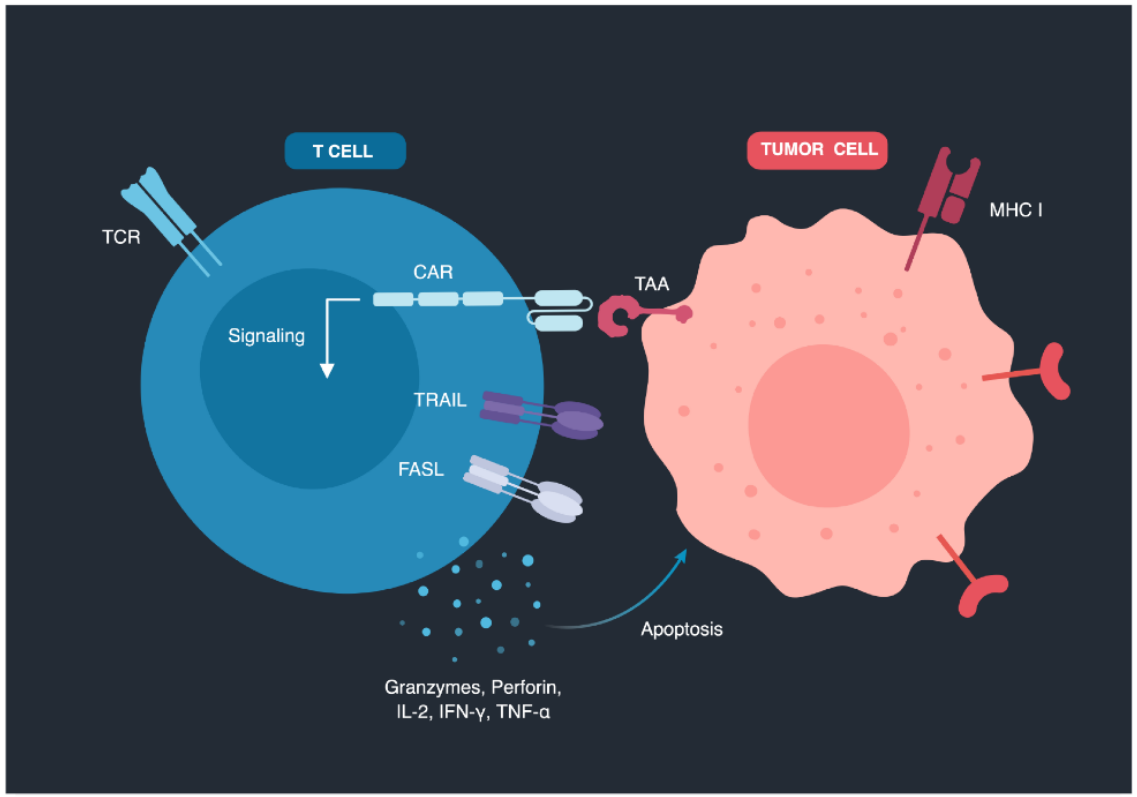
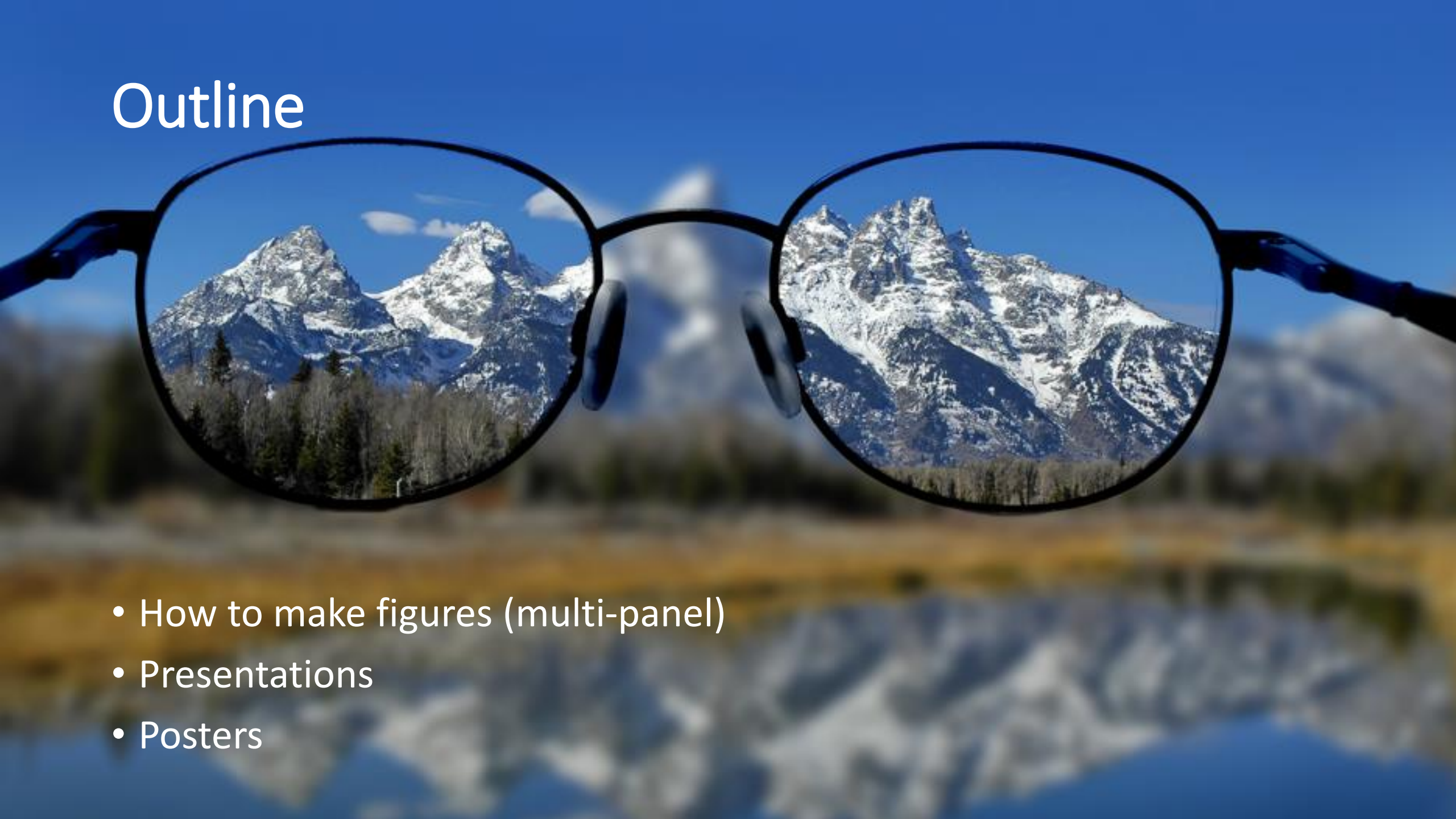


