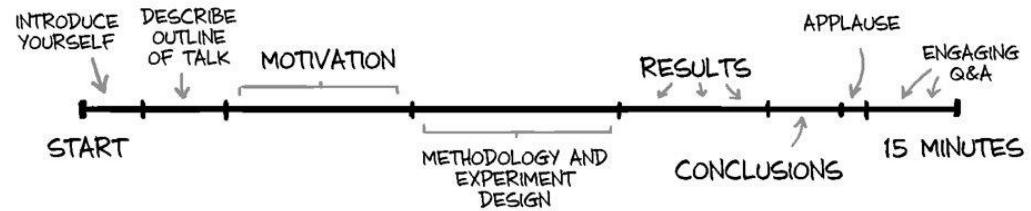


# Giving a talk

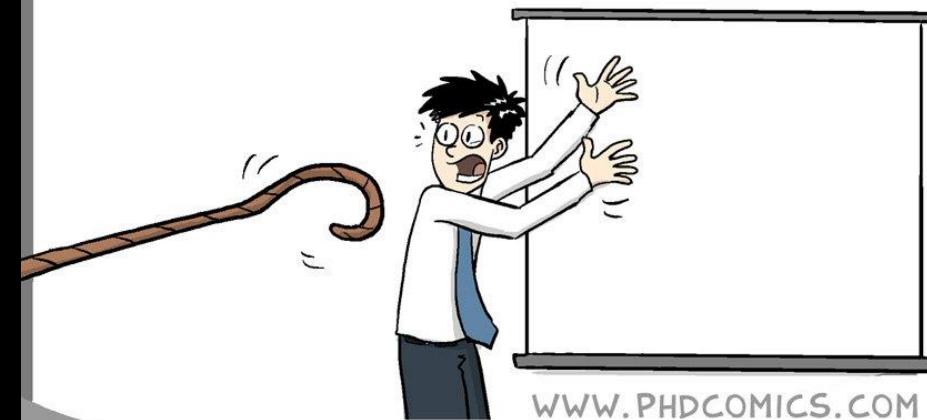
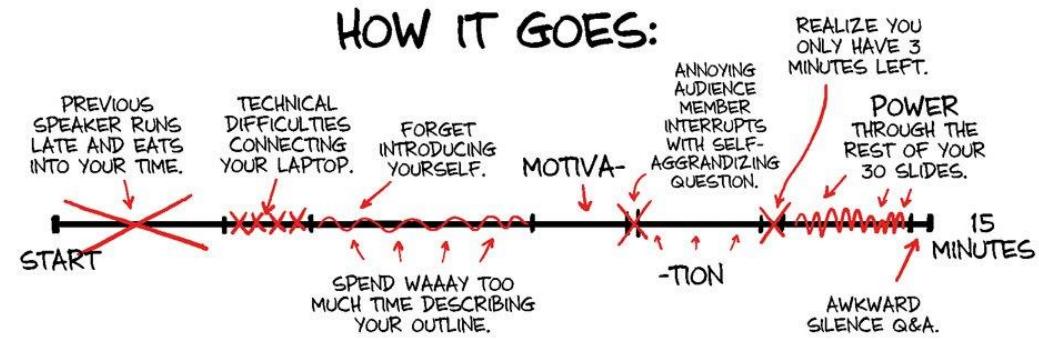
Henri Boffin  
ESO

## YOUR CONFERENCE PRESENTATION

### HOW YOU PLANNED IT:



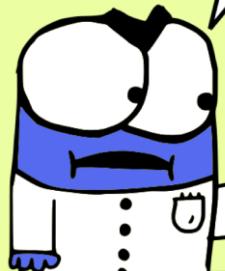
### HOW IT GOES:



WWW.PHDCOMICS.COM

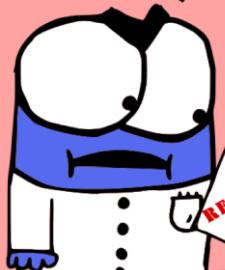
HOW IS YOUR  
RESEARCH GOING?

I DON'T  
WANT TO TALK  
ABOUT IT.



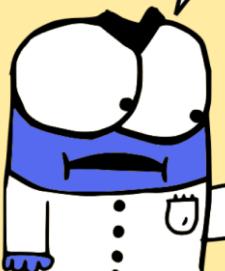
HOW IS YOUR  
RESEARCH GOING?

I DON'T  
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ABOUT IT.



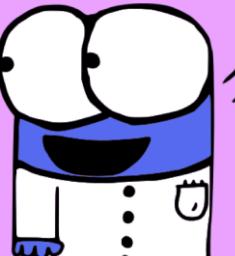
HOW IS YOUR  
RESEARCH GOING?

I DON'T  
WANT TO TALK  
ABOUT IT.



DO YOU WANT  
TO GIVE A TALK AT  
THE CONFERENCE?

I'D LOVE TO!



The presentation style depends on

Type of presentation

lecture?

invited colloquium?

short talk?

public talk?

Audience

specialists in your field?

students?

general public?

native speakers or not?

## Know thy Audience!

One needs to change content, language and style  
according to audiences

## Know thy Audience!

One needs to change content, language and style  
according to audiences

Effective communication is mind-reading

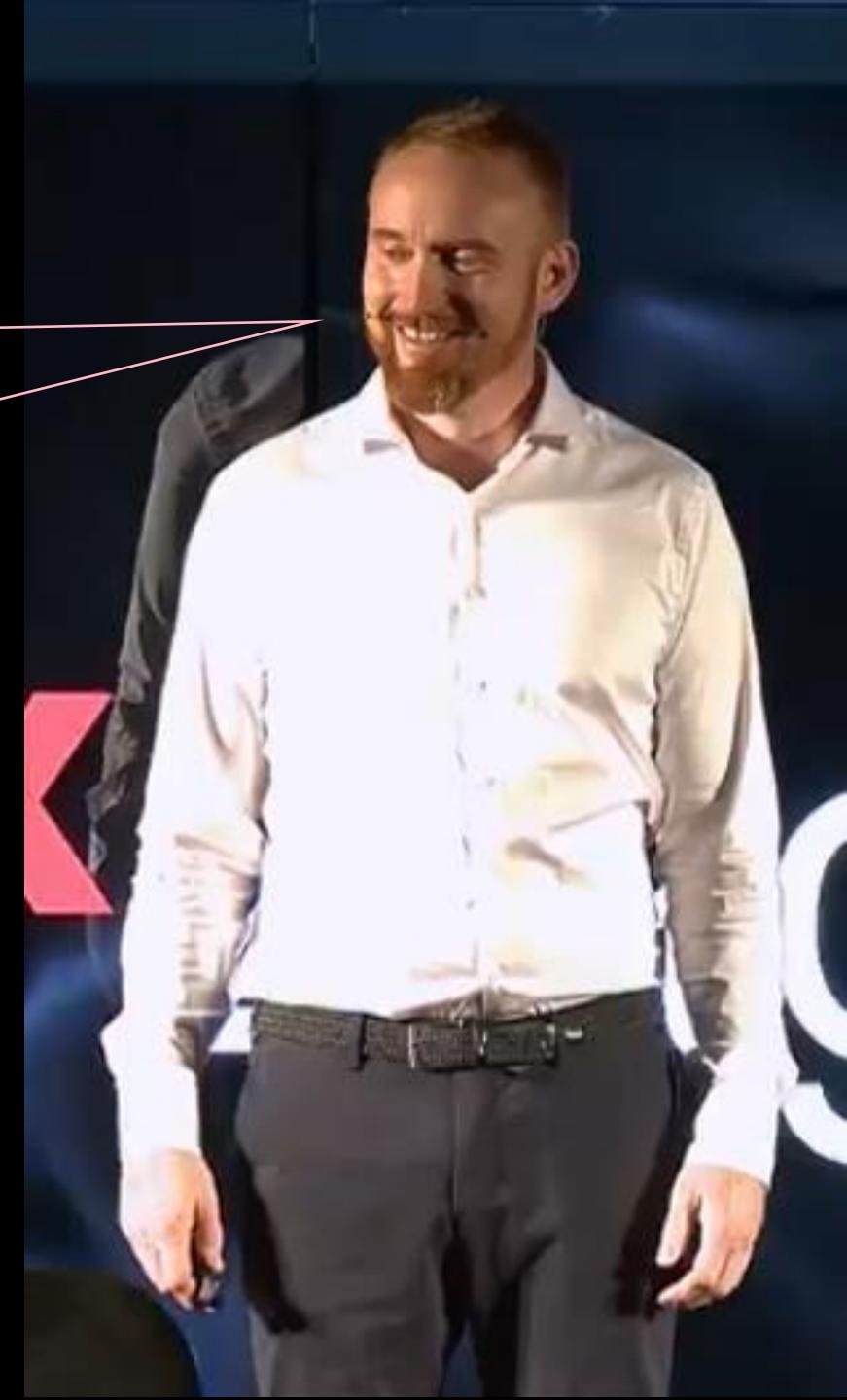
- what are their concerns?
- what do they know already?
- what do they think they know?
- do they have preconceptions?



110 core skills  
that you should learn and  
master, in order to overcome  
all your communication  
problems

David JP Phillips

What makes a good  
communicator, good?



Nervousness		Voice				Body language					Facial expressions			Language		Ultimate level
David JP Phillips	1	Swaying	7 Tempo beginning	16 Normal volume	25 Filler sounds	34 Neutral position	43 Shrugging shoulders	52 Pointing	61 Progression	70 Strategic positions	77 Neutral	86 Adapted	95 Hexacolon	104 Loves presenting		
	2	Squirming	8 Varied tempo	17 Volume increase	26 Elongated voice	35 Confident posture	44 Intensity variation	53 Volume/size	62 Empowering head angle	71 Bent knees	78 Matching	87 Flow	96 Tricolon	105 Roleplaying		
	3	Irrational movement	9 Normal tempo	18 Volume decrease	27 Pitch range	36 Amplifying posture	45 Functional	54 Regulators	63 Dysfunctional head angle	72 Amplification	79 Dramatising	88 Strong rhetorics	97 Repetition	106 Total intensity transition		
	4	Patting/Stroking	10 Tempo decrease	19 Volume decline	28 Melody	37 Ticks	46 Smooth	55 Rhythm of speech	64 Standard head angle	73 General eye contact	80 Mouth	89 Filler words	98 Anaphor	107 Acts out the obvious		
	5	Flight stance	11 Tempo increase	20 Unfunctional pause	29 Articulation	38 Feet planted	47 Distinct	56 Signs	65 Amplifying head movement	74 Swipes	81 Eyebrows	90 Negations	99 Epiphor	108 Present and authentic		
	6	Unbalanced feet	12 Correct enphasis	21 Thought pause	30 Staccato rhythm	39 Hip position	48 Adapted size	57 Ideograph	66 Owns the stage	75 Focus	82 Forehead	91 Repetitive words	100 Alliteration	109 Synchronisity		
	13	Playful emphasis	22 Effect pause	31 Dramatising	40 Angle	49 Standard pace	58 Drawings	67 Vertical movement	76 Functional	83 Eyes	92 Impossible words	101 Correction	110 Divergent			
	14	Base volume	23 Relaxation pause	32 Language change	41 Relaxed movement	50 Adapted pace	59 Emotional expressions	68 Horizontal movement	84 Self laugh	93 Visual language	102 Climax					
	15	Varied volume	24 Cord vibration	33 Sound effects	42 Dysfunctional gestures	51 Dramatising	60 Sounds	69 Step forward	85 Serious face	94 Evaluative	103 Anadiplosis					

1	Threatening posturing	16	Normal volume	25	Normal pace	34	Neutral position	43	Shrugging shoulders	52	Pointing	61	Progression	70	Strategic positions	77	Neutral	86	Adapted	95	Hexacolon	104	Lover presenting
2	Normal tempo	17	Normal volume	26	Normal pace	35	Neutral position	44	Intensity variation	53	Volume/Size	62	Empowering head angle	71	Step forward	78	Matching	87	Flow	96	Tricolon	105	Roleplaying
3	Normal tempo	18	Volume decrease	27	Smooth	36	Amplifying posture	45	Functional	54	Regulates	63	Dysfunctional head angle	72	Amplification	79	Dropoutting	88	Strong rhetorics	97	Repetition	106	Total intensity transition
4	Normal tempo	19	Volume decrease	28	Smooth	37	Smooth	46	Smooth	55	Rhythm of speech	64	Standard head angle	73	General eye contact	80	Mouth	89	Filler words	98	Anaphora	107	Acts out the obvious
5	Female increase	20	Unintentional pauses	29	Authenticity	38	Past posture	47	Distinct	56	Signs	65	Amplifying head movement	74	Swipe	81	Brows	90	Negations	99	Epilepsic	108	Present and authentic
6	Male increase	21	Thought pause	30	Smooth	39	Hip position	48	Adapted size	57	Ideaograph	66	Rejection	75	Focus	82	Forehead	91	Repetitive words	100	Alliteration	109	Synchronicity
7	Playful ambivalence	22	Effect pause	31	Smooth	40	Angle	49	Standard pace	58	Drawings	67	Vertical movement	76	Functional	83	Eyes	92	Impossible words	101	No!	110	Divergent
8	Base volume	23	Reassurance pause	32	Language change	41	Relaxed movement	50	Adapted pace	59	Emotional expressions	68	Horizontal movement	77	Functional	84	Self laugh	93	Visual language	102	Clenching		
9	Varied volume	24	Reassurance pause	33	Relaxed posture	42	Translating	51	Dysfunctional gestures	60	Sounds	69	Step forward	78	Serviceable	85	Serviceable	94	Reinforcing	103	Anactoplosis		

# Quality of your communication

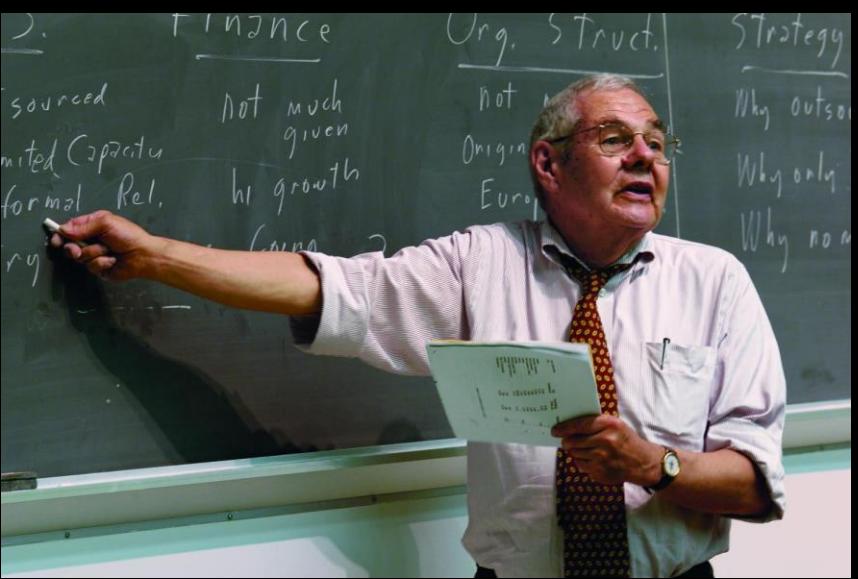
$$Q_{\text{uality}} = f(K, P, T)$$

K = knowledge

P = practice

T = Talent

# Break the preconception



We all like people who are **positive** and **enthusiast**

At the beginning of your presentation, a smile makes a difference

During the talk, be energetic and enthusiast

Authentic passion is one of the secrets of an excellent talk



What do people remember?



Words

7%



Voice Tone

38%



Body Language

55%



“People will forget  
what you said,  
people will forget  
what you did, but  
people will never  
forget how you  
made them feel.”

— Maya Angelou

Stage fright





*“The human brain is a wonderful organ.*

*It starts to work as soon as you  
are born and doesn’t stop until  
you get up to deliver a speech.”*

—George Jessel

Before you start

Why do you give this talk?

What is your message?

What should they remember?

Make a story on paper

WHAT IS YOUR OBJECTIVE?	MY OBJECTIVE IS...
WHAT ARE YOUR AUDIENCES' EXPECTATIONS?	AS [REDACTED], WHAT I AM EXPECTING FROM THIS PRESENTATION IS...
WHAT ARGUMENTS DO YOU HAVE TO ACHIEVE YOUR OBJECTIVE FOR THIS SPECIFIC AUDIENCE?	MY MAIN ARGUMENTS ARE...
WHAT IS YOUR MESSAGE?	THE ONE THING THAT I WANT MY AUDIENCE TO REMEMBER FROM MY TALK IS...

*Making slides  
should come  
after you have  
made the story,*



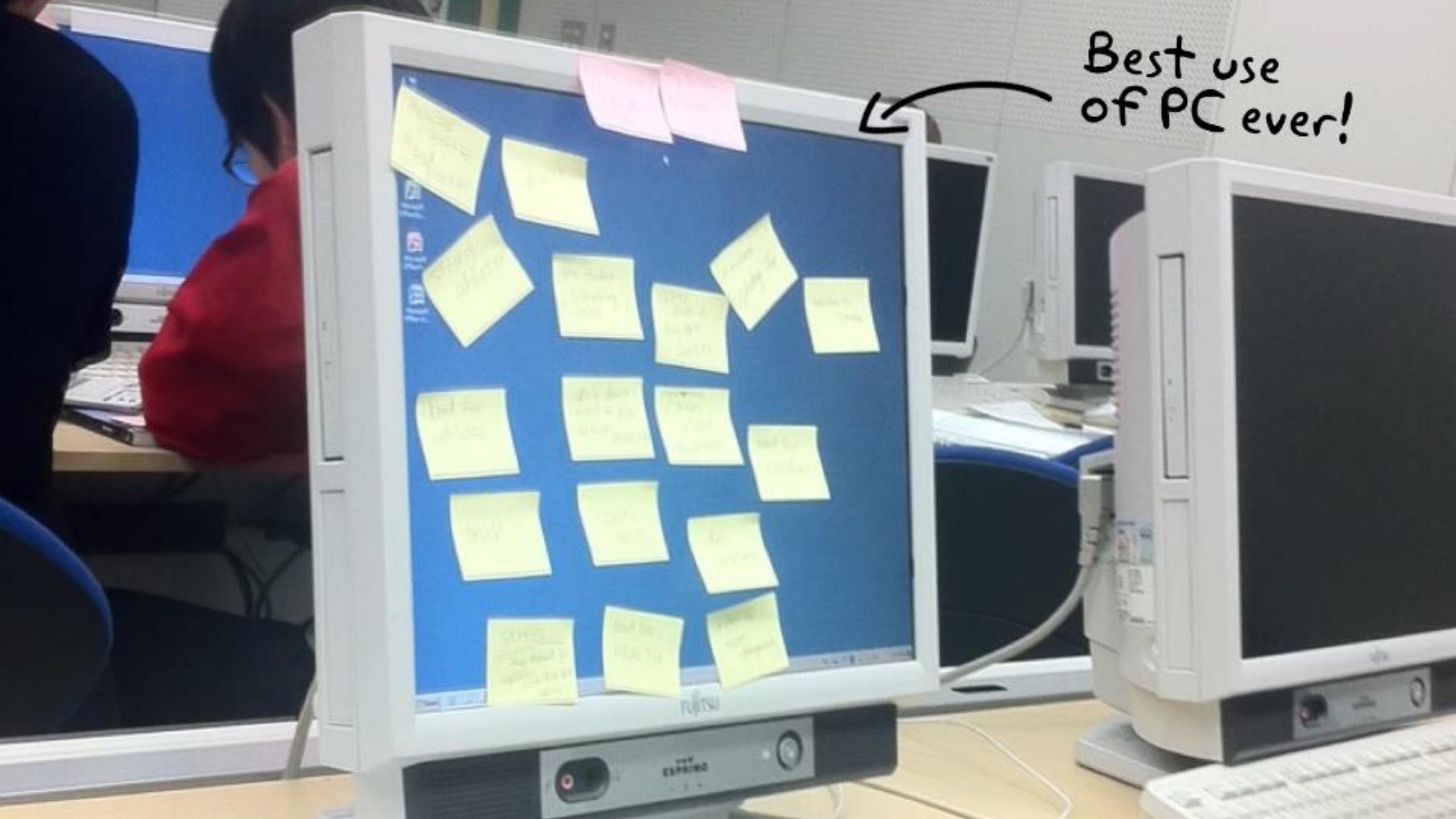
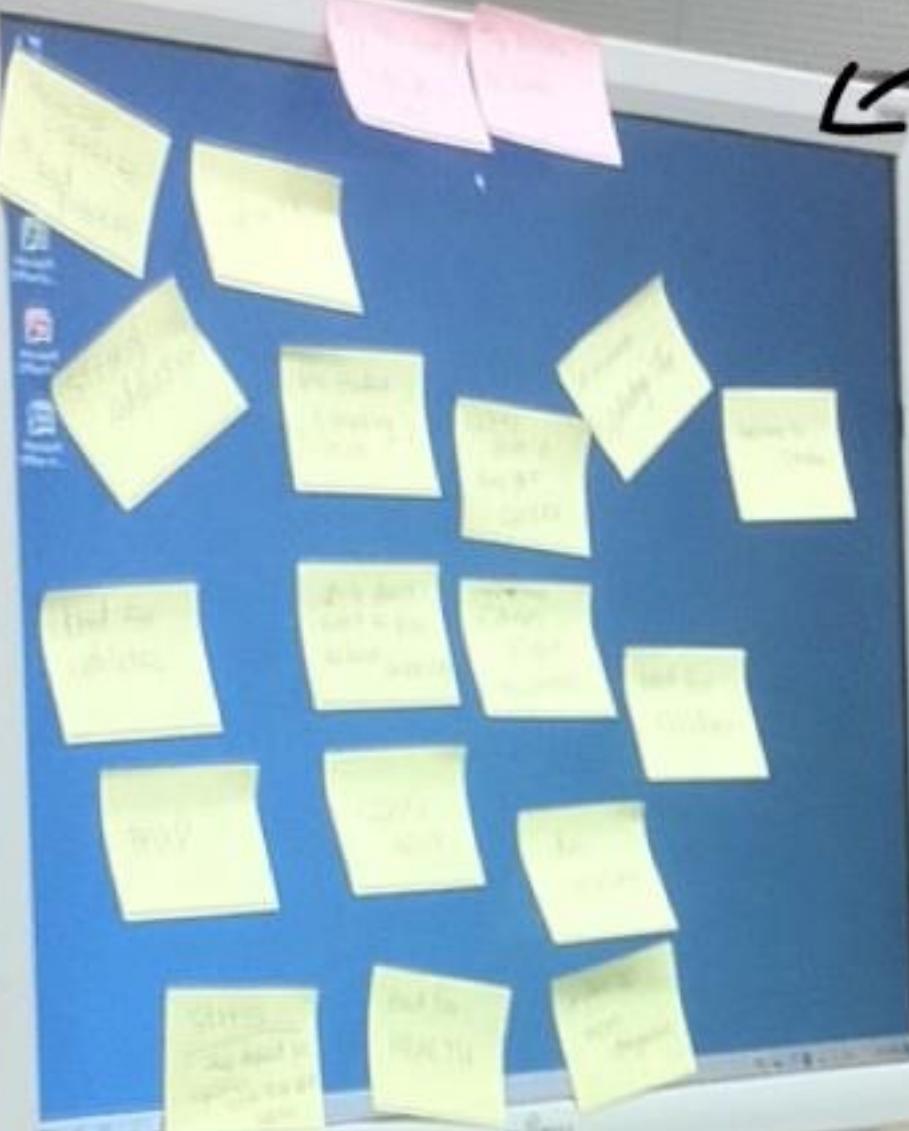


**EE** We don't know where we get our ideas from.  
We do know that...  
**we do not get them from our laptops.”**

— John Cleese



Best use  
of PC ever!



Choose a design

Decide on **fonts** to use (max. 2)

Before you start

Calibri

Default in  
PowerPoint  
Not great!

Century Gothic

Times

Arial

Avenir

*Lucida*

Bradley

This is an example of a serif typeface.

This is an example of a serif typeface.

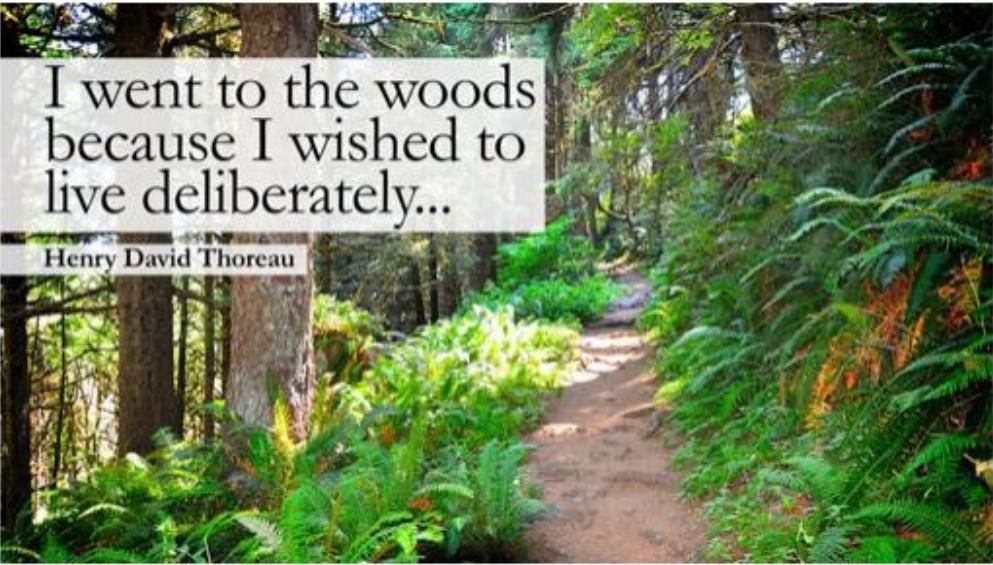
This is an example of a sans serif typeface.

This is an example of a sans serif typeface.

This is an example of a slab serif typeface.

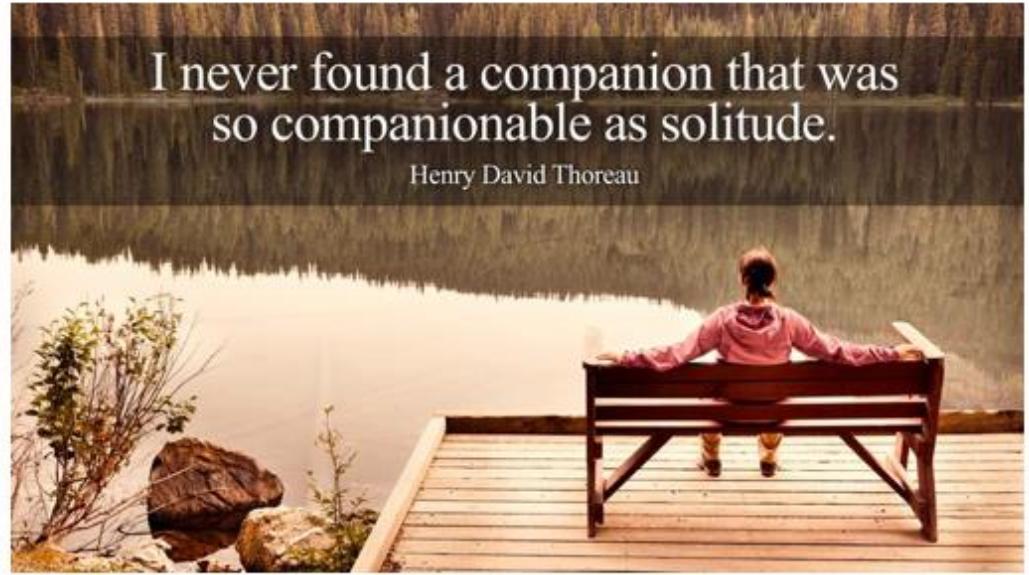
This is an example of a slab serif typeface.





