

GOOD SCIENCE AND BAD VISUALIZATION: DESIGN PRINCIPLES FOR DATA VISUALIZATION

Donato Giovannelli

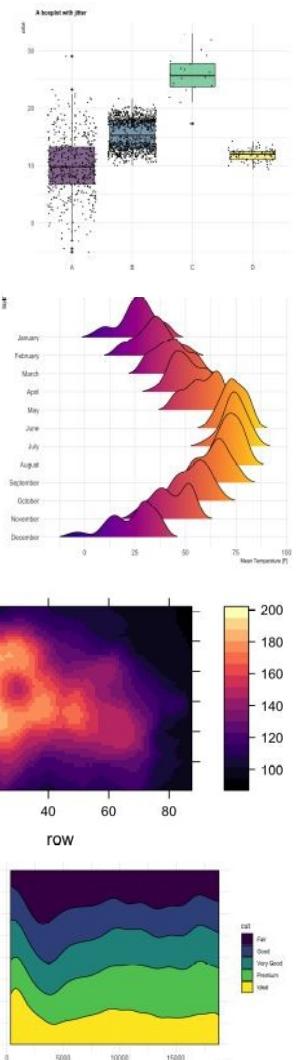
donato.giovannelli@unina.it

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MARINE



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All other information in this presentation are provided as is. This is meant to be a way to get you to start thinking about the design of your figures in a different way, hopefully pushing you to study the subject of information design and make better figures for your science.

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TODAY'S ROADMAP TO CLEAR COMMUNICATION

- WHY SHOULD YOU CARE
- EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT
- DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS
- TOOLS OF THE TRADE
- FROM GOOD TO GREAT

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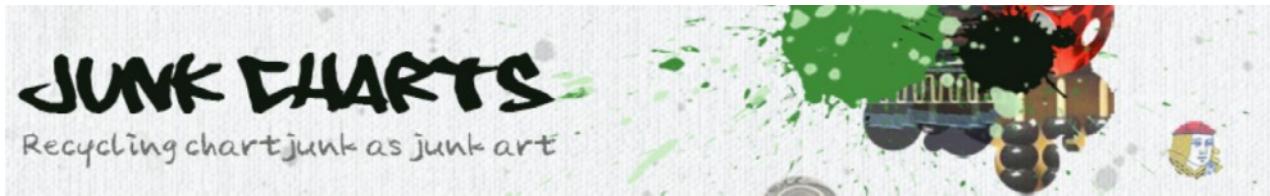
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RESOURCES



Nature Methods collection “Point of View” by Wong -
<http://go.nature.com/3nDvUlp>



Junk Charts blog - <https://junkcharts.typepad.com/>

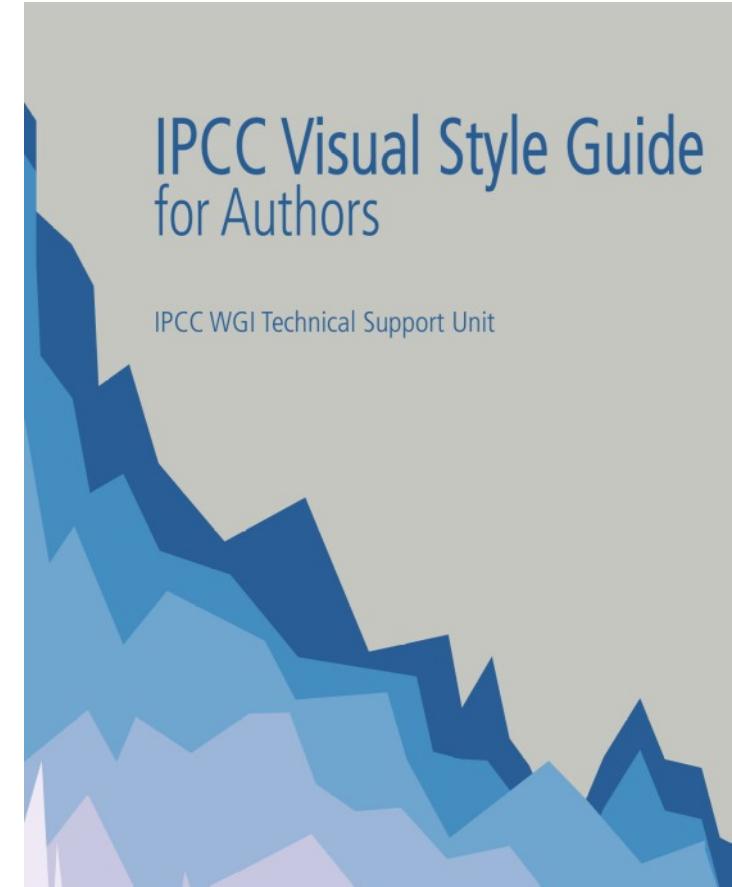
PLOS COMPUTATIONAL BIOLOGY

OPEN ACCESS

EDITORIAL

Ten Simple Rules for Better Figures

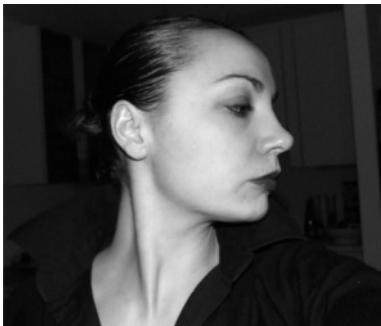
Rougier et al 2014 - <https://doi.org/10.1371/journal.pcbi.1003833>