Gunnar Blohm

Effective Scientific Communication

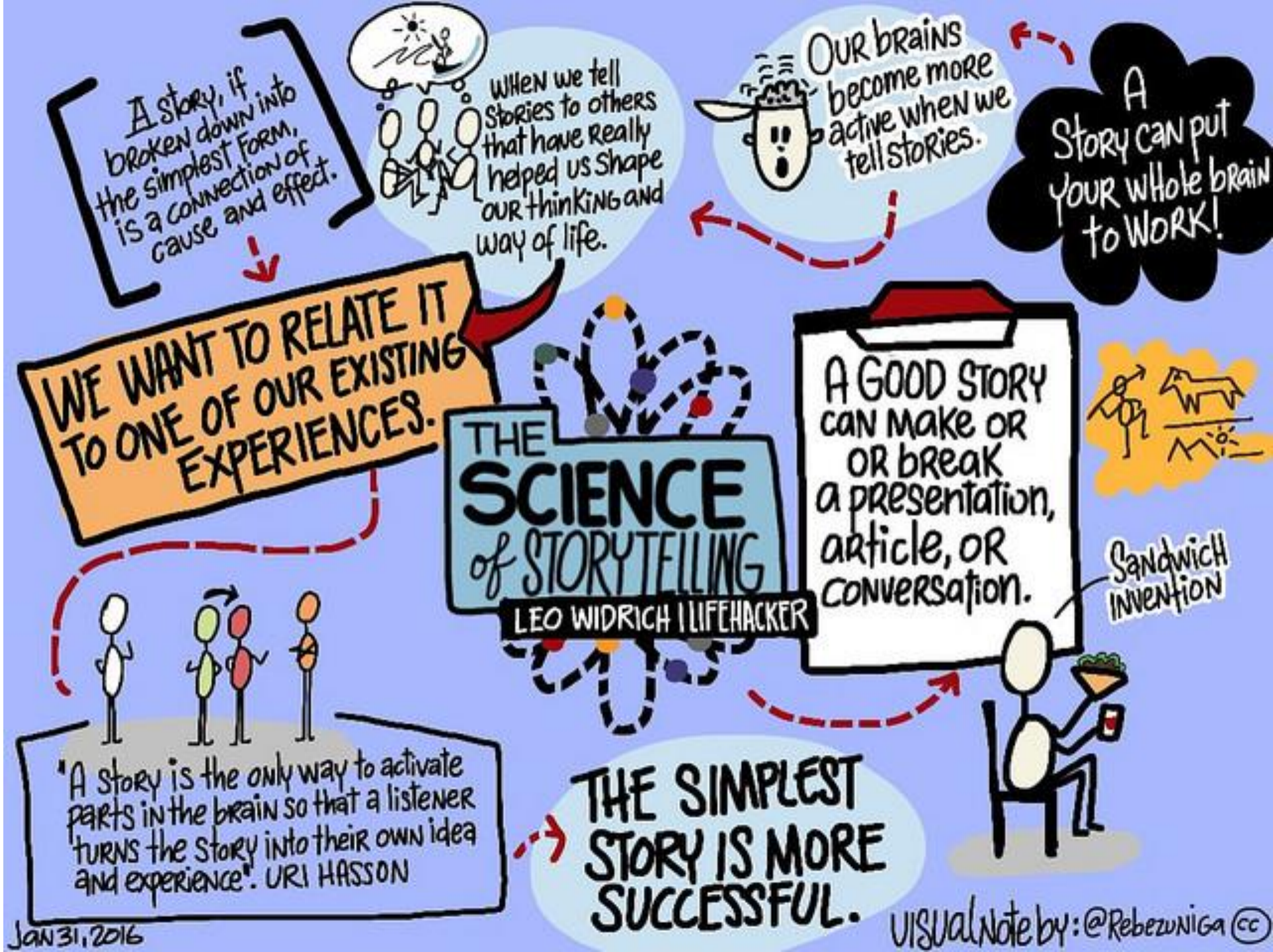
Outline



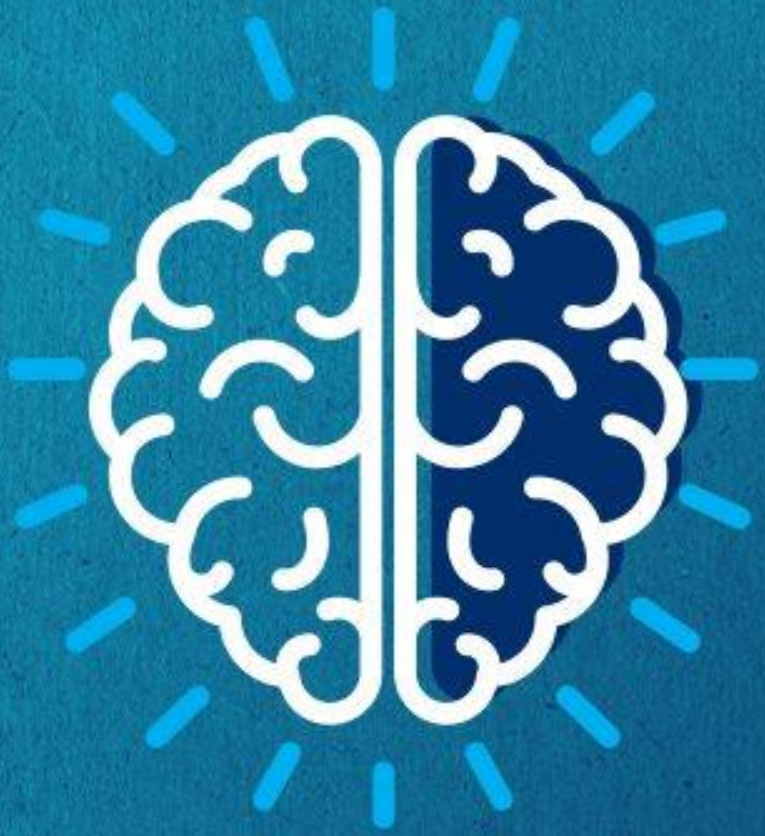
- How to make figures (multi-panel)
- Presentations
- Posters


A picture is worth a thousand words.

Figures should tell a story!



STORIES INCREASE INFORMATION RETENTION BY



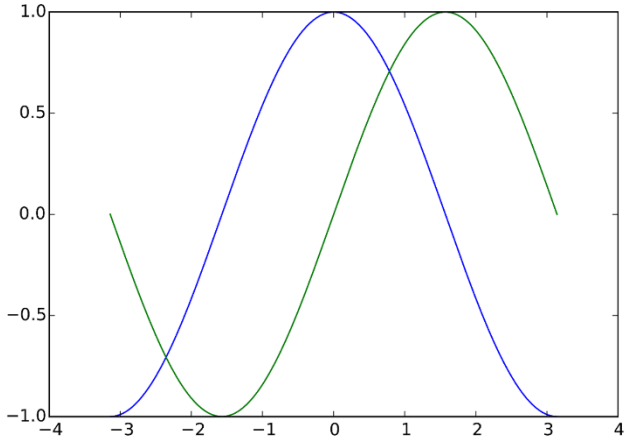
26%

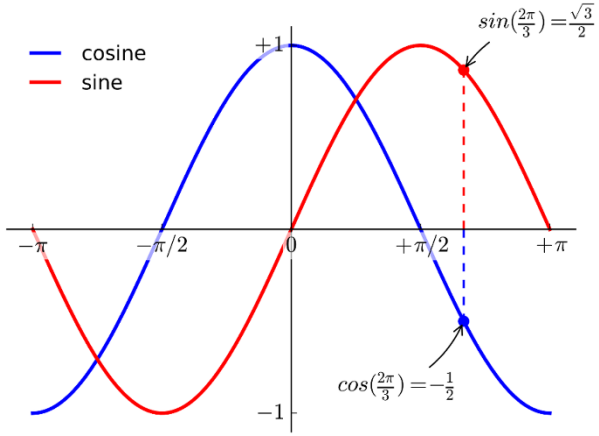
Frustrations from bad figures…

- Journal editor / reviewer concern about improper image manipulation
- Reviewers don’t understand the point of your figures
- Readers losing interest in your paper
- Your time being wasted in the review / publication process