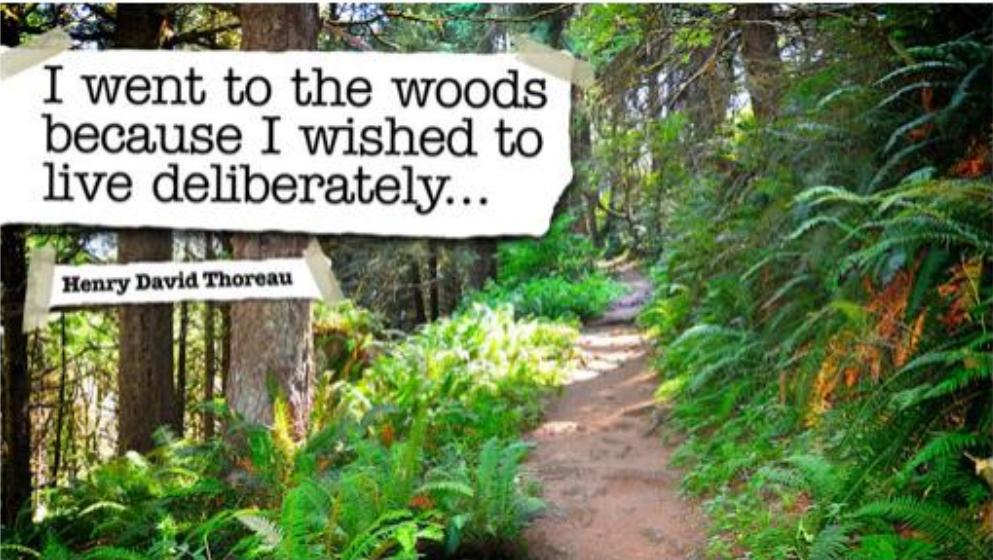
Henry David Thoreau

SERIF



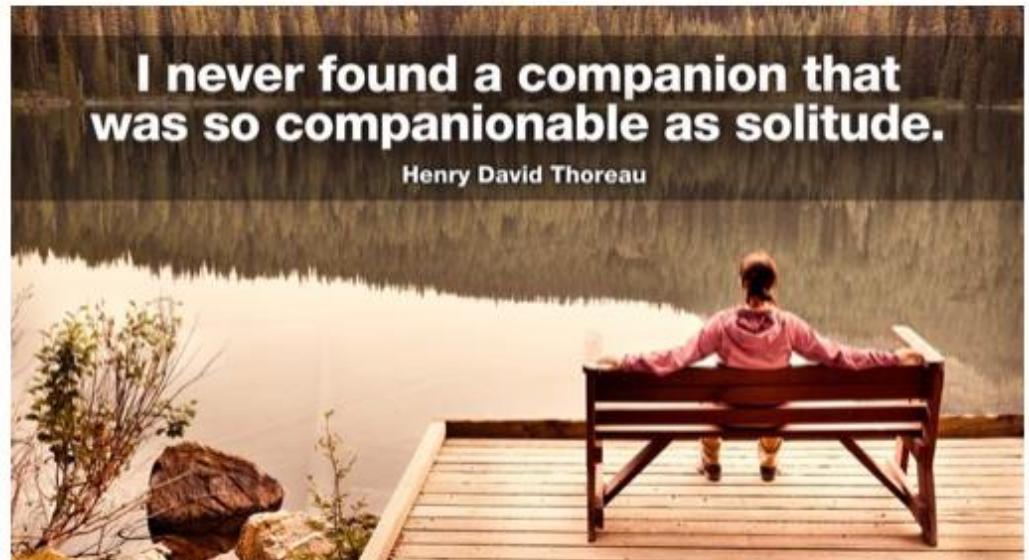
Henry David Thoreau

SERIF



Henry David Thoreau

SLAB SERIF



Henry David Thoreau

SANS SERIF

This is 10 point Century Gothic

This is 14 point Century Gothic

This is 18 point Century Gothic

This is 20 point Century Gothic

This is 24 point Century Gothic

This is 28 point Century Gothic

This is 32 point Century Gothic

This is 36 point Century Gothic

This is 44 point Century Gothic

This is 48 point Century Gothic

This is 54 point Century Gothic

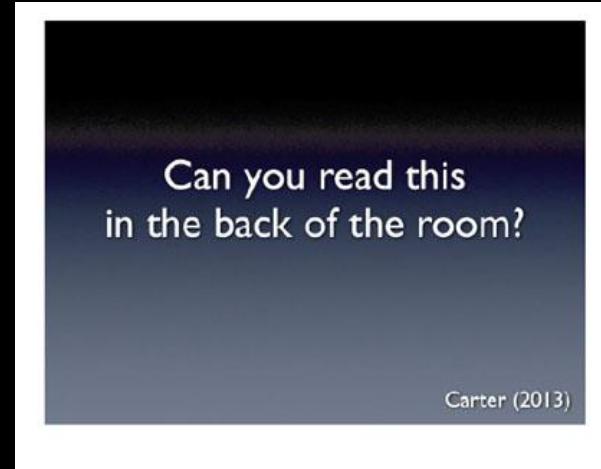
This is 60 point Century Gothic



## Ensure that all text is easy to read

Use 18-36 pts font to be seen in the back of the presentation room

Use smaller fonts for citations and footnotes

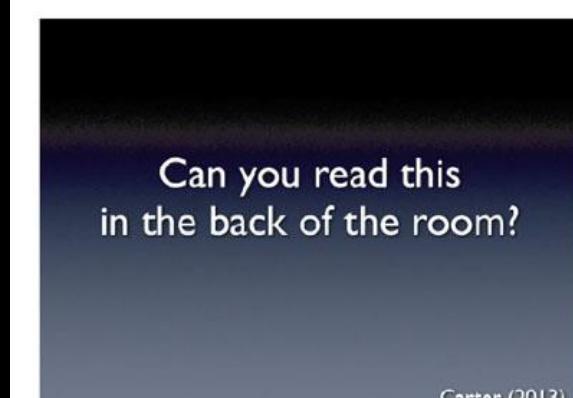


On a slide, it is harder to read underlined words or words in ALL CAPS

## Ensure that all text is easy to read

Use 18-36 pts font to be seen in the back of the presentation room

Use smaller fonts for citations and footnotes



On a slide, it is harder to read underlined words or words in ALL CAPS

If you want to emphasize a word, use **bold letters** or *italics*

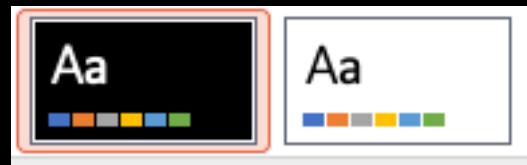
Or use colour!

Before you start

Choose a **design**

Decide on **fonts** to use (max. 2)

Decide on colour scheme



Calibri

Century Gothic

Times

Sans serif  
fonts work  
generally  
better on  
screen

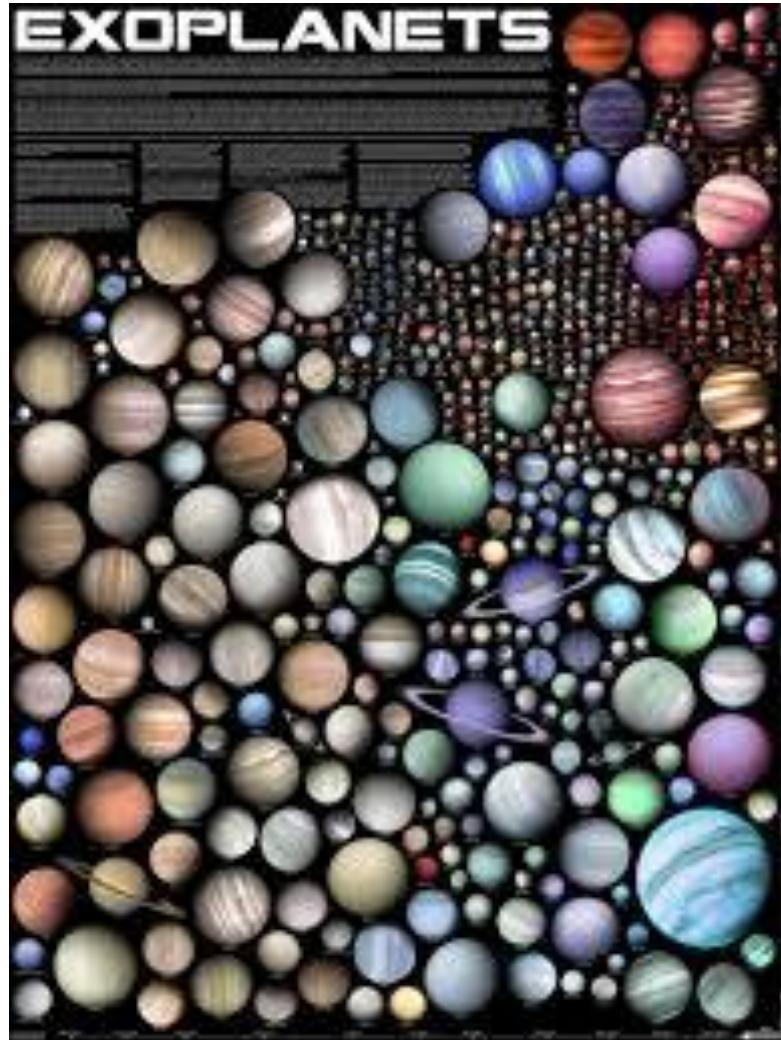
Arial

Avenir

*Lucida*

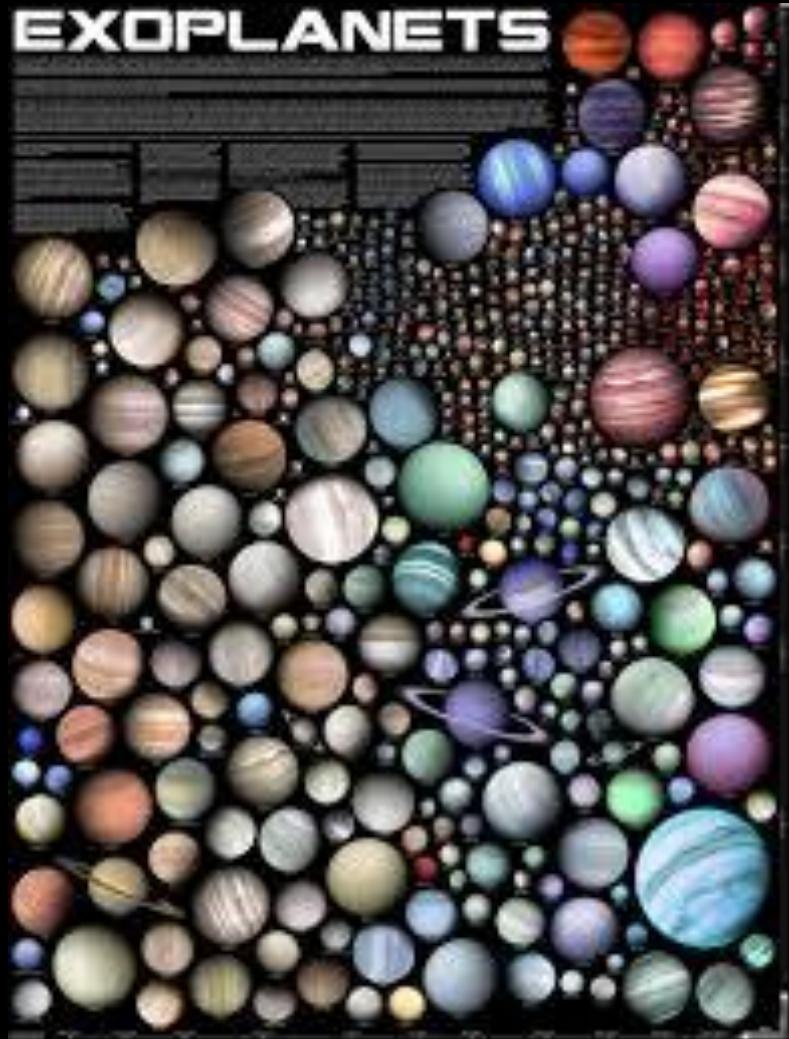
Bradley

Let me tell you something



This is not nice, no?

Contrast



This is much better:

Contrast

Keep It Super simple

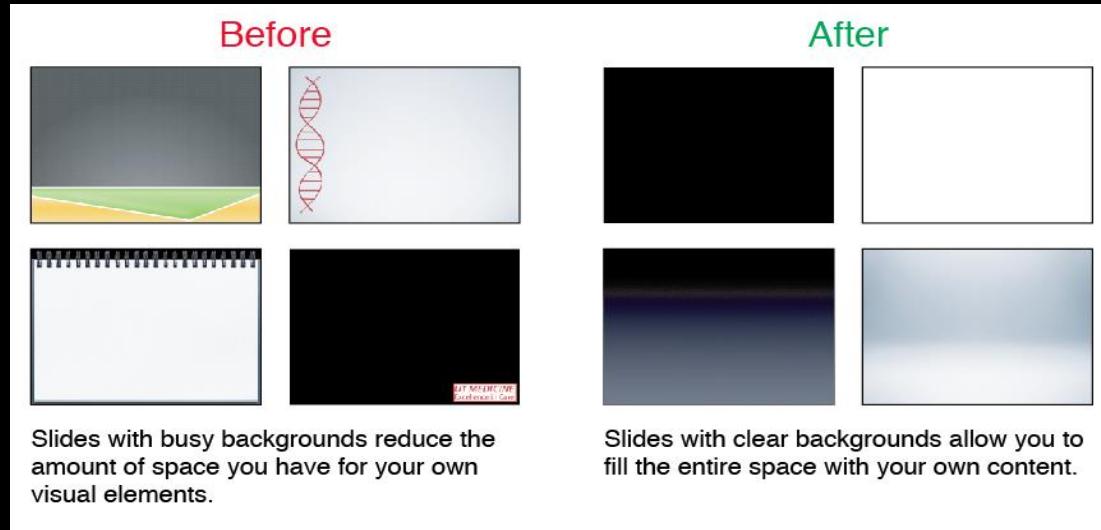
Remember:

The slides you use for your presentation  
shouldn't necessarily be the ones you  
distribute!

The star of the presentation is not your slides



# Choose slide backgrounds to optimize foreground content



SOCIETY for NEUROSCIENCE

Use backgrounds that lack visual content

Use a dark slide background

In some cases (small room, bad projector),  
use a white slide background

## Starting your presentation

Start with something your audience will be interested in!

Something relevant to them

Tell them why they should care  
(which means you need to know them!)

“Make me care. Please—emotionally,  
intellectually, aesthetically—just  
make me care.”

— Andrew Stanton

Opening: the main impressions you want to make

You know your field

You are possessed of the scientific curiosity

You enjoy doing research

You plan to convey some useful and interesting information

# Prepare an opening

## Ask a rhetorical question

“What is dark matter?  
And does it even  
exist?”

## Challenge the audience

“I urge you to acquire  
the necessary  
communication skills”

## Make a startling statement

## or show a nice figure

“To be a good  
scientist, you need  
to be a good  
communicator”

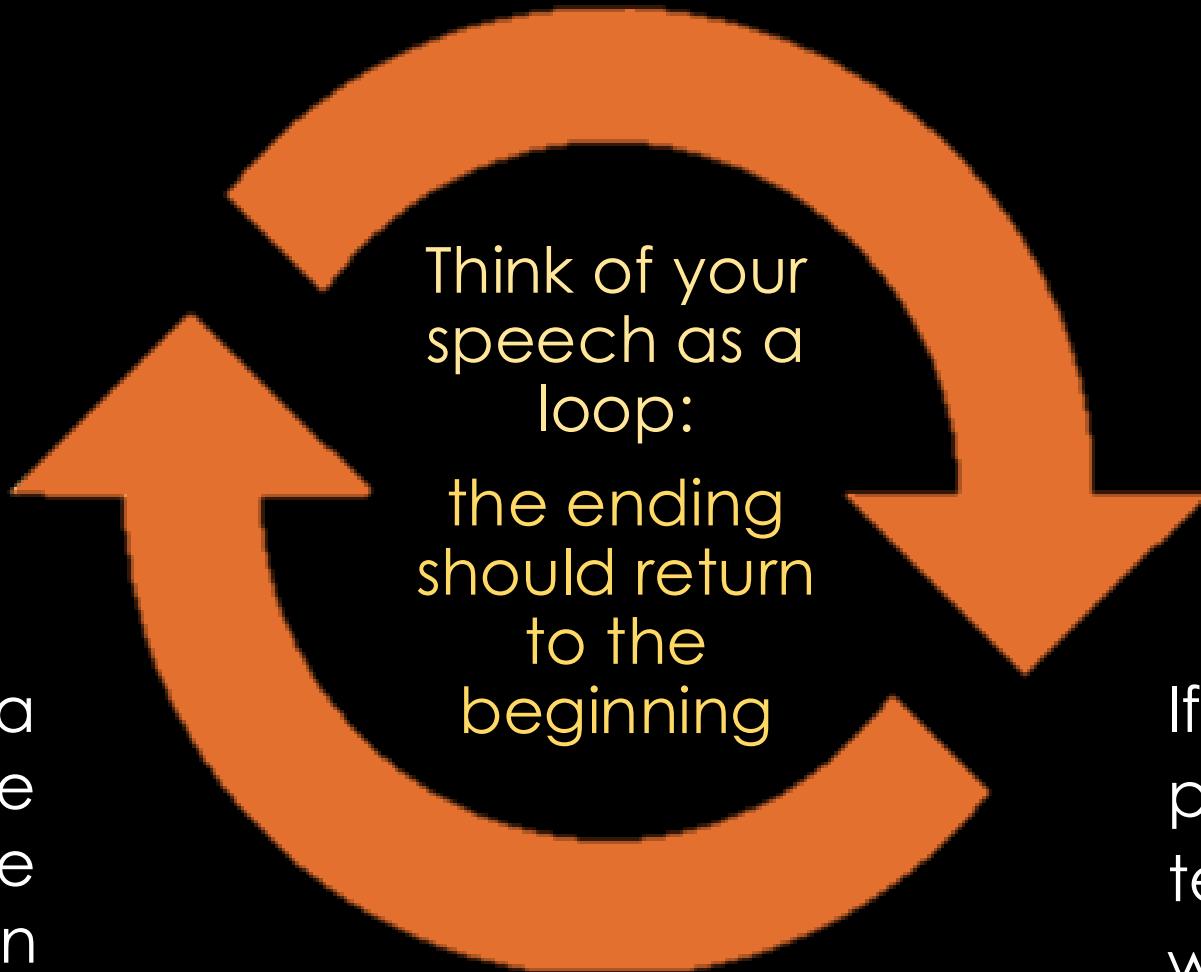
## Quote an authority

“As Richard Feynman  
said, ‘I’m smart enough  
to know that I’m dumb.’ ”

## Promise benefits

“At the end of this  
presentation, you will  
have learned several  
techniques to give a  
stunning presentation”

## Tie the loop



If you open with a provocative question, be sure to answer it in your closing

If you open with a promise to inform, tell them at the end what they learned

# A presentation

“Tell them what you’re going to tell them,  
tell them,  
and then tell them what you told them.”

# **Outline**

- Intro
- Post-AGB binaries and their circumbinary discs
  - Binary characteristics
  - Jet creation observed: circumcompanion
  - Resolving the second generation of proto-planetary discs
    - Multi-wavelength interferometric surveys
  - disc-binary interaction: depletion + lifetime
- Keplerian discs are fundamental to understand properties and evolution of interacting evolved binaries

Don't overestimate your audience

They want you to say  
what is important in your field

They don't mind hearing things  
they already understand

# Designing your slides

# Marketing development

## Car

- Long distances
- Bad accessibility
- Highways
- Negative environmentally
- Wasted travel time

## Bus

- Long distances
- Hard to increase accessibility
- Highways



90%

30 seconds

Guns don't kill people

Bullets kill people

Bullet points kill attention



# Being a referee for a journal article

this basically also applies for reviewing proposals job applications, etc.

- ▶ **be responsible, fair, and constructive**
- ▶ check the consistency of the arguments
- ▶ check that the authors pay proper credit and not just cite themselves
- ▶ check if the data presented are plausible
  - do the observational data or numerical results make sense and are they consistent with previous work?  
(this might require reading previous papers)
  - are the equations of theoretical work correct?
- ▶ check if the interpretation is well founded and clearly derived from the data presented
- ▶ check that the discussion sets the work in proper context of existing work
- ▶ check if the work presents sufficiently new results to warrant publication
- ▶ check if you recognize parts of the arguments or figures from previous publications
  - help uncovering plagiarism
- ▶ be concise and to the point (do not write a report that is longer than the paper)
- ▶ remember: in the end the community decides if the paper is worthy
- ▶ **what you do not have to do:**
  - reproduce every detail of the analysis
  - check observational data yourself and re-do the analysis
  - check numerical model by running similar things yourself
  - language corrections (but if you find major mistakes it is appreciated if you report on them)



Multitasking is a myth!

The brain can only focus  
on one task at a time

When people read, they  
do not listen to you

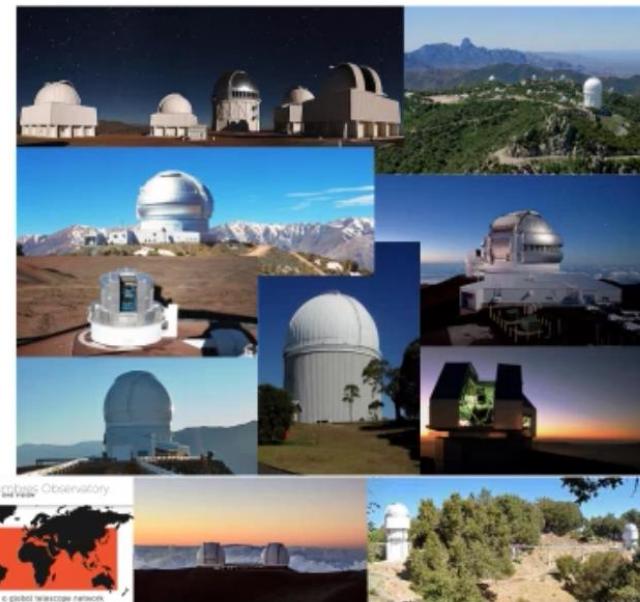


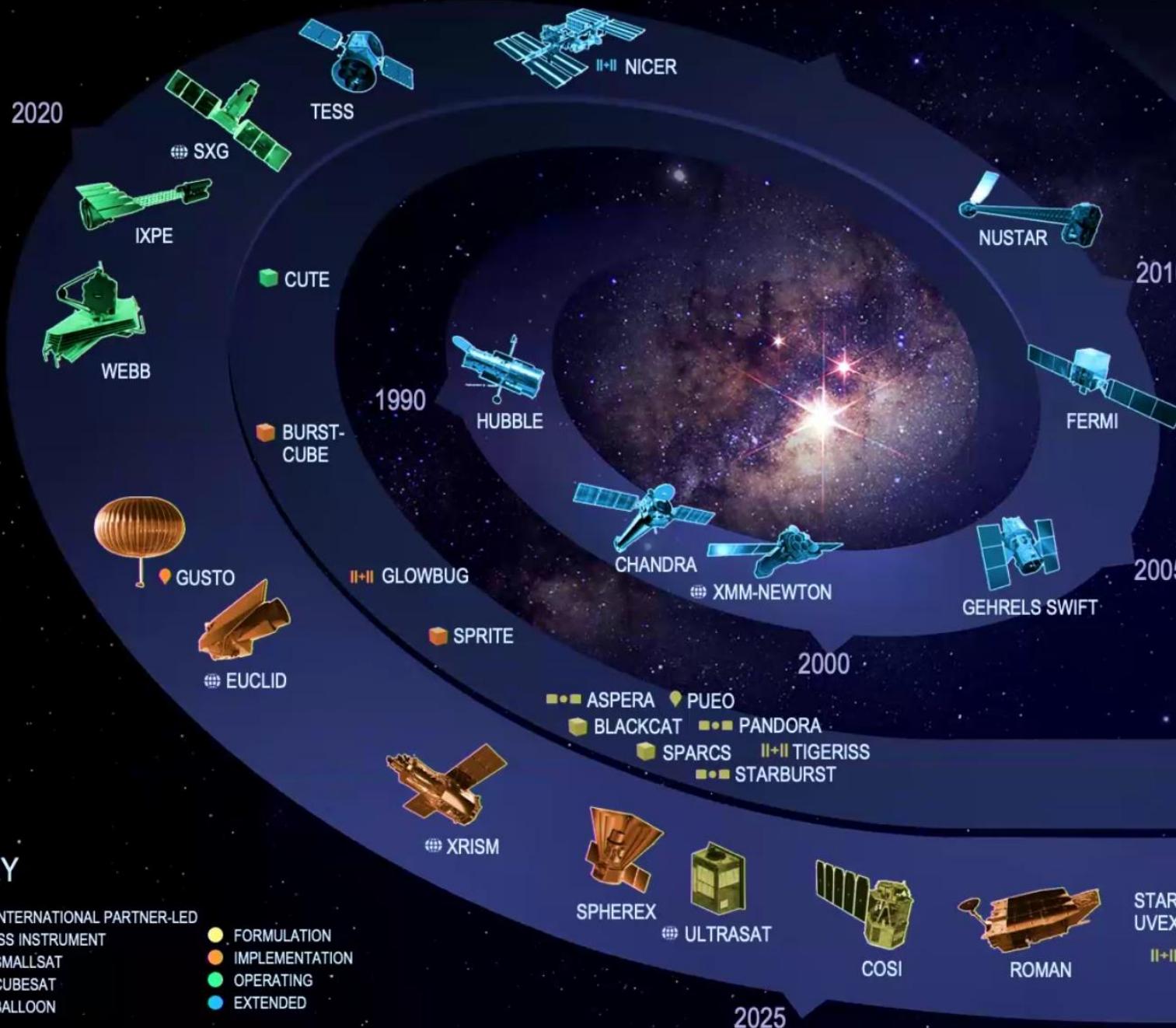
# NSF NOIRLab Overview

- NOIRLab is a Federally Funded Research and Development Center (FFRDC): “to conduct research for the US Government”
- The Association of Universities for Research for Astronomy (AURA) operates NOIRLab under a cooperative agreement with the NSF
- Part of the NOIRLab mission statement...”to promote excellence in astronomical research by providing access to information about the universe from state-of-the-art facilities, surveys, and archives.”
- In 2023A NOIRLab provides public open-access to:
  - Kitt Peak (WIYN 3.5m)
  - Cerro Tololo (4m, SMARTS → 1.5m, 0.9m)
  - Cerro Pachon (Gemini-S 8m, SOAR 4.2m)
  - Maunakea (Gemini 8m, Subaru 8m, Keck I, Keck II 10m)
  - Mt. Wilson (CHARA 6x1m)
  - Las Campanas (Baade, Clay 6.5m)
  - Las Cumbres Observatory (1m and 2m ‘s around the world)
  - MINERVA-Australis (5x1m)



*"It says it's sick of doing things like inventories and payrolls, and it wants to make some breakthroughs in astrophysics."*





Most of these missions have programs to fund the analysis of exclusive period data, archival data, joint programs, and theory programs that support the sciences of the missions during formulation and operations.

In addition, NASA has many Research & Analysis programs (R&A) that provides funding opportunities for the Astrophysics community.

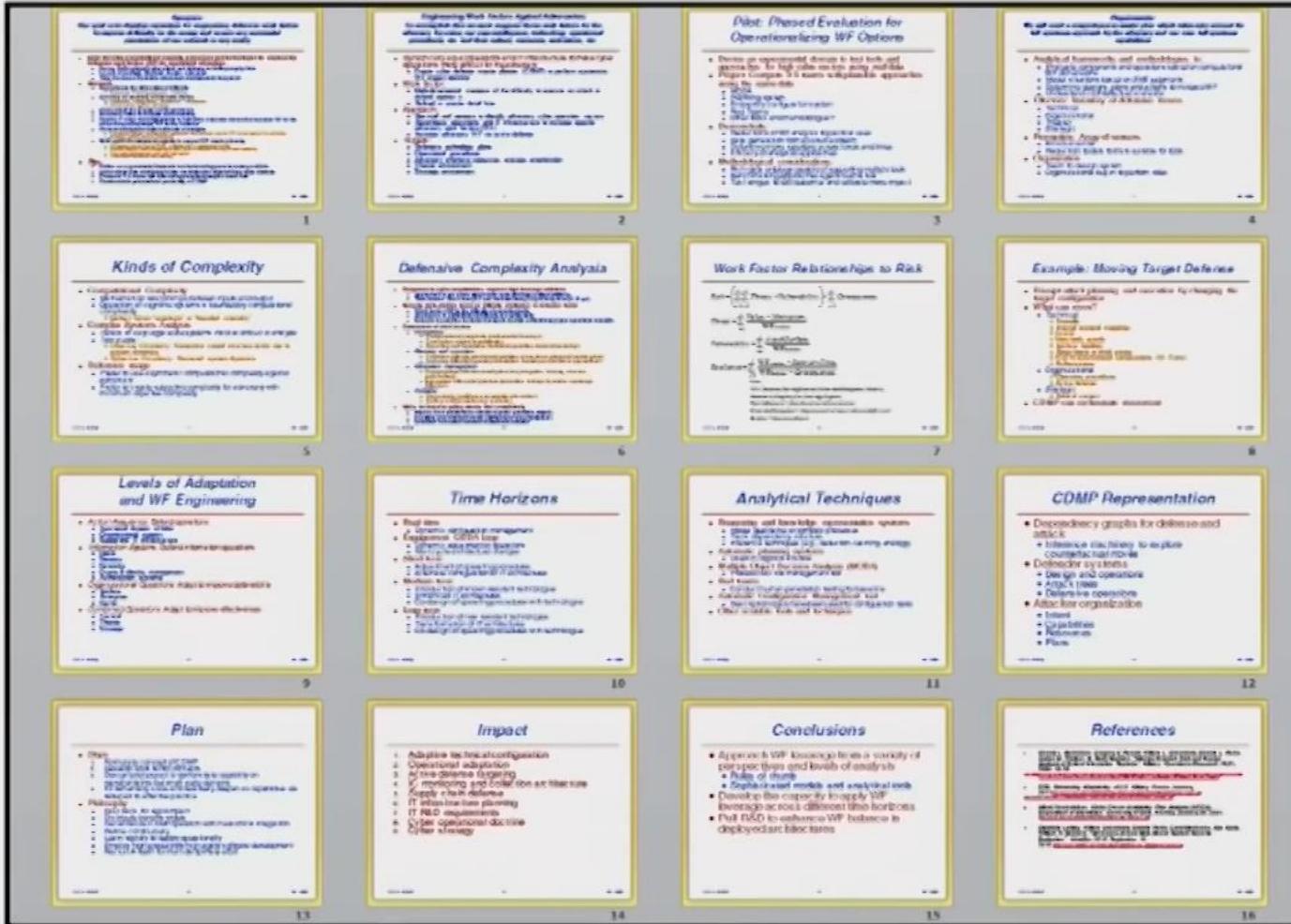
\$139M/year: Mission GO/GI programs  
\$135M/year: R&A investigations

**\$274M/year total community support**



**Historic ATLAS and CMS spokespersons Fabiola Gianotti and Joe Incandela commanding a global audience during their 4 July 2012 presentations.**

# The too-heavy crime





"OK, I'm now going to read out loud every single slide to you, word for word, until you all wish you'd just die."

