Scientific Writing

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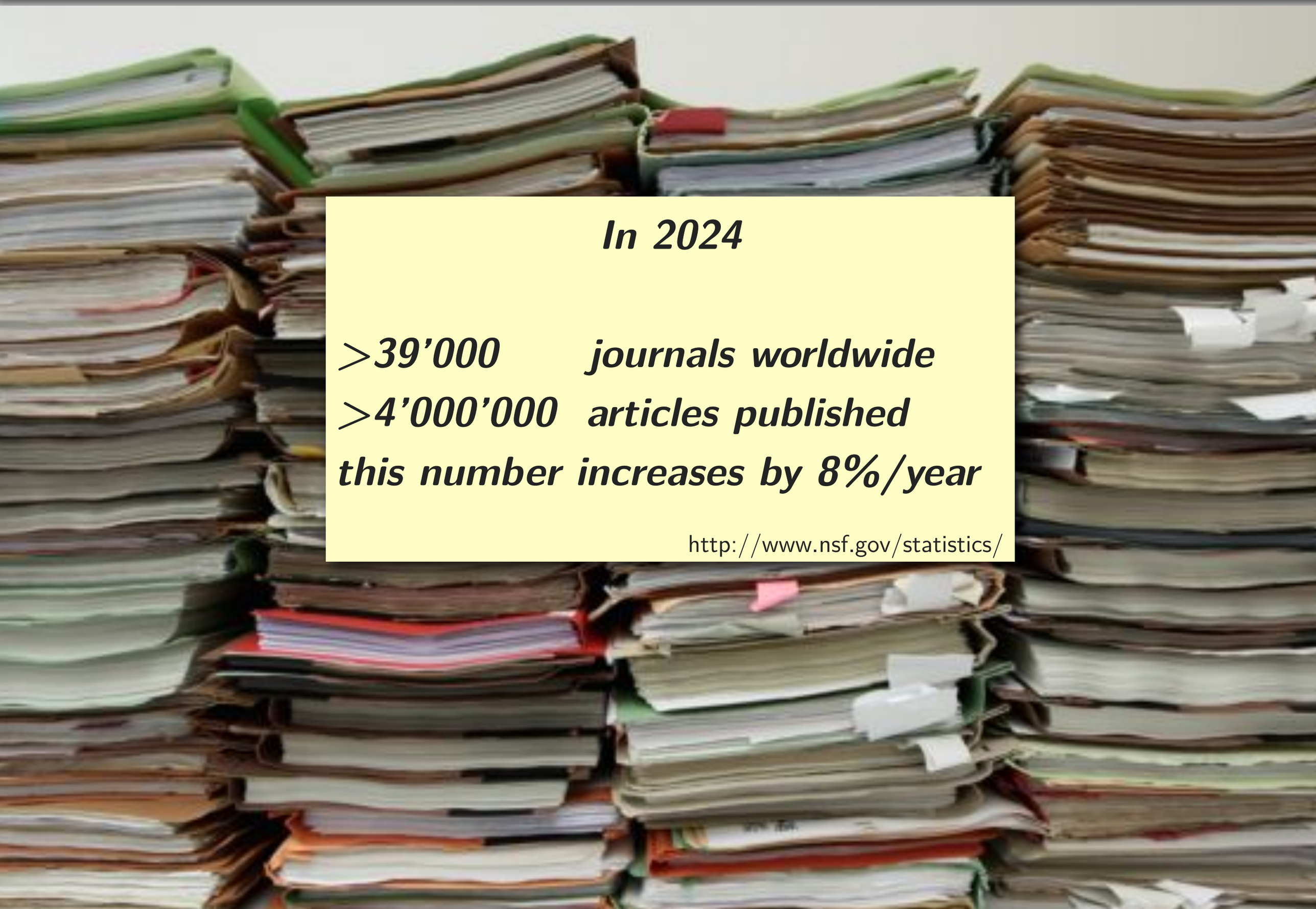
Laboratoire de Physique et Chimie de l'Environnement et de l'Espace

"He didn't publish, so he perished."

Why this course ?



In 2024

$>$39'000 journals worldwide

$>$4'000'000 articles published

this number increases by 8%/year

http://www.nsf.gov/statistics/

Why this course ?

- You will be increasingly often **evaluated**
- The number & quality of your publications is a major evaluation criterion for your academic career
  (but definitely not the only one)

> "Good publication is not just a matter of life and death, it is much more serious than that."
>
> Robert Day

- How many articles should you publish during your thesis ?
- How many as a first author ?
- How many articles per year are you supposed to publish as a senior researcher ?

The pillars of science : what we take for granted

What characterises scientific publications as opposed to other types of publications (journals, etc) ?

The pillars of science : what we take for granted

- **Independence** and **freedom** of research (at least, in our academic world)
- **Open** communication: conferences, seminars, publications, …
- **Peer** review (refereeing) with critical evaluation.
- **Repeatability** of work and compatibility with other results.

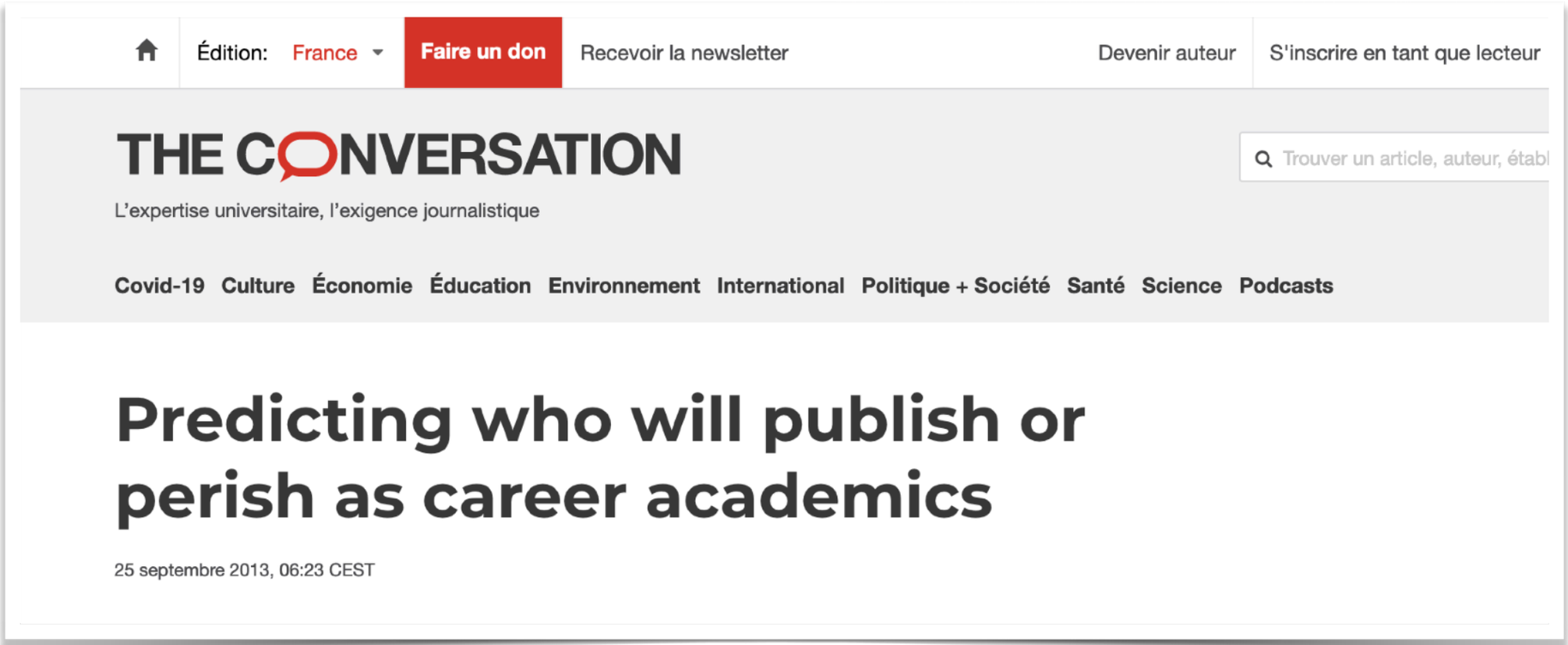
after S. Solanki (2011)

The dress code behind publishing

- Your publications can be properly read/understood only if you conform to a common writing style.

- The whole system (peer review, dissemination, …) relies on **mutual trust.**

How about you ?