10 simple rules for better figures

- Rule 1: Know Your Audience
- Rule 2: Identify your message
- Rule 3: Adapt figure to support medium
- Rule 4: Captions are NOT optional!
- Rule 5: Do not trust the defaults (colors, fonts, axis scaling etc)

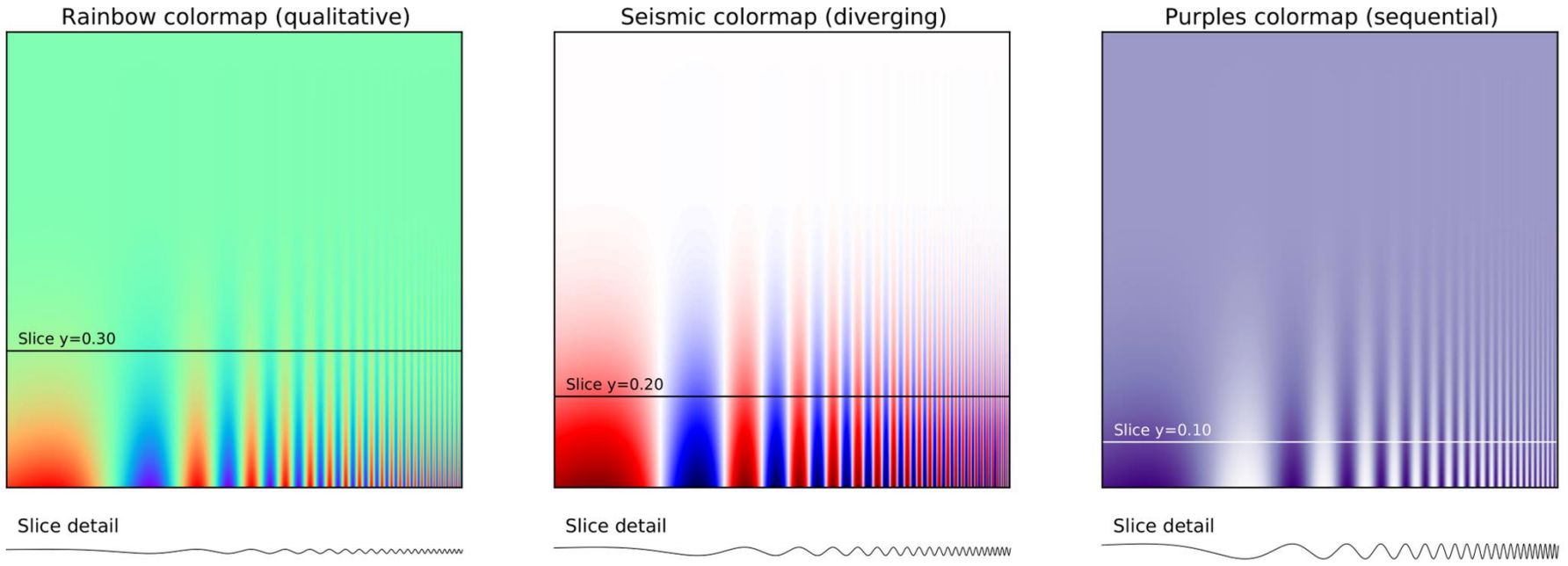




https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

10 simple rules for better figures