IPCC “Visual Style Guide” by Gomis and Pidcock, 2018 -
<https://bit.ly/37Az9of>

THANKS TO

MINIMAL SPACE

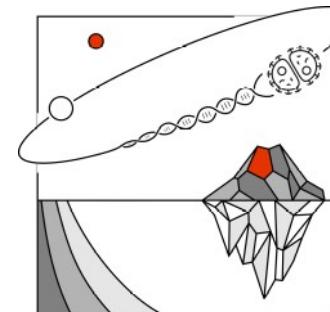
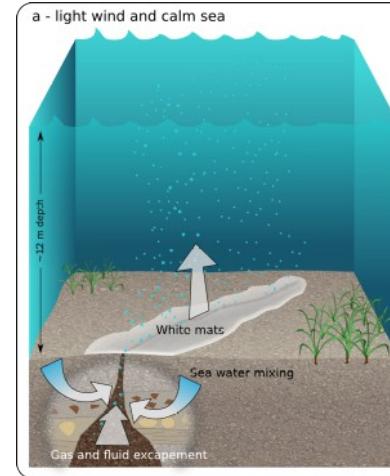


Patricia Barcala Dominguez

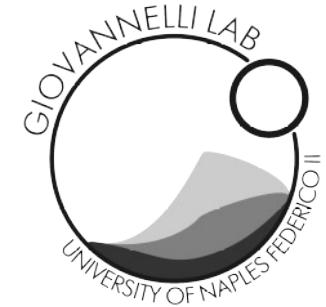
www.minimalspace.it



Some of the designs by Patricia:



BIOLOGY OF EXTREME
ENVIRONMENTS

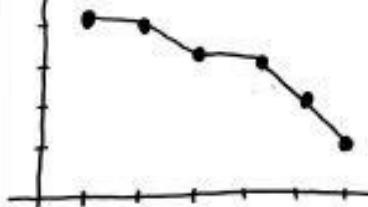


WHY SHOULD YOU CARE

I THINK WE SHOULD
GIVE IT ANOTHER SHOT.

WE SHOULD BREAK
UP, AND I CAN
PROVE IT.

OUR RELATIONSHIP



HUH.

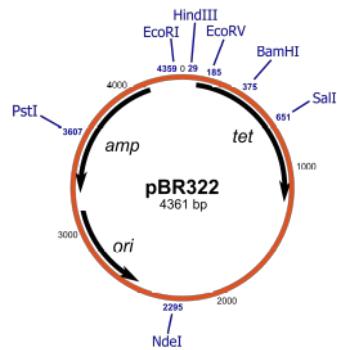
MAYBE YOU'RE RIGHT.

I KNEW DATA WOULD CONVINCE YOU.
NO, I JUST THINK I CAN DO
BETTER THAN SOMEONE WHO
DOESN'T LABEL HER AXES.

YOUR BEST EXPERIMENT (TO DATE)

WHY SHOULD YOU CARE

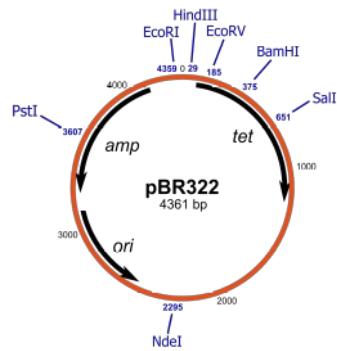
YOUR BEST EXPERIMENT (TO DATE)



START

WHY SHOULD YOU CARE

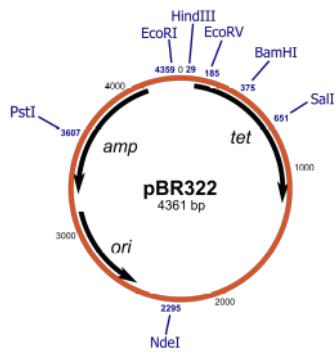
YOUR BEST EXPERIMENT (TO DATE)



START —————→

WHY SHOULD YOU CARE

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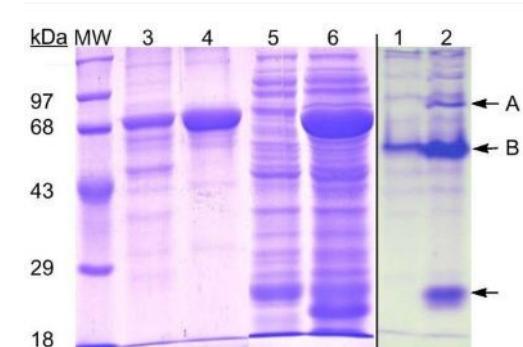
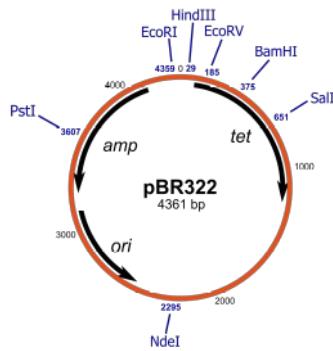