1	2	3	4	5	6
					An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.
7	8	9	10	11	12
13	14	15	16	17	18
Fairy and Folk tales Religious parables Ethical maxims Hobby Lascivious Experience					The Strong Story Hypothesis  The mechanisms that enable us human to tell, understand, and recombine stories separate our intelligence from that of other primates.
19	20	21	22	23	24
25	26	27	28	29	30
	 The strong story hypothesis The strong perception hypothesis The strong social animal hypothesis	  • Understanding ourselves • Understanding each other • Making ourselves smarter			

## Fishing industry's garbage

- Worldwide fishing industry dumps an estimated **150,000 tons of plastic** into the ocean each year.

This includes:

- packaging
- plastic nets
- lines
- buoys
- other



Trash on the beach  
Source: www.greenfeet.net

**BEFORE** (sample 8)

**Worldwide fishing industry  
dumps 150,000 tons of plastic  
into the ocean each year.**



Source: www.greenfeet.net

**AFTER** (sample 8)

Less is  
more

## **Food self-sufficiency**

- In 1961 Japan's food self-sufficiency was at **78%**.

- In 2014 that figure **is down to 39%**.

- What are the reasons for Japan's low rate?



Ross Norman

Japan Economy

March 30, 2014

**BEFORE** (sample 6)

**Food self-sufficiency**

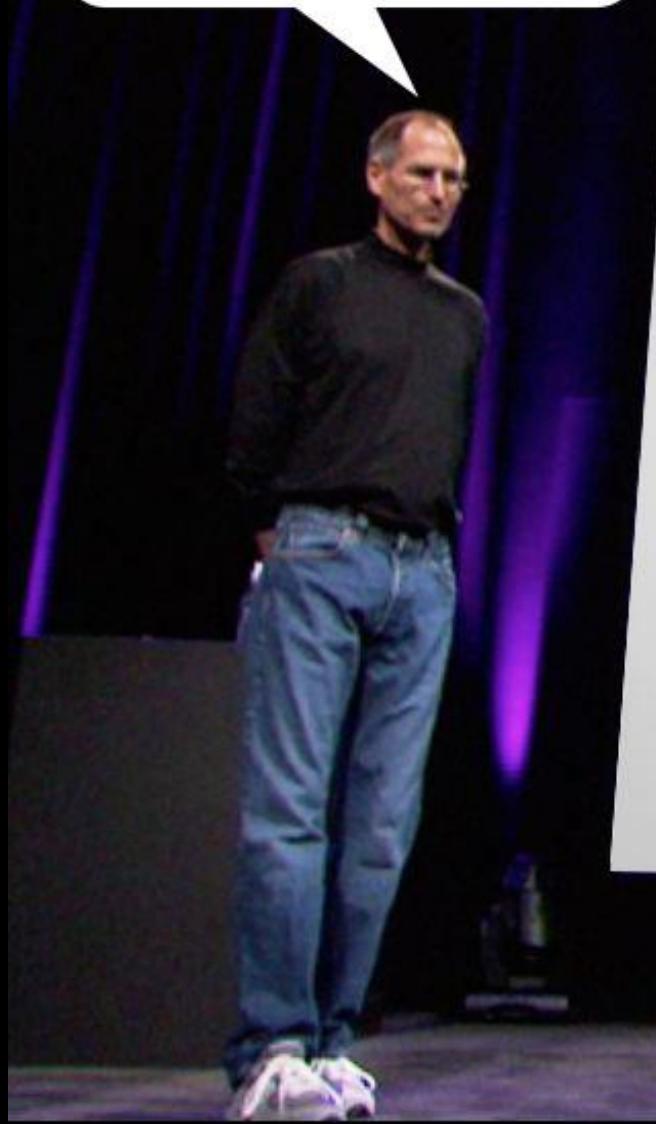
**1961: 78%**

**2014: 39%**



**AFTER** (sample 6)

*"Just read the summary on  
the slides and let me know  
when you are done okay?"*



# Introducing the iPhone!

*It is a very good phone, please buy!*



- "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.."
- "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum."
- "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum."
- "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum."
- "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum."



# Windows Live™

- Internet-based personal services to bring together your digital world
- Centered on the individual
- Communications, information, protection
- Separate from Windows
- MSN.com continues as programmed content
- Primary supported

# 2.0B

Songs purchased and downloaded

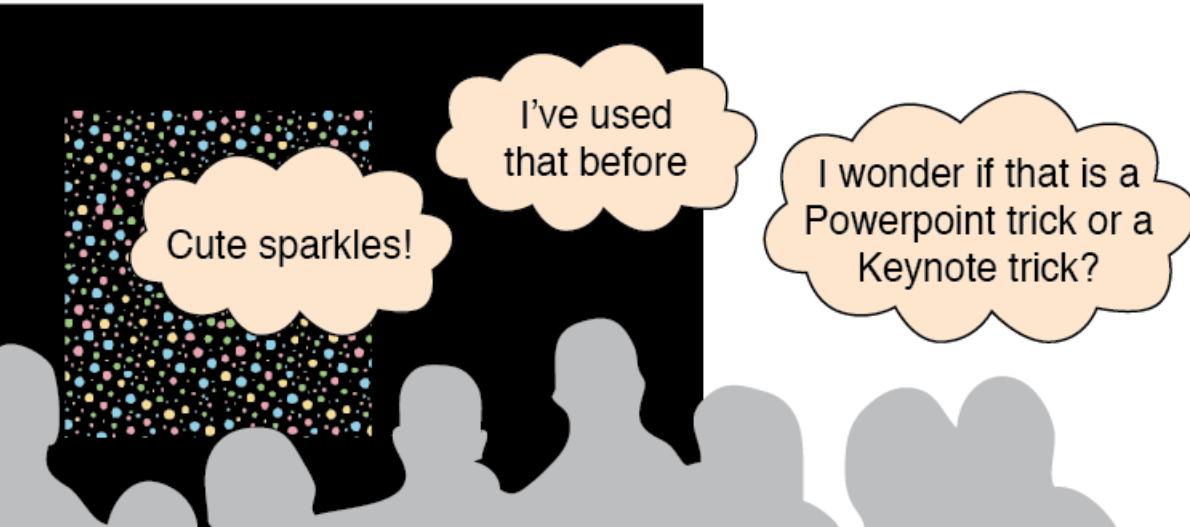


# Use animation/slide transitions wisely .....and sparingly

**What the presenter  
is thinking:**

I look more skilled  
because I'm turning  
my photo into confetti

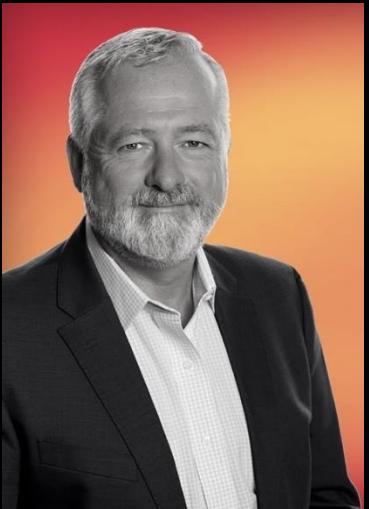
**What the audience is thinking:**



What the audience is *not* thinking about: **your message**

## A tip

Most, if not all, of the Microsoft templates  
shouldn't be used

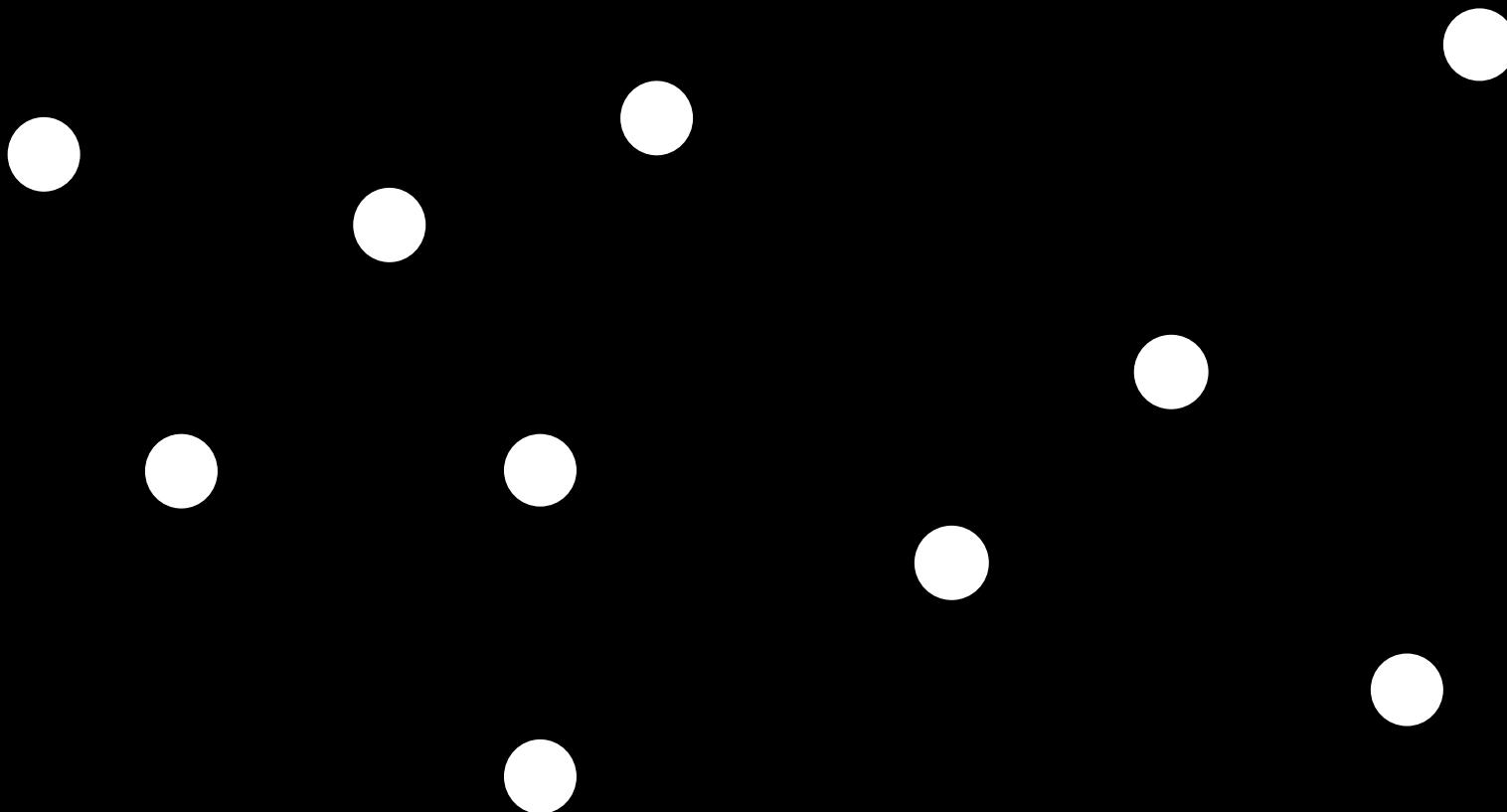


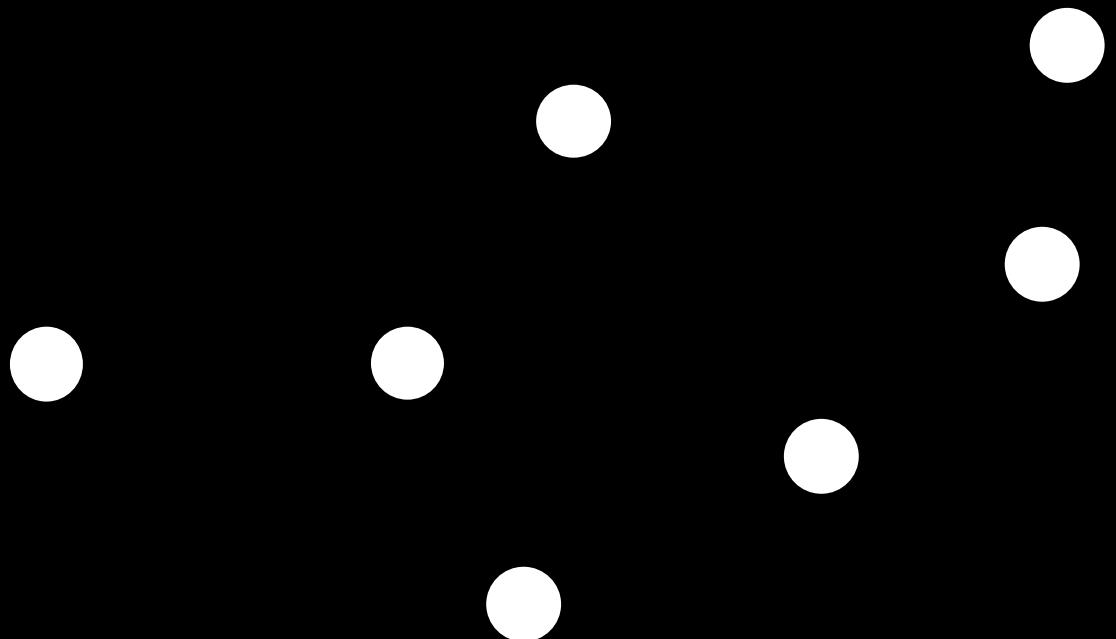
**“PowerPoint and Keynote are like tequila!  
They are not inherently evil, but given the right  
circumstances, they will make you do some really  
stupid things.”**

—Tim Pollard



An experiment





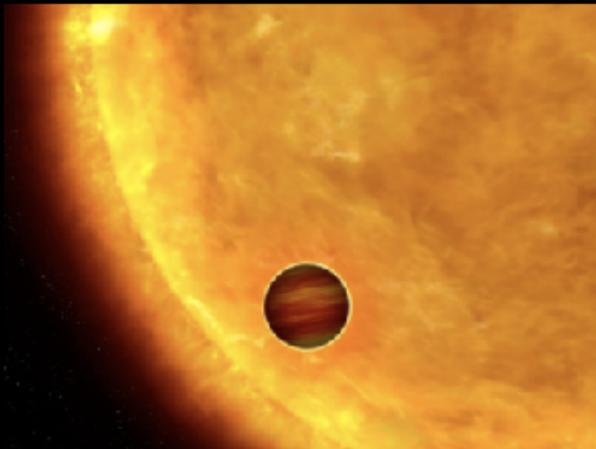


6

# Unexpected guests: hot and warm Jupiters defy our expectations of how planets form and evolve

## hot Jupiters

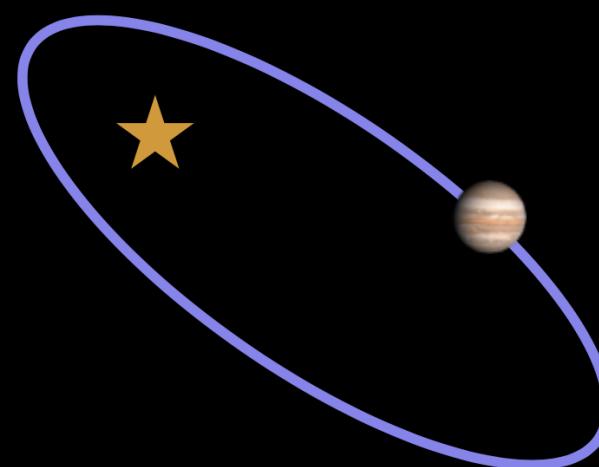
10x closer to their star  
than Mercury to the Sun



First discovered 1995  
Mayor & Queloz

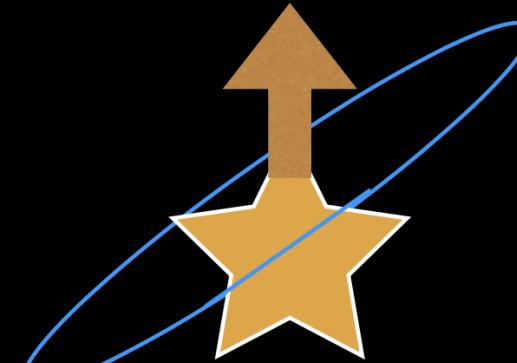
## highly elliptical orbits

e.g., HD 80606b  
eccentricity = 0.93  
(Earth:  $e = 0.02$ )



Naef+ 2001

## misaligned from host star's spin axis



Hebrard+ 2008

# Supercar Exterior

Flat free tires

Xenon lights

Air intake

New material

Aerodynamic

Innovations

Innovations

Reduced fuel

Active steering

Adaptive drive

Space concept

Versatile

## Supercar Exterior

Flat free tires

Xenon lights

Air intake

New material

Aerodynamic

Innovations

Innovations

Reduced fuel

Active steering

Adaptive drive

Space concept

Versatile

No contrast... people will read and not listen to you...

## Supercar Exterior

Flat free tires  
Xenon lights  
Air intake  
New material  
Aerodynamic  
**Innovations**

If you talk about a car... show the car  
Only highlight most important

## Supercar Exterior

### Facts about the Classic car

Versatility needs speed. That's why the Classic Car offers a maximum load capacity of 850 litres. With room for two golf bags and cases. It delivers V8 Twin Turbo at 307hp and a fuel consumption ranging from 12.2 to 20.5

### Exterior advantages of the Classic Car

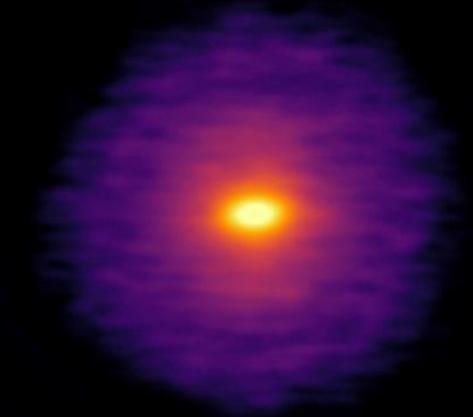
The exterior of the Classic Car combines the dynamic road-hugging focus of a coupé, delivering comfort in flat free tires, speed by its aerodynamics, handling by its new light weight material and visual perfection with Xenon lights and a beautiful air intake and reduced fuel.

## Supercar Exterior



Flat free tires  
Xenon lights  
Air intake  
New material  
Aerodynamic  
Innovations

Avoid GIF or running movies



Please look at me

Please listen to what I say

Stop watching this screen!

## Past & current Major PN Compilations

Before 1960

Messier, Herschel, Curtis,  
Vorontsov-Velyaminov, Minkowski

<500

Perek, Kohoutek; CGPN (1967)

1036

Acker et al. (1992) SECVPN

1143+347\*

Acker et al. (1996) SECVPN supp.

243+142\*

Kohoutek (2000) CGPN updated

1510

MASHI/MASHII (2 MNRAS papers 2006, 2008)

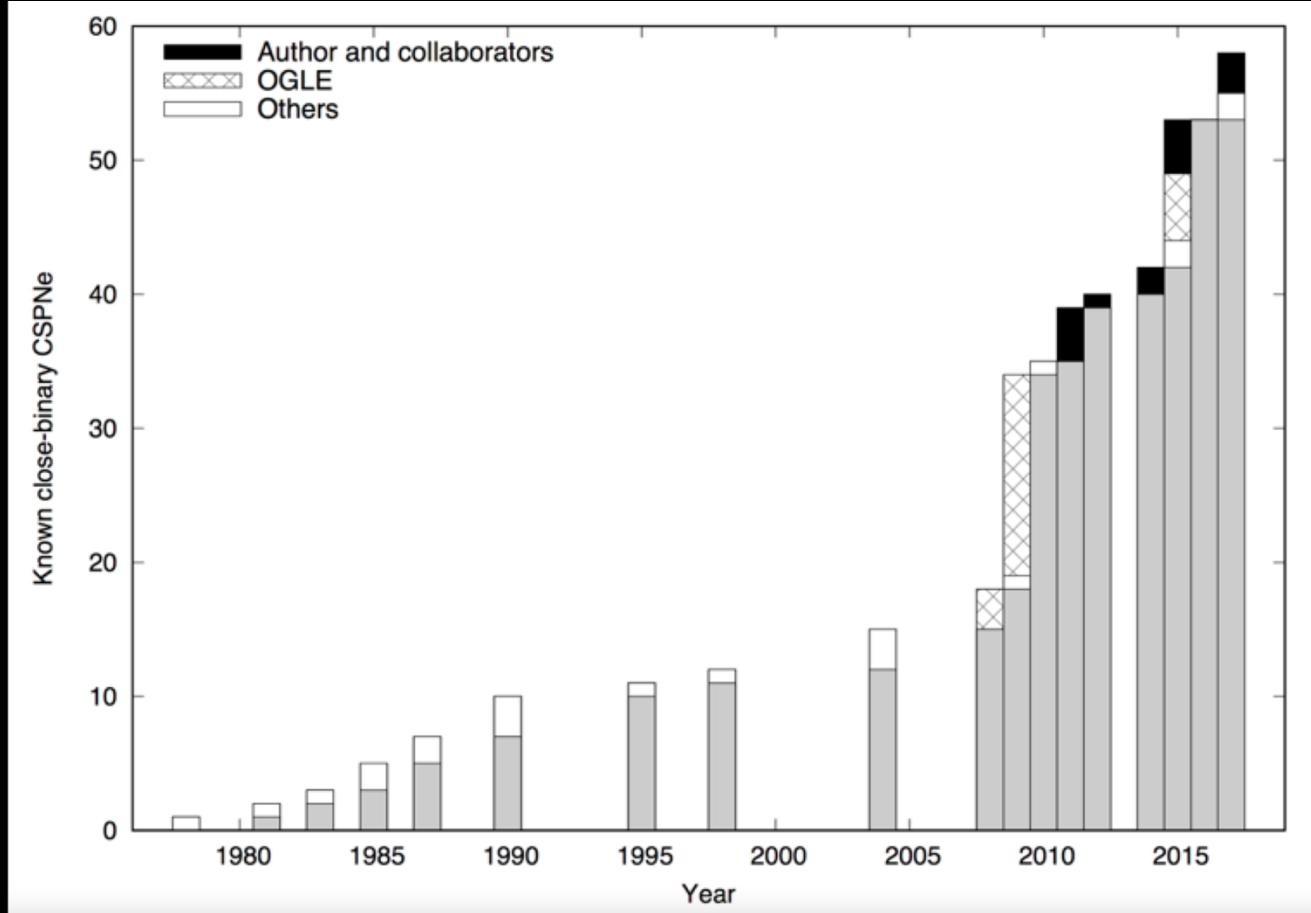
~1500

HASH - includes all the above (2021)  
(Galactic, LMC & SMC PN)

~4632

Make a graph  
instead that  
shows the same  
information

Prior to MASH/HASH catalogues were extremely  
inhomogeneous, biased and unrepresentative of the underlying  
PN population and badly affected by “mimics”



But please use  
colours

LARGER labels

Use correct  
matplotlib style...

# Summary and Next Steps

1. In preparation for high signal-to-noise and medium resolution spectra with JWST, we need to assess how our current modeling tools and theory compare to these better quality observations. To that end, I am working on applying the CHIMERA framework to medium resolution spectroscopy of brown dwarfs - starting with one test object, then will move on to a population of late T dwarfs observed with FIRE.
2. The increased spectral resolution of FIRE ( $R \sim 6000$ ) compared to SpeX ( $R \sim 100$ ) gives much more precise constraints on the T-P profile and chemical abundances, particularly of CO and H<sub>2</sub>S. Choice of line list matters greatly for these kinds of observations, with the potential to lead to very different retrieved abundances.
3. Our retrieved abundances are reasonable compared to ATMO non equilibrium chemistry models, but there are lingering questions around the surface gravity and T-P profile.

# Acknowledgements



John Smith  
Akiro Kurasawa  
Alice Canol  
Alex Zhou  
Jorge Santos  
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Zhanbei Tan  
Rohit Bhajwan  
Janice Player  
Gloria Zhang



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USDA  
Cal-EPA



**Collaborators**  
Jack Jones, Univ. Illinois  
Don Yu, Univ. Alabama  
Gary Duhense, PNNL  
Maria Stucchi, Univ. Trento  
Hans Bruger, Max Plank Inst.



zoom

## Ending

Do not put lot of text

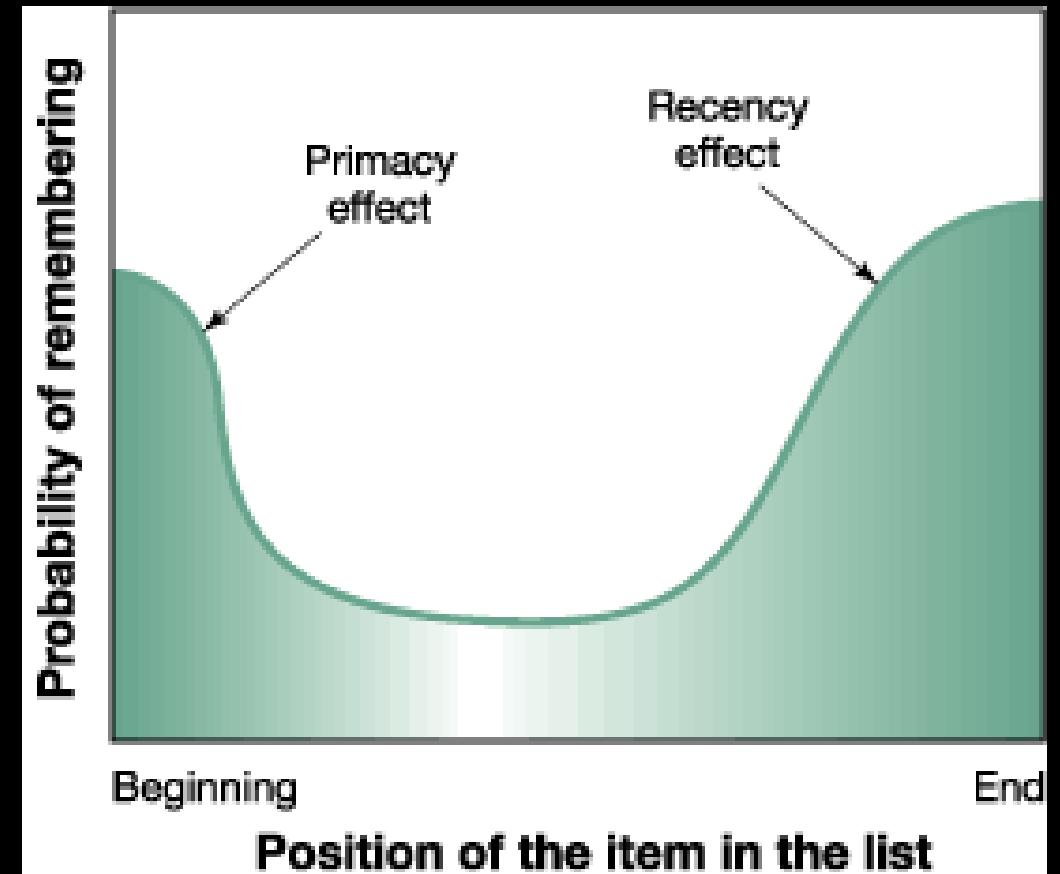
Don't finish with slide “Thank you”

Finish with main result and figure

(+name and contact details)

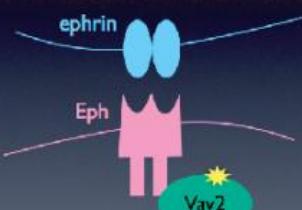
## Primacy and Recency effects

People remember best what they heard first and last



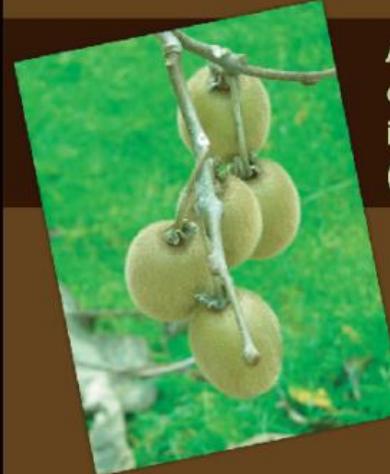
# End your talk with a summary diagram

## A link between ephrins and Vav2



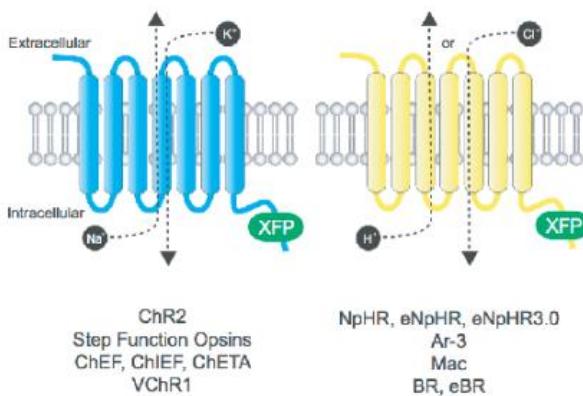
- Eph receptors interact with Vav2
- ephrin stimulation of Eph causes phosphorylation of Vav2

A glycoprotein inhibitor of pectin methylesterase in kiwi fruit (*Actinidia chinensis*)

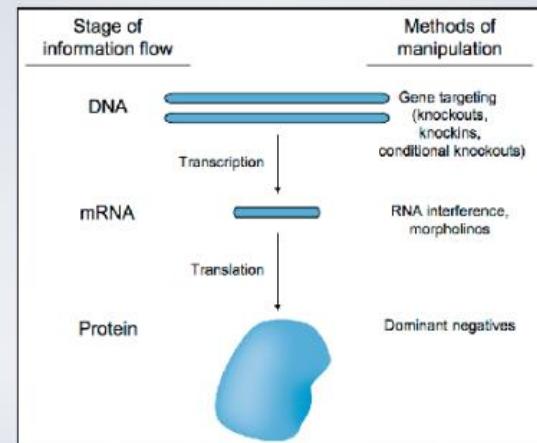


- Interacts with pectin methylesterase
- 28 kDa glycoprotein
- Inhibits other sources of enzyme

## The Optogenetic Toolkit



## Manipulating Endogenous Genes



# One more thing....



## Benjamin Franklin effect

1966: Psychological experience

### Benjamin Franklin effect

*“He that has once done you a kindness will be more ready to do you another than he whom you yourself have obliged.”*

## Benjamin Franklin effect

More sinister side: if someone does something to harm you, they become more likely to do so again. That is something to avoid.