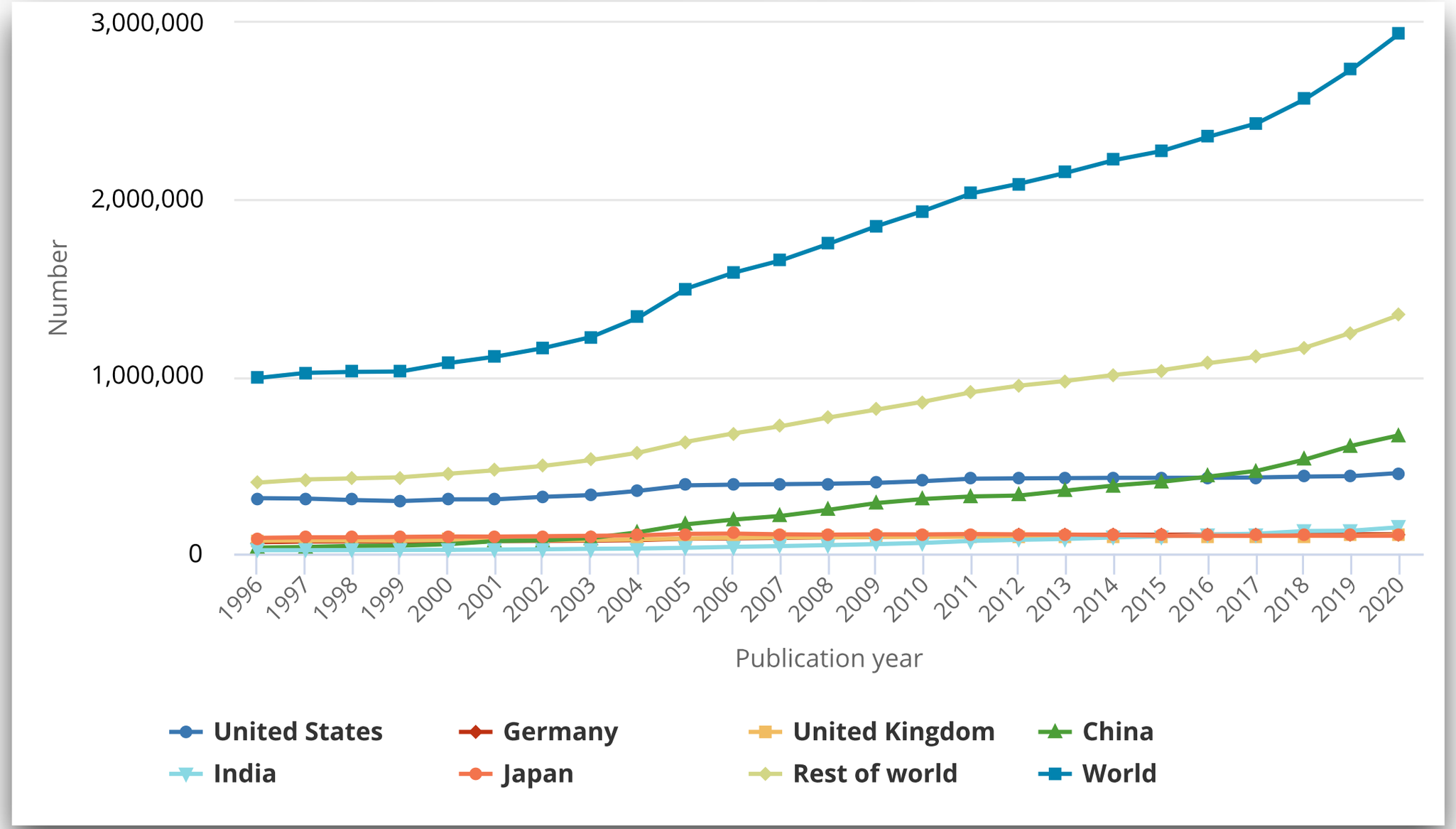


https://theconversation.com/predicting-who-will-publish-or-perish-as-career-academics-18473

- Start publishing as soon as possible !
- Especially if you're a woman and if English is not your native language

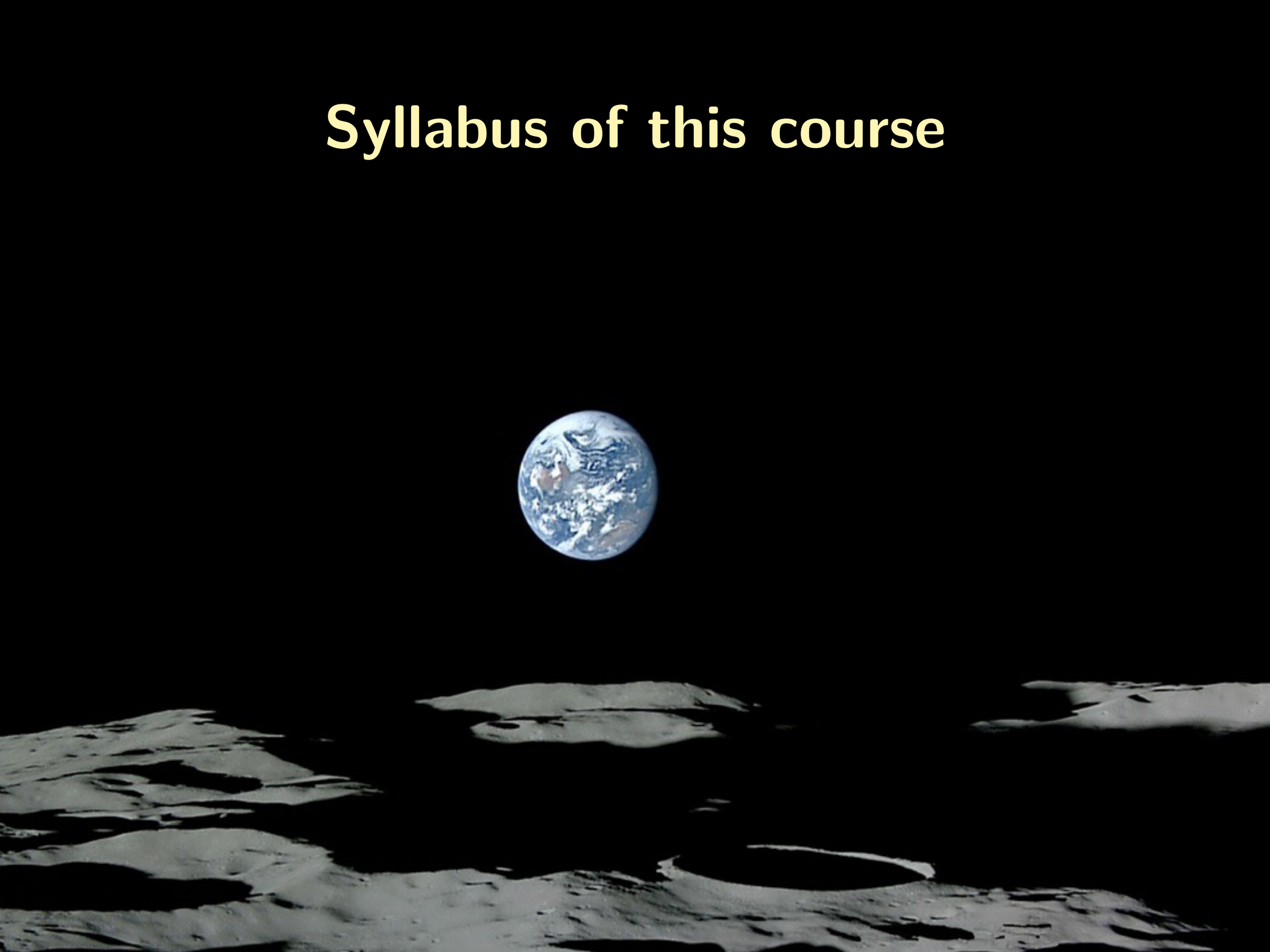
How many publications in science & engineering ?

S&E articles, by selected region, country, or economy and rest of world: 1996–2020



https://ncses.nsf.gov/pubs/nsb20214/publication-output-by-country-region-or-economy-and-scientific-field

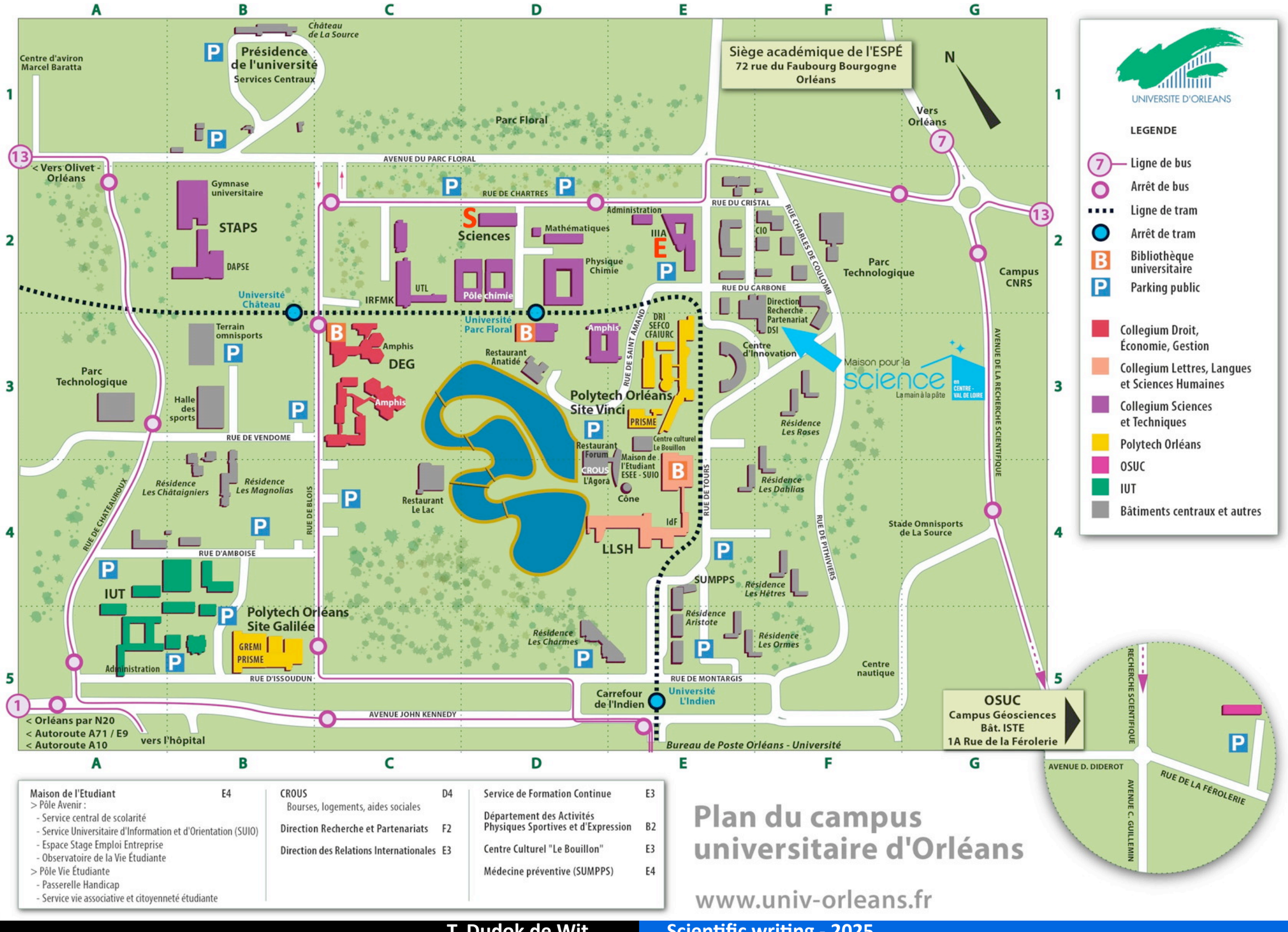
Syllabus of this course



Organisation

- Four instructors
  - Jean-Louis Rouet (ISTO/UFR Sciences)
    jean-louis.rouet@univ-orleans.fr
  - Pascale SOLON (SCD, Bibliothèque Univ.)
    arnaud.moizard@univ-orleans.fr,
    delphine.maillart@univ-orleans.fr
  - Thierry Dudok de Wit (LPC2E/OSUC)
    ddwit@cnrs-orleans.fr
- Language : English
- Location: see on Celene

Where ?