START



WHY SHOULD YOU CARE

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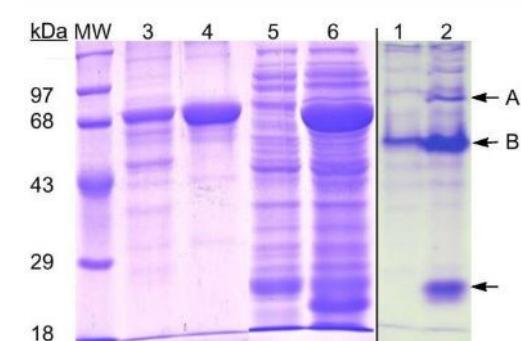
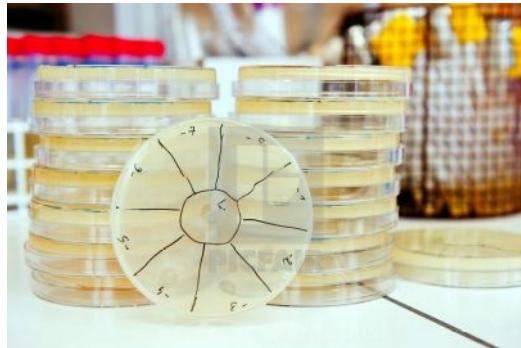
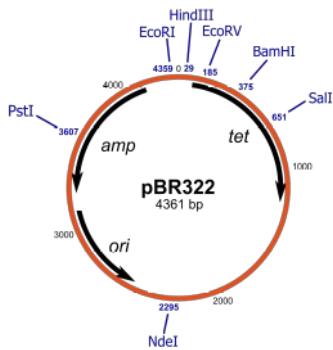


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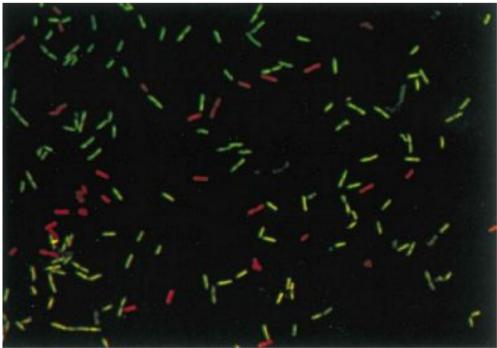


WHY SHOULD YOU CARE

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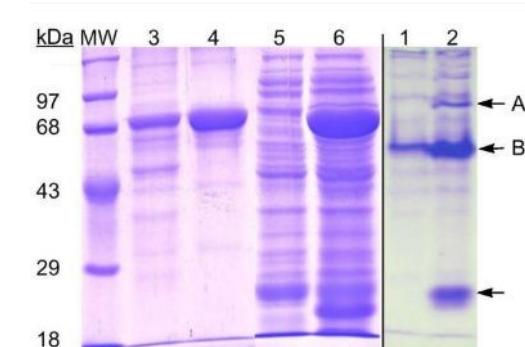
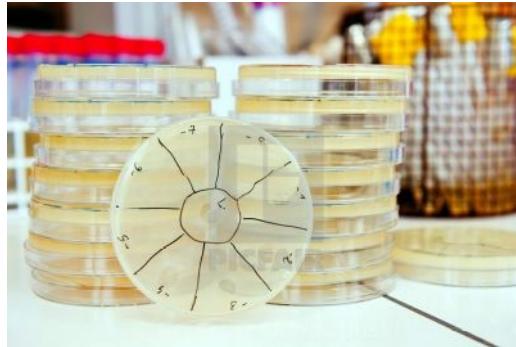
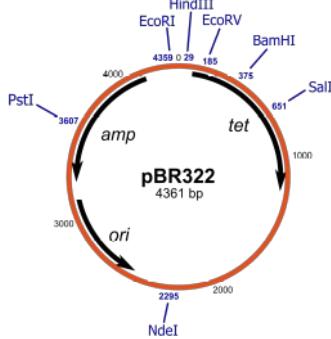


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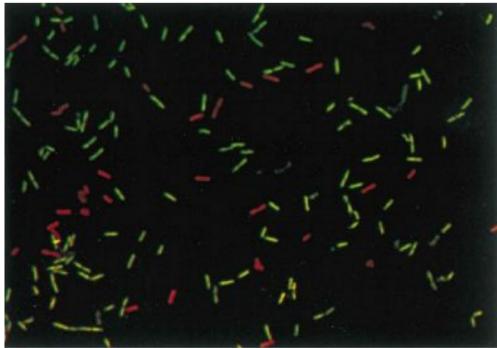


WHY SHOULD YOU CARE

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START

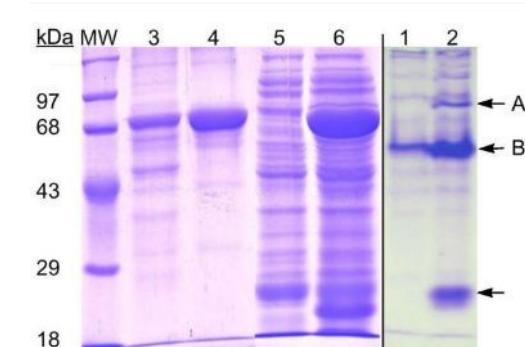
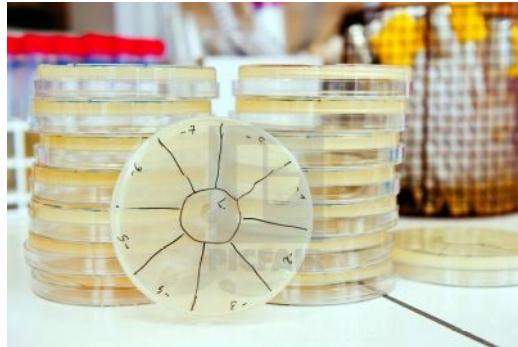
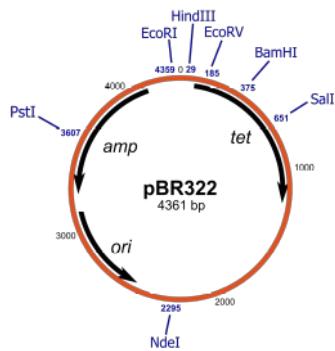