Thus, it is better to keep your presentation on time  
rather than be asked to end it.

(don't make it too short neither)

Making good slides takes time

Hofstadter's Law:  
“It always takes longer than you expect, even when you take into account Hofstadter's Law.”



# Practice, Practice, Practice



By failing to prepare, you are preparing to fail.

~ Benjamin Franklin

Memorise the opening, transitions,  
and closing

Don't memorise the rest, but  
practice, expressing your key  
ideas aloud, in complete  
sentences

## Before your talk

Test that your presentation works well on the conference computer  
(fonts/animations/colours/...);

Always have a backup copy of your presentation that you can reach easily (USB drive, google drive, or even email to yourself ...);

Get familiar with the room and the audience

A story, again!

In presentations, incorporating storytelling techniques is a fantastic way to help your audience engage with your content.

We are 22 times more likely to remember something if it is told as a story.

A story, again!

In presentations, incorporating storytelling techniques is a fantastic way to help your audience engage with your content.

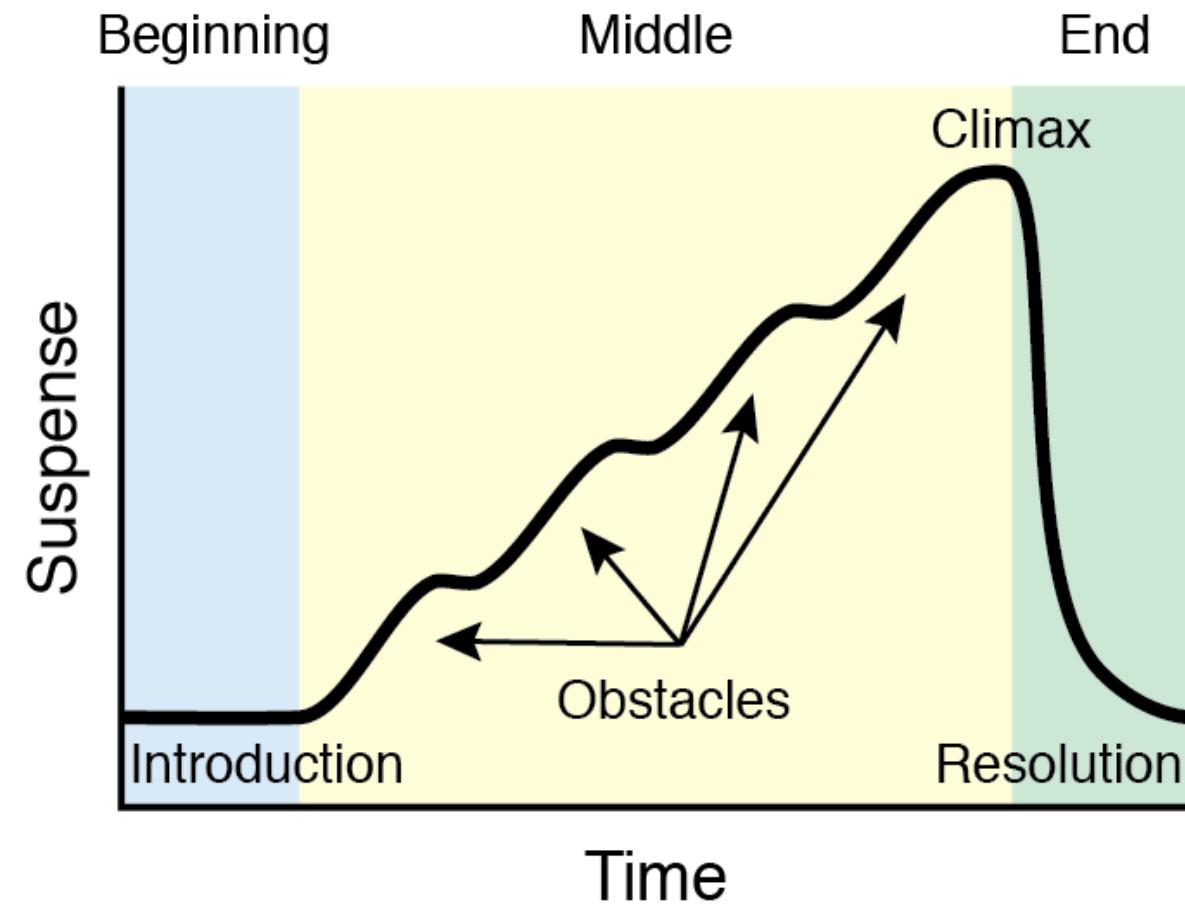
We are 22 times more likely to remember something if it is told as a story.

The story can be as simple as:

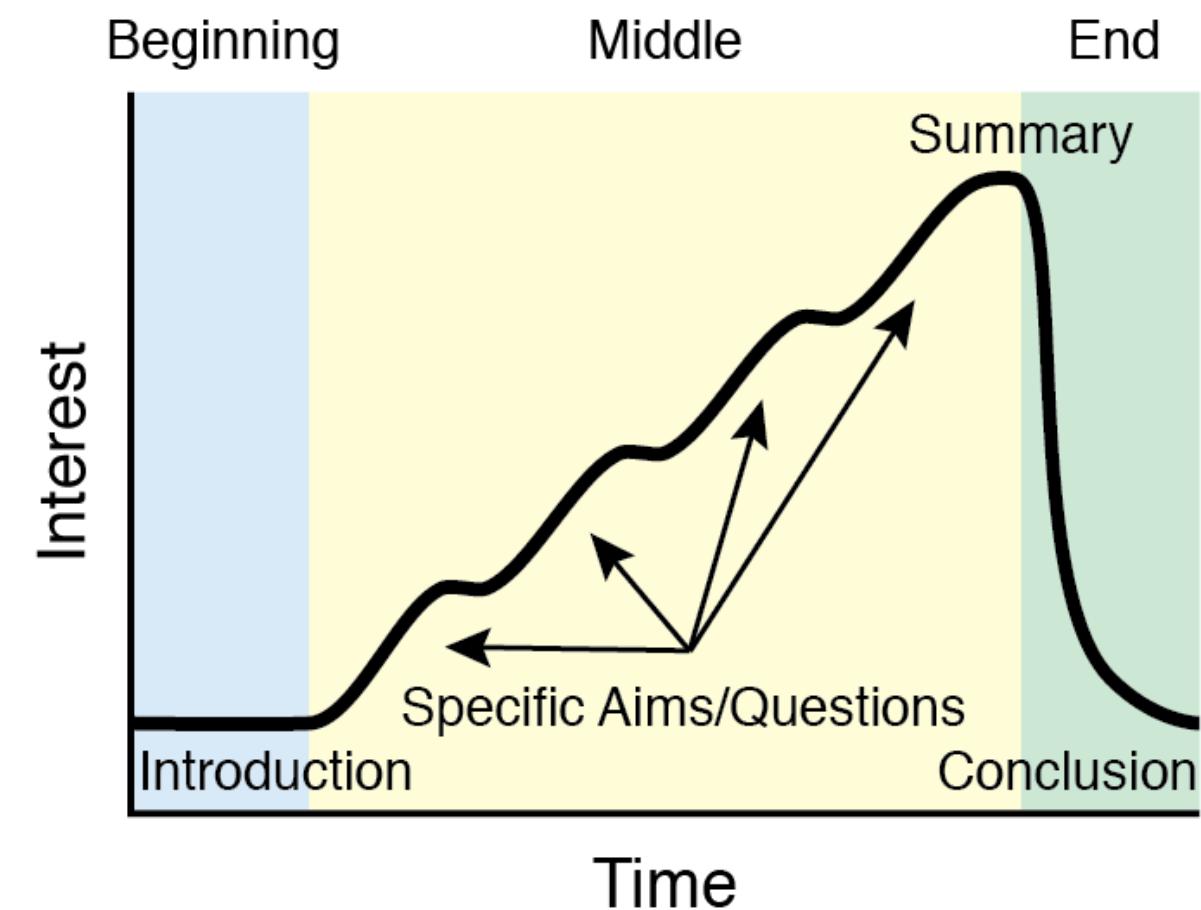
1. The problem
2. The experiment
3. The solution

A good science talk is a good story

## Action movie



## Science Talk



Marc J. Kuchner

# MARKETING for SCIENTISTS

HOW TO SHINE  
IN TOUGH TIMES

GET THE JOB YOU WANT

WIN THE FUNDS YOU NEED

SHARE YOUR PASSION  
FOR DISCOVERY



Formerly titled *Star Wars: From the Adventures of Luke Skywalker*  
**George Lucas**

## Star Wars IV: A New Hope

## A Talk



The camera pans around an intricate spaceship floating in space to set the mood.



There is some serious action involving spaceships and droids, which likely mystifies you at this point.



Innocent Luke meets some curious robots.

You show some pretty images to set the mood.

You show some Family Portrait figures, which summarise the work of many research groups on one chart, speaking to the experts in the room and illustrating how serious this field is.

You zoom out and tell how you innocently got interested in the field.

## Star Wars IV: A New Hope

## A Talk



Luke finds that his aunt and uncle have been killed and his home has been burned down.

You explain to everyone how you found that the prevailing theory fails to fit the data. You show the “before” half of the Before/After figure.



Luke sets out on a quest to find the answers.

You tell how you naïvely set out on a quest to find the answers.



Luke meets the evil ruler Darth Vader.

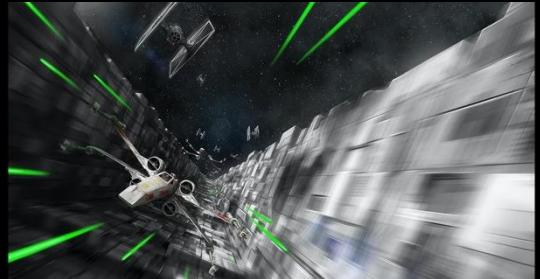
You meet some challenges. This problem is hard!



Luke escapes and returns with the Force.

You invent/hypothesise a new idea that might solve the issue.

## Star Wars IV: A New Hope



Action scene: a race through the canyons of the Death Star chased by Tie Fighters. It's exciting, though you can't follow every laser beam.

Luke blows up the Death Star using the Force, but the evil Darth Vader gets away. Luke is awarded the medal of a hero.



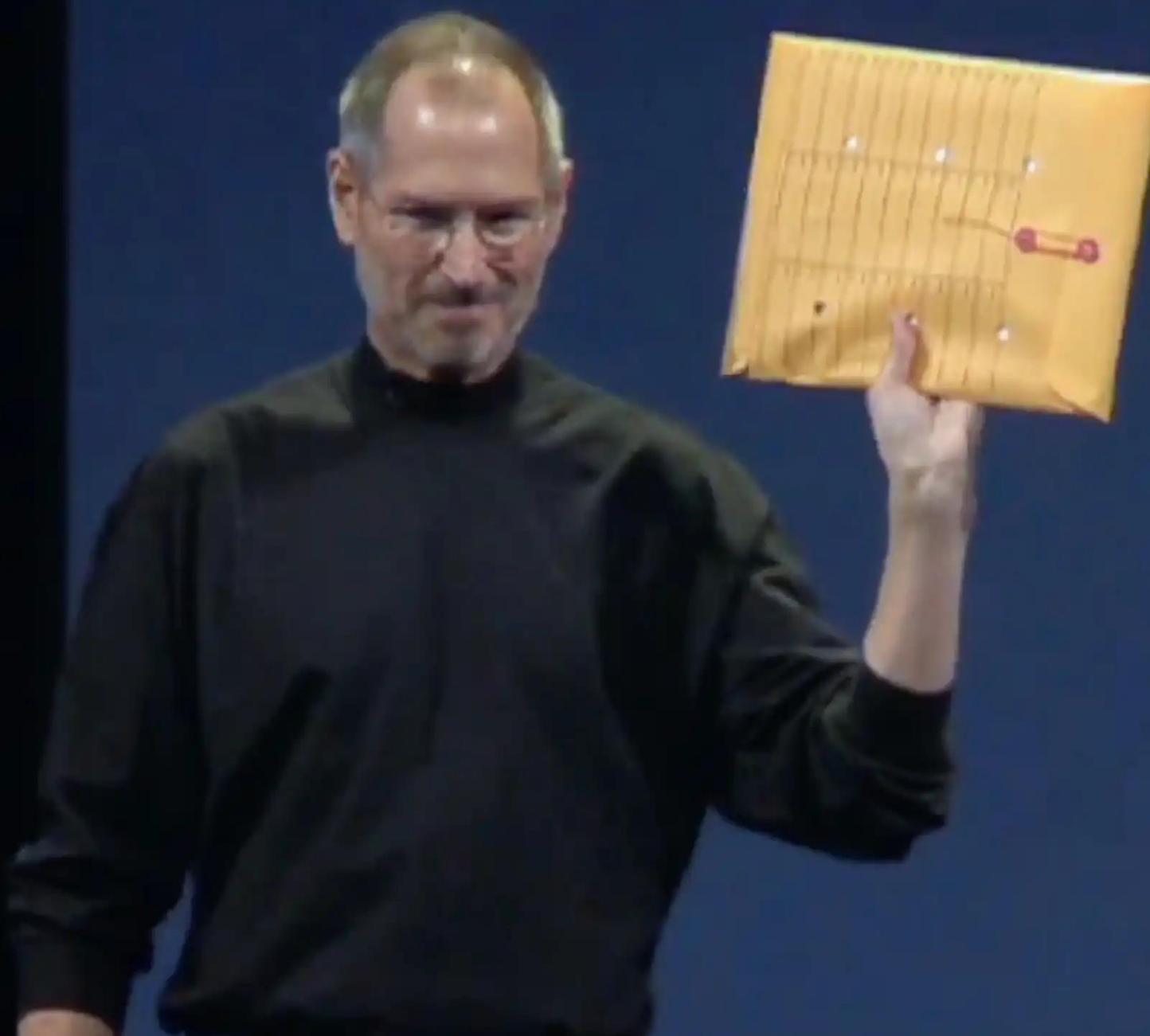
The credits roll: May the Force Be with You!

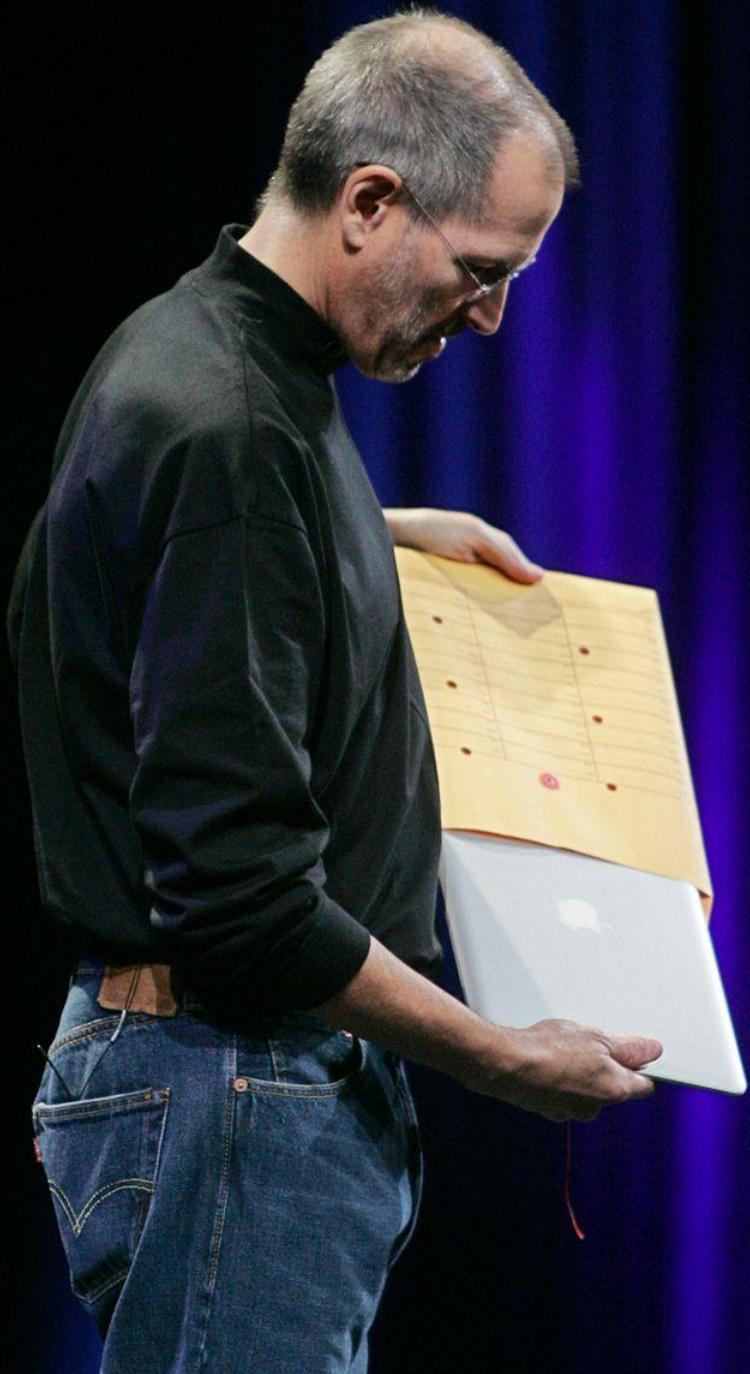
## A Talk

You zoom through the technical details, rapid fire, now addressing only the experts.

You show both halves of the Before/After figure. Turns out, your new idea works and changes the course of science, though important problems remain.

You show the Before/After figure one more time at the end and leave it up on the screen during questions.





## Recap: Giving talk

One size doesn't fit all

Body language and voice

Stage fright is fine

Slide design – sober is best

6 elements at most

Practice!

Hollywood movie

## Common presentation mistakes

Planning words before visual support

Trying to cover too much

Discussing every aspect

Including every detail

Not focusing on your audience's needs

Assuming you can be smooth and professional without practice

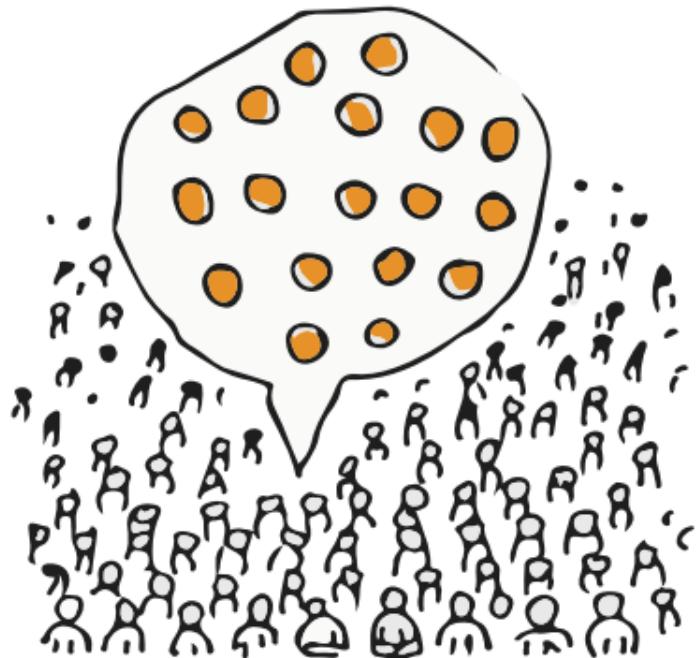


## Communicating to the public

### Science communication



scientists



the public

## Why communicate?

Accountability to  
the public (tax  
payers) and  
policy-makers

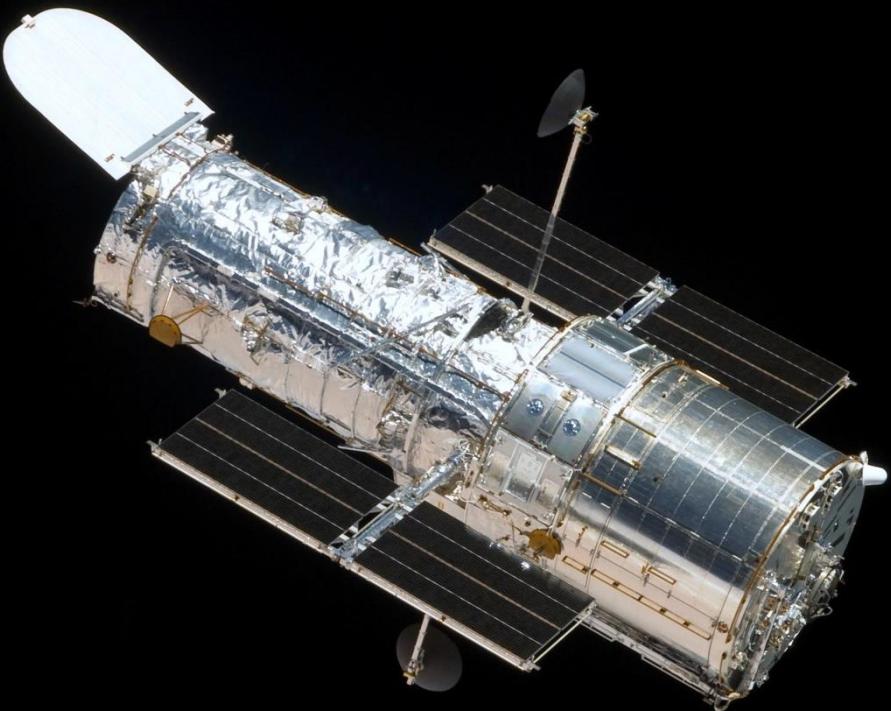
Support government  
strategy on recruiting  
the next generation  
of scientists and  
engineers

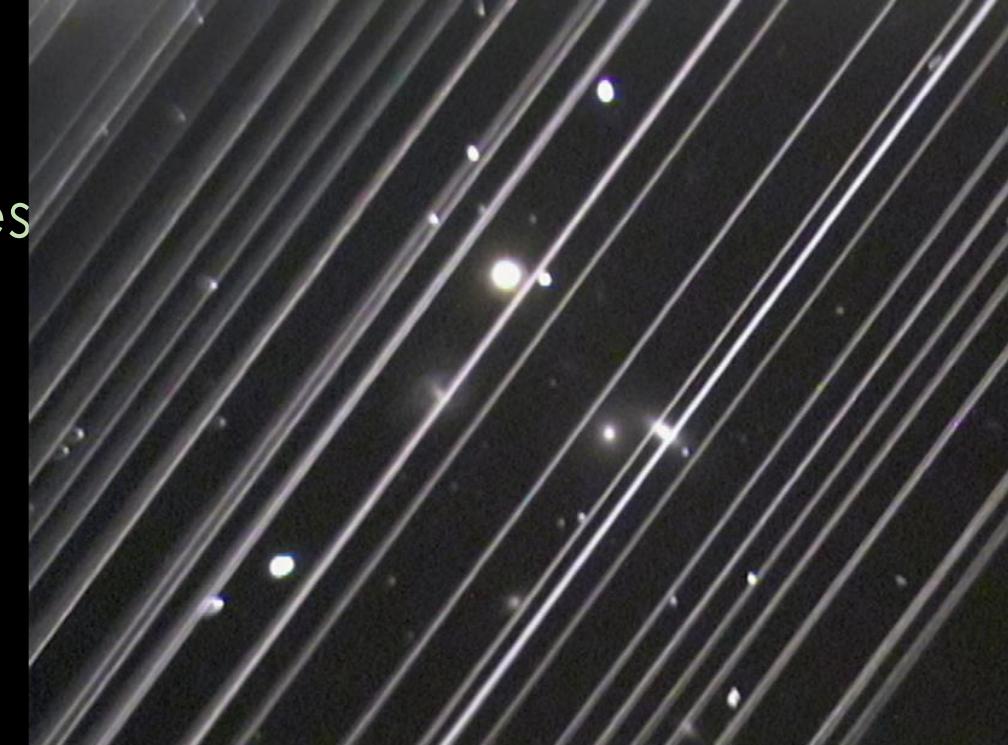
New projects!

The 1-2% spent on outreach is what will  
give us the 98% to build the telescope  
—Prof. Gilmore, 2008

Astronomy is in  
competition with all  
other sciences

# Importance of communication





The 60 satellites launched on Friday are the first of the Starlink mega constellation that, once complete will include as many as 12,000 satellites.



**Elon Musk**  @elonmusk · May 27

Exactly, potentially helping billions of economically disadvantaged people is the greater good. That said, we'll make sure Starlink has no material effect on discoveries in astronomy. We care a great deal about science.



126



146



1.4K

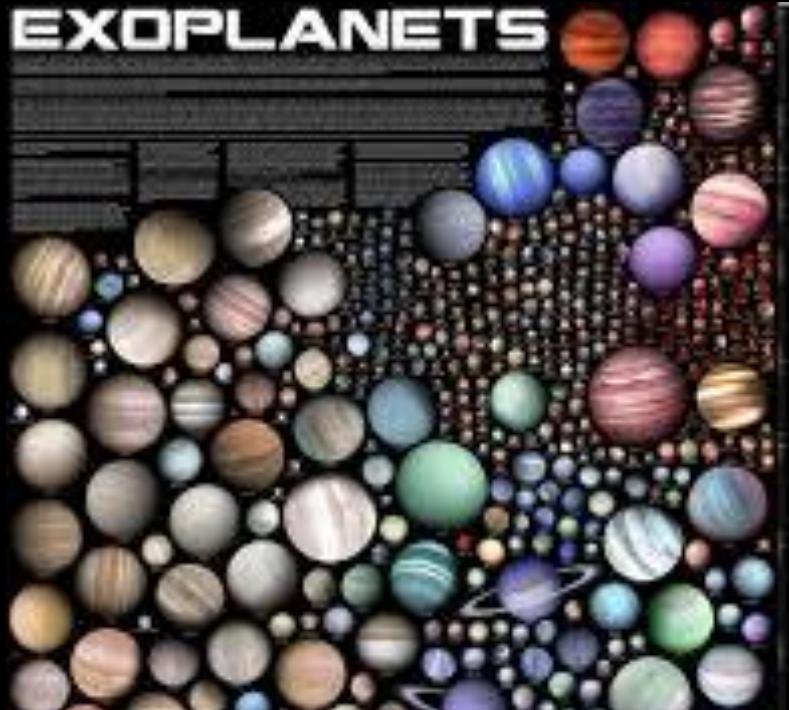
STAR  
WARS

# There is no Plan B



“That’s here, that’s home, that’s us... on a  
mote of dust suspended in a sunbeam”

Philosophical questions... and religion



There are planets everywhere!  
So is Earth special?  
Are Humans special?