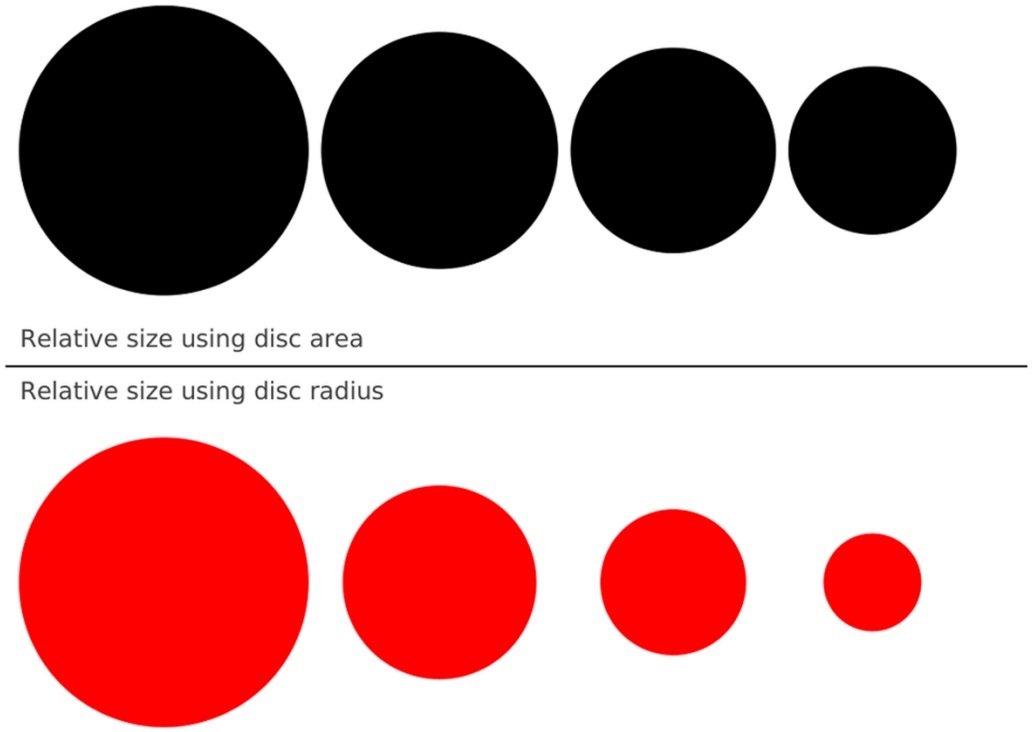
- Rule 6: Use color effectively

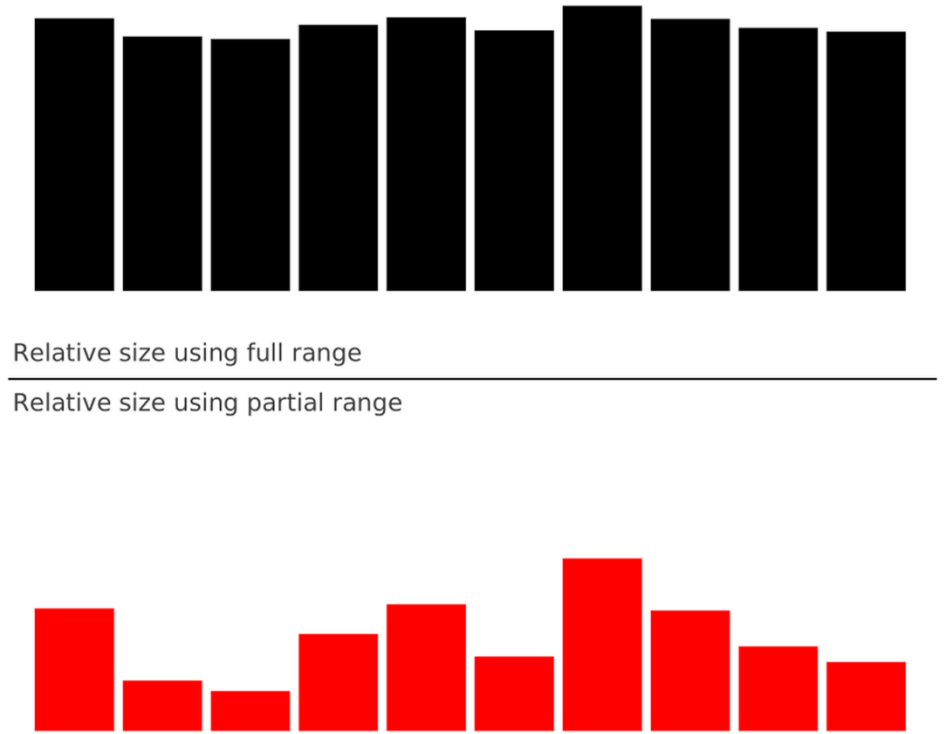


https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

10 simple rules for better figures

- Rule 7: Do not mislead the reader





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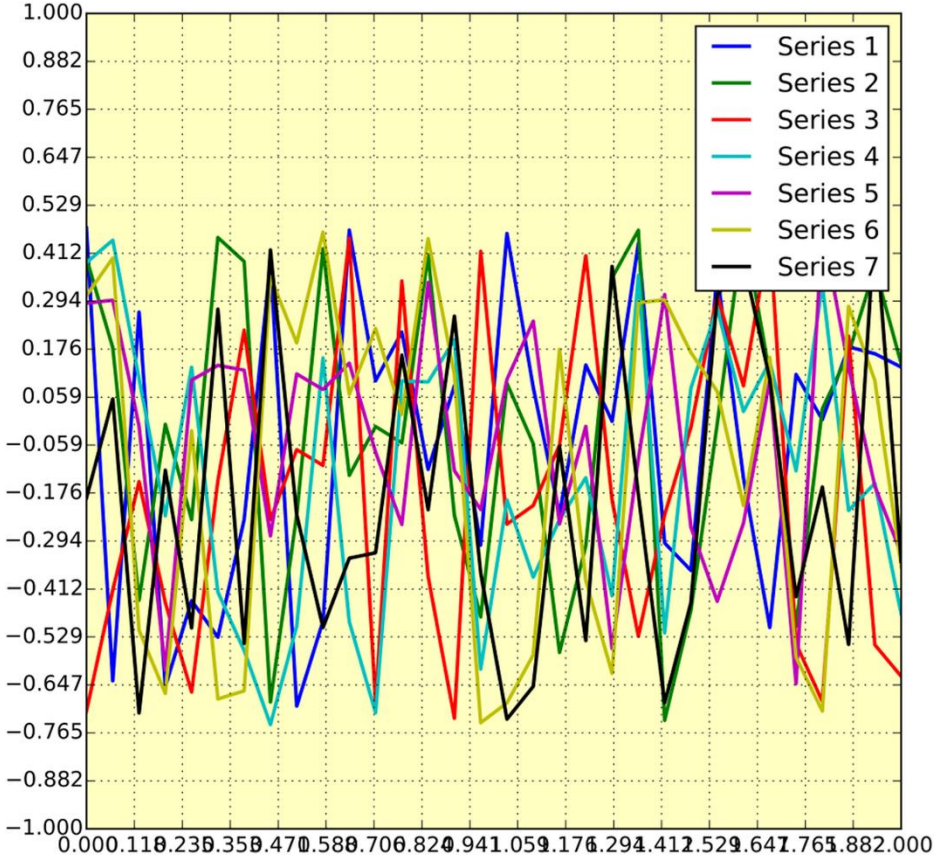
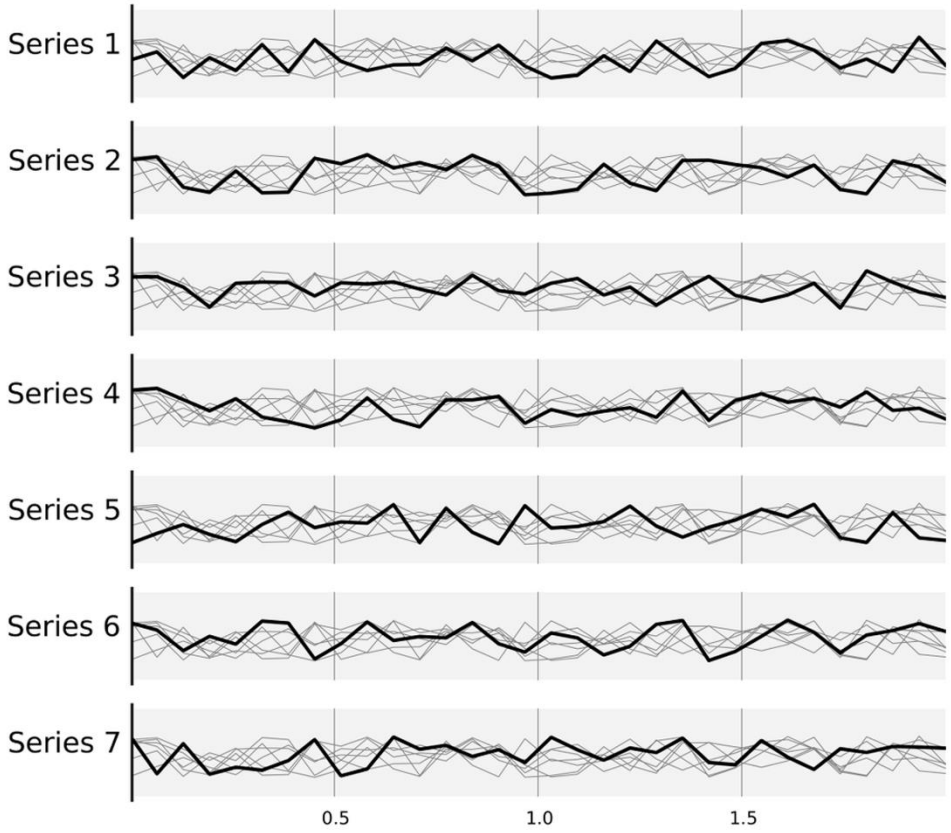
10 simple rules for better figures