R7	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	station	layer	chla	fco	cpe	ldp	pst	che	lip	bac	pst-cho	tpn	pbm	sub	arc	bar
2	ST7	0-1	11.43	218.69	230.33	4.98	2.07	0.37	0.74	1.71	6.65	2.73	5.47	151519820	62386732	0.42
3	ST7	0-1	13.13	230.69	240.43	5.94	2.62	0.47	0.94	1.83	11.19	2.97	5.94	175992858	74032050	0.41
4	ST7	0-1	9.74	207.11	220.23	4.03	1.51	0.27	0.54	1.59	2.12	2.50	5.00	127046781	50741414	0.43
5	ST7	1-3	4.44	114.29	118.73	3.80	1.75	0.49	0.84	1.68	3.64	NA	NA	NA	NA	NA
6	ST7	1-3	5.19	146.09	151.28	4.21	2.00	0.56	1.06	1.76	3.94	NA	NA	NA	NA	NA
7	ST7	1-3	3.70	82.47	86.17	3.39	1.50	0.41	0.62	1.61	3.35	NA	NA	NA	NA	NA
8	ST7	3-5	3.74	77.58	81.31	4.61	2.52	0.33	1.14	2.22	7.68	0.40	0.80	22934613	12801425	0.28
9	GT7	3-5	3.09	96.10	90.00	4.96	2.98	0.37	1.60	2.40	9.27	0.46	0.92	23747031	14400004	0.25
10	ST7	3-5	3.58	69.05	72.63	4.33	2.12	0.29	0.67	2.04	6.10	0.34	0.68	22121395	11202246	0.33
11	ST7	5-10	3.23	62.47	65.69	4.92	4.98	0.27	0.30	2.77	19.07	0.14	0.39	10877676	1977100	0.69
12	ST7	5-10	3.91	76.99	80.90	5.03	5.81	0.35	0.40	3.09	22.92	0.16	0.47	12160277	2210475	0.69
13	ST7	5-10	2.55	47.94	50.48	4.82	4.14	0.20	0.20	2.46	15.22	0.11	0.32	9595074	1743726	0.69
14	ST4	0-1	2.91	58.64	61.54	5.02	0.16	0.27	4.78	0.51	0.62	3.00	6.00	178464006	58364649	0.51
15	ST4	0-1	4.00	72.52	74.34	7.84	0.17	0.33	5.03	0.60	0.77	3.24	6.47	212767897	67094691	0.52
16	ST4	0-1	1.81	44.75	48.75	2.20	0.14	0.20	4.52	0.41	0.47	2.77	5.53	144160115	49634407	0.49
17	CT4	1-3	8.04	121.11	130.06	8.00	1.38	0.25	0.47	1.02	5.47	NA	NA	NA	NA	NA
18	ST4	1-3	9.54	135.93	145.47	7.26	1.55	0.26	0.63	1.01	6.45	NA	NA	NA	NA	NA
19	ST4	1-3	8.38	106.30	114.64	6.54	1.17	0.22	0.31	0.83	4.49	NA	NA	NA	NA	NA
20	ST4	3-5	6.28	97.66	103.96	6.07	1.35	0.19	0.15	1.02	7.51	1.65	3.30	94323186	24209857	0.59

WHY SHOULD YOU CARE

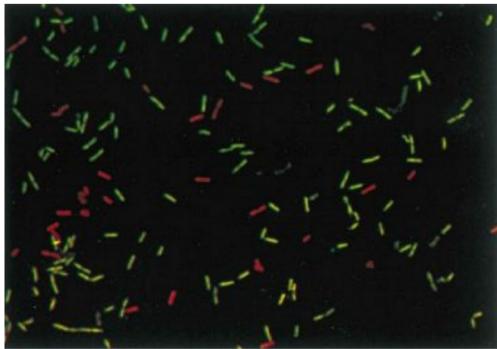
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YOUR BEST EXPERIMENT (TO DATE)