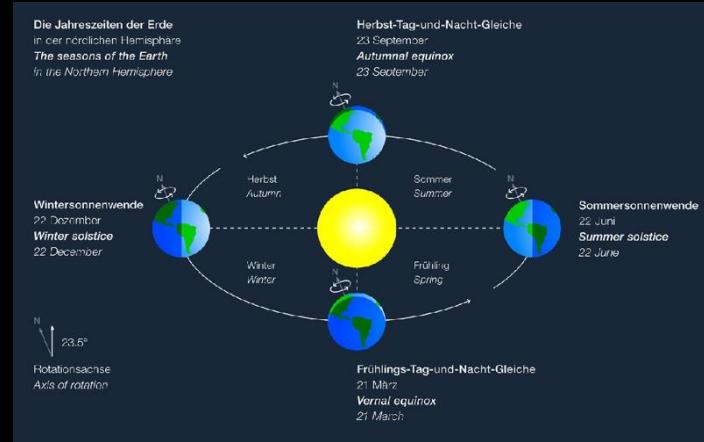


INDEPENDENT

## Pope Francis says he would baptise aliens: 'Who are we to close doors?'

Pontiff made the out-of-this-world pledge during homily on acceptance

# Astronomy in daily life...

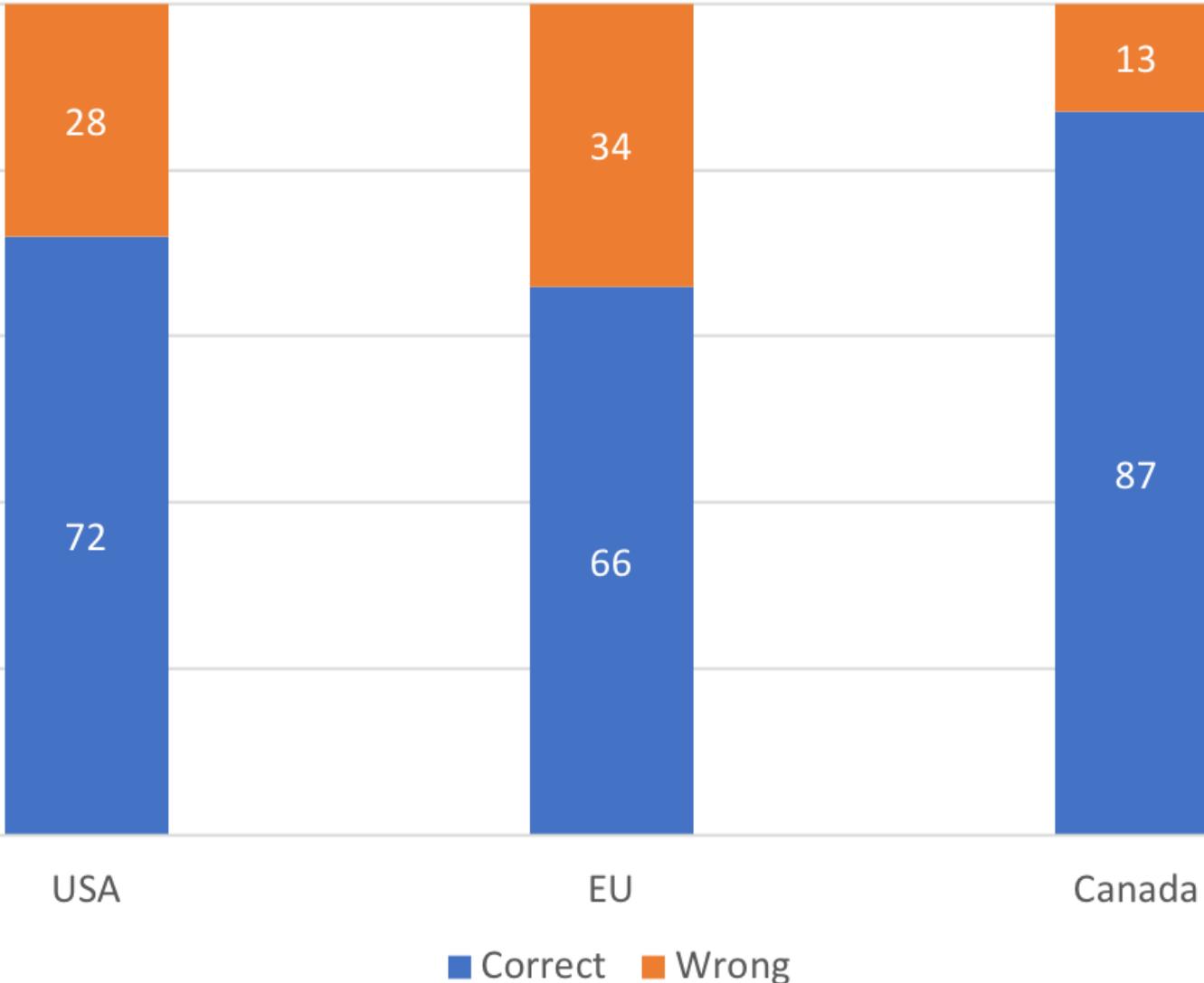


INDEPENDENT

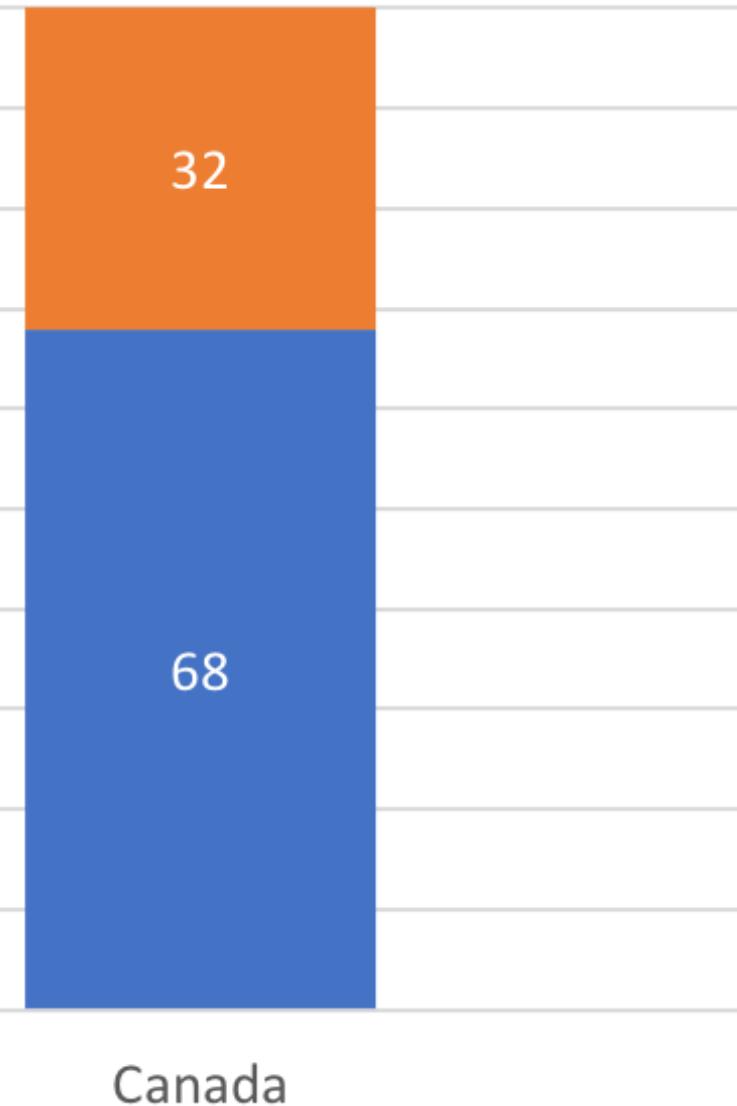
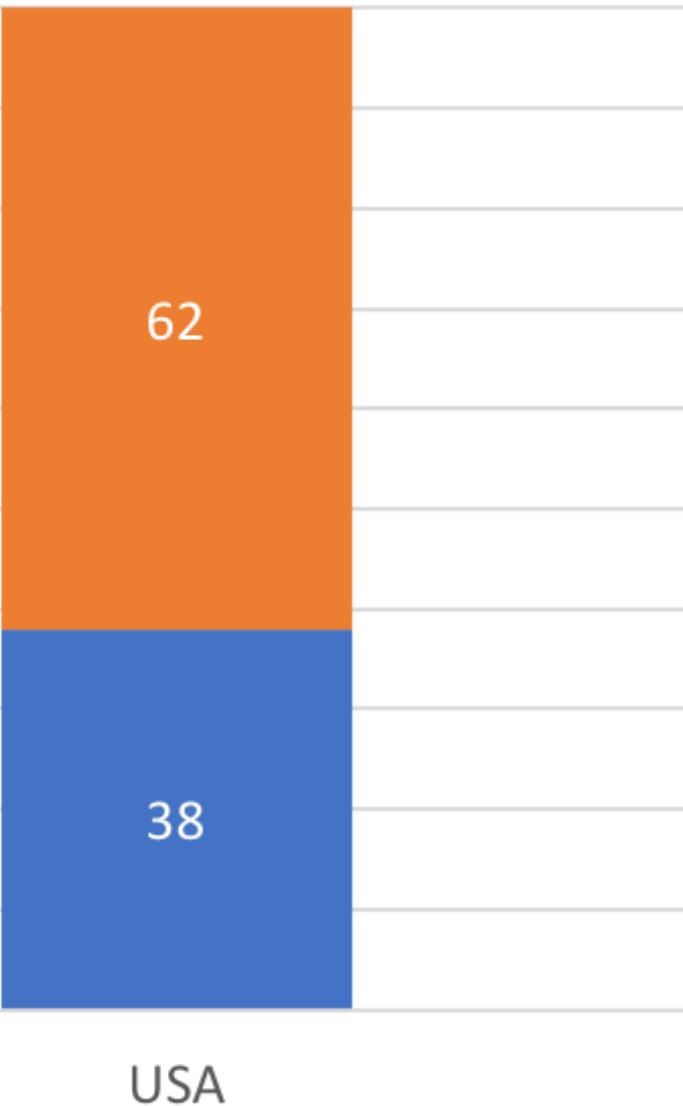
Same is true in Europe, cf. Eurobarometers

**One in four Americans 'don't know the Earth orbits the Sun' and only half believe in evolution**

## *Does the Earth go around the Sun?*

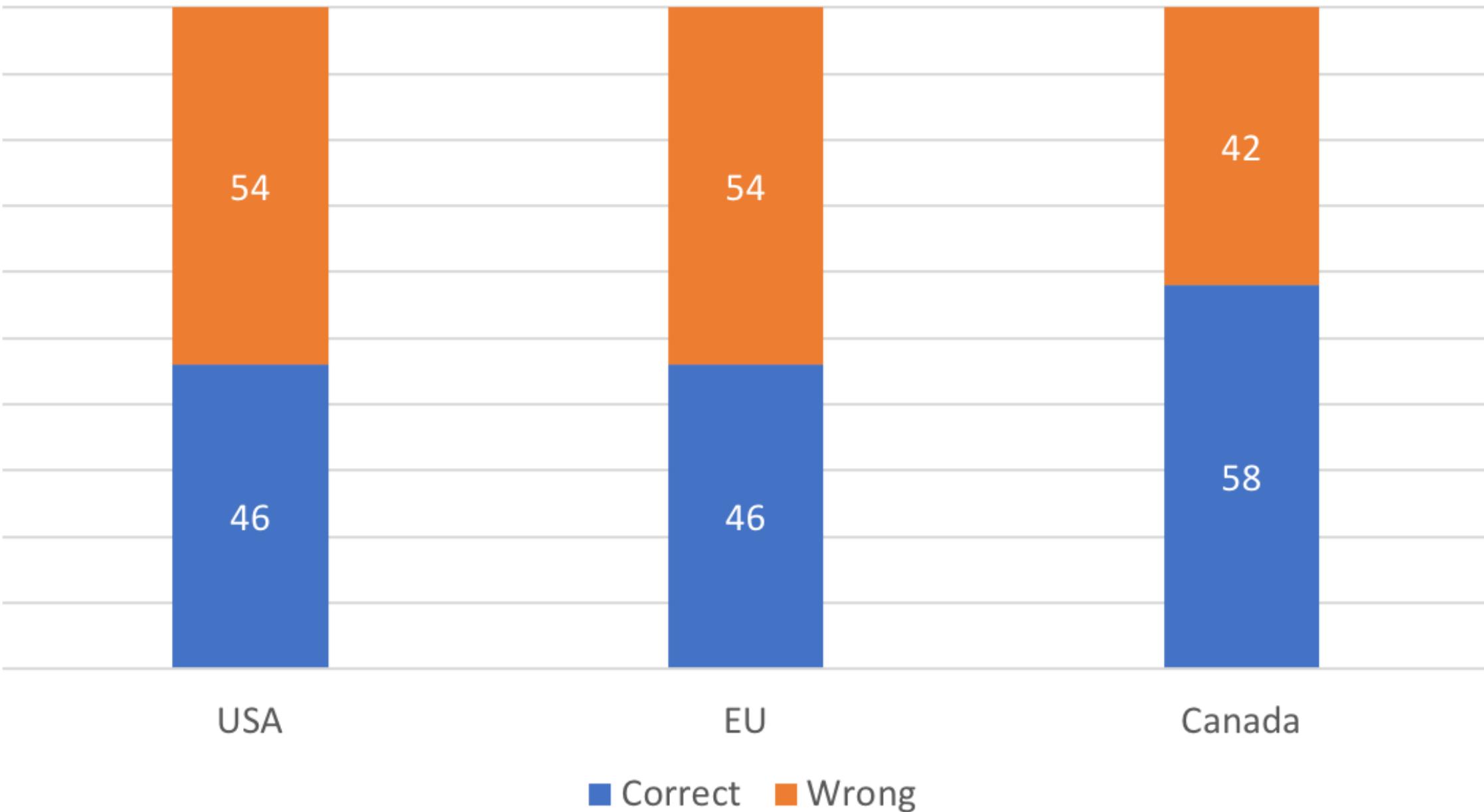


*The universe began with a huge explosion.*



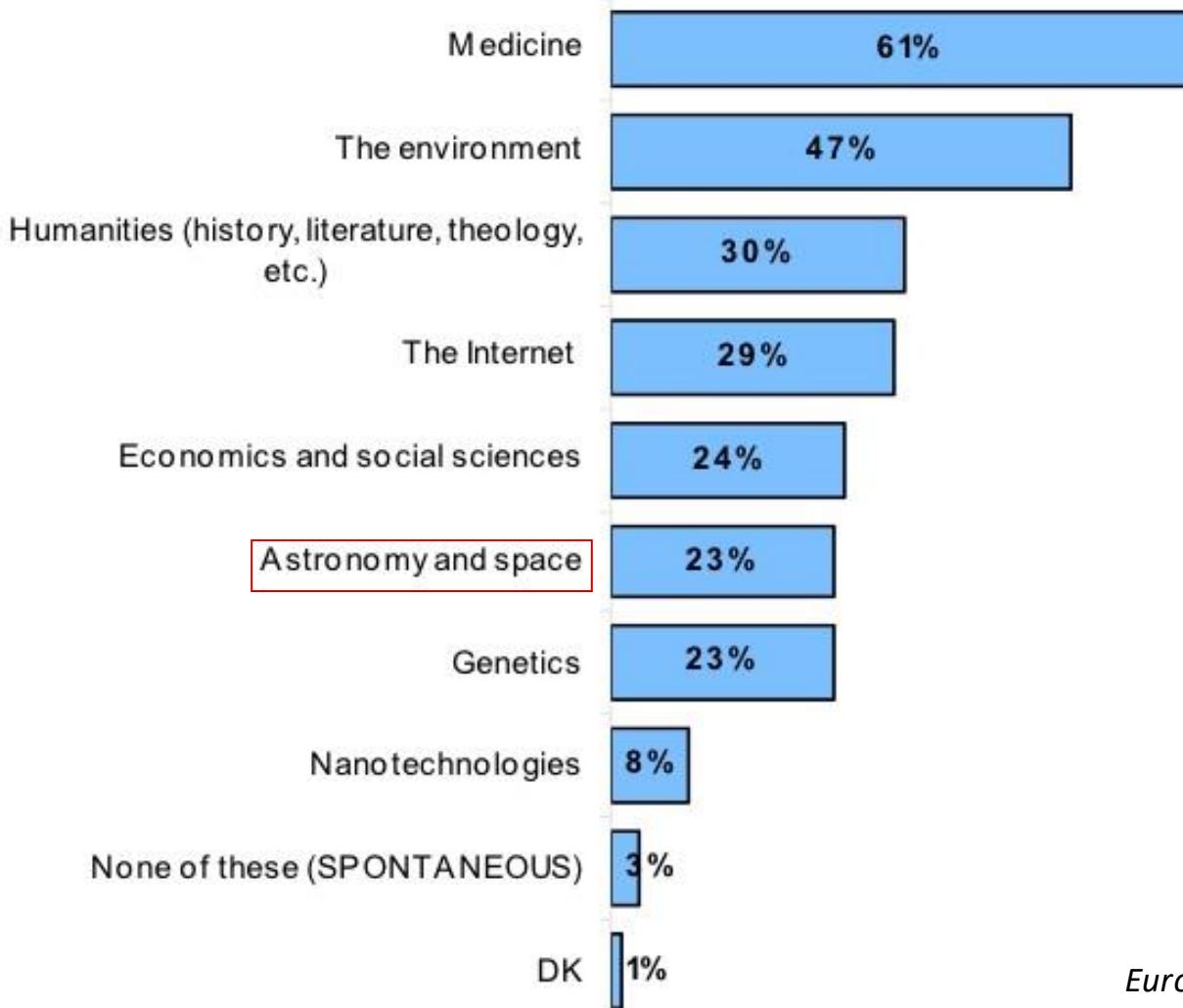
■ Correct ■ Wrong

## *Are electrons smaller than atoms?*



IF VERY OR MODERATELY INTERESTED IN 'NEW INVENTIONS AND TECHNOLOGIES' OR 'SCIENTIFIC DISCOVERIES':

**Which science and technology developments are you most interested in? % EU25**



*Eurobarometer 2005*





Never overestimate the interest of people for  
astronomy! (we are biased)

Be sure to know what your audience knows before  
engaging with them

And choose your words carefully

Talking with public/media

Come up with sound bites

“Looking at the data for the first time was one of those ‘Wow!’ moments that happen only once or twice in an astronomer’s lifetime,” says Giacomo Beccari.

Give a human dimension to your science

Talking with public/media

## Metaphors

1 microarcsecond corresponds to viewing the shape of a golf ball at more than 8,000 km distance.

The energy of the new subatomic particle is equivalent to that of a baseball traveling a hundred kilometres an hour.

Don't say 13.7%, say one out of seven.

## Alternative framing

“99% of young Londoners do not commit serious youth violence.”

→ 1% of young Londoners do commit serious violence

Given the population of London:

There are 10,000 seriously violent young people in the city!

Numbers don't speak for themselves; we are telling a story!

words have meaning

What is wrong with this message?

*“Models indicate that, if we don’t reduce carbon emissions, by the year 2100 the global average temperature could increase by as much as 8°C.”*



What is wrong with this message?

*“Models indicate that, if we don’t reduce carbon emissions, by the year 2100 the global average temperature could increase by as much as 8°C.”*

You need to focus on where your audience works and lives, and talking about now.

## Terms that have different meanings for scientists and the public

Scientific term	Public meaning	Better choice
enhance	improve	intensify, increase
aerosol	spray can	tiny atmospheric particle
positive trend	good trend	upward trend
positive feedback	good response, praise	vicious cycle, self-reinforcing cycle
theory	hunch, speculation	scientific understanding
uncertainty	ignorance	range
error	mistake, wrong, incorrect	difference from exact true number
bias	distortion, political motive	offset from an observation
sign	indication, astrological sign	plus or minus sign
values	ethics, monetary value	numbers, quantity
manipulation	illicit tampering	scientific data processing
scheme	devious plot	systematic plan
anomaly	abnormal occurrence	change from long-term average

Importance of reframing

Changing the way we present things can  
have large impact



## Handicap, Emploi et Inclusion

Thomas Saillard, Autiste Neuro-atypique (RQTH) • 2nd  
2W • G

Join

■□■ C'est parfois en changeant la façon de présenter un message, que l'on change la compréhension des personnes sur un sujet qui nous touche.

[See translation](#)





# Writing and communicating your science

Henri Boffin



Anyone worked on their website?

# Minimal Web Marketing Strategy for the Busy Student/Postdoc

Create an email signature

Update the Wikipedia article that's about  
your research

Linked-In: make a profile

Make a research website

Web site

Contact Information

CV, with your photo

List of publications with links to papers (+lay summary or visual abstracts)

Images and Videos

Web site

# Give Away Freebies

Slides of your talks (! ©)

Figures

Catalogues

Codes, including  
codes to make  
figures or to  
access  
catalogues

Links to observatories, supercomputers, ...

## Lay summary

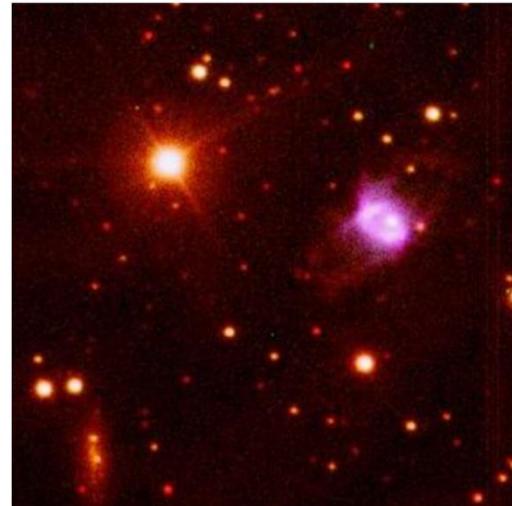
A paragraph outlining the article content, aimed at non-specialists in the field and written in a way that they can easily understand

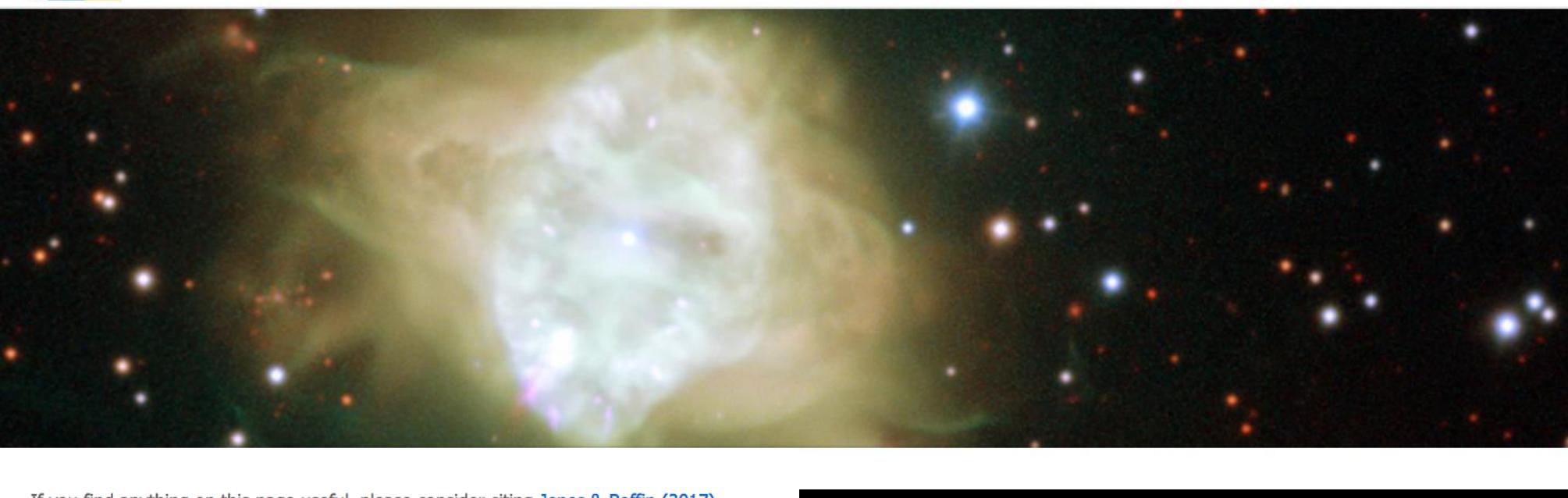
One final sentence which explains why the research is important, and what the article has concluded

# Planetary nebulae

It is now clear that a binary evolutionary pathway is responsible for a significant fraction of all planetary nebulae, and despite the futile resistance of some in the community, it may well be that binarity is a near requirement for the formation of an observable planetary nebula. With [David Jones](#), I have written an [extensive review](#), as well as a [book](#) on this subject.

These reviews were based on extensive work done with various colleagues and that involved finding new binaries inside [Ethos-1](#), [NGC 6326](#) and [NGC 6778](#), [Abell 70](#), [Fleming 1](#), [the Necklace](#), [Hen 2-39](#), [Hen 2-11](#), [Hen 2-428](#), [Hen 2-155](#) and [Hen 2-161](#), [Te 11](#), [IC 4776](#), [M 3-1](#), and [NGC 2346](#).





If you find anything on this page useful, please consider citing [Jones & Boffin \(2017\)](#) and/or [Boffin & Jones \(2019\)](#). Thanks!

**A sortable table of post-CE binary PNe. Click on the header to resort!**

**Key:**

Irr: Irradiation/reflection effect

Ecl: Eclipsing

Ell: Ellipsoidal modulation

DB: Doppler beaming

SB1: Single-lined spectroscopic binary

SB2: Double-lined spectroscopic binary

C: Composite spectrum

B: Bipolar

E: Elliptical

I: Irregular

MS: Multiple shells

\* denotes variability reported but not conclusively binary in origin

\*\* denotes that the object was published as a binary but has since been listed as uncertain and in need of further study by [Miszalski et al. \(2011\)](#)

All coordinates are J2000. Changes and/or additions can be requested by email to [David Jones](#)

Last updated 24th August 2021

PN	RA	Dec	Period (days)	Phot. type	Spectroscopy*	Morphology*	ADF*	References*
PC 12	16:43:53.8	-18:57:12	0.592	Ell	-	-	-	<a href="#">Jacoby et al. (2021)</a>
CGMW 4-3783	18:55:04.9	-23:28:13	0.6982	Ell	-	-	-	<a href="#">Jacoby et al. (2021)</a>
*Y-C 2-32	18:55:30.7	-21:49:40	30	Irr?	-	-	-	<a href="#">Jacoby et al. (2021)</a>
*Me 2-1	15:22:19.3	-23:37:31	22	Irr?	-	-	-	<a href="#">Jacoby et al. (2021)</a>



Make your papers,  
data, and codes freely  
available to all

“Science is like  
a parachute:  
if it is not open,  
it won’t save  
you!”

You’ll also gain  
recognition and  
sympathy

# Website

<https://pages.github.com/>

<https://astrosites.github.io/tutorial>

The screenshot shows a dark-themed GitHub Pages website template. At the top, there are two tabs: "stevenstetzler.github.io/index.html" and "AstroSites". The URL in the address bar is "https://stevenstetzler.github.io". The page features a large, central image of the Crab Nebula. To the left of the image, there is a form with fields for "Name" (containing "FIRST LAST"), "Headshot" (with an arrow pointing to the nebula image), and "Blurb about you" (with an arrow pointing to placeholder text). Below the nebula image, there are fields for "POSITION" and "INSTITUTION", followed by a "CIRRICULUM VITAE" button. At the bottom, there are three navigation buttons: "ABOUT ME", "RESEARCH", and "COMMUNITY". A footer at the very bottom contains the text "© UNTITLED. DESIGN: HTML5 UP". Red arrows point from the labels "Name", "Headshot", "Blurb about you", and "Navigation buttons" to their respective elements on the page.