- Rule 8: Avoid chart junk

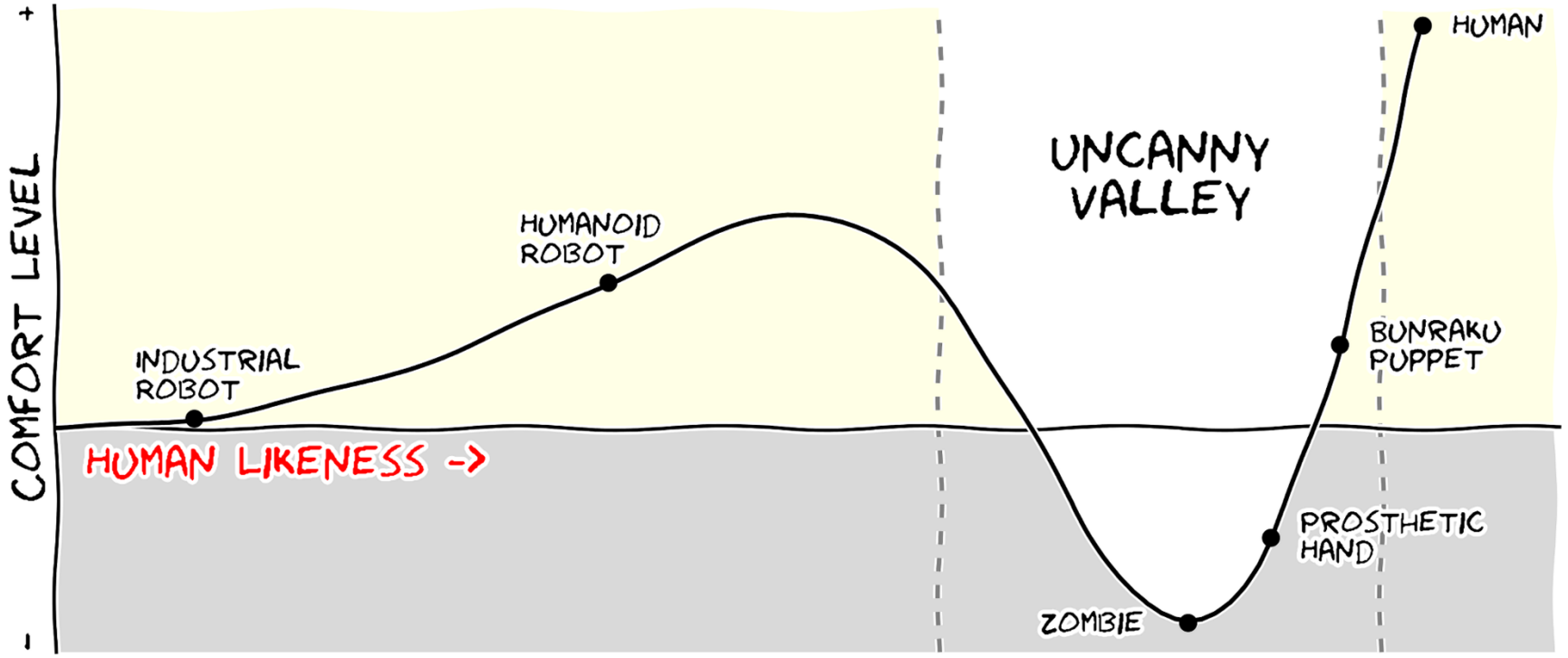




https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

10 simple rules for better figures

- Rule 9: Message trumps beauty



https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

10 simple rules for better figures

- Rule 10: Get the right tool!
  - Matplotlib Python plotting
  - R project stats & graphs
  - Inkscape vector graphics editor
  - TikZ and PDG (Tex for graphics)
  - GIMP image manipulation
  - Gravit Designer vector art
  - Biorender (free for educational use)
  - ImageJ instead of Photoshop
  - …

https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

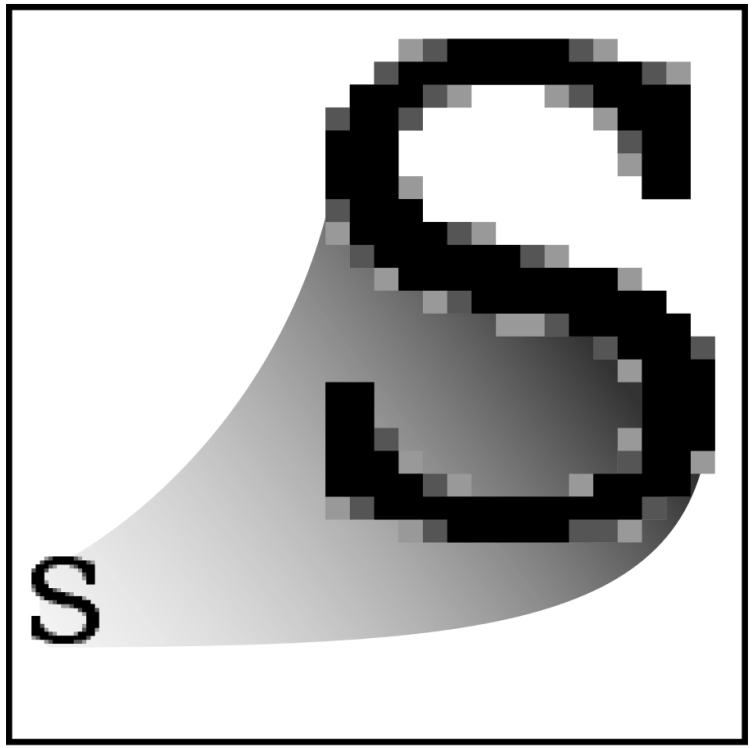
Hurdles & solutions

- Hurdle 1: “I’m not an artist”
  - Solution: learn the basics!
- Hurdle 2: “Making figures takes *way* too long”
  - Solution: start early and be smart about software

https://blog.quartzy.com/improving-your-science-figures-what-i-learned-from-conversations-with-100-scientists

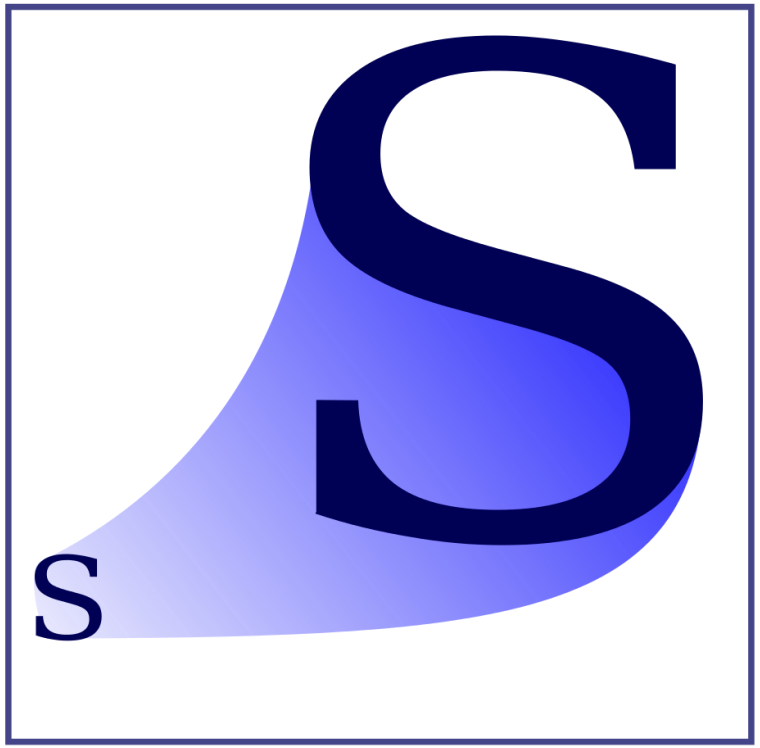
More tips

- Use vector data instead of raster data where possible
- You will likely have to provide EPS or TIFF files for articles
- Check journal figure size/formatting requirements!
- Style consistency!