Maison de l'Etudiant	E4	CROUS Bourses, logements, aides sociales	D4	Service de Formation Continue	E3
> Pôle Avenir :		Direction Recherche et Partenariats	F2	Département des Activités Physiques Sportives et d'Expression	B2
- Service central de scolarité		Direction des Relations Internationales	E3	Centre Culturel "Le Bouillon"	E3
- Service Universitaire d'Information et d'Orientation (SUIO)				Médecine préventive (SUMPPS)	E4
- Espace Stage Emploi Entreprise					
- Observatoire de la Vie Étudiante					
> Pôle Vie Étudiante					
- Passerelle Handicap					
- Service vie associative et citoyenneté étudiante					

Plan du campus universitaire d'Orléans

www.univ-orleans.fr

Contents

- Writing a good scientific document (T. Dudok de Wit)
- Different types of documents (T. Dudok de Wit)
- Basics of LaTeX : Styles and typography (J.-L. Rouet)
- Documentary research and how to organise references (P. Solon)
- Open science, ethical aspects (P. Solon)
- The submission and revision process (T. Dudok de Wit)

Homework

Mandatory to validate this course

- Attend the course (attendance sheet)
- Submit a **short article** (3-6 pages) by mid-May
  - follow rules of scientific publishing
  - LaTeX preferable but not mandatory
- Submit a **peer review** by the end of May
  - review the article of one of your colleagues
  - anonymous

What we will NOT address

- Oral communication (how to give a talk)
- Non-scientific writing (reports, …)
- Making posters
- Specifics of publishing in social sciences, medicine, etc.

Useful documents

- All relevant documents are on CELENE

  https://celene.univ-orleans.fr/course/view.php?id=2338

Notation

Whenever you see such a box

$=$ take home message

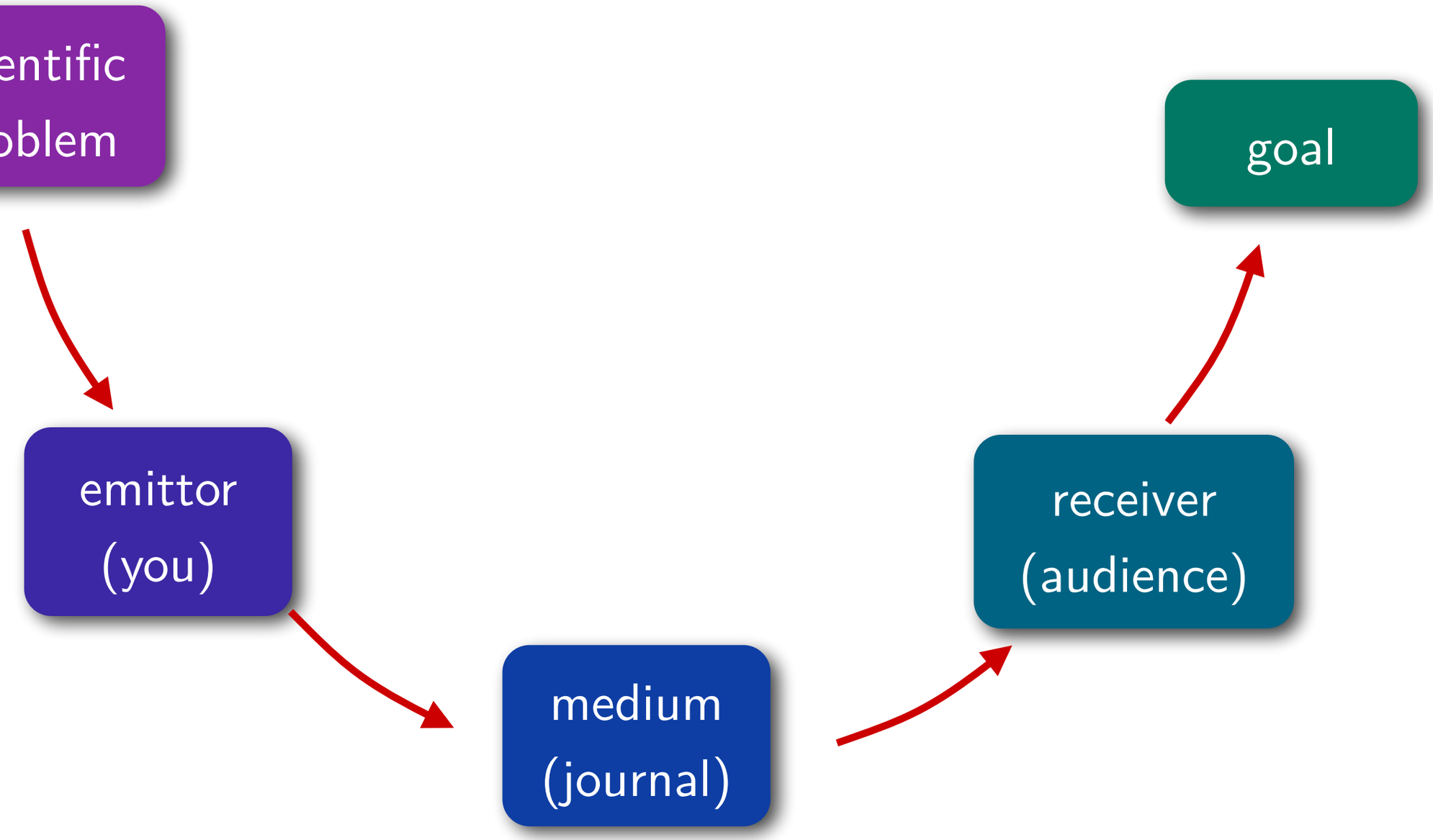
Setting your priorities straight

Quizz : why should I publish ?

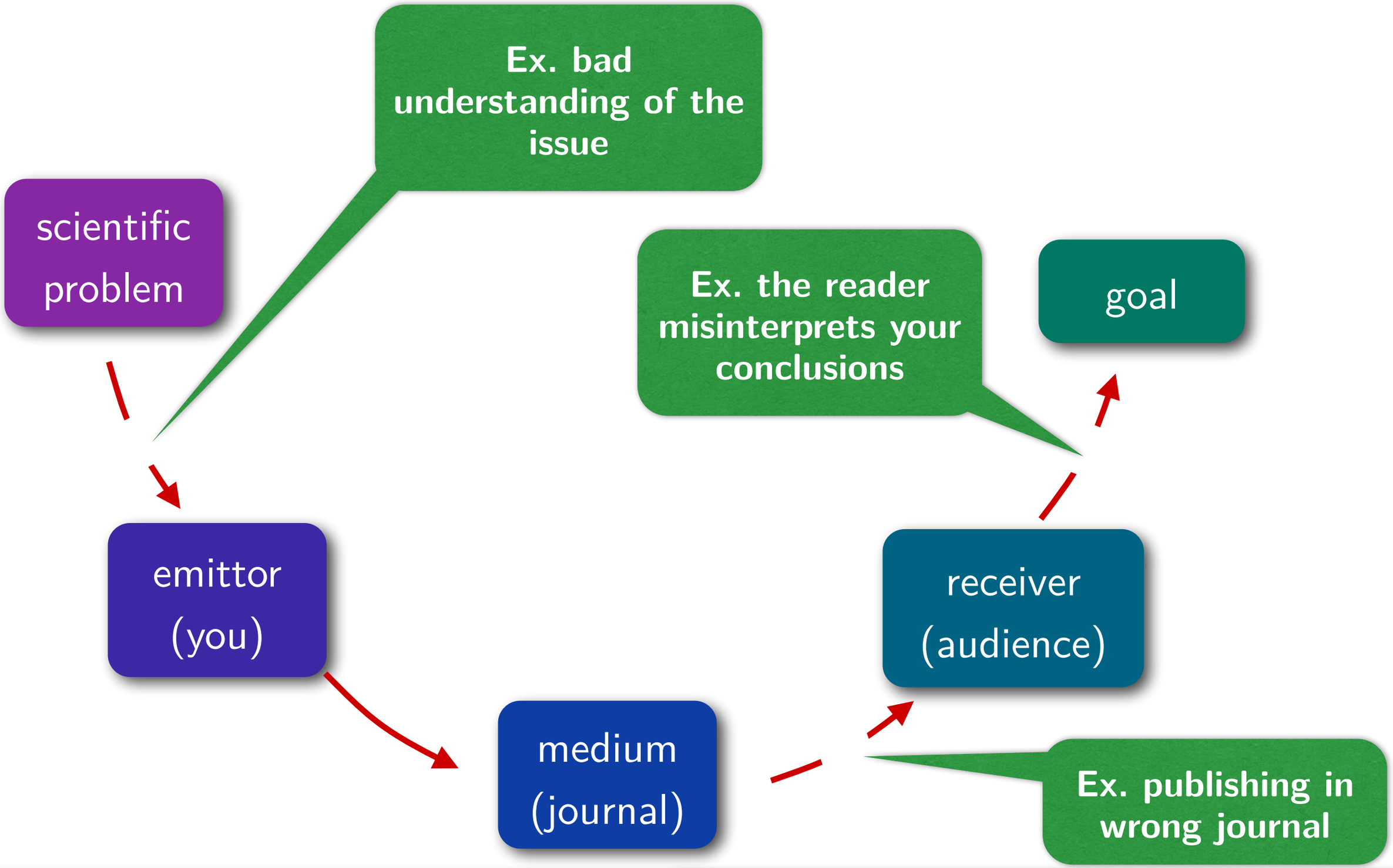
Priorities

- **Audience** : who am I writing for ?
- **Message** : what do I want to communicate ?
- **Objective** : why should I communicate on this ?