**FIRST LAST**

Name →

Headshot →

Blurb about you →

Navigation buttons →

POSITION  
INSTITUTION

CIRRICULUM VITAE

ABOUT ME   RESEARCH   COMMUNITY

© UNTITLED. DESIGN: HTML5 UP

**A Resource for Creating a Website to Promote Your Scientific Work**

EMILY MORAVEC  <sup>1</sup>

<sup>1</sup>*Astronomical Institute of the Czech Academy of Sciences, Boční II 1401/1A, 14000 Praha 4, Czech Republic*

(Received November 26th, 2020; Accepted December 15th, 2020)

Submitted to BAAS



Some of the things you learned

The process of writing

The structure of a scientific paper

Writing for the reader

**CONGRATULATIONS!**



**WELL DONE**

Give a stunning presentation

Practice, practice, practice



hboffin@eso.org

Please provide feedback

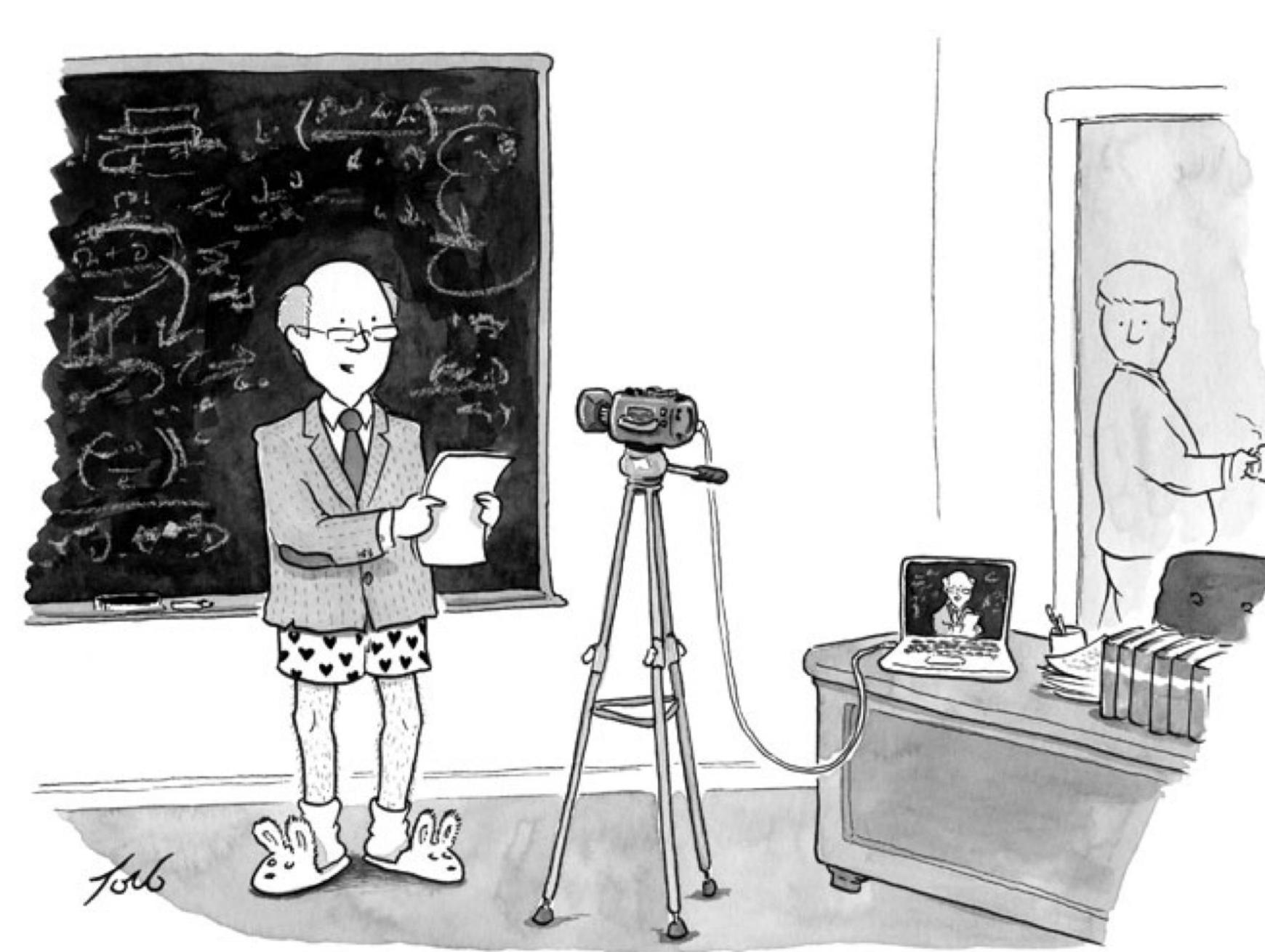
<https://forms.office.com/e/hgEM0DjrEu>

**Writing and Communicating Your  
Science**









## Virtual presentations

"I'm honored to share my research at your virtual academic conference."

Attention spans are even shorter online.



## 72% of Finland's national land area covered by forests

- Lorem ipsum dolor sit amet, consectetur adipiscing elit.
    - Vestibulum ac dui ex. Suspendisse aliquet dui non turpis finibus,
  - Vitae pretium libero dapibus. Praesent vel felis risus.
    - Donec facilisis, eros ac rhoncus sagittis, odio risus lacinia augue, ut cursus
  - Psum sem sed mi. Nam rutrum, enim sed commodo facilisis,
  - Pui nibh commodo lorem, sit amet porta leo turpis ac magna.
  - Nulla et urna lacinia, porttitor urna eu, euismod massa.
- Ut nec turpis sit amet eros eleifend cursus malesuada quis arcu.  
(Sed varius tortor non urna commodo elementum.)

*Donec auctor consectetur nulla ac im*

Quisque tristique, eros eget pellentesque congue, lorem metus



## Place yourself in the frame

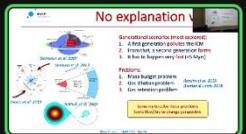


**BEFORE:** Usual way, less engaging.



**AFTER:** Much better.

Henri



MPA video d...

Heran Xiong

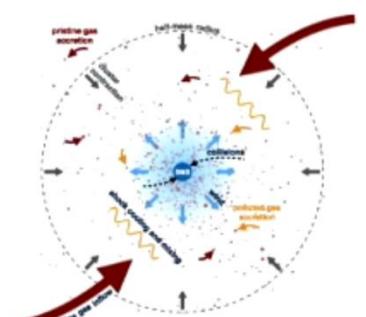
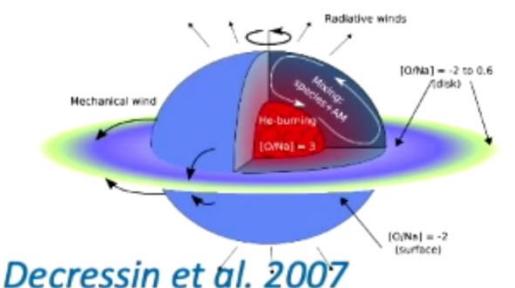
Sharmila

timo prusti

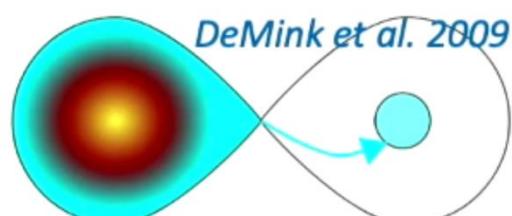
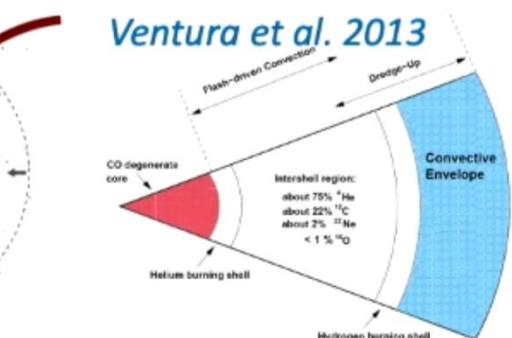
&gt;



# No explanation w...



*Ventura et al. 2013*



**Generational scenarios (most explored):**

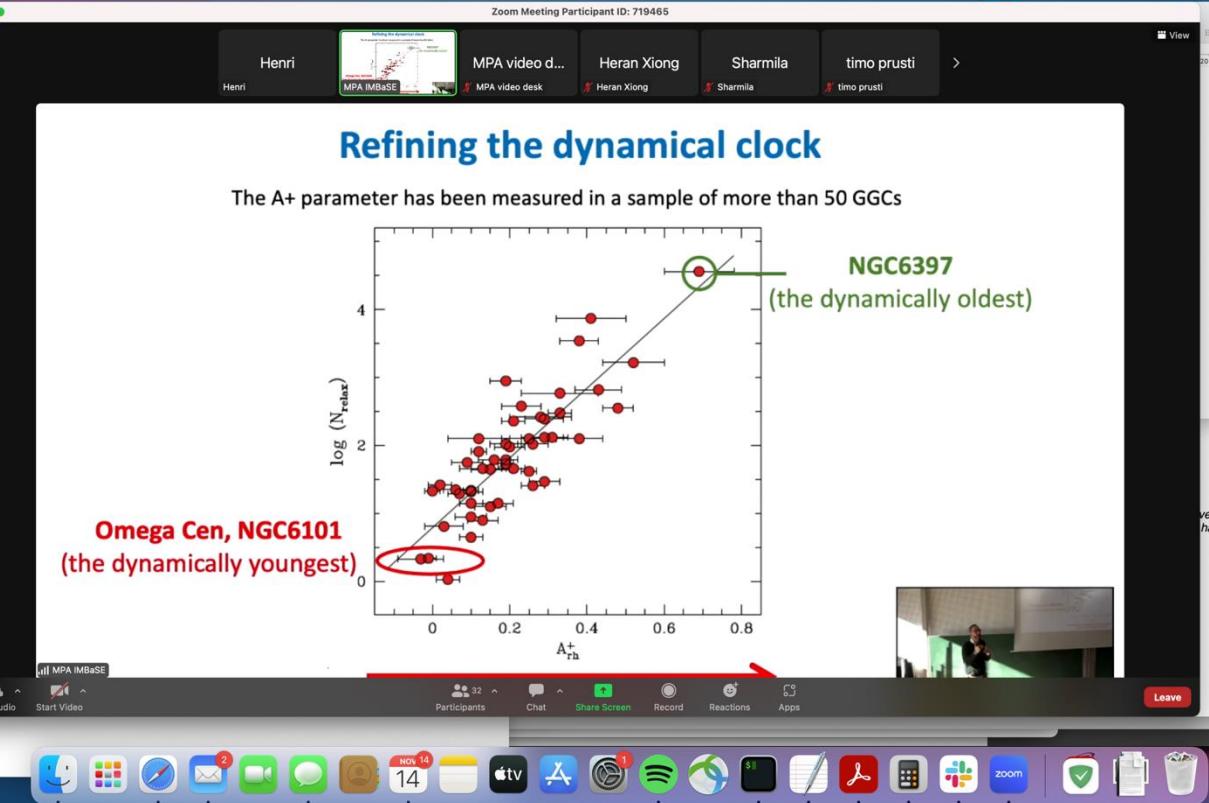
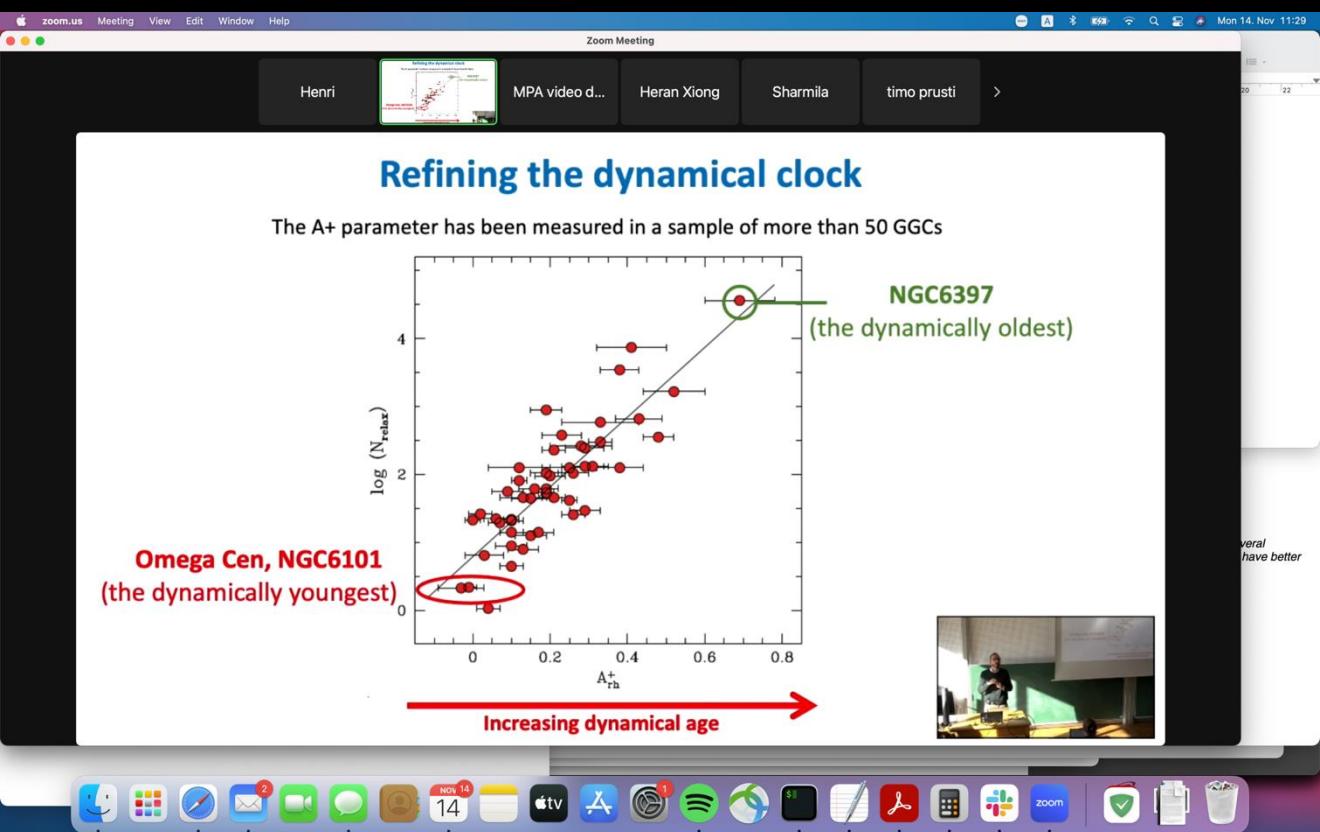
1. A first generation **pollutes** the ICM
2. From that, a second generation **forms**
3. It has to happen very **fast** (<5 Myrs)

**Problems:**

1. Mass-budget problem
2. Gas dilution problem
3. Gas retention problem

*Renzini et al. 2015  
Bastian & Lardo 2018*

Some try to solve these problems  
Some (few) try to change perspective





Try to avoid a messy environment like this.



Bokeh (blur) filter can eliminate visual clutter.



A clean space gives room for visuals to pop.



Using a well-lit white screen as background.



Dress adequately and have correct posture



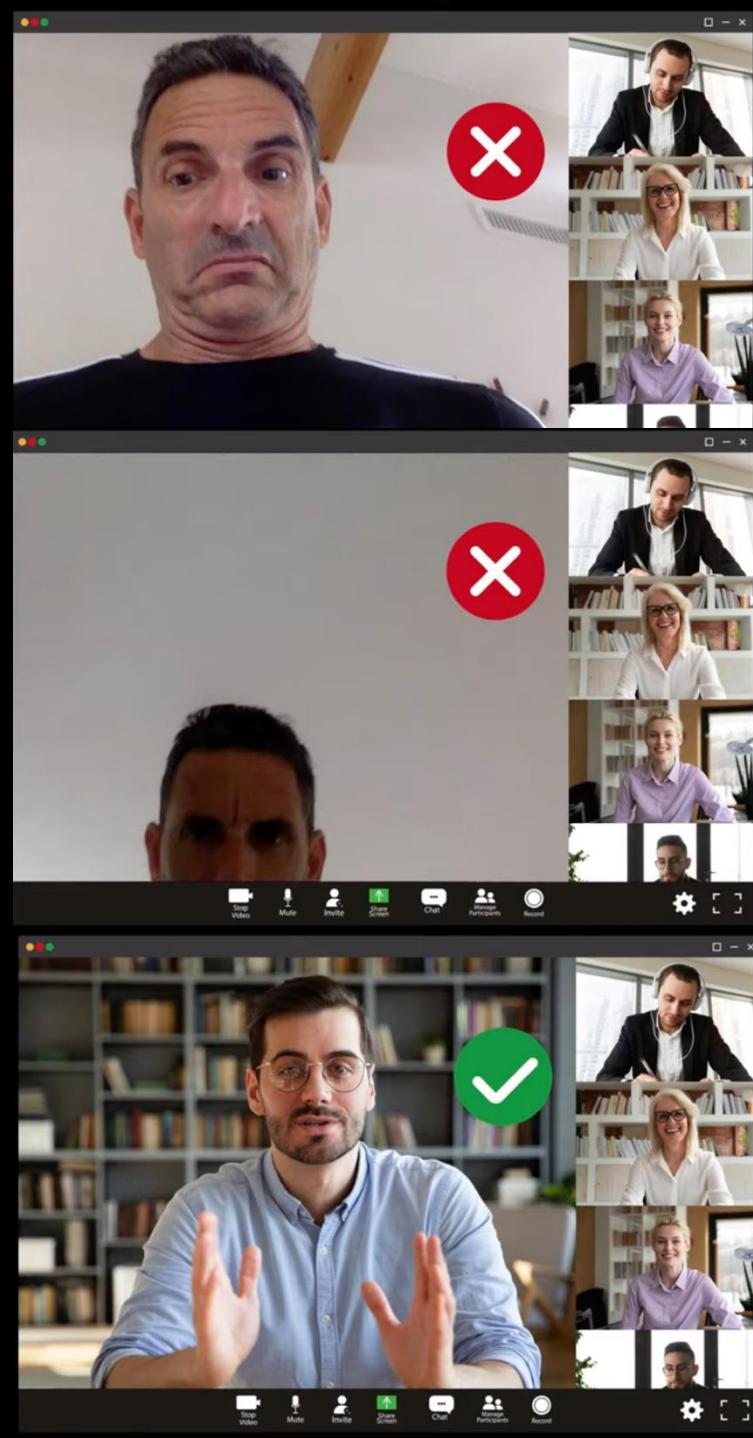
A young woman with long brown hair is smiling broadly at the camera. She is wearing a light gray cardigan over a white t-shirt. Her right hand is raised in a waving gesture. The background is a bright, modern interior with a sofa and a shelf. The overall mood is friendly and welcoming.

Look at the  
camera

Smile





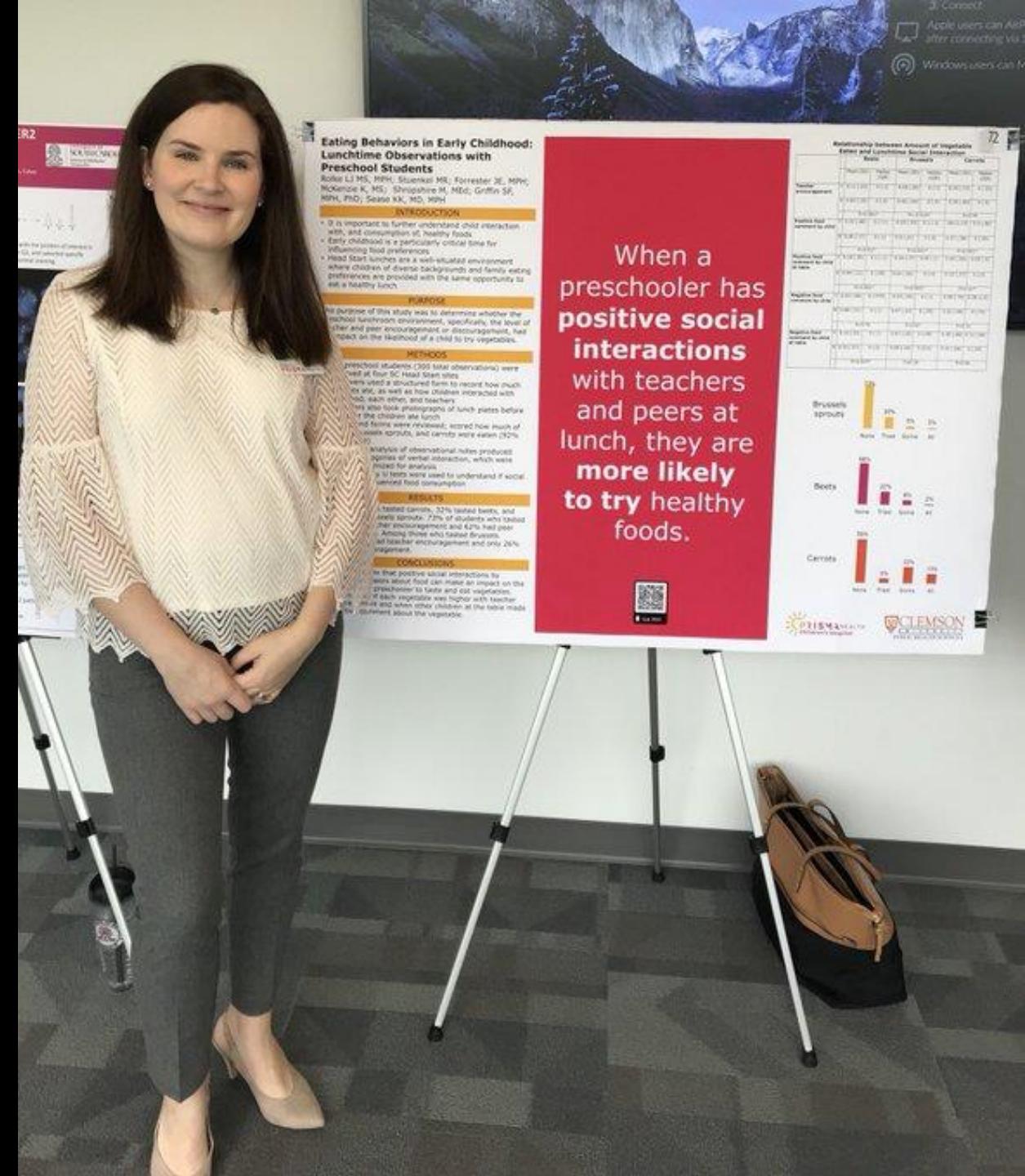


# Title is the most important (again!)

## Poster is an aid

You should be there during poster session

# Posters



# Use white space



© 1969 VOLKSWAGEN OF AMERICA, INC.

## Think small.

Our little car isn't so much of a novelty any more.  
A couple of dozen college kids don't try to squeeze inside it.  
The guy at the gas station doesn't ask where the gas goes.  
Nobody even stares at our shape.  
In fact, some people who drive our little

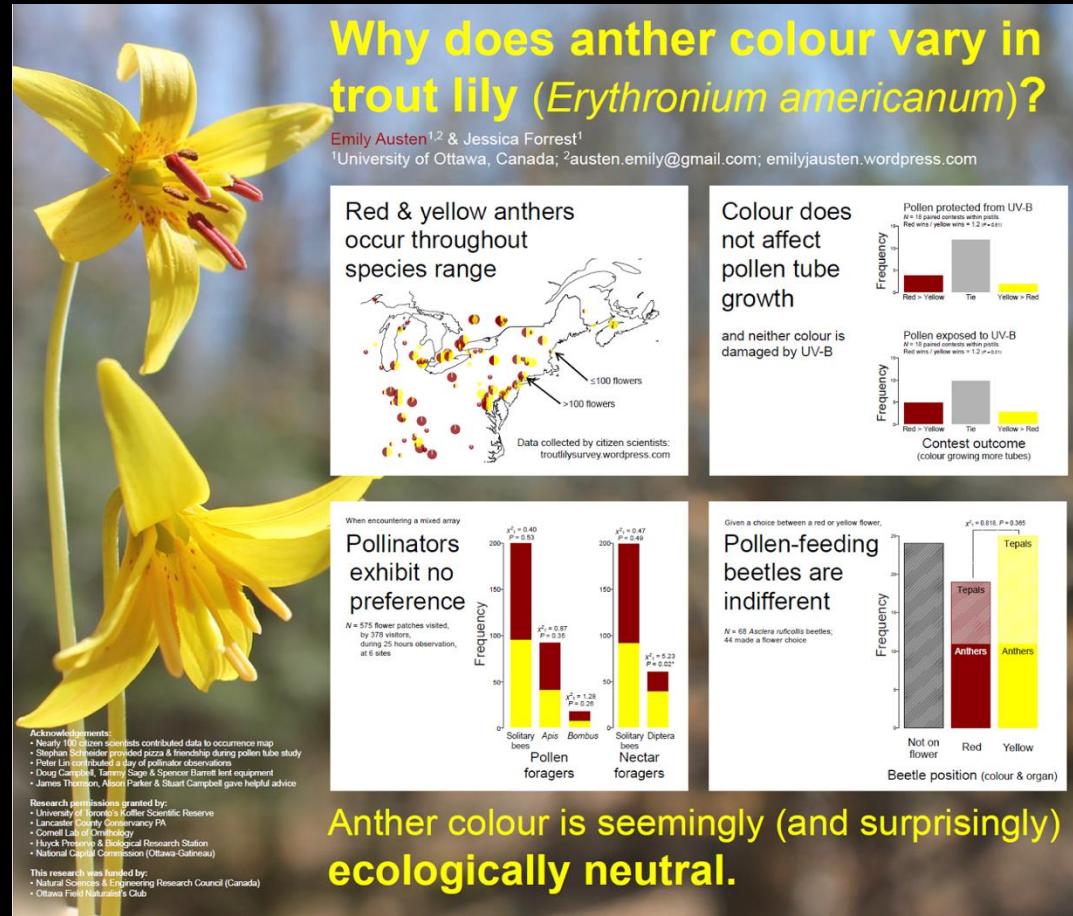
blower don't even think 32 miles to the gallon is going any great guns.  
Or using five pints of oil instead of five quarts.  
Or never needing anti-freeze.  
Or racking up 40,000 miles on a set of tires.  
That's because once you get used to

some of our economies, you don't even think about them any more.  
Except when you squeeze into a small parking spot. Or renew your small insurance. Or pay a small repair bill. Or trade in your old VW for a new one.  
Think it over.



Have a main image  
(that breaks the symmetry)

# Have a main image



# Irradiation Investigation: Exploring the Molecular Gas in NGC 7293

J. Bublitz<sup>1</sup>, J. H. Kastner<sup>1</sup>, P. Hill-Blanc<sup>2</sup>, T. Forveille<sup>2</sup>, M. Santander-García<sup>3</sup>, J. Alcolea<sup>3</sup>, V. Bujarrabal<sup>3</sup>, R. Montez Jr.<sup>4</sup> (<sup>1</sup>RIT – Rochester, NY, USA; <sup>2</sup>IPAG – Grenoble, France; <sup>3</sup>OAN-IGN – Madrid, España; <sup>4</sup>SAO – Cambridge, MA, USA)



## Introduction

Many planetary nebulae (PNe) retain significant quantities of molecular gas and dust in the final stages of stellar evolution. Photoionization and dissociation drive the chemical evolution of this material through extreme UV and (often) X-ray emission from their central stars. The utility of well-defined geometry make PNe ideal testbeds for modeling the effects that radiation-driven heating and chemistry have on molecular gas in photodissociation region (PDR) environments.

With this as motivation, we have carried out IRAM 30m APEX 12m ALMA radio studies of the Helix Nebula and its molecule-rich globules, aimed at understanding how the CSPN radiation field drives PN molecular chemistry.

## The Helix Nebula

- NGC 7293 is one of the nearest PNe at 200 pc [4], angular diameter  $\sim 28'$
- 100 kK CSPN, age  $\sim 15,000$  yrs – an evolved nebula well suited to study of irradiated molecular gas chemistry
- The PN contains numerous dense, molecule-rich globules within its ionized region, as well as an extended envelope of colder gas and dust
- Our IRAM 30m and APEX 12m surveys targeted 6 positions of the Helix (Fig. 1, center): the inner globules A, B, and C, distant envelope positions East and West; and an intermediate position at the inner envelope Rim

## Imaging the Globules with ALMA



Figure 1: Left: ALMA moment 0 image stamps of Globule B in 1mm and 3mm transitions of CO, HCN, HCO<sup>+</sup>, and HNC. Center: HST optical image of the Helix Nebula, with positions and beamwidths of our 30 m observations indicated (circles). Right: ALMA moment 0 image stamps of Globule C in the same molecular transitions as Globule B. CO image also published in [2].