Raster

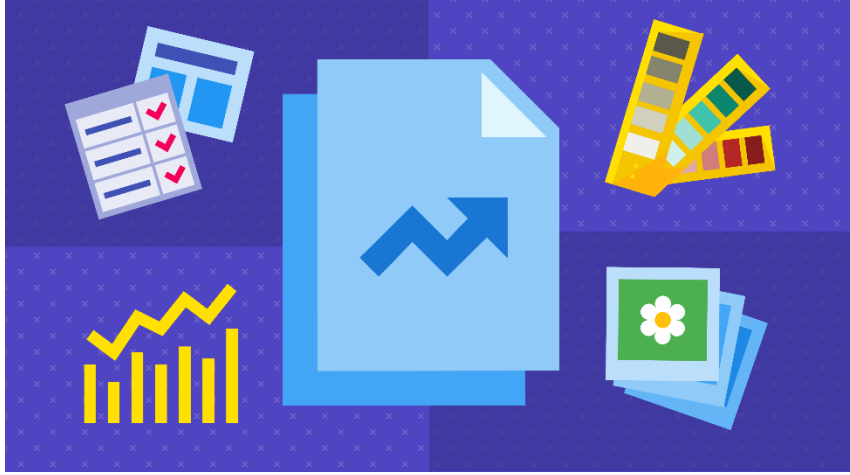
.jpeg .gif .png



Vector

.svg

Multi-panel figures



- Colors and line styles create correspondences
- Make sure graphs are logically related
- Panels need to “fit together”
- Ensure intended comparisons are easy (same axes, same colors, etc)
- **One message / figure!**
- Label all panels and describe them in captions

HOW TO WRITE STRONG & EFFECTIVE FIGURE LEGENDS

17 Tips
You Should Know

https://wordvice.com/how-to-write-effective-figure-titles-and-legends/

Figure legends

- General
  - Keep the average length around 100-300 words.
  - Use complete sentences to aid comprehension, but phrases are permissible.
  - Use the same abbreviations, terminology, and units as in the body of your article, particularly in Methods and Results.
  - **Always double-check your journal's Guide for Authors for specific instructions about figures and captions.**

Figure legends

- Title
  - For each figure, make sure the title can adequately describe all of the panels of that figure. If it's not possible to create a single title that fits all, reconsider how you group the images.
  - Use descriptive language to highlight the methods or type of analysis performed (e.g., "Structural comparison of peptide-activated XY receptors").
  - Use declarative language to emphasize a conclusion or major finding (e.g., "Compound ABC accelerates insulin production").
  - Use the active voice with strong verbs.

Figure legends

- Materials and Methods
  - Keep it brief. Only include information that is necessary to interpret the figure. The description might include details like the treatments and conditions applied or the models used. It should contain enough detail so the reader does not have to search the methods section for additional information.
  - Confirm whether the journal wants you to include or exclude from legends, the details regarding the methods and materials used.
  - Use past tense for verbs when discussing completed experiments.

Figure legends

- Results
  - Summarize the conclusion in one sentence.
  - If you use a declarative title, consider whether you should restate the results in the body of the legend.
  - Include sample size, p-values and number of replicates, if applicable.
  - Use past tense for verbs.

Figure legends

- Definitions
  - In the figure (not the legend), define any symbols, abbreviations, colors, lines, scales, error bars, etc. Also, label any other aspect of your figure that might not be readily understood.
  - Avoid naming conventions that are only used by your organization. Instead, use intuitive or standard names that outsiders can understand.

Oral presentations

10 simple rules for an effective presentation

1. Have something worth presenting (talk to the audience)
2. Organize your presentation
3. Show rather than tell stories (make take-home message persistent)
4. Less is more (talk only when you have something to say)
5. Plan to take less time than allotted
6. Be aware of your facial expressions and eyes
7. Use hand motions and movements to your advantage
8. Pause frequently, speak slowly, and remember to breathe
9. Practice, but do not memorize!
10. Practice one more time than you think you should…

http://blog.cambridgecoaching.com/ten-simple-rules-for-giving-an-effective-presentation

A GOOD PRESENTATION SHOULD HAVE NO MORE THAN 10 SLIDES.