Communication chain



Breaking the communication chain

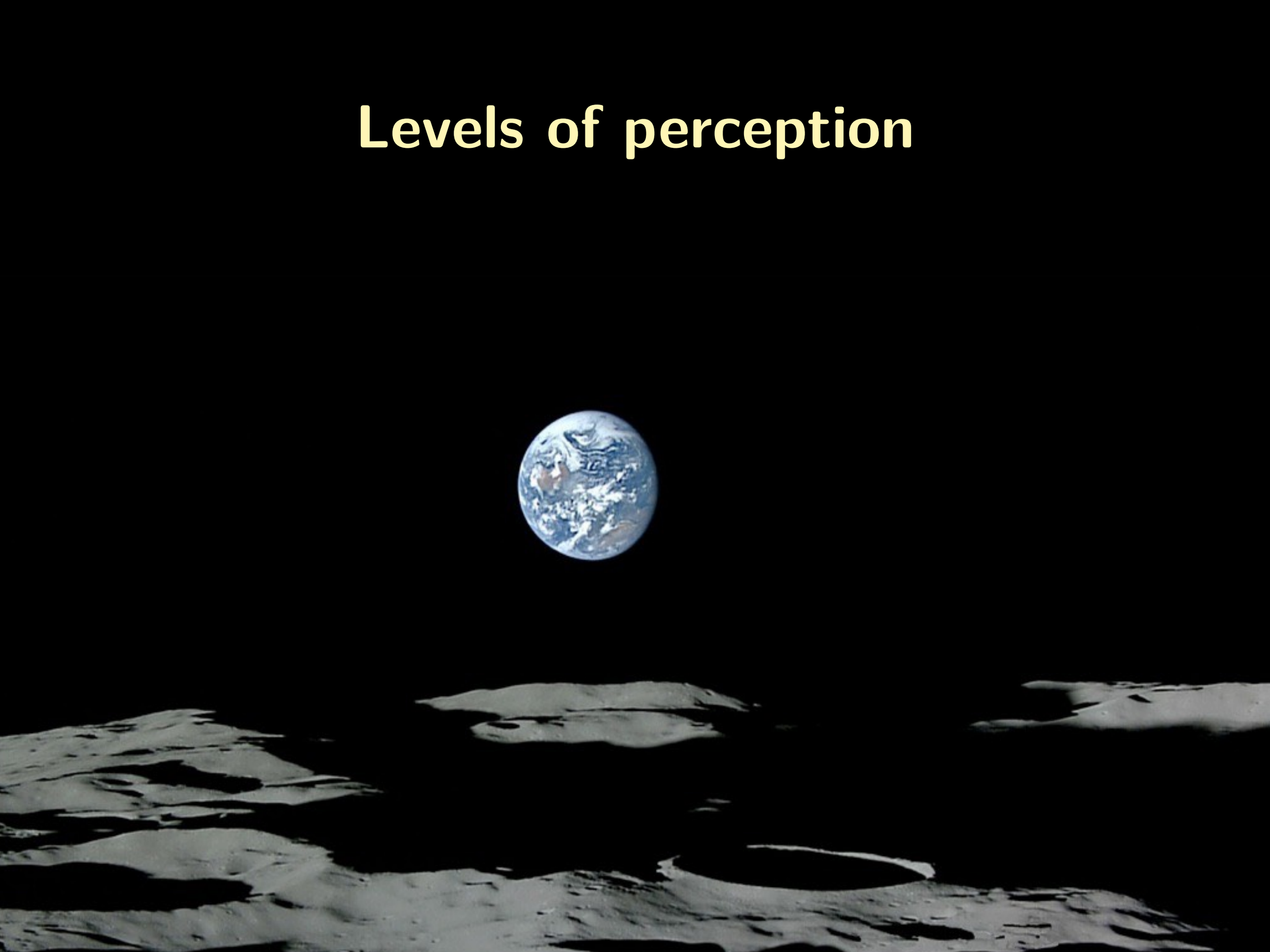


Take home message

Any rupture will break the full chain

Take home message: are all links working ?

Levels of perception



Levels of perception

Although consistently active, every few thousand years, Mount Vesuvius erupts in spectacular style with stunning fireworks. The last time it did so, in ad 79, it consumed the city of Pompeii in the flames. To protect the observatory, it was decided to build it far enough from the summit to be safe from ejected debris and high enough on a knoll to avoid the lava flows.

- What different styles can you detect ?

3 levels of communication

1. Conceptual

- ideas, reasoning, analysis, ...
- conveys the reasoning
- *e.g. I understand what you mean*

2. Factual

- facts, feelings, ….
- tells about your role
- *e.g. I measured these quantities...*

3. Emotional

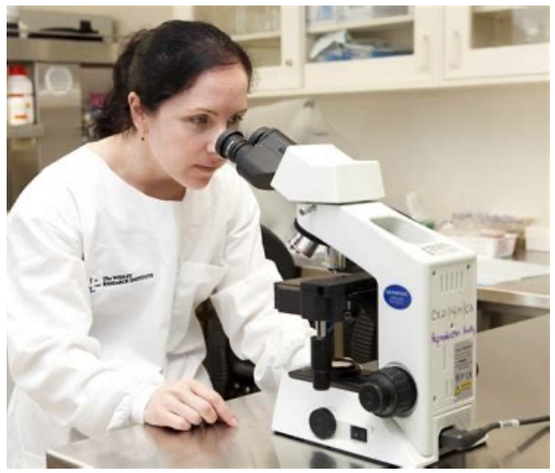
- feelings, belief, emotions, ...
- allows you to share your feelings
- *e.g. I'm impressed by the way you...*

3 levels of communication

- These 3 levels correspond to our 3 entities of perception
  - **spirit** (conceptual, rational) : I **understand** what you write
  - **body** (factual, sensitivity) : I **gather the facts** you mention
  - **heart** (emotional, feelings) : I **adhere** to what you say

You need a mixture of all three levels to communicate properly

3 levels of communication



Scientific communication should be factual and objective

- but not completely devoid of emotion

What is the main level of ... ?

- As a consequence, we pursued the investigation by...
- By lowering the combustion temperature we found...
- Many have wondered before why this occurs so often...
- Note in particular the unusual strength of...
- This inspiring study led to a remarkable result...
- According to this result, we cannot distinguish...
- This result comes as a surprise, because of the large...

Avoid

- **Jargon** :
  “atmospheric deposition of athropogenically-derived acid substances”

- **Euphemism** :
  “The rat lost its integrity”

- **Inflated language** :
  “a three-dimensional biopolymer composite”

Avoid stale language (“langue de bois”)

Le comité propose de considérer cet objectif comme un enjeu majeur et de l’arrimer à des outils clairement établis dans les règles du nouveau programme pour en garantir une opérationnalisation effective.

Language course at ENA

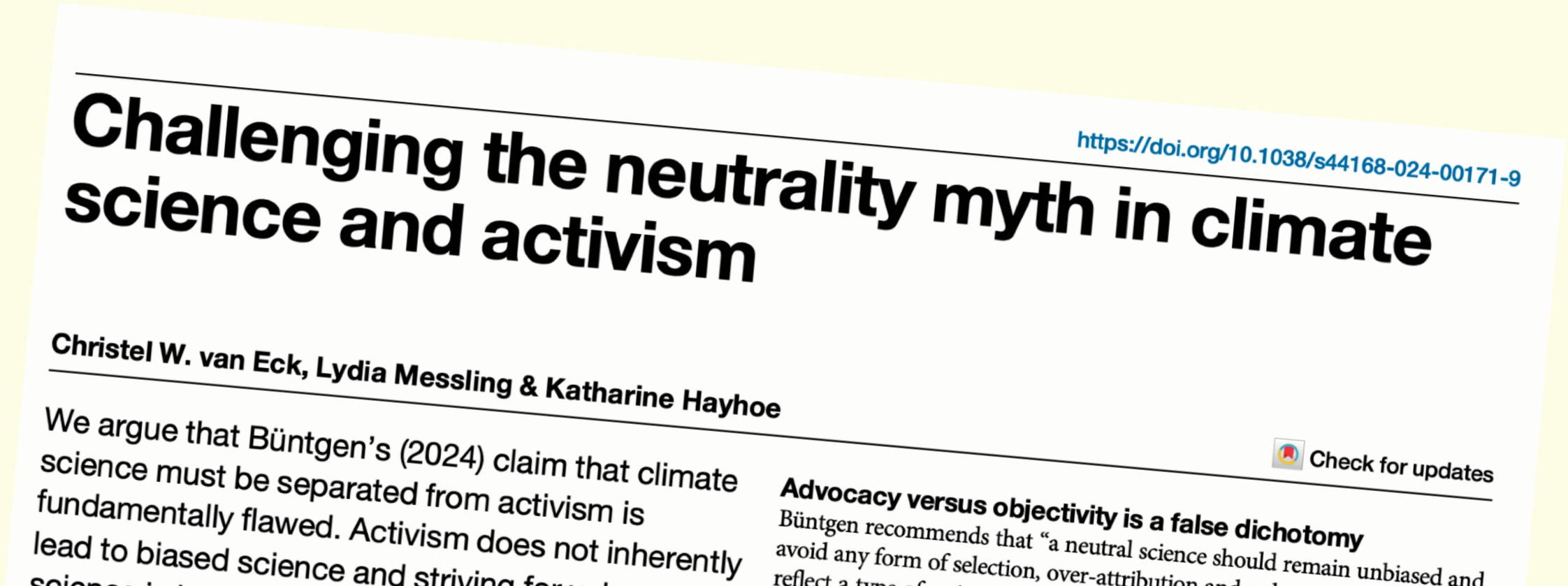
Neutrality

- Should/can scientific articles be both **neutral** and **objective** ?

Neutrality

- Should/can scientific articles be both **neutral** and **objective** ?