START

months to years

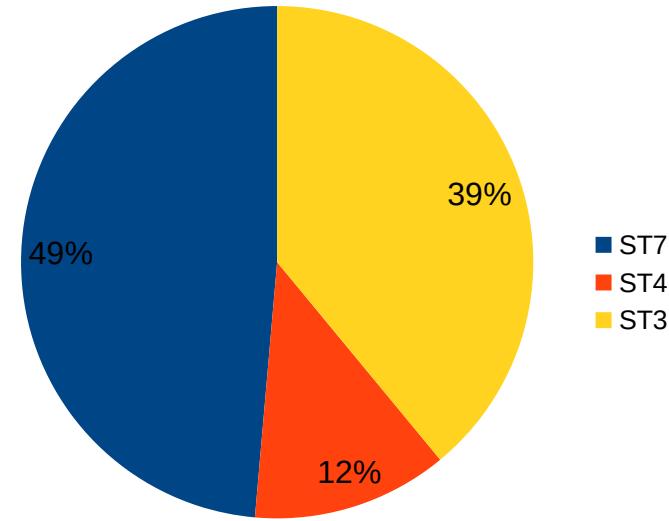
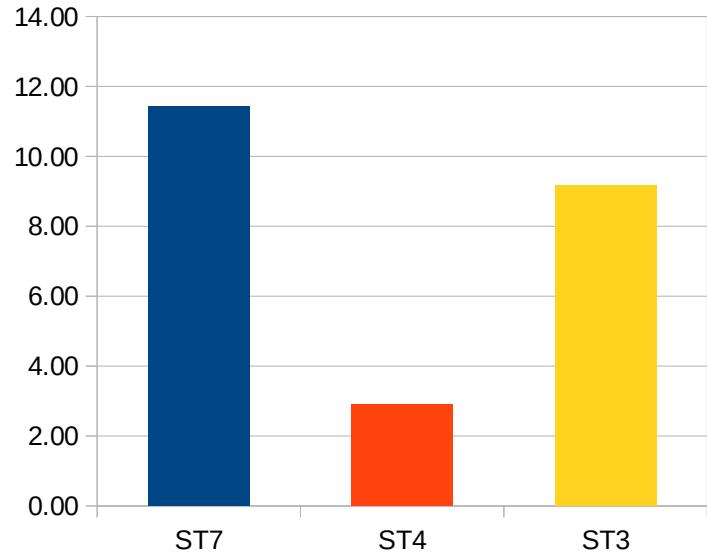


R7	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
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5	ST7	1-3	4.44	114.20	118.73	3.80	1.75	0.49	0.64	1.68	3.64	NA	NA	NA	NA	NA
6	ST7	1-3	5.19	146.09	151.28	4.21	2.00	0.56	1.06	1.76	3.94	NA	NA	NA	NA	NA
7	ST7	1-3	3.70	82.47	86.17	3.39	1.50	0.41	0.62	1.61	3.35	NA	NA	NA	NA	NA
8	ST7	3-5	3.74	77.58	81.31	4.61	2.52	0.33	1.14	2.22	7.68	0.40	0.80	22934613	12801425	0.28
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18	ST4	1-3	9.54	135.93	145.47	7.26	1.55	0.26	0.63	1.01	6.45	NA	NA	NA	NA	NA
19	ST4	1-3	8.35	106.30	114.64	6.54	1.17	0.22	0.31	0.83	4.49	NA	NA	NA	NA	NA
20	ST4	3-5	6.28	97.66	103.96	6.07	1.35	0.19	0.15	1.02	7.51	1.65	3.30	94323186	24209857	0.59

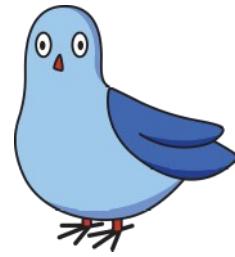
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WHY SHOULD YOU CARE

And often the results is:

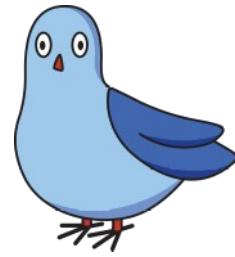


WHY SHOULD YOU CARE



EGOISTIC

WHY SHOULD YOU CARE



EGOISTIC



ALTRUISTIC

WHY SHOULD YOU CARE

ALTRUISTIC

1. Make your science count

WHY SHOULD YOU CARE

ALTRUISTIC

1. Make your science count



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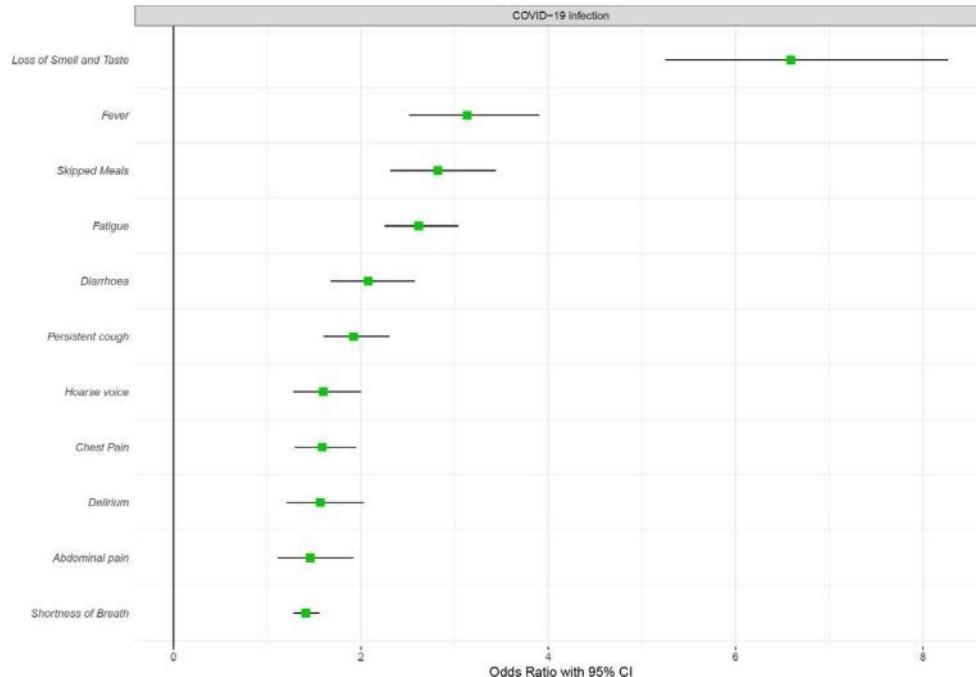
Brief Communication | Published: 11 May 2020