GUY KAWASAKI


NO MORE THAN SIX WORDS
ON A SLIDE. EVER.
SETH GODIN

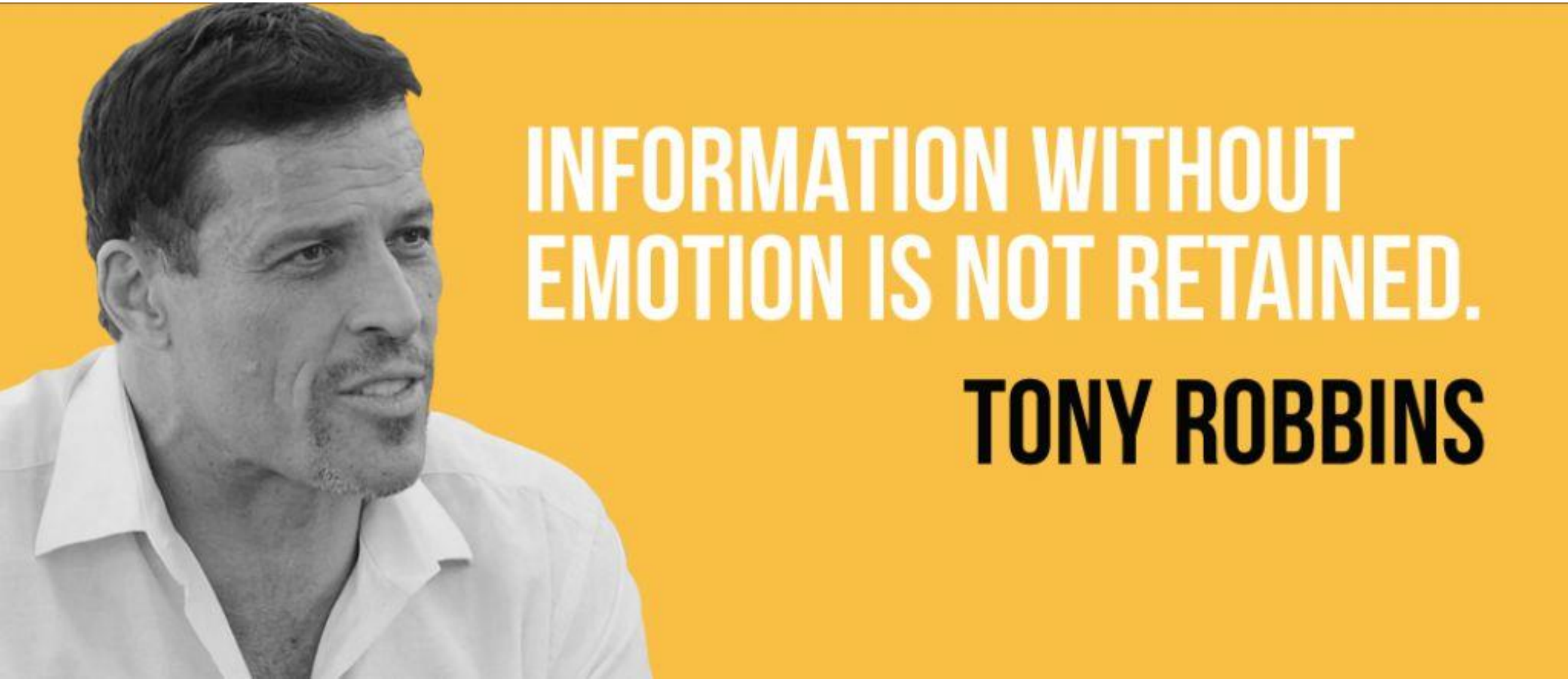

YOU MAKE MISTAKES.
ADMIT THEM QUICKLY AND
GET ON WITH IMPROVING.
STEVE JOBS

THE MORE YOU UNDERSTAND WHAT SOMEBODY WANTS, NEEDS, AND FEARS, THE MORE YOU CAN ADD VALUE.

TONY ROBBINS

A HANDHELD REMOTE
IS AN ABSOLUTE MUST.

GARR REYNOLDS


INFORMATION WITHOUT
EMOTION IS NOT RETAINED.
TONY ROBBINS

More tips…

- Don’t overcrowd your slides
- Use animations sparingly but effectively
- Concentrate on your core message!
- Show passion – if you’re not excited about your presentation, then who will be???
- Start strongly! – grab your audience’s attention and hold it…
- Be pleasant on the eyes!

Poster presentations

No!!!

Title

Authors

Intro

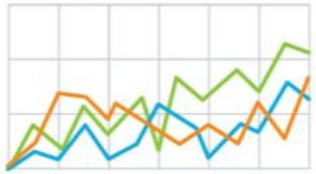
H1

H2

Methods

1.
2.
3.
4.

Results



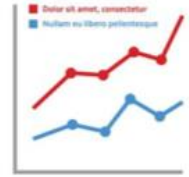
Discussion

More research is needed, but...

Main finding goes here, translated into **plain english**. **Emphasize** the important words.

Take a picture to download the **full paper**

Extra Tables & Figures



10 simple rules for a good poster presentation

1. Define the purpose
2. Sell your work in 10 seconds
3. The title is important
4. Poster acceptance means nothing… (no endorsement)
5. Rules for good paper writing apply to posters too!
6. Good posters have unique features that papers don’t have
7. Layout and format are critical
8. Content is important but keep it concise (highlight major findings)
9. Posters should have your personality
10. The impact of a poster happens during AND after the poster session…

https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.0030102

Poster development steps

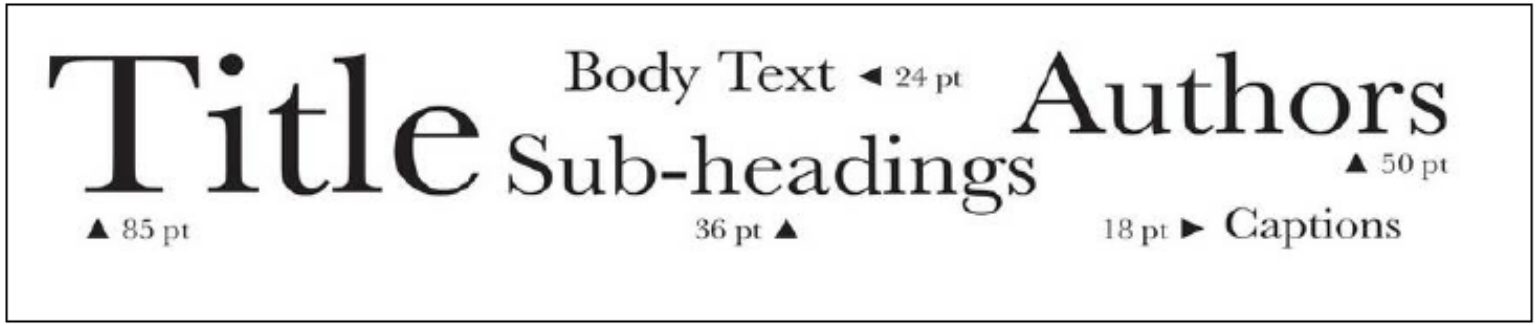
- Conceptualize
  - Audience
  - Guidelines
  - Material
- Development
  - Design, size, layout
  - Outline of content
  - Flow!
- Review
  - Outside perspective / feedback

Where to begin

- Review conference poster guidelines (size!)
- Start with your submitted abstract
- Think about creating a **storyboard**
  - Create rough visualization of your poster
  - Should contain no content or data
  - Enables visualizing dimensions, provides rough outline, defines section spaces
- Choose software
  - InkScape, Adobe Illustrator, CorelDraw (NOT Powerpoint!)
  - Do everything in that software to avoid formatting issues, lost images etc

Design

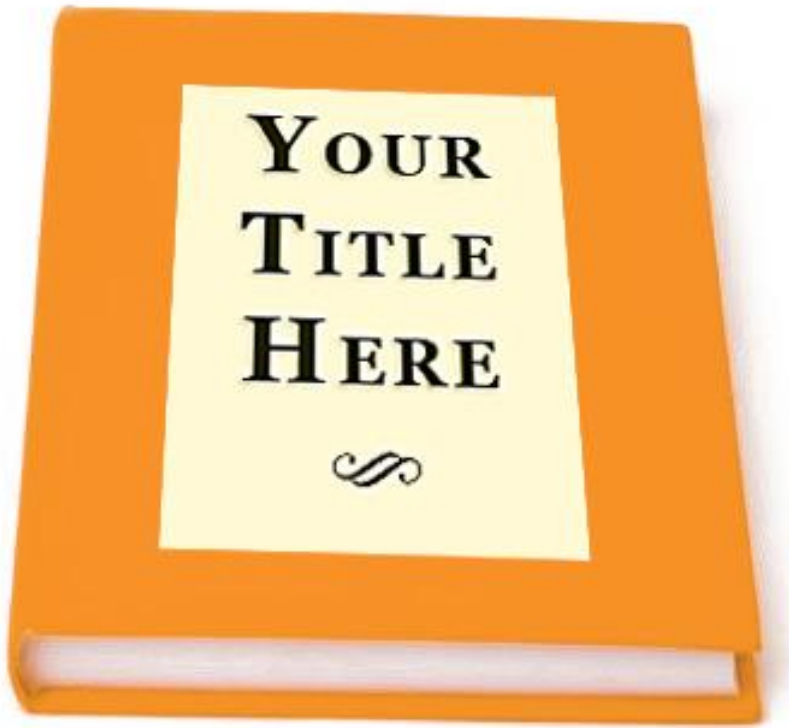
- Color
  - Use sparingly
  - Use color coding! – same color = same thing…
- Font
  - Consistency!
  - Sans serif!
- Column structure



- Ensure good contrast between background and content
- Use headlines, bullets, numbering to make it easy to read
- Use all space!