  Objective ? always
  Neutral ? not necessarily



Challenging the neutrality myth in climate science and activism

https://doi.org/10.1038/s44168-024-00171-9

Christel W. van Eck, Lydia Messling & Katharine Hayhoe

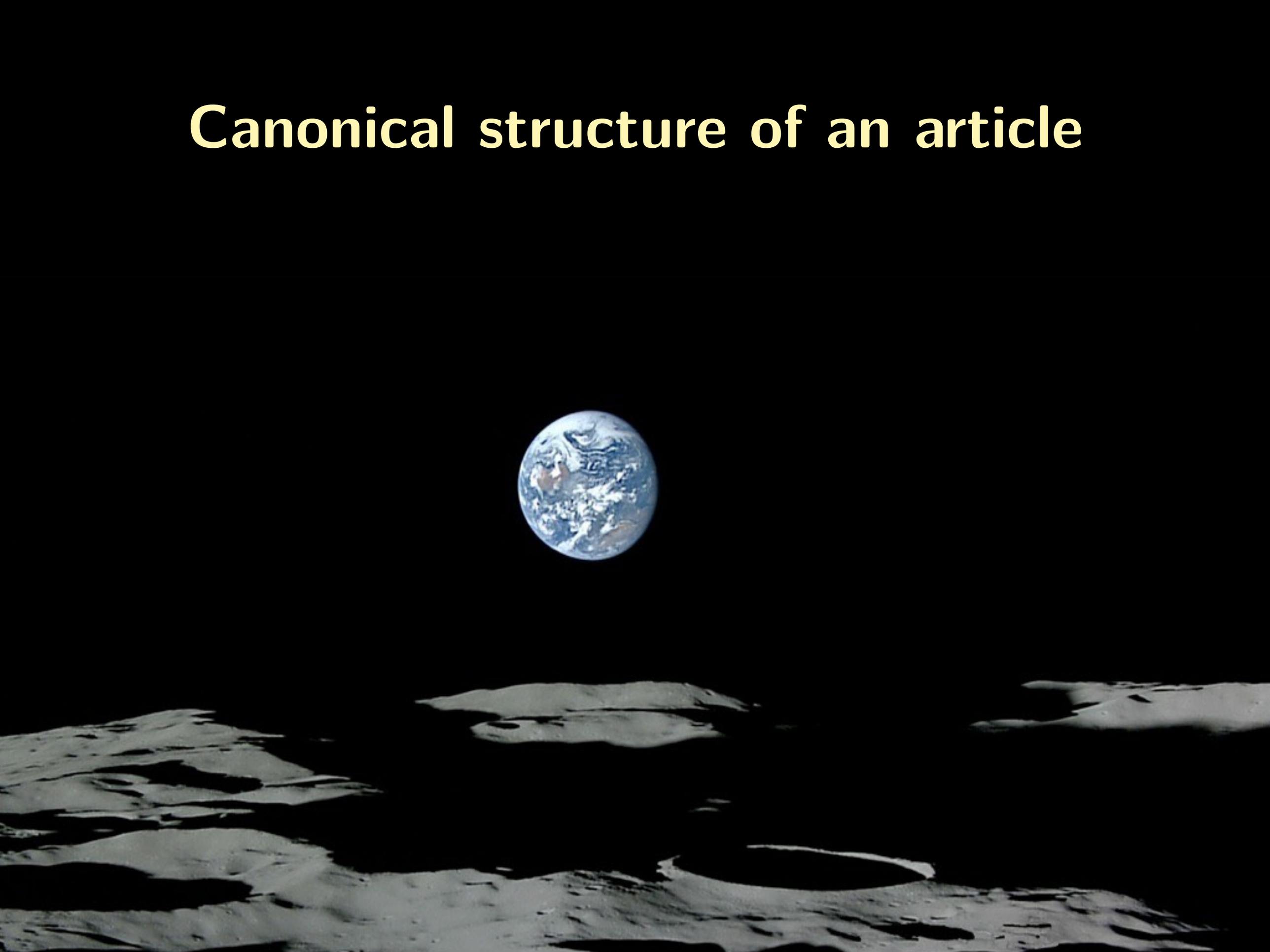
We argue that Büntgen's (2024) claim that climate science must be separated from activism is fundamentally flawed. Activism does not inherently lead to biased science and striving for

Check for updates

Advocacy versus objectivity is a false dichotomy

Büntgen recommends that "a neutral science should remain unbiased and avoid any form of selection, over-attribution and

Canonical structure of an article



Canonical structure

- Title
- Author(s)
- Abstract
- Keywords

Front matter

- Introduction
- Methods
- Results
- Discussion
- Conclusion

Main body (IMRAD)

- Acknowledgements
- References
- Supplementary material

Ending

Canonical structure

- Title
- Author(s)
- Abstract
- Keywords
- Introduction
- Methods
- Results
- Discussion
- Conclusion
- Acknowledgements
- References
- Supplementary material

Introduction

Methods

Results

and

Discussion

= IMRAD

Canonical structure

- The IMRAD structure is **universal**
- Readers can therefore locate immediately what they are looking for = they know how to find their way

If you do not follow this plan
= your communication will not be efficient

1. Title

What makes a good title ?

Titles

- Title = first (and often sole) contact with your audience

Your title must inform the person and encourage him/her to read your article

A good title is…

- concise (ideally < 15 words) and immediate to understand
- catchy
- sells the main outcome rather than the method
- specific = it tells right away what this work is about
- matches the editorial policy of the journal
- avoids acronyms and jargon
- does not have to be a sentence, but must be syntaxically correct

Which title ?

- You are a spectroscopist who has carried out a detailed study of star clusters. You have just written an article about star formation, showing that the distribution of novel stars (protostars) in these molecular clouds does not match the standard model.

- Read the next titles and determine which ones are better – and **why** they are better

Which title ?

1. Spectroscopic observations of the Eagle, Orion and Carina nebulae

2. Protostar distribution and the formation of massive new stars: testing the cluster-assist model

3. Can patterns of protostar distribution within molecular clouds distinguish between competing models of massive star formation ?

4. Detailed images of protostar neighbourhoods do not support the cluster-assist model of massive star formation

5. On the observation of protostellar masses

Titles : examples

BEFORE : On the accurate estimation of scaling exponents in the observational study of scale-invariant phenomena in finite time series

AFTER : Pseudo-nonstationarity in the scaling exponents of finite-interval time series

Some poor titles

Regional development in eastern Uganda, 1975-95

Spatio-temporal analysis of plasma fluctuations

Magnetohydrodynamic Simulation of a Sigmoid Eruption of Active Region 11283

Was Jane Austen ever in love?

Burning down the pagoda in order to roast the pork

On the application of Exploratory Data Analysis for characterization of cryospheric data sets

Some better titles

Wavelet analysis of turbulence reveals the multifractal nature of the Richardson cascade

Pattern formation outside of equilibrium

Climate: How unusual is today's solar activity?

Will Comet ISON (C/2012 S1) Survive Perihelion?

Learning the parts of objects by non-negative matrix factorization

How about these titles ?

You Probably Think This Paper's About You: Narcissists' Perceptions of Their Personality and Reputation

Children and Mini-Magnets: An Almost Fatal Attraction.

Snakes on a spaceship - An overview of Python in Heliophysics

The mouth, the anus and the blastopore - open questions about questionable openings

No solar hiding place for greenhouse skeptics

Find a good title for this abstract

Milankovitch proposed that Earth resides in an interglacial state when its spin axis both tilts to a high obliquity and precesses to align the Northern Hemisphere summer with Earth's nearest approach to the Sun. This general concept has been elaborated into hypotheses that precession, obliquity or combinations of both could pace deglaciations during the late Pleistocene. Earlier tests have shown that obliquity paces the late Pleistocene glacial cycles, but have been inconclusive with regard to precession, whose shorter period of about 20,000 years makes phasing more sensitive to timing errors. No quantitative test has provided firm evidence for a dual effect.

Here I show that both obliquity and precession pace late Pleistocene glacial cycles. Deficiencies in time control that have long stymied efforts to establish orbital effects on deglaciation are overcome using a new statistical test that focuses on maxima in orbital forcing. The results are fully consistent with Milankovitch's proposal but also admit the possibility that long Southern Hemisphere summers contribute to deglaciation.

LETTER

doi:10.1038/nature10626

Combined obliquity and precession pacing of late Pleistocene deglaciations

Peter Huybers[1]

Milankovitch[1] proposed that Earth resides in an interglacial state when its spin axis both tilts to a high obliquity and precesses to align the Northern Hemisphere summer with Earth's nearest approach to the Sun. This general concept has been elaborated into hypotheses that precession[2], obliquity[3,4] or combinations of both[5–8] could pace deglaciations during the late Pleistocene[9,10]. Earlier tests have shown that obliquity paces the late Pleistocene glacial cycles[4,11] but have been inconclusive with regard to precession, whose shorter period of about 20,000 years makes phasing more

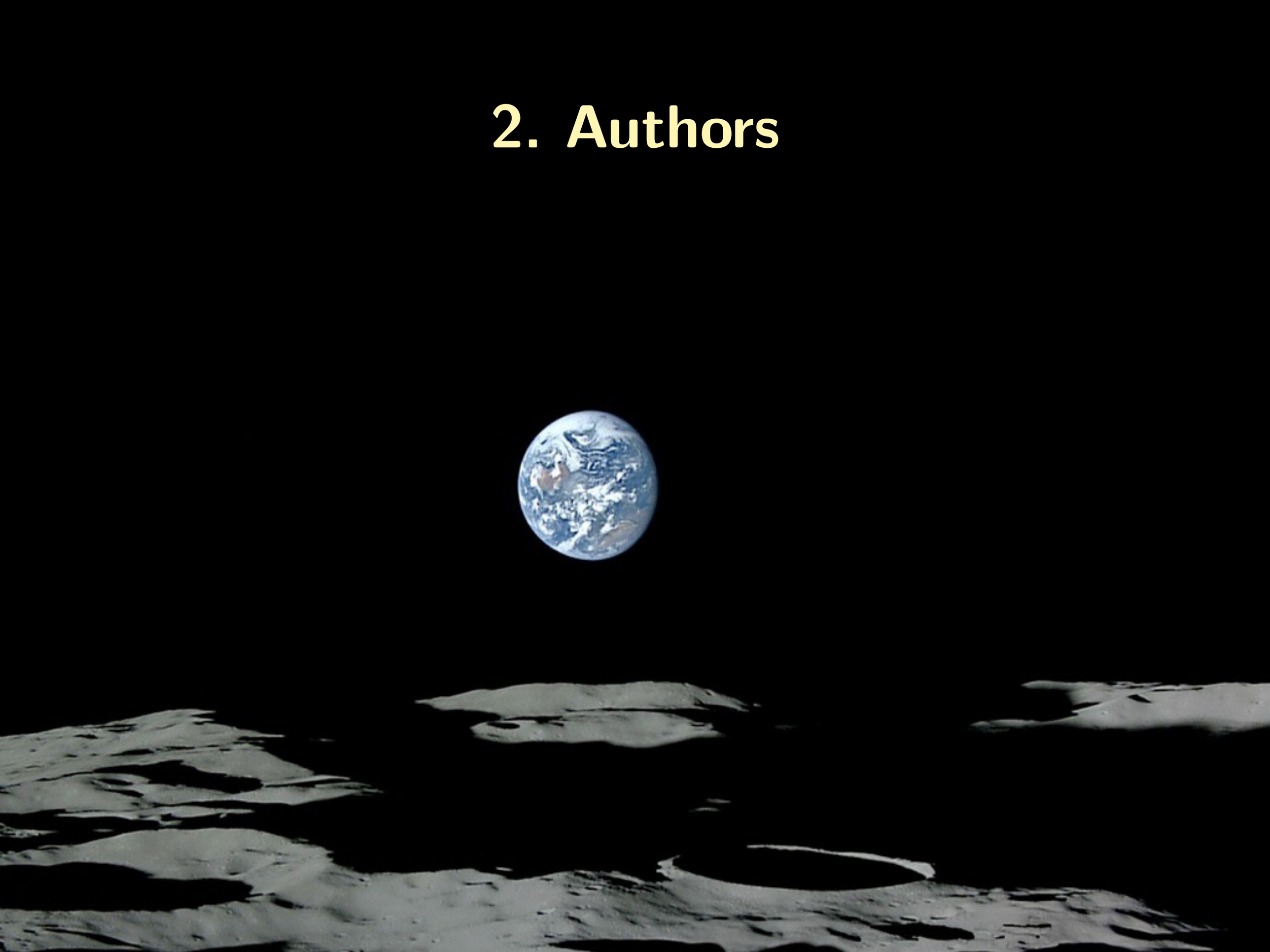
account for uncertainty in the ^{40}K decay constant[18,19], it is now represented as occurring at 780 ± 8 kyr (1 s.d.). Terminations are identified by local maxima in the time rate-of-change of the δ^{18}O record that exceed a value of 0.095‰ per kyr, giving the usual termination features[20] except that termination 3 contains two parts that are labelled 3a and 3b (Fig. 1a). (Thresholds ranging between 0.07‰ and 0.17‰ per kyr would give different numbers of terminations but give similarly significant results.) The average uncertainty in the age of the 12 identified termination features is 8 kyr (1 s.d.), with older ages