## HNC/HNC vs CSPN UV Flux

- HCN and HNC are found in many PN molecular environments [8, 3]
- We recently discovered a robust anti-correlation between HNC/HCN line intensity ratio and CSPN UV luminosity in PNe [3]
- Further study with the Helix Nebula reveals the line ratio decreases with increasing incident UV flux (Fig. 2)
  - One explanation is gas heating by CSPN UV, which regulates the temperature of cold molecular gas (as Orion Complex studies suggest [7, 5, 6])
  - Selective photodissociation could also favor conversion of HNC into HCN with greater UV exposure[1], producing such a trend
- Analysis of this molecular line ratio could increase our understanding of chemical pathways in PNe and other PDRs
- Modeling of Globule B (Fig. 3) suggests HNC/HCN should decrease at greater depth, contrary to the observed trend

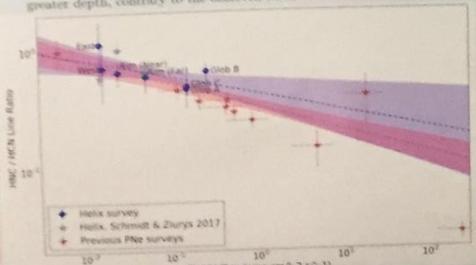
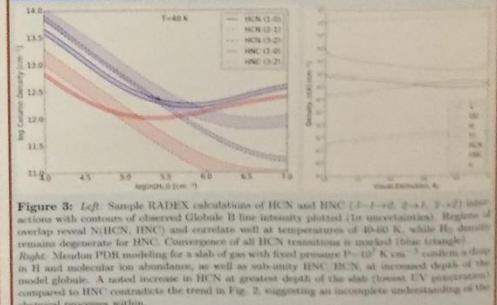


Figure 2: HNC/HCN line intensity ratio vs CSPN UV flux for the Helix Nebula and previous PNe survey samples. Linear regression fits to Helix survey data (blue) and error data set (red) are displayed with 1 $\sigma$  error shaded.

## Modeling PDR Environments



## Results and Summary

We are exploiting the unique properties of the Helix to follow up our discovery of an anti-correlation between HNC/HCN line intensity ratio and CSPN UV flux.

- HNC/HCN is a tracer of UV irradiation in PDR environments
- Heightened HCN through direct heating or possibly selective photodissociation of HNC
- Models with RADEx/Meudon PDR provide globule properties (e.g., density, temperature,...)
- ALMA images will enable detailed chemical-structural study of the globules

## References

- [1] Agudo et al. 2017, ApJ, 848, 104
- [2] Grönqvist et al. 2014, ApJ, 795, 134
- [3] Agudo et al. 2018, ApJ, 856, 901
- [4] Hester et al. 2013, ApJ, 773, 105
- [5] Hester et al. 2014, ApJ, 787, 105
- [6] Hester et al. 2015, ApJ, 809, 105
- [7] Hester et al. 2016, ApJ, 823, 105
- [8] Hester et al. 2017, ApJ, 847, 105



# PIGS IN SPACE: EFFECT OF ZERO GRAVITY AND AD LIBITUM FEEDING ON WEIGHT GAIN IN CAVIA PORCELLUS

## ABSTRACT:

One ignored benefit of space travel is a potential elimination of obesity, a chronic problem for a growing majority in many parts of the world. In theory, when an individual is in a condition of zero gravity, weight is eliminated. Indeed, in space one could conceivably follow ad libitum feeding and never even gain an gram, and the only side effect would be the need to upgrade one's stretchy pants ("exercise pants"). But because many diet schemes start as very good theories only to be found to be rather harmful, we tested our predictions with a long-term experiment in a colony of Guinea pigs (*Cavia porcellus*) maintained on the International Space Station. Individuals were housed separately and given unlimited amounts of high-calorie food pellets. Fresh fruits and vegetables were not available in space so were not offered. Every 30 days, each Guinea pig was weighed. After 5 years, we found that individuals, on average, weighed nothing. In addition to weighing nothing, no weight appeared to be gained over the duration of the protocol. If space continues to be gravity-free, and we believe that assumption is sound, we believe that sending the overweight — and those at risk for overweight — to space would be a lasting cure.

Colin B. Purrington  
6673 College Avenue, Swarthmore, PA 19081 USA



SPACE-EXES



## CONCLUSIONS:

Our view that weight and weight gain would be zero in space was confirmed. Although we have not replicated this experiment on larger animals or primates, we are confident that our result would be mirrored in other model organisms. We are currently in the process of obtaining necessary human trial permissions, and should have our planned experiment initiated within 80 years, pending expedited review by local and Federal IRBs.

## ACKNOWLEDGEMENTS:

I am grateful for generous support from the National Research Foundation, Black Hole Diet Plans, and the High Fructose Sugar Association. Transport flights were funded by SPACE-EXES, the consortium of wives divorced from insanely wealthy space-flight startups. I am also grateful for comments on early drafts by Mariana Athletic Club, Corpus Christi, USA. Finally, sincere thanks to the Cuy Foundation for generously donating animal care after the conclusion of the study.

## INTRODUCTION:

The current obesity epidemic started in the early 1960s with the invention and proliferation of elastane and related stretchy fibers, which released wearers from the rigid constraints of clothes and permitted monthly weight gain without the need to buy new outfits. Indeed, exercise today for hundreds of million people involve only the act of wearing stretchy pants in public, presumably because the constrictive pressure forces fat molecules to adopt a more compact tertiary structure (Xavier 1965).

Luckily, at the same time that fabrics became stretchy, the race to the moon between the United States and Russia yielded a useful fact: gravity in outer space is minimal to nonexistent. When gravity is zero, objects cease to have weight. Indeed, early astronauts and cosmonauts had to secure themselves to their ships with seat belts and sticky boots. The potential application to weight loss was noted immediately, but at the time travel to space was prohibitively expensive and thus the issue was not seriously pursued. Now, however, multiple companies are developing cheap extra-orbital travel options for normal consumers, and potential travelers are also creating new ways to pay for products and services that they cannot actually afford. Together, these factors open the possibility that moving to space could cure overweight syndrome quickly and permanently for a large number of humans.

We studied this potential by following weight gain in Guinea pigs, known on Earth as fond of ad libitum feeding. Guinea pigs were long envisioned to be the "Guinea pigs" of space research, too, so they seemed like the obvious choice. Studies on humans are of course desirable, but we feel this current study will be critical in acquiring the attention of granting agencies.

## MATERIALS AND METHODS:

One hundred male and one hundred female Guinea pigs (*Cavia porcellus*) were transported to the International Space Laboratory in 2010. Each pig was housed separately and deprived of exercise wheels and fresh fruits and vegetables for 48 months. Each month, pigs were individually weighed by duct-taping them to an electronic balance sensitive to 0.0001 grams. Back on Earth, an identical cohort was similarly maintained and weighed. Data was analyzed by statistics.

## RESULTS:

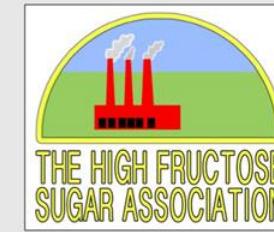
Mean weight of pigs in space was  $0.0000 \pm 0.0002$  g. Some individuals weighed less than zero, some more, but these variations were due to reaction to the duct tape, we believe, which caused them to be alarmed push briefly against the force plate in the balance. Individuals on the Earth, the control cohort, gained about 240 g/month ( $p = 0.0002$ ). Males and females gained a similar amount of weight on Earth (no main effect of sex), and size at any point during the study was related to starting size (which was used as a covariate in the ANCOVA). Both Earth and space pigs developed substantial dewlaps (double chins) and were lethargic at the conclusion of the study.

## LITERATURE CITED:

- NASA. 1982. Project STS-XX: Guinea Pigs. Leaked internal memo.
- Sekulić, S.R., D. D. Lukač, and N. M. Naumovic. 2005. The Fetus Cannot Exercise Like An Astronaut: Gravity Loading Is Necessary For The Physiological Development During Second Half Of Pregnancy. Medical Hypotheses. 64:221-228.
- Xavier, M. 1965. Elastane Purchases Accelerate Weight Gain In Case-control Study. Journal of Obesity. 2:23-40.



# Put logos at the top of your poster to ruin poster aesthetics, reduce legibility of title, and undermine the ability of your graphs to visually compete for viewers' attention



Colin Purrington

666 Teipai Street, Posterville, PA 19801, USA

## Introduction

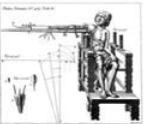
Your reader was mildly intrigued by the title, but you have exactly two sentences to hook them into reading more. So describe exactly what your interesting question is and why it really needed to be addressed. Gratuitous background information will cause them to walk away.

Typography research has shown that text is easier to read if you use a serif font such as Times. But use a non-serif font for title, headings, etc., to subtly tag them as different. Research has also shown that fully justified text (like this paragraph) is harder to read, so don't do this, even if it seems cool and professional looking.

## Materials and methods

Few people really want to know the gruesome details of what you've been up to, so be brief. And be visual. Use a photograph, drawing, or flow chart if possible, supplemented with only a brief overview of your procedure.

If you can somehow attach an object, an iPad, etc., that can involve viewers in active way, do so. Refer to the companion website (see bottom right section) for more ideas if you are creatively challenged.



**Figure 2.** Hand-drawn illustrations are preferable to computer-generated ones. Just bribe or flirt with an artist to get them to help you out. A photograph of you actually doing something might be nice.

## Literature cited

- Bender, D.J., E.M. Bayne, and R.M. Brigham. 1996. Lunar condition influences coyotes (*Canis latrans*) howling. *American Midland Naturalist* 136:413-417.
- Brooks, L.D. 1988. The evolution of recombination rates. Pages 87-105 in *The Evolution of Sex*, edited by R.E. Michod and B.R. Levin. Sinauer, Sunderland, MA.
- Scott, E.C. 2005. *Evolution vs. Creationism: an Introduction*.

## Results

The overall layout in this arena should be visually compelling, with clear cues on how a reader should travel through the components. You might want a large map with inset graphs. Or have questions on left and answers with supporting graphs on right. Be sure to separate figures from other figures by generous use of white space. When figures are too cramped, viewers get confused about which figures to read first and which legend goes with which figure. Cramped content just looks bad, too. The big thing to remember is that a Results section on a poster does not need to look like a Results section on a manuscript, so feel free to be creative.

If you can add small drawings or icons to your figures, do so — those visual cues can be priceless aids in orienting viewers. And use colored arrows or callouts to focus attention on important parts of graphs. You can even put text annotations next to arrows to tell reader what's going on that's interesting in relation to the hypothesis test. E.g., "This outlier was most likely caused by contamination when I sneezed into tube." Also, don't be afraid of using colored connector lines to show how one part of a figure relates to another figure.

Figures are preferred but tables are sometimes unavoidable, like death. If you must include one, go to great efforts to make it look professional (the table, that is). Look in a respectable journal and emulate the layout, line types, line thickness, text alignment, etc., exactly. A table looks best when it is first composed within Microsoft Word, then inserted as an Object. Use colored text or arrows to draw attention to important parts of the table.

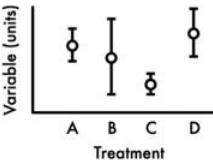
Paragraph format is fine, but so are bullet lists of results:

- 9 out of 12 brainectomized rats survived
- Brainectomized rats ate less
- Control rats completed maze faster, on average, than rats without brains

This sample results section is way too wordy, in case you were wondering.

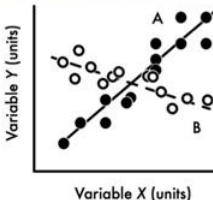
University of California Press, Berkeley.  
Society for the Study of Evolution. 2005. Statement on teaching evolution. <<http://www.evolutionssociety.org/statements.html>>. Accessed 2005 Aug 9.

### Do treatments differ in their effects?



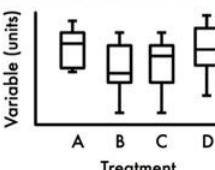
**Figure 3.** Legends can describe the experiment, answer the question, and even include statistics if you so choose (unlike a manuscript figure legend). But keep brief!

### Do As and Bs respond differently to X?



**Figure 4.** Label elements instead of relying on annoying keys that are defaults in most software. Add pictures of A and B if they are actually things (e.g., icons of aster and begonia flowers).

### Are medians of treatment A and D different?



**Figure 5.** For the love of God, don't be tempted to reduce font size in figure legends, axes labels, etc. Your viewers are probably most interested in reading your figures and legends.

## Conclusions

Conclusions should not be mere reminders of your results—that would be boring. You want to guide the reader through what you have *concluded* from the results, and you need to make the first several sentences understandable on their own and interesting...because many conference attendees will start reading this section first. If you don't hook them, they'll walk. These first several sentences should refer back, explicitly, to the burning issue mentioned in the introduction. (If you didn't mention a burning issue in the introduction, go back and fix that.)

A good conclusion will also explain how your conclusions fit into the literature on the topic. E.g., how exactly does your research add to what is *already* published on the topic? It's important to be humble and generous in this section, so assume that authors of previous literature may be at the conference, and further assume they are crabby and influential. You can also draw upon less formal types of context such as conversations you have had with smart and important people (God, personal communication).

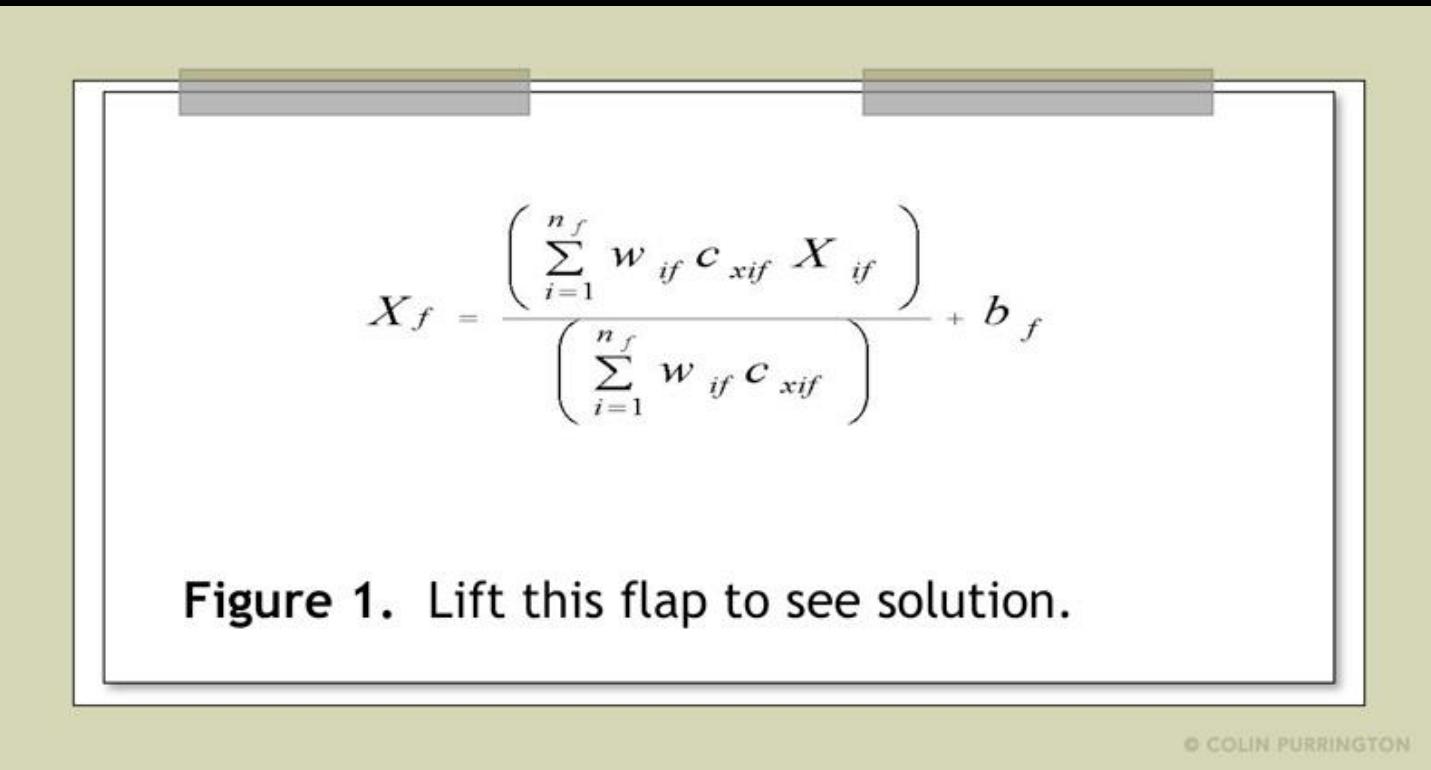
Finally, you want to tell readers who have lasted this long what needs to be done next, and who should do it. E.g., are you taking the next logical step, or should another discipline follow up on your amazing result? It's OK to put a bit of personality into this ending because viewers expect posters to be personal, and if you're not actually standing there to convey your enthusiasm, your poster should be doing that for you.

If you have a graphical way to express the next iteration of your hypothesis, by all means include it. For example, you might make a graph of hypothetical data that shows an expected result in a future experiment. That's something you couldn't do in a traditional manuscript, but it's totally fine for a poster.

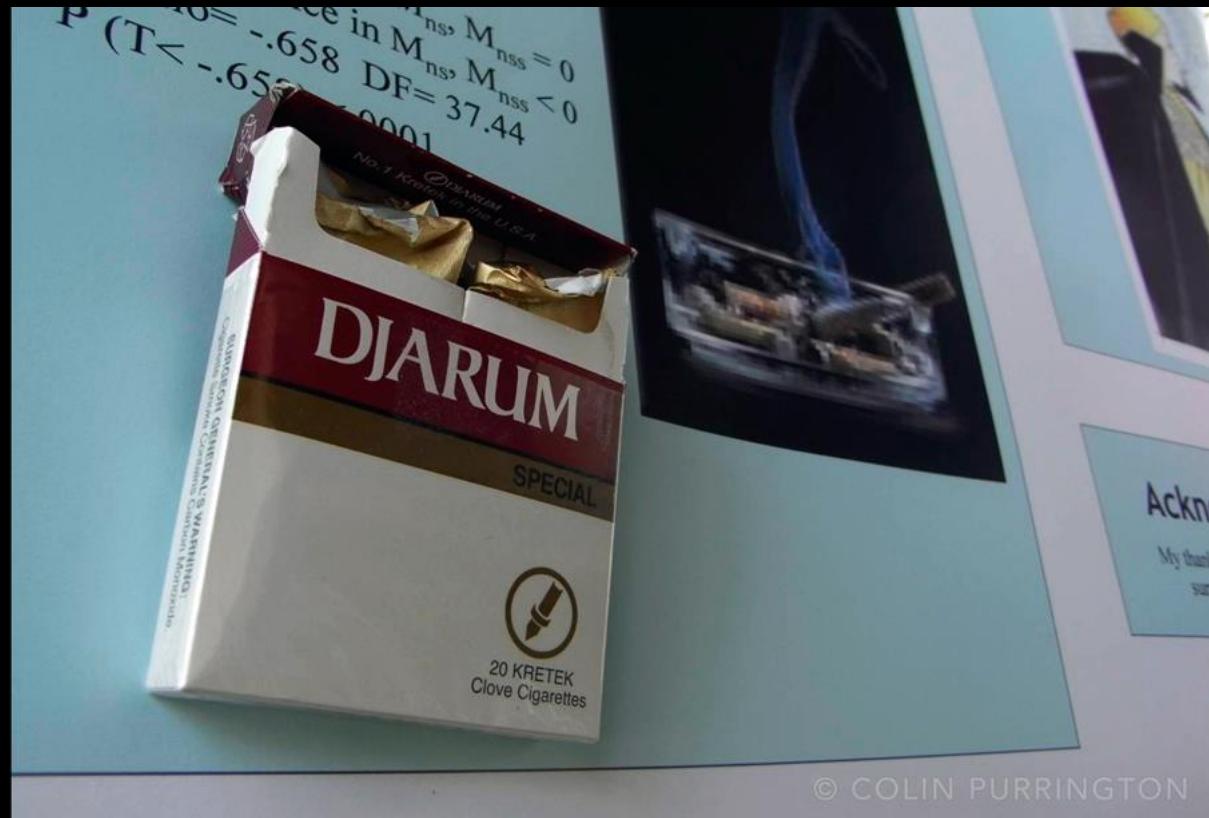
## Further information

More tips than you'd ever want can be found on "Designing conference posters," at <http://colinpurrington.com/tips/academic/posterdesign>. [Note the URLs should be stripped of automatic hyperlink formatting prior to poster printing a poster; you can do this by right-clicking, then "remove hyperlink."] This file and contents copyright Colin Purrington. Free for people to link to and use, but not for plagiarizing, adapting, or hosting elsewhere (thanks!).

## Add hidden-panel



# Add 3D dimension



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DO NOT  
PUT LOGOS.  
HERE.

# Title pitched at general audience that provides conclusion or at least hints at something interesting

Doing so crowds the title and visually distracts from important graphics. Put logo on your business card, not poster.

DO NOT PUT LOGOS here, either.

Colin B. Purrington, Department of Posterology, Hudson University

## Introduction to question(s)

Three sentences max. Persuade reader you have novel, interesting question(s).

Resist urge to use all the white space.

## Results and Conclusions

Put a question here.

Insert a LARGE photograph, chart, quotation, map, or table that addresses question on left. Annotate with arrows and callout text boxes so that viewer is visually led through how question is addressed. Keep font size of all text as big or bigger than rest of poster.

Put an interesting conclusion here. Three sentences max. Two better. One best.

## Methodology

Three sentences max.

Sometimes adding a pic is good.

Put another question here.

Do the same here if you have a second question.

Put an interesting conclusion here.

## Literature cited

Author, J. 2012. Article title. *Journal of Something* 1:1-2.

## Acknowledgments

Be brief.

## Further information

Please see <https://colinpurrington.com/tips/poster-design> for more templates and advice. I'm at colinpurrington@gmail.com if you have a question or comment.

DO NOT  
PUT LOGOS  
HERE.

Doing so crowds the title and visually  
distracts from important graphics. Put  
logo on your business card, not poster.

# Title pitched at general audience that provides conclusion or at least hints at something interesting

DO NOT PUT LOGOS here, either.

Colin B. Purrington, Department of Posterology, Hudson University

## Introduction

Three sentences max.

Persuade reader you have novel, interesting question(s) and hypothesis. Resist urge to use all the white space.

## Materials and methods

Three sentences max.

If viewer truly wants to know gruesome details, they'll ask or email you. Sometimes adding a pic is good.

## Results

Highlight your LARGE photographs, charts, maps, or in this central arena.

Don't include every graphic you've made that relates to project. Choose one. Or two. And separate graphics with plenty of white space.

If you have just one or two simple graphics, viewers will be drawn to explore them. If you have too many or they are too complicated, they will be repelled.

Annotate graphics with arrows and callout boxes so that viewer is **visually** led through how hypothesis is addressed. The goal is to enable viewers to understand the logic behind your conclusions *without you needing to be there*.

Keep font size of all text (even graph labels) as big or bigger than in rest of poster.

## Conclusions

Explain why outcome is interesting. Don't assume it's obvious. Three sentences max.

Maybe include a sentence about what you plan to do next.

As for Introduction, don't feel like you need to fill the entire box.

I.e., if you retain a lot of white space you will attract more viewers. Seriously.

## Literature cited

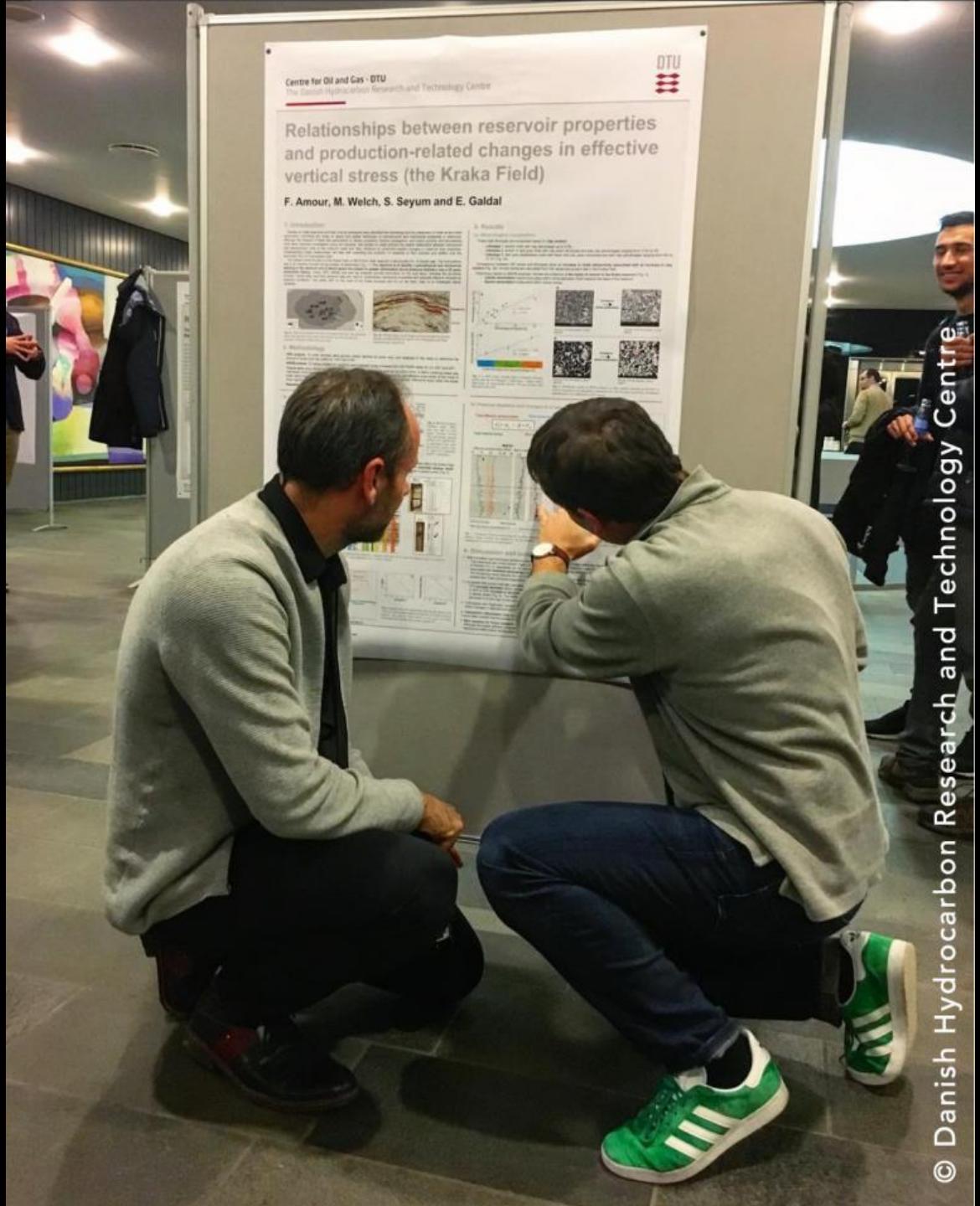
Author, J. 2012. Article title. *Journal of Something* 1:1-2.

## Acknowledgments

Be brief.

## Further information

Please see <https://colinpurrington.com/tips/poster-design> for more templates and tips. I'm at colinpurrington@gmail.com if you have a question or comment.



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Avoid vertical posters

If you have no choice,  
put less important  
information at the  
bottom

Don't put too much text



SUPPORTED BY THE CHARLES LEWIS INSTITUTE

## O<sup>6</sup>-Benzylguanine Inhibits Tamoxifen Resistant Breast Cancer Cell Growth and Resensitizes Breast Cancer Cells to Anti-Estrogen Therapy

Joshua Smith<sup>1</sup>, George C Bobustuc<sup>1</sup>, Rafael Madero-Visbal<sup>1</sup>, Jimmie Colon<sup>1</sup>, Beth Isley<sup>1</sup>, Jonathan Ticku<sup>1</sup>, Kalkunte S. Srivenugopal and Santhi Konduri<sup>1</sup>

<sup>1</sup>Cancer Research Institute of M.D Anderson Cancer Center Orlando <sup>2</sup>Texas Tech University Health Sciences Center, Amarillo, TX



### Abstract

Endocrine therapies using anti-estrogens are least toxic and very effective for breast cancers, however, tumor resistance to tamoxifen remains a stumbling block for successful therapy. Based on our recent study on the involvement of the DNA repair protein MGMT in pancreatic cancer (Clin Cancer Res 15, 6087-2009), here, we investigated whether MGMT overexpression mediates tamoxifen resistance. Specifically, we determined whether administration of MGMT inhibitor [O<sup>6</sup>-benzylguanine (BG)] at a non-toxic dose alone or in combination with the anti-estrogens (tamoxifen/fulvestrant) curtails human tamoxifen resistant breast cancer cell growth. Further, we also determined whether BG sensitizes breast cancers to tamoxifen using tamoxifen resistant cells.