A good title is key!

- Should convey the most interesting finding / message
- Sell your work!
  - Make it catchy
  - Pose question, define a scope, or hint at major finding
  - Short, sharp, compelling!
- NEVER use all caps!
- Eye catching and prominent on page
- Avoid confusing acronyms…



Layout

- **Minimize text!!!**
- Organized
- Clear flow
- Well defined sections
- Headings = messages!
- Leave breathing room…
- Guide eyes – arrows, numbering etc.
- Main points at eye level!
- Don’t bury conclusions
- Lists of sentences rather than blocks of text

Bad poster

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

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

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.

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 news 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 +/- 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 of 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.

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 Mañana Athletic Club, Corpus Christi, USA. Finally, sincere thanks to the Cuy Foundation for generously donating animal care after 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. Naumović. 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.

Better poster

Computing Coherent Sets using Continuous Diffusion

Andreas Denner, Oliver Junge

Coherent Sets

We look for a pair (A_0, A_1) of sets, such that

$$\rho(A_0, A_1) := \frac{\mu(A_0 \cap \mathcal{T}^{-1} A_1)}{\mu(A_0)} \approx 1$$

and then call the pair (A_0, A_1) coherent.

General Setting

Time-dependent ODE, $\mathrm{div}(b) = 0$

$\dot{x} = b(t,x),\ x \in \mathbb{R}^d$

$\mathcal{T} = \mathcal{T}_{t_0,t_1}$ flow map

Goal

We look for the maximally coherent pairs i.e. a pair (A_0, A_1) of sets with

$$\rho(A_0, A_1) = max$$

Ansatz: We compute the maximal singular value/vector of transfer operator see [Froyland, 2013]

Difficulty

Set $A_1 = \mathcal{T}(A_0)$, for any A_0, then

$$\rho(A_0, A_1) = \frac{\mu(A_0 \cap \mathcal{T}^{-1} A_1)}{\mu(A_0)} = 1.$$

Adding Continuous Diffusion

Ornstein Uhlenbeck Process

$x_t = b(t,x) + \epsilon \xi_t,\ x(0) = x^0$

where ξ_t is Brownian motion, and $\mathcal{T}^\epsilon = \mathcal{T}^\epsilon_{0,1}$ is the (perturbed) flow map.

Transfer Operators

Let (X, A, μ) be a measure space. If $\mathcal{T} : X \to X$ is a nonsingular transformation the unique operator

$$\mathcal{P} : \mathcal{L}^2(X) \to \mathcal{L}^2(X)$$

defined by

$$\langle \mathcal{P} f, g \rangle = \langle f, g \circ \mathcal{T} \rangle$$

is called Frobenius-Perron operator corresponding to $\mathcal{T}$.

Fokker-Planck Equation

$$u_t = \frac{\epsilon^2}{2} \Delta u - \mathrm{div}(u\, b(x))$$
$$u(0,x) = f(x)$$

which is affiliated to the Ornstein-Uhlenbeck process.

$\mathcal{P}^\epsilon$ is the corresponding solution operator (perturbed transfer operator).

Theorem

If $\|b\|_{C^1} < \infty$, then $\mathcal{P}^\epsilon_t : \mathbb{L}^2 \to \mathbb{L}^2$ is compact and doubly stochastic. Then

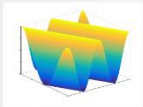
$$\max_{(A_0,A_1) \subset X \times X} \rho_\epsilon(A_0, A_1) \approx \sigma_2(\mathcal{P}_\epsilon)$$

Spectral Collocation

$V \subset \mathbb{L}^1(X)$ approximation space with basis $exp(ikx)$

We solve the equation $\varphi_t = \underbrace{\frac{\epsilon}{2}\Delta\varphi}_{\text{diagonal}} + \underbrace{\mathrm{div}(\varphi b)}_{\text{via fft}}$

for $\varphi \in V$ efficiently in Fourier space.



Aliasing

$$\partial_t \varphi = \tfrac{\epsilon^2}{2}\Delta\varphi - \underbrace{\mathrm{div}\mathcal{F}(\mathcal{F}^{-1}(\varphi) b(t,x))}_{\text{Aliasing}}$$

Skew symmetric form:

$$\mathrm{div}(\mathcal{F}^{-1}(\varphi) b) = \tfrac{1}{2}\mathrm{div}(\mathcal{F}^{-1}(\varphi) b) + \tfrac{1}{2}\nabla(\varphi) b$$

Stiffness

$$\partial_t \varphi = \underbrace{\frac{\epsilon^2}{2}\Delta\varphi}_{\text{stiff}} - \mathrm{div}\mathcal{F}(\mathcal{F}^{-1}(\varphi) b(t,x))$$

Exponential time-differencing:

We intgrate the linear part $\mathcal{L} = \frac{\epsilon}{2}\Delta\varphi$ explicitly

Construction FPO

We construct the discrete FPO via

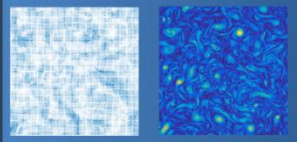
$$P_{jk} = \mathcal{P}^\epsilon \varphi_k(x_j),\ P \in \mathbb{R}^{M \times N},$$
$$k = -(N-1)/2, \ldots, (N-1)/2,$$
$$j = 1, \ldots, M.$$

and compute

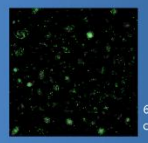
$$\sigma_2(\mathcal{P})$$

Radial Basis Functions

(Alternative Discretisation)



Negative Part of Okubo-Weiss Field as distribution of randomly chosen centers of locally supported functions (e.g. Wendland functions).



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Dellnitz, M. and Junge, O.(1999). On the approximation of complicated behaviour. SIAM Journal on Numerical Analysis, 36(2):491-515

Froyland, G. (2013). An analytic framework for identifying finite-time coherent sets in time-dependent dynamical systems. Physica D: Nonlinear Phenomena.

Kassam, A.-K. and Trefethen, L. N. (2005). Fourth-order time-stepping for stiff pdes. SIAM Journal on Scientific Computing, 26(4):1214-1233.f

Presentation schedule

- Attend your poster at all times (not just your time slot)
- Have at least 3 presentations available
  - 30 second elevator pitch – the one big thing, use this to capture attention!
  - 2-3 minute run through – here is the main argument
  - 10-15min – here are all the details…
- Use posters to make new contacts and update existing contacts on your progress
  - Engage in meaningful dialogs – ask questions, advice, feedback
- Posters are about dissemination AND feedback!
- Take notes!!!