One last thing…

- A title is much more likely to attract attention if it starts with the **main findings** or consequences (rather than context)
- Search engines are more likely to find it if it contains **key words** (and not “New results …”)

- Examples
  - “The Laschamp geomagnetic excursion featured in nitrate record from EPICA-Dome C ice core”
  - “Excavating Neandertal and Denisovan DNA from the genomes of Melanesian individuals”
  - “Oxidation products of biogenic emissions contribute to nucleation of atmospheric particles”

2. Authors



Authors

- After the title, the names of the authors are the second item people will read

Why does the author/affiliation list matter ?

- It tells the reader who contributed to the study
- It establishes the authority of your work (affiliations, institutions, etc)
- It allows indexing your paper in databases
- It allows interested readers to contact you
- It matters for your funding agencies

Who should appear as co-author ?

1. Those who wrote the text
2. Those who made the plots
3. Those who analysed the data, ran the simulations
4. Those who provided the data
5. Those who did the field work
6. Those who coordinated the field campaign
7. The engineers and technicians who contributed to the study
8. The students who worked on the data during an internship
9. Those who first emitted the idea
10. The team leader
11. The director of the laboratory
12. The person who provided the funding

Who are the authors ?

Authors ***must*** meet all 3 of the following criteria

1. He/she has made **substantial** contributions to the work (i.e. design of the experiment, data analysis, interpretation, etc.)

AND

2. He/she has contributed to writing the manuscript or to revising it.

AND

3. He/she has approved the final version.

Authors

Review of Particle Physics

Yao, W.-M.; Amsler, C.; Asner, D.; Barnett, R. M.; Beringer, J.; Burchat, P. R.; Carone, C. D.; Caso, C.; Dahl, O.; D'Ambrosio, G.; De Gouvea, A.; Doser, M.; Eidelman, S.; Feng, J. L.; Gherghetta, T.; Goodman, M.; Grab, C.; Groom, D. E.; Gurtu, A.; Hagiwara, K.; Hayes, K. G.; Hernández-Rey, J. J.; Hikasa, K.; Jawahery, H.; Kolda, C.; Kwon, Y.; Mangano, M. L.; Manohar, A. V.; Masoni, A.; Miquel, R.; Mönig, K.; Murayama, H.; Nakamura, K.; Navas, S.; Olive, K. A.; Pape, L.; Patrignani, C.; Piepke, A.; Punzi, G.; Raffelt, G.; Smith, J. G.; Tanabashi, M.; Terning, J.; Törnqvist, N. A.;sTrippe, T. G.; Vogel, P.; Watari, T.; Wohl, C. G.; Workman, R. L.; Zyla, P. A.; Armstrong, B.; Harper, G.; Lugovsky, V. S.; Schaffner, P.; Artuso, M.; Babu, K. S.; Band, H. R.; Barberio, E.; Battaglia, M.; Bichsel, H.; Biebel, O.; Bloch, P.; Blucher, E.; Cahn, R. N.; Casper, D.; Cattai, A.; Ceccucci, A.; Chakraborty, D.; Chivukula, R. S.; Cowan, G.; Damour, T.; DeGrand, T.; Desler, K.; Dobbs, M. A.; Drees, M.; Edwards, A.; Edwards, D. A.; Elvira, V. D.; Erler, J.; Ezhela, V. V.; Fetscher, W.; Fields, B. D.; Foster, B.; Froidevaux, D.; Gaisser, T. K.; Garren, L.; Gerber, H.-J.; Gerbier, G.; Gibbons, L.; Gilman, F. J.; Giudice, G. F.; Gritsan, A. V.; Grünewald, M.; Haber, H. E.; Hagmann, C.; Hinchliffe, I.; Höcker, A.; Igo-Kemenes, P.; JAckson, J. D.; Johnson, K. F.; Karlen, D.; Kayser, B.; Kirkby, D.; Klein, S. R.; Kleinknecht, K.; Knowles, I. G.; Kowalewski, R. V.; Kreitz, P.; Kursche, B.; Kuyanov, Yu. V.; Lahav, O.; Langacker, P.; Liddle, A.; Ligeti, Z.; Liss, T. M.; Littenberg, L.; Liu, J. C.; Lugovsky, K. S.; Lugovsky, s. B.; Mannel, T.; Manley, D. M.; Marciano, W. J.; Martin, A. D.; Milstead, D.; Narain, M.; Nason, P.; Nir, Y.; Peacock, J. A.; Prell, S. A.; Quadt, A.; Raby, S.; Ratcliff, B. N.; Razuvaev, E. A.; Renk, B.; Richardson, P.; Roesler, S.; Rolandi, G.; Ronan, M. T.; Rosenberg, L. J.; Sachrajda, C. T.; Sakai, Y.; Sarkar, S.; Schmitt, M.; Schneider, O.; Scott, D.; Sjöstrand, T.; Smoot, G. F.; Sokolsky, P.; Spanier, S.; Spieler, H.; Stahl, A.; Stanev, T.; Streitmatter, R. E.; Sumiyoshi, T.; Tkachenko, N. P.; Trilling, G. H.; Valencia, G.; van Bibber, K.; Vincter, M. G.; Ward, D. R.; Webber, B. R.; Wells, J. D.; Whalley, M.; Wolfenstsein, L.; Womersley, J.; Woody, C. L.; Yamamoto, A.; Zenin, O. V.; Zhang, J.; Zhu, R.-Y.

Journal of Physics G: Nuclear and Particle Physics, Volume 33, Issue 1, pp. 1-1232 (2006).

07/2006

Authors

- The order of the authors **does matter**
  - usually the first ones are the most important ones
  - but each community has its habits (e.g. alphabetical order in mathematics)

- The first author should always be the one who directed the study and coordinated the writing

For you as young scientist it is important to appear as first author

Can I change the order of the authors

- while submitting ?
- during the revision ?

One last thing…

- If you are the lead author, then **you** are the one who decides and takes responsibility

- Return the favour = asking a scientist to be co-author when you wish to strengthen a collaboration with him/her.

  Use with care !

3. Abstract

Abstract or Summary ?

Abstract or Summary ?

- **Abstract** : summarises the main points without detail.
  Articles start with an abstract.

- **Summary** : can be more detailed, including figures, etc.
  Theses include a summary.

Abstract

Abstract = **teaser / trailer**

What makes a good abstract ?

Abstract

Good abstract are

- **Clear** : short sentences, no jargon
- **Informative** : explain what the study is about, present the main outcome
- **Complete** : cover all key aspects of the work
- **Self-contained** : non-experts must be able to get the idea
- **Catchy** and attractive : to encourage people to continue reading
- **Brief** : typically < 200 words
- **Include keywords** : important for search engines

Abstract

Typical structure of a good abstract (this may vary)

Context	What are the issues ?
Objectives	What do I want to achieve ?
Method	How did I proceed ?
Results	What did I obtain ?
Consequences	What are the impacts and the perspectives ?

Detect the 5 main sections of this abstract

Predicting function-related amino acids in proteins with unknown function or unknown allosteric binding sites in drug-targeted proteins is a task of paramount importance in molecular biomedicine. In this paper we introduce a simple, light and computationally inexpensive structure-based method to identify catalytic sites in enzymes. Our method, termed cutoff lensing, is a general procedure consisting in letting the cutoff used to build an elastic network model increase to large values. A validation of our method against a large database of annotated enzymes shows that optimal values of the cutoff exist such that three different structure-based indicators allow one to recover a maximum of the known catalytic sites. Interestingly, we find that the larger the structures the greater the predictive power afforded by our method. Possible ways to combine the three indicators into a single figure of merit and into a specific sequential analysis are suggested and discussed with reference to the classic case of HIV-protease. Our method could be used as a complement to other sequence- and/or structure-based methods to narrow the results of large-scale screenings.

from : Aubailly & Piazza, Sci. Rep. 5 (2015) 14874

Exercise

Predicting function-related amino acids in proteins with unknown function or unknown allosteric binding sites in drug-targeted proteins is a task of paramount importance in molecular biomedicine. In this paper we introduce a simple, light and computationally inexpensive structure-based method to identify catalytic sites in enzymes. Our method, termed cutoff lensing, is a general procedure consisting in letting the cutoff used to build an elastic network model increase to large values. A validation of our method against a large database of annotated enzymes shows that optimal values of the cutoff exist such that three different structure-based indicators allow one to recover a maximum of the known catalytic sites. Interestingly, we find that the larger the structures the greater the predictive power afforded by our method. Possible ways to combine the three indicators into a single figure of merit and into a specific sequential analysis are suggested and discussed with reference to the classic case of HIV-protease. Our method could be used as a complement to other sequence- and/or structure-based methods to narrow the results of large-scale screenings.

from : Aubailly & Piazza, Sci. Rep. 5 (2015) 14874

Avoid in your abstract

- Acronyms (except for well-known ones such as UV, AI, …)
- Looooooooong sentences (especially for the French)
- Cryptic sentences
- Lack of conciseness
- Repetitions / redundant information
- Lack of information on the results /
  too much focus on the introduction only
- References (some exceptions are possible)

Abstract

Evaluate each single word in your abstract:

Is it useful, redundant ?