Real-time tracking of self-reported symptoms to predict potential COVID-19

WHY SHOULD YOU CARE

ALTRUISTIC

1. Make your science count

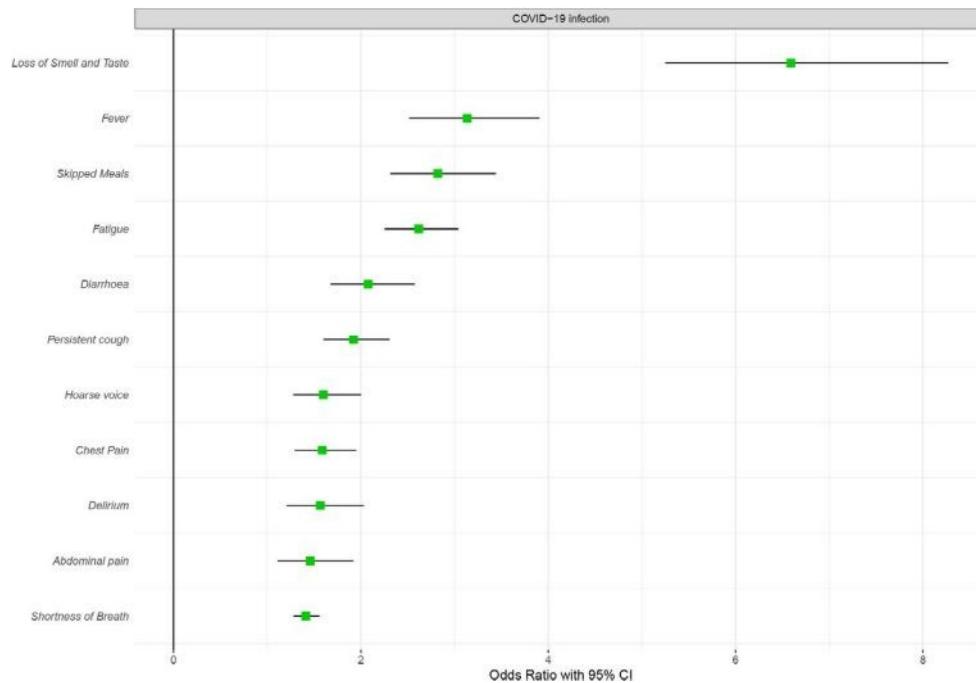


<https://www.medrxiv.org/content/10.1101/2020.04.05.20048421v1>

WHY SHOULD YOU CARE

ALTRUISTIC

1. Make your science count

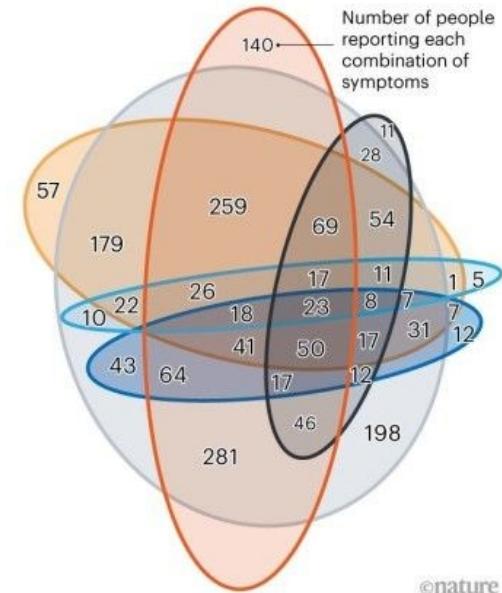


<https://www.medrxiv.org/content/10.1101/2020.04.05.20048421v1>

TRACKING SYMPTOMS

On 7 April, around 60% of app users who tested positive for COVID-19 and reported symptoms had lost their sense of smell.

— Anosmia (loss of smell) — Cough — Fatigue
— Diarrhoea — Shortness of breath — Fever



