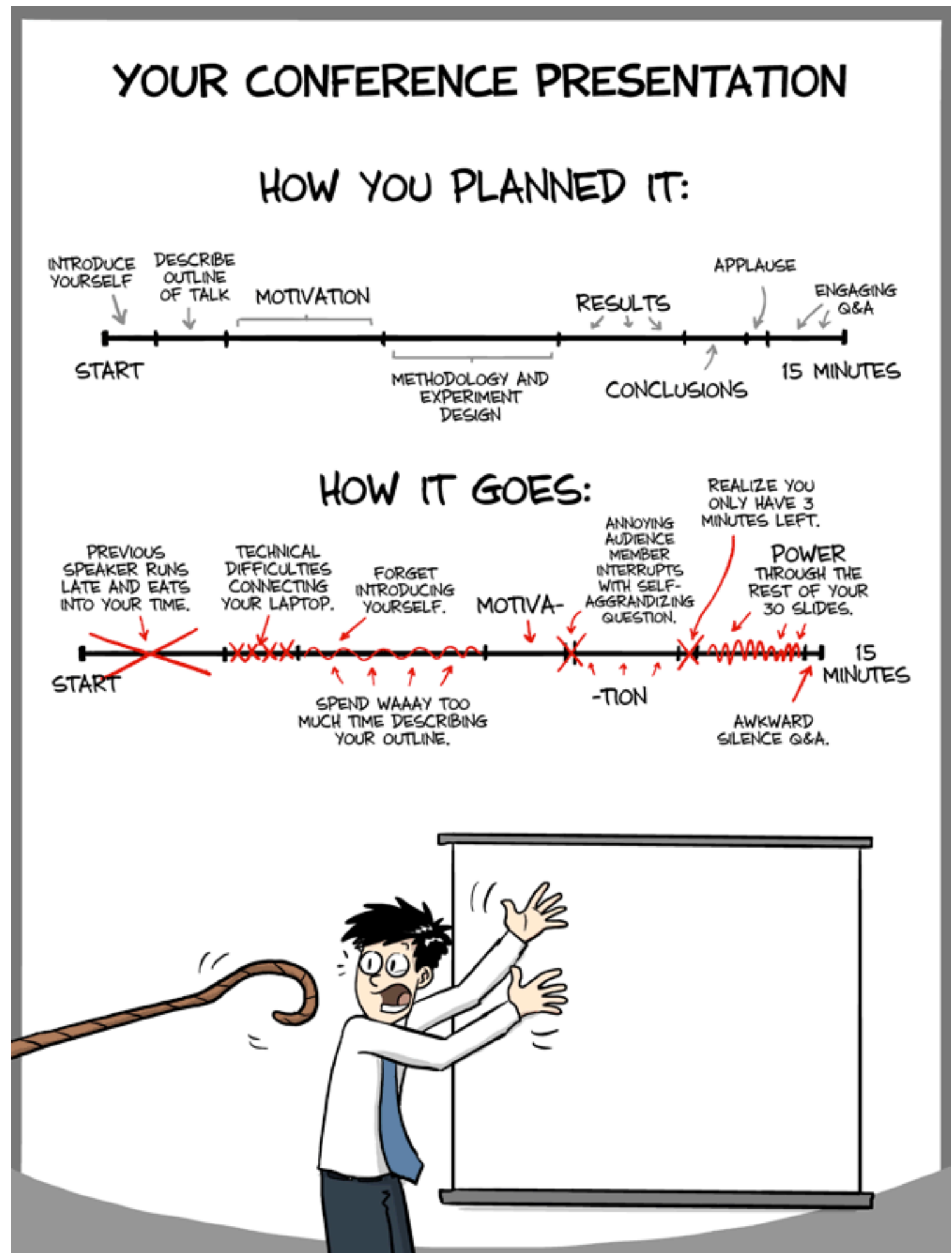
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## PRACTICE!

- **Theater**, no improvisation.
- Practice and practice
  - Top to bottom
  - Out loud
  - Mirror
  - **Record** yourself
  - Find an **audience**
  - Memorize the first sentences
- Special **attention to time!**



Without  
practice...



# TIME FOR QUESTIONS

**BE HONEST**



# TIME FOR QUESTIONS

## BE HONEST

- Provoke questions in your talk .



# TIME FOR QUESTIONS

## BE HONEST

- Provoke questions in your talk .
- Repeat the question loud.



# TIME FOR QUESTIONS

## BE HONEST

- Provoke questions in your talk .
- Repeat the question loud.
- Don't be evasive if you don't know.



# TIME FOR QUESTIONS

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- Provoke questions in your talk .
- Repeat the question loud.
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- Be concise.



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# Thank you for your attention!