Is there a better alternative ?

Beyond the abstract

Some journals ask for additional material such as

- **Key points** that summarise the main findings

  focus on the main **outcomes**, NOT on what you did

- **Plain language summary** for the layman

  no jargon at all, focus on **societal impacts**

  more examples at
  https://publications.agu.org/plain-language-summaries-collection/

Geophysical Research Letters

RESEARCH LETTER
10.1029/2020GL090115

Special Section:
Parker Solar Probe Observations at Venus: VGA1-2

Plasma Double Layers at the Boundary Between Venus and the Solar Wind

D. M. Malaspina[1,2], K. Goodrich[3], R. Livi[3], J. Halekas[4], M. McManus[3], S. Curry[3], S. D. Bale[3,5], J. W. Bonnell[3], T. Dudok de Wit[6], K. Goetz[7], P. R. Harvey[3], R. J. MacDowall[8], M. Pulupa[3], A. W. Case[9], J. C. Kasper[10], K. E. Korreck[9], D. Larson[3], M. L. Stevens[9], and P. Whittlesey[3]

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Key Points:

- Plasma double layers are detected near the Venusian bow shock
- Multiple double layers are identified in a small amount of burst data
- Kinetic processes may help mediate interaction between the solar wind and induced magnetospheres

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Abstract The solar wind is slowed, deflected, and heated as it encounters Venus's induced magnetosphere. The importance of kinetic plasma processes to these interactions has not been examined in detail, due to a lack of constraining observations. In this study, kinetic-scale electric field structures are identified in the Venusian magnetosheath, including plasma double layers. The double layers may be driven by currents or mixing of inhomogeneous plasmas near the edge of the magnetosheath. Estimated double-layer spatial scales are consistent with those reported at Earth. Estimated potential drops are similar to electron temperature gradients across the bow shock. Many double layers are found in few high cadence data captures, suggesting that their amplitudes are high relative to other magnetosheath plasma waves. These are the first direct observations of plasma double layers beyond near-Earth space, supporting the idea that kinetic plasma processes are active in many space plasma environments.

Plain Language Summary Venus has no internally generated magnetic field, yet electric currents running through its ionized upper atmosphere create magnetic fields that push back against the flow of the solar wind. These induced fields cause the solar wind to slow and heat as the flow is deflected around Venus. This work reports observations of very small plasma structures that accelerate particles, identifiable by their characteristic electric field signatures, at the boundary where the solar wind starts to be deflected. These small plasma structures observed at Venus have been studied in near-Earth space for decades but have never before been found near another planet. These structures are known to be important ctrical currents in space plasmas and the blending of dissimilar plasmas. Their

Example : Abstract

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Example : Plain language summary

Plain Language Summary Venus has no internally generated magnetic field, yet electric currents running through its ionized upper atmosphere create magnetic fields that push back against the flow of the solar wind. These induced fields cause the solar wind to slow and heat as the flow is deflected around Venus. This work reports observations of very small plasma structures that accelerate particles, identifiable by their characteristic electric field signatures, at the boundary where the solar wind starts to be deflected. These small plasma structures observed at Venus have been studied in near-Earth space for decades but have never before been found near another planet. These structures are known to be important to the physics of strong electrical currents in space plasmas and the blending of dissimilar plasmas. Their identification at Venus is a strong demonstration that these small plasma structures are a universal plasma phenomena, at work in many plasma environments.

Example : Key points

Key Points:

- Plasma double layers are detected near the Venusian bow shock
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Plain-language summary: tips

- Think about your audience (e.g. journalists, science-interested public). What is their level of science-specific knowledge? What is going to interest them in your work?
- NO jargon
- Explain what your study is about
- Explain what you found
- **Explain why this matters**. People want to ask "Why should I care ?"

from AGU

When should I write the abstract ?

- Tip

Write your abstract **after** all other parts have been written

4. Introduction

- What makes a good introduction ?

Introduction

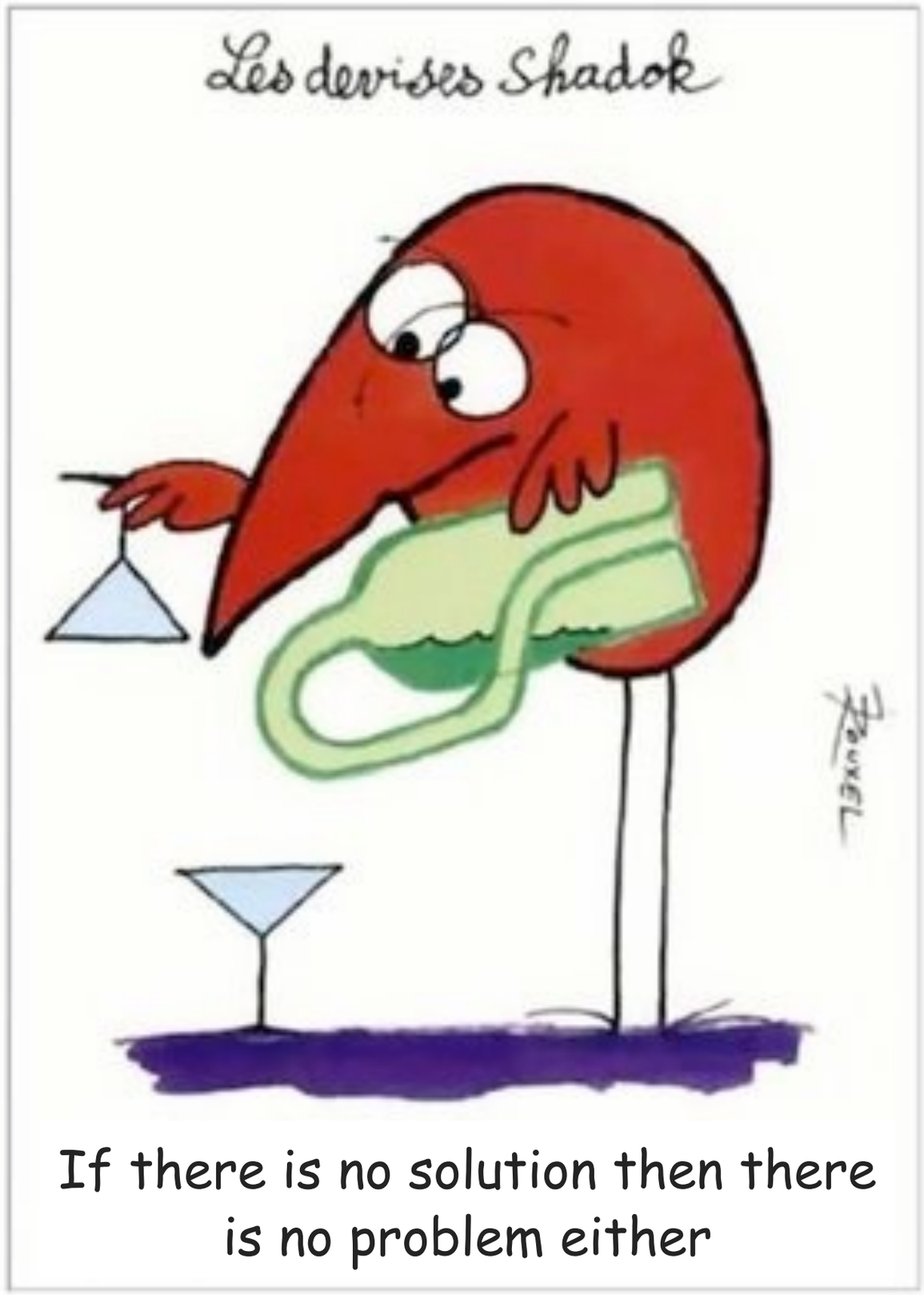
- Your introduction is like an **opening**
- The tone and the style are important. If too dull, then the reader may well skip the article

Introduction: main points

- Start with the **big picture** and progressively narrow down the scope to your topic
- Explain the state of the art and why **your** contribution matters
- End by clearly stating **what problem you will be addressing**

Introduction

Very IMPORTANT:
Say explicitly what problem/issue you will be addressing



Example

The development of efficient parallel preconditioners is currently an important issue in scientific computing. The most significant advances have been done in the class of sparse approximate inverses that allow to apply the preconditioner through a matrix–vector product instead of a sequence of forward and backward substitutions. One of the most efficient algorithms appears to be the factorized sparse approximate inverse (FSAI) [16] that has the advantage of exhibiting a very good parallelization degree also in the construction stage. Moreover, it preserves the possible positive definiteness of the stiffness matrix, thus allowing for the use of the preconditioned conjugate gradient (PCG) method as a solver. The FSAI performance on a single processor, however, can be much lower than that of a standard ILU decomposition, requiring many more iterations to converge. The main goal of the present study is to investigate the potential state-of-the-art performance for solving a geomechanical model in a parallel computer environment. In particular, the question we aim at answering is the following: how many processors are needed using a standard FSAI preconditioner to be competitive with the most advanced preconditioning strategies available on scalar computers for a large-size ill-conditioned geomechanical problem? The answer can provide interesting indications on the current parallelization degree of a geomechanical code and the most promising paths to be followed for improving this potential.

The paper is organized as follows. The finite element (FE) integration of the differential equa-

Ferronato et al. 2011

Properly cite the literature

- Take time to go through the literature and check who already addressed your problem…

  Many authors ignore (intentionally or unintentionally) what others have written before on the same topic.

- **Ethical conduct**
  - Properly acknowledge what others have done before you
  - Give them credit in a fair way : do NOT only cite team members or close friends.