©nature

<https://www.nature.com/articles/d41586-020-01023-2>

WHY SHOULD YOU CARE

ALTRUISTIC

2. Clear up confusion regarding the message

WHY SHOULD YOU CARE

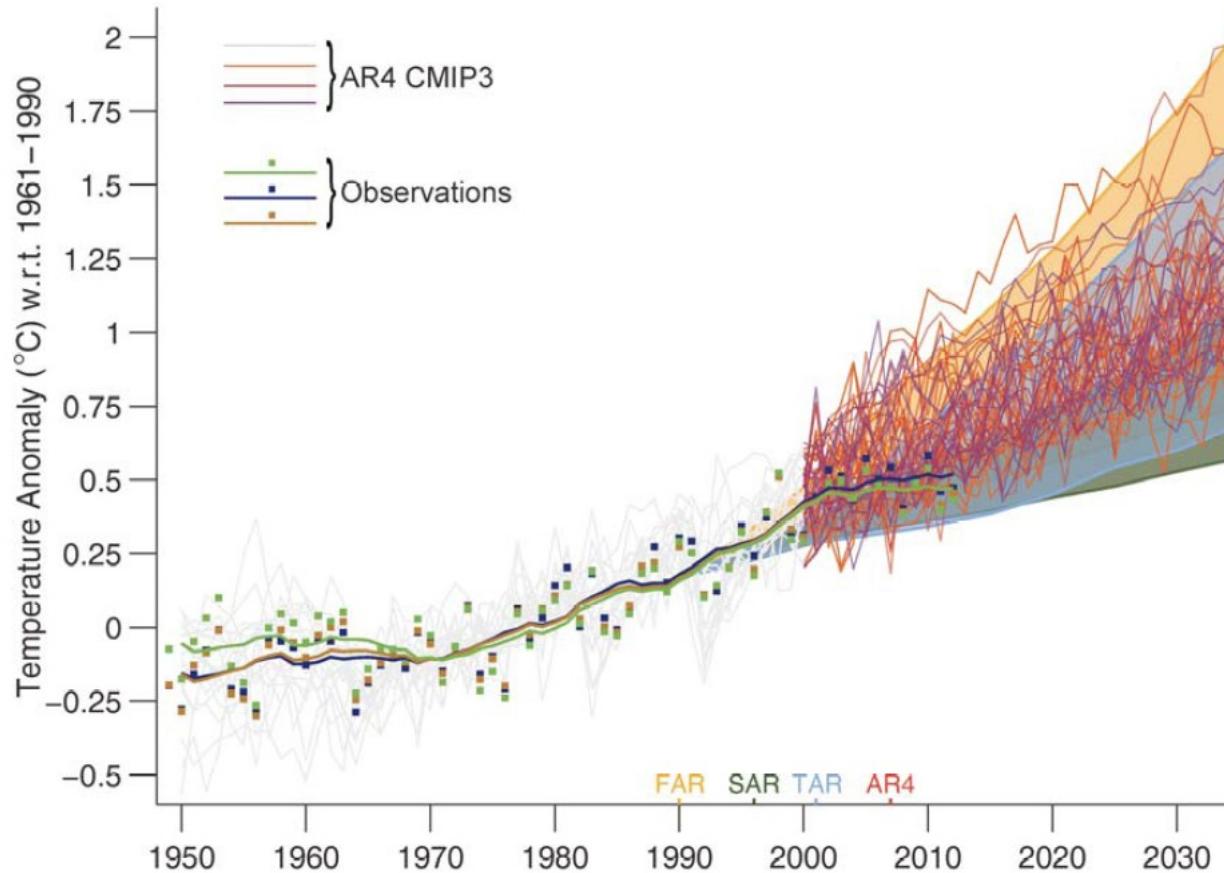
IPCC Visual Style Guide
for Authors

IPCC WGI Technical Support Unit

IPCC "Visual Style Guide" by Gomis
and Pidcock, 2018

ALTRUISTIC

2. Clear up confusion regarding the message



WHY SHOULD YOU CARE

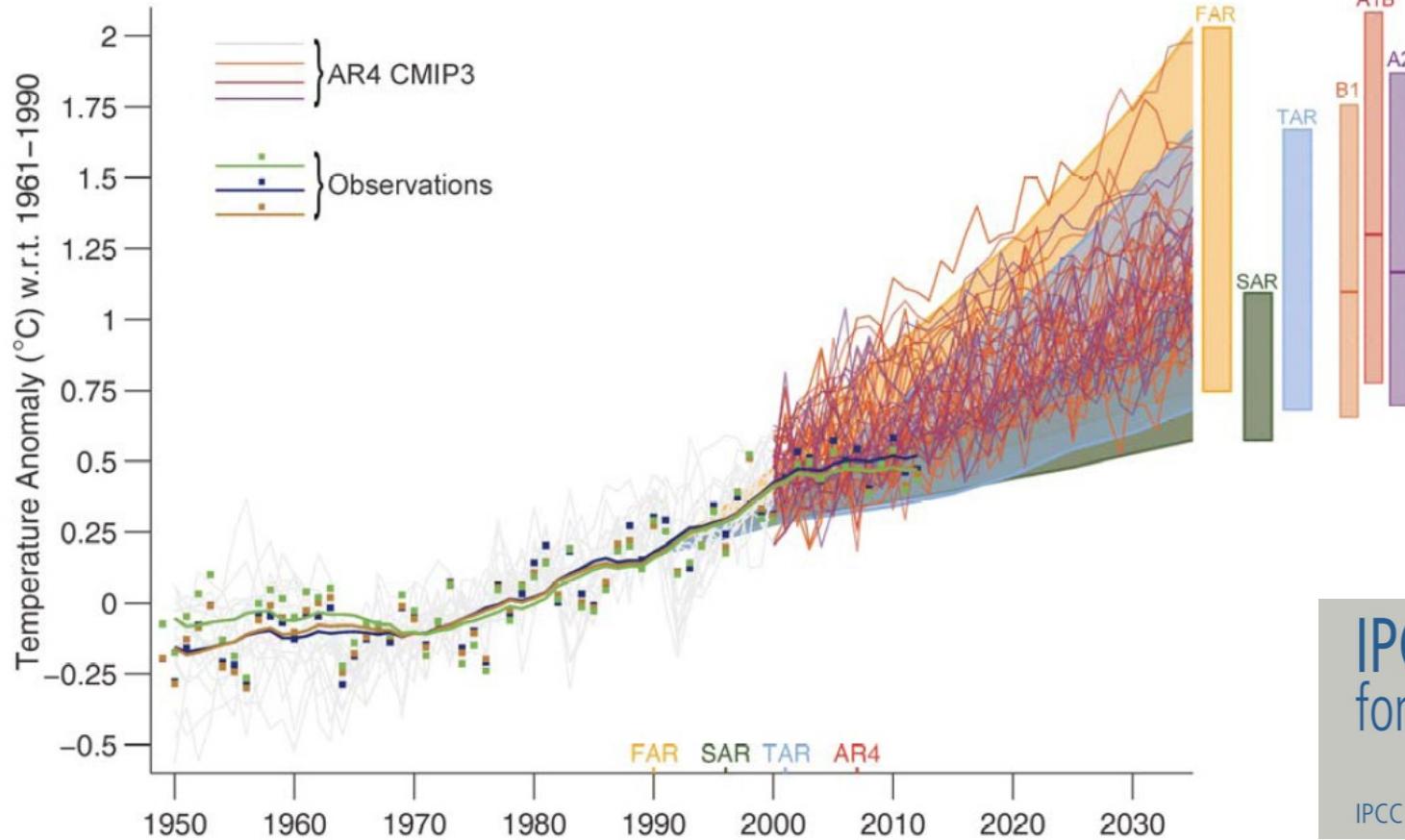
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ALTRUISTIC