MGMT expression was found to be increased in breast cancer cells relative to normal breast epithelial cells. Also, MGMT levels were significantly higher in tamoxifen resistant MCF-7 compared to the parental cells. Silencing of the ER $\alpha$  expression using a specific siRNA resulted in augmentation of MGMT mRNA and protein levels by 2 fold. We also observed an inverse correlation between MGMT and p53 levels in breast cancer cell lines; moreover, p53 downregulation was accompanied by increased MGMT expression. Other experiments showed that BG alone or BG in combination with tamoxifen or fulvestrant decreased ER $\alpha$  expression, whereas tamoxifen alone and fulvestrant alone increased and decreased the same respectively. However, all three treatments increased p21 expression. Thus, BG and tamoxifen in combination inhibited tamoxifen resistant breast cancer growth in a dose-dependent manner and it also re-sensitized resistant breast cancer cells to anti-estrogen therapy (TAM/ICI). These combinations also enhanced the cytochrome C release and the PARP cleavage, indicative of apoptosis. In breast cancer xenografts, BG alone or a combination of BG with tamoxifen or fulvestrant caused significant tumor growth delay and immunohistochemistry revealed that BG inhibited the expression of MGMT, ER $\alpha$ , ki-67 and increased p21<sup>cleaved</sup> staining. These findings suggest that MGMT inhibition may provide a novel and effective approach for overcoming tamoxifen resistance.

### Introduction

Recent advances in breast cancer research have identified key pathways involved in the repair of DNA damage induced by chemotherapeutic agents. The ability of cancer cells to recognize DNA damage and initiate DNA repair is an important mechanism for therapeutic resistance and has a negative impact on therapeutic efficacy. A number of DNA-damaging alkylating agents attack the nucleophilic O<sup>6</sup> position on guanine, forming mutagenic and highly cytotoxic interstrand DNA crosslinks. The DNA repair enzyme O<sup>6</sup>-alkylguanine DNA methyltransferase (AGT), encoded by the gene MGMT, repairs alkylation damage by catalyzing the transfer of a methyl group from the damaged DNA to a non-coding strand. MGMT is expressed constitutively in normal cells and tissues. In breast tumors, MGMT gene expression is elevated and levels are up to 4-fold higher than in the normal breast. Interestingly, it has been shown that tamoxifen accelerates proteasomal degradation of MGMT in human cancer cells. In 1991, Pegg, Moschel, and Olson determined that O<sup>6</sup>-benzylguanine (BG) inhibited AGT and potentiated the cytotoxicity of both chloroethylenes and methylation agents. In a series of important observations, they fully characterized the interaction between ER $\alpha$  and AGT and its therapeutic impact. They showed ER $\beta$  binds AGT, transactivates AGT to release active-site cysteine [29]. The therapeutic impact is very rapid and more potent than other alkylating agents. AGT inhibiting BG is also able to bind to ER $\alpha$  and activate ER $\alpha$  by interacting directly with both cytoplasmic and nuclear AGT. Because BG is a pseudonucleotide for MGMT which results in the covalent transfer of benzyl group to the active site cysteine, the MGMT protein is degraded after each reaction. This stoichiometric reaction mechanism effectively depletes the AGT content in tumors and the associated repair of alkylation damage. BG is currently undergoing clinical trials in various cancers to increase the efficacy of alkylating agents.

Interestingly, several observations suggest an inverse correlation between the levels of MGMT and p53 tumor suppressor proteins where wild-type p53 suppressed expression of endogenous MGMT [30]. Unfortunately, the function is often inactive or suppressed in certain cancers therefore suppression of ER $\alpha$ /p53 activity is essential for the success of some treatments. However, whether or not this is mediated by suppression of MGMT expression has yet to be determined. To date, the cross-talk between MGMT and ER $\alpha$ /p53 (and the link to p53 expression) has not been explored in drug (i.e., tamoxifen) resistant tumors. The anti-estrogen tamoxifen is the most commonly used treatment for patients with estrogen receptor positive breast cancer. Although many patients benefit from tamoxifen in the adjuvant and metastatic settings, resistance to this endocrine therapeutic agent is an important clinical problem. The primary goal of present study was to investigate the mechanisms of anti-estrogen drug resistance and to design new therapeutic strategies for circumventing this resistance. The results show that MGMT expression is increased in TAM-resistant breast cancers and inhibition of MGMT by BG significantly improves TAM-sensitivity.

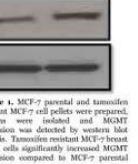
### Results

**Prolonged Treatment of Tamoxifen Increases MGMT Expression:** We developed a tamoxifen resistant MCF-7 cell line by using prolonged treatment of tamoxifen on the parental ER-positive breast cancer cell line, MCF-7. Tamoxifen-resistant MCF-7 cells proliferate at rates similar to the parental MCF-7. Prolonged treatment of tamoxifen onto MCF-7 cells increased MGMT expression compared to parental MCF-7 cells by 2 fold (Fig.1).



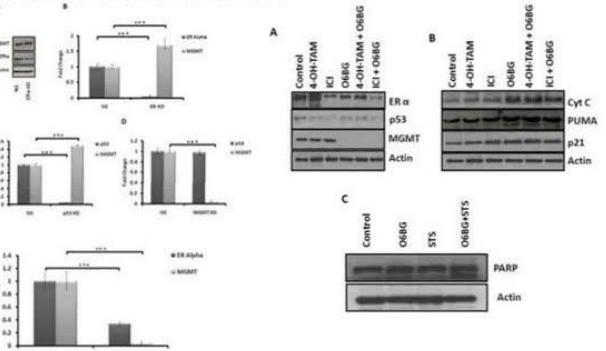
**Figure 1.** MCF-7 parental and tamoxifen resistant MCF-7 cell pellets were prepared, protein lysates were resolved on 10% SDS-PAGE and ER $\alpha$  expression was detected by western blot analysis. Tamoxifen resistant MCF-7 breast cancer cells significantly increased MGMT expression compared to MCF-7 parental cells.

**Transcriptional Regulation Between MGMT and p53:** Previously, it was reported that p53 negatively regulates MGMT in breast cancer cells. Therefore, we addressed whether or not silencing the p53 enhances endogenous MGMT transcription. Tamoxifen-resistant MCF-7 cells were transfected with either p53 siRNA (p53-KD) (Fig.2C) or MGMT siRNA (MGMT-KD) (Fig.2D) along with Non-specific siRNA (NS). MGMT expression was significantly reduced in NS treated cells compared to control experiments showing a ~ 4-fold augmentation (Fig.2A) and as expected, knocking down MGMT decreased MGMT transcription when as p53 mRNA levels were unaffected in MGMT knockdown cells (Fig.2D). These results confirm that p53 can regulate MGMT at the transcriptional level.



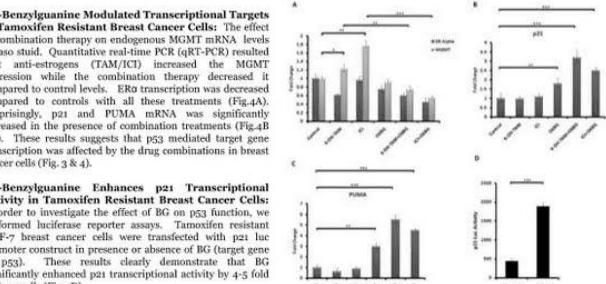
**Figure 1.** MCF-7 parental and tamoxifen resistant MCF-7 cell pellets were prepared, protein lysates were resolved on 10% SDS-PAGE and MGMT transcription was determined by qRT-PCR. (A) Tamoxifen resistant MCF-7 breast cancer cells significantly increased MGMT expression compared to MCF-7 parental cells.

**O<sup>6</sup>-Benzylguanine Plays a Dual Role in Tamoxifen Resistant MCF-7 Cells:** Contrasting with the experiments above, we studied whether or not knocking down MGMT has any effect on ER $\alpha$  transcription. As expected, knocking down MGMT decreased MGMT gene transcripts. However, it was interesting to find that ER $\alpha$  gene transcription was also reduced after MGMT silencing (Fig.2E). These data demonstrate that BG has the ability to attenuate the not only the MGMT, but also the ER $\alpha$  transcription, indicating a possible dual role for MGMT blockers in these breast cancer cells.



**Figure 2.** (A) Tamoxifen resistant MCF-7 cells were transfected with ER $\alpha$  siRNA (ER $\alpha$ ) or NS siRNA (NS) and cells were harvested 72 h post-transfection. Total proteins were isolated and ER $\alpha$  and MGMT expression was determined by western blot analysis. MGMT protein was significantly increased in ER $\alpha$  (100nM) (ER $\alpha$ -KD) and NS (control) (NS) cells. (B) Tamoxifen resistant MCF-7 cells were transfected with ER $\alpha$  siRNA (100nM) (ER $\alpha$ -KD) and NS (control) (NS) and cells were harvested 72 h post-transfection. Total RNA was isolated and MGMT and ER $\alpha$  transcription was determined by qRT-PCR. (C) Tamoxifen resistant MCF-7 cells were transfected with p53 siRNA (20 nM) knock down (p53-KD) and tamoxifen resistant MCF-7 breast cancer cells. MGMT and p53 transcription was determined by qRT-PCR. (D) Tamoxifen resistant MCF-7 cells were transfected with non-specific siRNA (NS) (control) and MGMT siRNA (100nM) knock down tamoxifen resistant MCF-7 breast cancer cells. MGMT and p53 transcription was determined by qRT-PCR. There was no significant correlation between MGMT and p53.

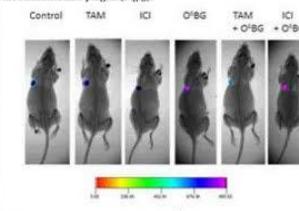
**O<sup>6</sup>-Benzylguanine Modulates p53 Down-Stream Targeted Protein Expression:** Encouraged by the results reported, we investigated the effect of combination therapy on endogenous MGMT, p53, and ER $\alpha$  protein expressions. As expected, BG decreased MGMT expression, while combination therapy (4-OH-TAM or ICI combined with BG) significantly decreased both MGMT and ER $\alpha$  expressions. BG alone or in combination with tamoxifen or ICI decreased ER $\alpha$  expression, whereas tamoxifen alone and ICI alone increased and decreased the same respectively (Fig.3A). p53 expression was slightly altered after ICI treatment. The reduction in p53 expression by ICI alone was reversed when BG was combined (Fig.3A). We investigated the effect of BG on proteins which are involved in cell cycle regulation, apoptosis in tamoxifen resistant breast cancer cells. All these treatments significantly increased the p21<sup>cleaved</sup> protein expression (Fig.3B). PUMA expression was also increased with these treatments. Hence, PUMA may have translocated to the mitochondria, cytochrome C is released (Fig.3B), and apoptosis was triggered in these cells in presence of combination therapy. PARP cleavage is seen in BG treated cells in presence of staurosporin as an indicative of apoptosis (Fig.3C). Therefore, this data suggest that BG promotes cell cycle arrest and can induce apoptosis by modulating p53 function.



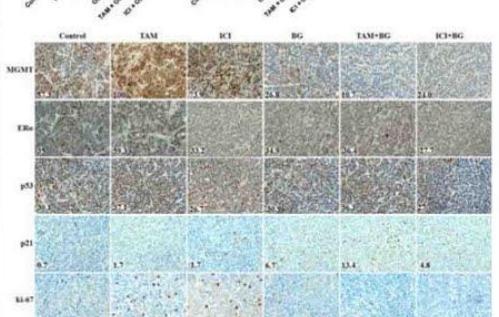
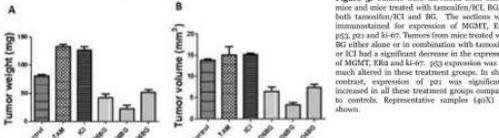
**Figure 3.** (A) Tamoxifen resistant MCF-7 cells were transfected with ER $\alpha$  siRNA (ER $\alpha$ ) or NS siRNA (NS) and cells were harvested 72 h post-transfection. Total proteins were isolated and western blot analysis was performed. (A) ER $\alpha$  (100 nM) (ER $\alpha$ -KD) and NS (control) (NS) cells. (B) Cytochrome C, PUMA, p21, p53 expression was determined by qRT-PCR. (C) Tamoxifen resistant MCF-7 cells were transfected with 4-OH-TAM or ICI alone or with BG for 48 h and later treated with staurosporin (5  $\mu$ M/L) for 6 hrs PARP cleavage was determined by western blot analysis.

**O<sup>6</sup>-Benzylguanine Inhibits Tamoxifen Resistant Breast Cancer Cell Growth and Increases Resistant Breast Cancer Cell Sensitivity to Anti-Estrogen Therapy (TAM/ICI):** Detailed analysis revealed that all the mice had tumors in the breast. The data summarized in Table 1 show the daily BG alone or in combination with twice weekly tamoxifen/ICI significantly decreased median tumor volume and weight as compared with that seen in tamoxifen/ICI treated and control mice. The combination of BG with tamoxifen or ICI produced the greatest decrease in median tumor volume as compared with control mice (83.99 mm<sup>3</sup>, 9.33 mm<sup>3</sup> (TAM+BG), respectively;  $p < 0.0001$ ; (83.99 mm<sup>3</sup>, 31.60 mm<sup>3</sup> (ICI+BG), respectively;  $p < 0.0001$ ). Tumor weight was also significantly reduced in mice treated with combination therapy as compared with control mice (81.23 mg, 22.30 mg (TAM+BG), respectively,  $p < 0.0005$ ; (81.23 mg, 51.57 mg (ICI+BG), respectively,  $p < 0.0005$ ). (Table 1). Body weight was not changed among all treatment groups as compared with control mice. No visible liver metastases were present (enumerated with the aid of a dissecting microscope) in all treatment groups.

**Histology and IHC Analysis:** We next determined the *in vivo* effects of BG (alone or in combination) with tamoxifen/ICI. Tumors from mice treated from different treatment groups were processed for routine histological and IHC analysis. Tumors from mice treated with BG alone or in combination with tamoxifen/ICI exhibited a significant decrease in Ki-67 as compared with tumors treated with tamoxifen/ICI alone or control group. p53 expression was not markedly altered in these treatment groups. In sharp contrast, the expression of p21 was significantly increased in tumors from mice treated with BG either alone or in combination with tamoxifen/ICI. The images were analyzed by ImageJ (NIH) and MGMT, ER $\alpha$ , p53, p21 and ki-67 expressions were quantified by the ImmunoRatio plugin (Fig.5).



**Figure 4.** Tumors from control mice and mice treated with tamoxifen/ICI, BG, or both tamoxifen/ICI and BG. The software was ImmunoRatio (NIH) and the markers used were MGMT, ER $\alpha$ , p53, p21 and ki-67. Tumors from mice treated with tamoxifen/ICI alone or in combination with tamoxifen/ICI had a significant decrease in the expression of MGMT, ER $\alpha$  and ki-67. p53 expression was not significantly increased in these treatment groups. In contrast, expression of p21 was significantly increased in all these treatment groups compared to controls. Representative samples (x0) are shown.



### Conclusions

- In the present study, we observed that prolonged treatment with anti-estrogens causes drug resistance by increasing the expression of the DNA repair enzyme O<sup>6</sup>-benzylguanine (BG).
- Decreasing the expression of MGMT by exposing breast cancer cells to BG sensitized these cells to anti-estrogen therapy (tamoxifen and ICI 82.7%;BG).
- We also observed that combination therapy of anti-estrogens and MGMT blockers not only overcome the MGMT derived drug (tamoxifen and ICI) resistance but also increased the efficacy of anti-estrogen therapy by decreasing estrogen receptor expression and restoration of the functional activity of p53 in tamoxifen-resistant breast cancer cells.
- Combination therapy inhibited tamoxifen resistant breast tumor growth *in vivo*.

### Acknowledgements

We would like to thank the Florida Department of Health, Rosalind-Cole Cancer Research Program (cRNs) for their funding of this project.

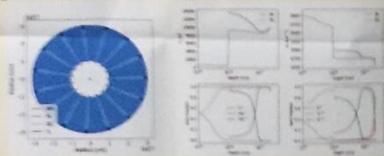
# Bi-abundance photoionization models of planetary nebulae

## Abstract

We explore the behavior of Te(BJ) - the Balmer jump electronic temperature - and ADF - the abundance discrepancy factor - as determined from synthetic emission generated with bi-metallicity (normal and metal-rich) photoionization models of PN. We determine the fraction of oxygen embedded in the metal-rich region (with a fraction of volume less than 1%) to be roughly between 25% and 60% of the total amount of oxygen in the nebula in the case of PN NGC 6153.

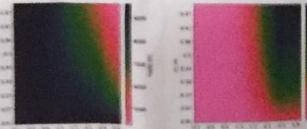
## The models

- With the code Cloudy v17.02beta (Ferland et al. 2017 RMxAA 53, 385) we simulate a PN with two metallicities: close to solar and metal-rich (see right side of following figure).
- The initial parameters are set up based on a 3D chemically inhomogeneous model (Yuan et al. 2011 MNRAS 411, 1035) of PN NGC 6153 with a measured ADF(O<sup>++</sup>) = 9.2 (Liu et al. 2000 MNRAS 312, 585).
- We vary the volume contribution ( $\Omega/4\pi$ ) and the abundance contrast factor between the metal-rich and normal components (ACF). For an ACF = 2.1 dex we show the Te, ne, H<sup>+</sup>, He<sup>+</sup>, He<sup>++</sup>, O<sup>+</sup>, O<sup>++</sup>, and O<sup>+++</sup> as a function of depth, in the right side of the following figure (with ACF = 2.1 dex).



## Estimating the Te(BJ) and ADF(O<sup>++</sup>)

- Using the synthetic spectra generated from the combined models we estimate the Balmer Jump temperature (left side of figure).
- We determine the electronic temperature and density (with [OIII] and [Cl III] line ratios) and the ionic abundances of O<sup>++</sup>/H<sup>+</sup> with CELs and ORLs, to finally obtain the ADF(O<sup>++</sup>) which is shown on the right side of the figure.



## Comparing to observations

In the left side of the following figure, we compare the temperature difference  $\Delta T = Te([OIII]) - Te(BJ)$  and the ADF(O<sup>++</sup>) that results from our models (color gradient dots) with the observed values for the PN NGC 6153 (red diamond). From this we find that two solution families of models adjust the observed value: lower ACF and higher  $\Omega$  or higher ACF and smaller  $\Omega$ . They are shown in the right of the following figure.



## Two solutions from our models



	Normal	Rich clumps	Behind clumps	Shadow
$-Te$ [K]	9654 (9654)	618 (532)	8852 (7267)	6236 (6226)
$-n_e$ [ $\text{cm}^{-3}$ ]	2767 (2767)	4046 (5730)	2721 (2603)	2711 (2711)
12-log(O/H)	8.75 (8.75)	10.95 (11.65)	8.75 (8.75)	8.75 (8.75)
$\Omega/4\pi$	0.64 (0.82)	0.36 (0.18)	0.36 (0.18)	0.36 (0.18)
H <sup>+</sup> /H	0.99 (0.99)	1.00 (1.00)	0.99 (0.99)	0.98 (0.98)
O <sup>+/O</sup>	0.68 (0.68)	0.66 (0.69)	0.26 (0.93)	0.51 (0.51)
O <sup>++/O</sup>	0.85 (0.85)	0.86 (0.29)	0.73 (0.00)	0.48 (0.48)
O <sup>+++/O</sup>	0.07 (0.07)	0.09 (0.02)	0.00 (0.00)	0.00 (0.00)
$\Omega_{\text{min}}$ ( $10^{-3} \text{ M}_\odot$ )	8.45 (9.72)	6.67 (11.02)	4.67 (1.68)	0.00 (1.39)
Vol [ $10^{36} \text{ cm}^3$ ]	444.51 (563.89)	723 (1.16)	240.54 (88.53)	0.00 (0.74)
% mass	0.36 (77.63)	1.18 (13.44)	35.16 (17.39)	0.00 (2.66)

\* Fraction of solid angle for each component  
Table: Physical parameters for each one of the four components, for the two solutions S<sub>1</sub>, and S<sub>2</sub> (in parenthesis).

This work has been submitted by Gómez-Llano & Morisset for publication

# No long lines

THE TIMES Friday November 6, 2015 | www.thetimes.co.uk | No. 21388

30 best shows to book for Christmas Times2

Bricks & Mortar Why country piles are a bargain now

## Universities allowed to raise fees if they improve teaching

Universities will be allowed to increase their fees at certain fee-setting bodies under new rules to encourage them to offer high-quality lectures and tutorials under central government proposals.

From next year, instead of the current system of 12 universities a year, only six out of the three sectors of higher education will have the power to decide their own standards of academic teaching would be allowed to charge the most, while universities whose standards are found to have slipped could be forced to cut fees for new recruits. A regulator to champion students' interests would also be set up.

The plan represents the first attempt to test whether, on the quality of teaching, the move towards the big picture of higher education is paying off.

A joint paper from the Department for Business suggests modest initial changes from 2012 when all universities meeting basic quality checks could increase fees above £20,000 to fees with subsidies.

In subsequent years, universities would face more competition by offering postgraduates at teaching fees, the introduction of a new funding system for teaching.

In the meantime, the government says it wants to make sure a majority of students are in courses with a teaching fee linked to teaching standards.

It wants to base fee increases on

the lowest maximum fees that are set and those to be charged. The quality of teaching would be assessed over three or five years with universities subgrouped or grouped together. The new system will come into force in 2016.

Increasing university fees would depend on teaching quality, it said. In England average fees are £9,200.



# Gaia DR2 distances to planetary nebulae

Arturo Manchado (1,2,3), Iker González-Santamaría (4), Minia Manteiga (4), Ana Ulla (5) Carlos Dafonte (4)

(1) Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain, [amr@iac.es]  
 (2) Universidad de La Laguna, Dept. Astrophysics, 38206 La Laguna, Tenerife, Spain  
 (3) CSIC, Spain

(4) Dept. of Information and Communication Technology, Universidade da Coruña (UDC), Campus Elviña s/n, 15071 A Coruña, Spain  
 (5) Universidad de Vigo (UVigo), Dept. Applied Physics, Campus Lagoas-Marcosende, s/n, 36310 Vigo, Spain

## ABSTRACT

We present a catalogue of central stars of planetary nebulae (CSPN) with reliable distances and positions obtained from Gaia Data Release 2 (DR2) astrometry. By X-matching different catalogues with Gaia

DR2 astrometry we were able to identify 1571 objects in Gaia second archive, for which we assumed distances calculated upon a bayesian statistical approach. For a more detailed study, within this set, we select a subset of 211 PNe, those ones with most reliable distances. We have compared

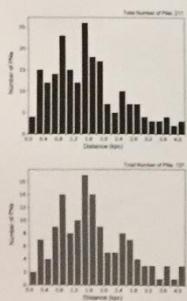
distances with distances derived with other methods. In addition, we have found that the Gaia sample is completed up to 2 Kpc. Distances derived from parallaxes allow us to analyze the galactic distribution and estimate other parameters like sizes, kinematic ages or bolometric magnitudes and luminosities.

## SELECTION CRITERIA

- We considered all PNe listed in Kerber et al. (2003); Stanghellini & Haywood (2010); Weiszmann & Gamen (2011), and HASH database (Parker et al. 2016) (2554 PNe).
- X-match with Gaia DR 2 (1948 sources with measured parallaxes).
- After visual inspection, we selected only stars within 5 arcseconds of the PN coordinate (1736 PNe).
- We set a lower limit for parallax relative errors of 30%.
- We set a lower limit for unit weight error  $UWE < 1.9$  (this depends on the quality of the photometry), and renormalised unit weight error  $RUWE < 1.4$  (This depends on the quality of the photometry) (Lindgren et al. 2018).
- Finally 211 Gaia PN (GAPN) fulfill the above criteria.
- Distances were derived upon a bayesian statistical approach (Bailer-Jones et al. 2018).

## COMPLETENESS OF THE SAMPLE

In Figure 1, we show the histogram of the whole GAPN sample, for all Galactic longitudes, and for Galactic longitudes between -90 and 90. It is shown that the number of PNs drops abruptly, for distance larger than 2 Kpc, therefore we can conclude that the sample is complete up to 2 kpc.



**Figure 1** Histogram of distances for GAPN for the full sample (upper panel) and only for objects in the galactic centre direction with longitudes between -90 and +90 (lower panel).

## COMPARISON WITH OTHER DISTANCES DETERMINATIONS

In Figure 2, we compare our distances with those of Harris et al. (2007), for astrometry; Hopkins (2001), for non-LTE model stellar atmosphere fitting; Stanghellini & Haywood (2010), for statistical distances; Frew et al. (2016); for surface brightness versus radius; and Schönbäumer et al. (2018), for hydrodynamic model fitting.

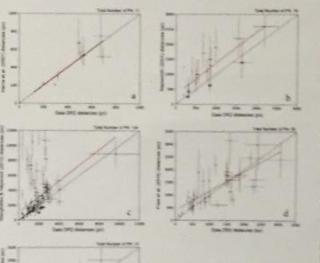
As can be seen the comparison with other astrometric distances, such as those in Harris et al. (2007), shows a good agreement between uncertainties.

Statistical distances (Stanghellini & Haywood 2010) do not agree with Gaia ones, showing overestimated values in many cases. A linear fit to these distances leads to a bias of 1 kpc. The scatter in Fig. 1 shows that such bias is affected by the presence of a marginal group of objects displaying wide discrepancies with DR2. A possible explanation is that those objects are bipolar or butterfly-like PNe, and such a statistical method cannot be applied to those classes of objects.

The non-LTE stellar atmosphere models, calculate  $T_{eff}$  and surface gravity  $g$  values, which are then used to estimate the mass and luminosity. But far, this method has been applied to 27 CSPN (Bauer et al. 2018). The comparison with the distances derived from the hydrodynamic model fitting (Figs 1 and 2) shows a trend to the largest errors in DR2 distances (lower panel in Fig. 1). A similar fit (hydrodynamic model) to these distances is shown in Fig. 2.

However, for  $T_{eff} > 9000$  (star symbols in panel b), the agreement is very good. A plausible explanation is that non-LTE models are not using line-blanketed atmospheres.

Finally, when considering the results of Frew et al. (2016) and Schönbäumer et al. (2018) determinations, we found no clear bias between their results and our derivations (see panels d and e of Fig. 1). The Frew et al. (2016) distance scale was based on a statistically derived relation of the H $\alpha$  surface brightness evolution with nebular radius. Schönbäumer et al. (2018) converted the distance to 15 round-shaped PNe by assuming the expansion velocity of the nebular rim and shell edges, and by correcting the velocities of the respective shock fronts with 1D radiation-hydrodynamics simulations of nebular evolution.



**Figure 2** Comparison between DR2 and other distance derivations.

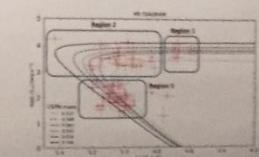
## EVOLUTIONARY TRACKS

After examining several literature compilations with PNe data on  $T_{eff}$  visual magnitudes, and interstellar reddening derivations, for consistency we selected the GAPN in common with the Frew (2008) compilation.

We selected objects with precise values, and restricted our selection to those objects that were neither known binaries nor H-deficient PNe.

Once the luminosities were derived, the stars can be plotted on a HR diagram to compare their distribution with the prediction of evolutionary models for post-AGB stars, e.g. Miller Bertolami (2017).

Figure 3 shows such HR diagram together with the evolutionary tracks for a wide range of masses. Considering the location on the HR diagram of the stars, from Fig. 3, we interpolated masses and evolutionary ages, as shown in Fig. 4. Most of the stars have masses between 0.525 and 0.625 M $_{\odot}$ .



**Figure 3** Hertzsprung-Russell diagram for a selection of GAPN stars, together with Miller Bertolami (2017) evolutionary tracks.

However, for

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# How does sleep disturbance affect hemodialysis patients?

## Methods and Cohort

Adults on maintenance HD with OSA (**n = 36**)



Polysomnogram & Epworth Sleepiness Scale (ESS)



Interview to explore patient experience (**n = 26**)



## Findings

Severity of sleep apnea did not affect patients' sleep duration, sleep efficiency or ESS.

**However,**

**70%** reported broken sleep

**62%** felt unrefreshed upon wakening

## Themes from Interview



Broken sleep



Feeling unrefreshed



Impact of poor sleep



Having to "soldier on"

**Conclusion:** Sleep disturbance is common and has a profound impact on health and QoL of hemodialysis patients. The conflicting message between patient interview and self-reported questionnaires indicate a need for multidisciplinary approaches and improved patient communication to truly capture the health needs of individuals.

**Reference:** Chu G, Price E, Paech G, Choi P and McDonald V. Sleep apnea in maintenance hemodialysis: a mixed methods study. *Kidney Medicine*, 2020

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