Do not auto-cite yourself excessively

REPORT

How Long Is the Coast of Britain? Statistical Self-Similarity and Fractional Dimension

BENOIT MANDELBROT

SCIENCE • 5 May 1967 • Vol 156, Issue 3775 • pp. 636-638 • DOI: 10.1126/science.156.3775.636

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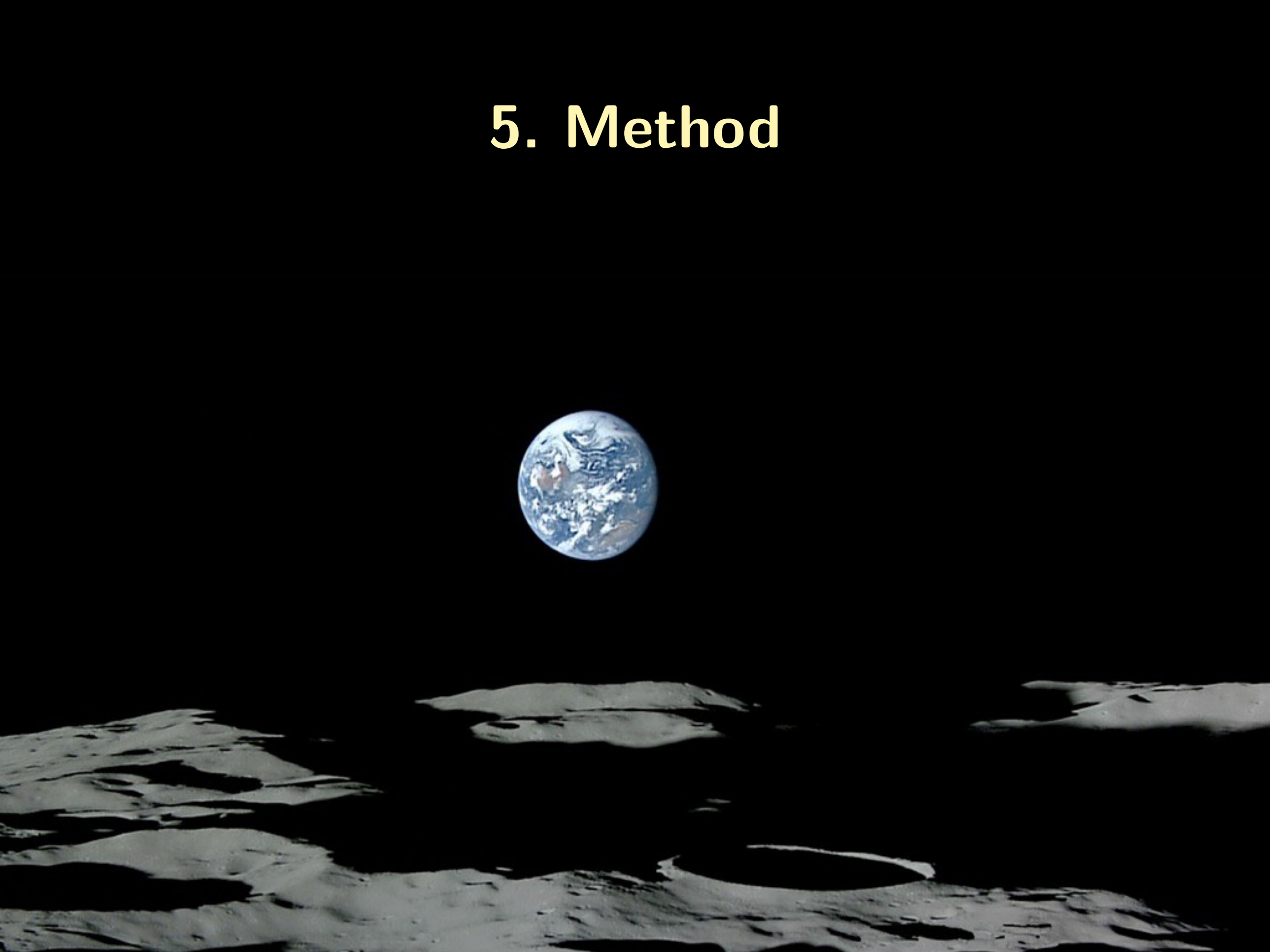
Questions

- Should the introduction already mention the main results (spoiler) ?

5. Method



Method

- **Method** = how did I proceed ?
  - what data ?
  - experimental protocol
  - data processing and management
  - working hypotheses (be explicit)

- **Traceability** : other people must be able to replicate your study

- **FAIR** : Findable, Accessible, Interoperable, Reusable

Method

Example: the discovery of cold fusion was a major breakthrough

But no one was able to replicate the work of the discoverers...

6. Results

Results

- Present all your results **clearly**
- Highlight what is **novel, unusual, surprising**…
- If there are many results : don’t try to interpret them too much before you have provided the global picture
- **No cherry picking** : present what works and what does NOT work (or remains unexplained)

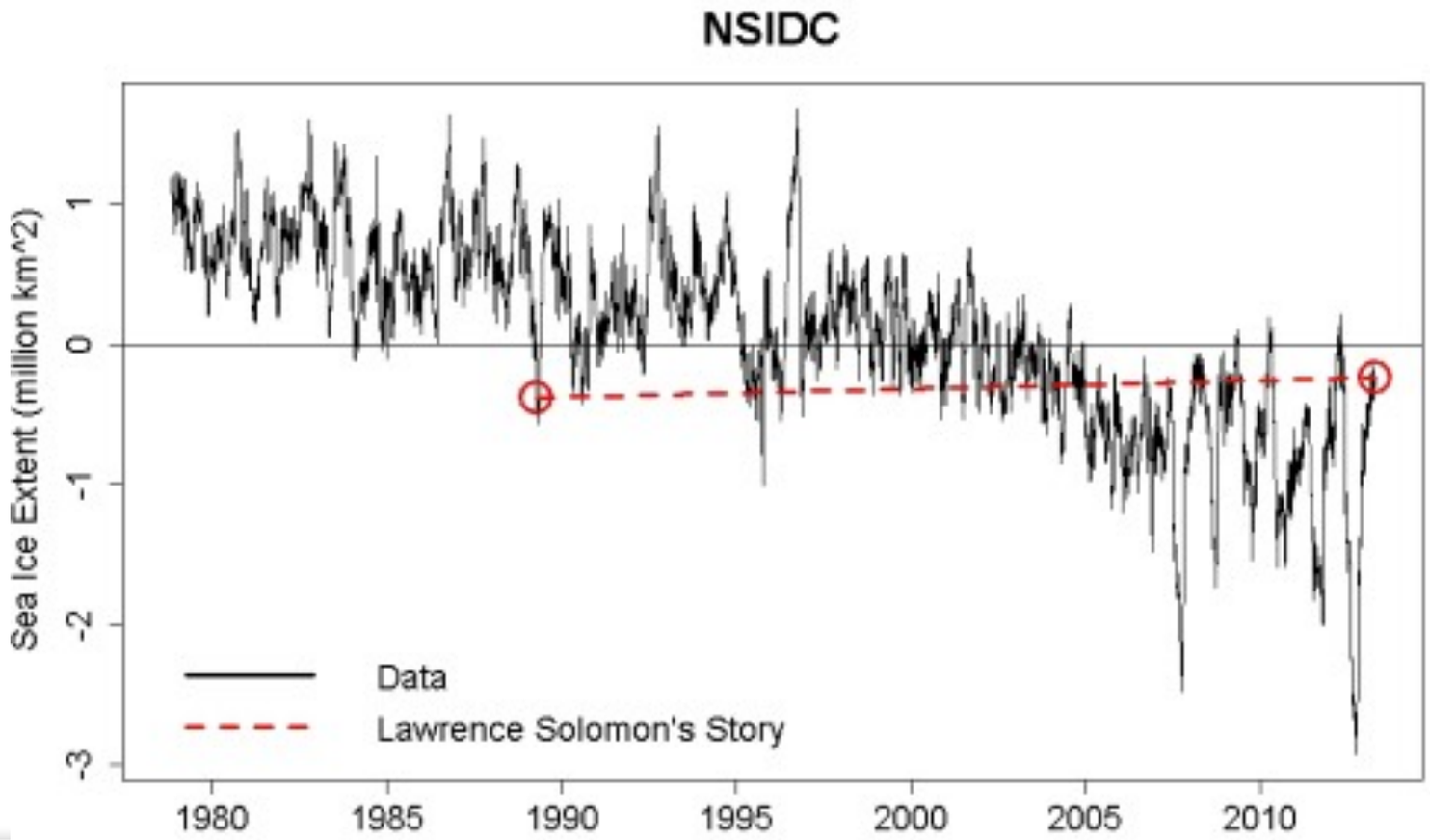
No cherry picking

Leite's Culinaria

No cherry picking

Cherry picking, suppressing evidence, or the fallacy of incomplete evidence is the act of pointing to individual cases or data that seem to confirm a particular position while ignoring a significant portion of related and similar cases or data that may contradict that position. Cherry picking may be committed intentionally or unintentionally. This fallacy is a major problem in public debate.

[Wikipedia, 2021]



Lawrence Solomon (2019)

Results

- **Question** : If a study leads to **negative** results (e.g. the expected effet was not observed), should I nevertheless publish that ?

"Scientific findings are like an iceberg, it floats with around 10% of published discovery above 90% of negative results."

See for example : https://www.negative-results.org/

Alas, very few people publish negative results…

7. Discussion

Discussion

- The discussion is the core of your study
- This is where **you** will provide your added value

Highlight what is YOUR original contribution to the issue

Discussion

- Sell your results: highlight what is new
- But do not oversell : be careful with “best”, “first”, “novel”, “first ever”, “new paradigm”, …
- Put your results in context: compare with others, be honest, discuss what does NOT work

Golden rule : Say what you mean, and mean what you say

Discussion

Tell a story : good articles are often structured like a story, with a buildup of tension, followed by an unwinding

8. Conclusion

Conclusion

- Conclusion ≠ abstract !
- Conclusion =
  - **Synthesis** of the results
  - Emphasise what **progress** has been made
  - Highlight the **impacts**, the larger implications
  - If relevant, discuss **perspectives** and new ways of elaborating on this problem

Conclusion

- Many readers will jump directly from the abstract to the conclusions.
- The reader is not supposed to have to read the article in order to understand the conclusion