2. Clear up confusion regarding the message



WHY SHOULD YOU CARE

IPCC Visual Style Guide
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and Pidcock, 2018

EGOISTIC

3. Good communication increases your likelihood of getting a job

**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 a grain, and the only side effect would be to upgrade one's stretchy pants ("space pants"). But because mass diet schedules 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 we were not offered. Every 30 days, each Guinea pig was weighed. After 5 years, we found that individuals, on average, weighed nothing more than they did when nothing more than weight appeared to be gained on the balance of the spectrum. 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 1980s 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 intra-orbital travel options for normal consumers and potential travellers 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.

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 startup. I am also grateful for comments on early drafts by Matrena Athletic Club, Corpus Christi, USA. Finally, sincere thanks to the Guy Foundation for generously donating animal care after the conclusion of the study.

LITERATURE CITED:

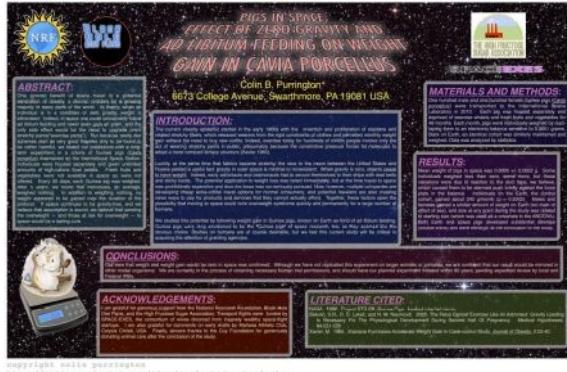
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Sekulić, S.R., D. D. Lukšić, and N. M. Naumović. 2005. The Fetus Cannot Exercise Like An Astronaut: Gravity Loading Is Necessary For The Physiological Development During Second Half Of Pregnancy. Medical Hypotheses. 64:221-226.
Xavier, M. 1965. Elastane Purchases Accelerate Weight Gain In Case-control Study. Journal of Obesity. 2:23-40.

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WHY SHOULD YOU CARE

EGOISTIC

3. Good communication increases your likelihood of getting a job



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 matters to be addressed. Give some graphs on introduction.

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 titles, headings, etc., to subtly tug them as different. Research has also shown that fully justified text (like this paragraph) is harder to read, so don't do that; even if it seems cool and professional looking.

Materials and methods

Few people really want to know the gory details of what you've been up to, so be brief. And be visual. Use a photograph, drawing, or flowchart if possible. If you can't get away with a photo, draw a schematic procedure. If you can't somehow afford 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're 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 coyote (*Canis latrans*) howling. *American Midland Naturalist* 136:413-417.
Bordet, J. 1984. The estimation of recombination rates. Pages 87-105 in *The Evolution of Sex*, edited by R.E. Michod and D.R. Levin. Sinauer, Sunderland, MA.
Scott, E.C. 2005. *Evolution vs. Creationism: an Introduction*.

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

University of California Press, Berkeley.
Society for the Study of Evolution. 2003. Statement on teaching evolution. <<http://evolutionstatements.org/statements.html>>. Accessed 2005 Aug 9.

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



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 sure that seems interesting. Because most people 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 don't have 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 honest and generous in this section. You never know who your literature may be at the conference, and further assume they are crabby and inflexible. You can also draw upon less formal types of context such as conversations you have had with smart and interesting people (Grid, personal communication).

Finally, you want to tell readers who have lasted this far that you are a good person. E.g., "I'm a good person, 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 their to defend 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.

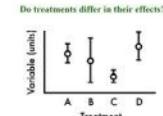


Figure 3. Legends can describe the experiment, answer the question, and even include statistics if you so choose (unlike a manuscript Figure legend). Just keep brief!

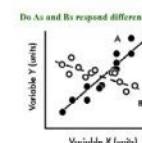


Figure 4. Label elements instead of relying on annoying keys that are defaults on most software. Add pictures of A and B if they are actually things (e.g., icons of aster and begonia flowers).

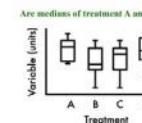


Figure 5. For the love of God, do not be tempted to reduce font size in figure legends, axes labels, etc. Your viewers are probably most interested in reading your figures and legends.

Acknowledgments

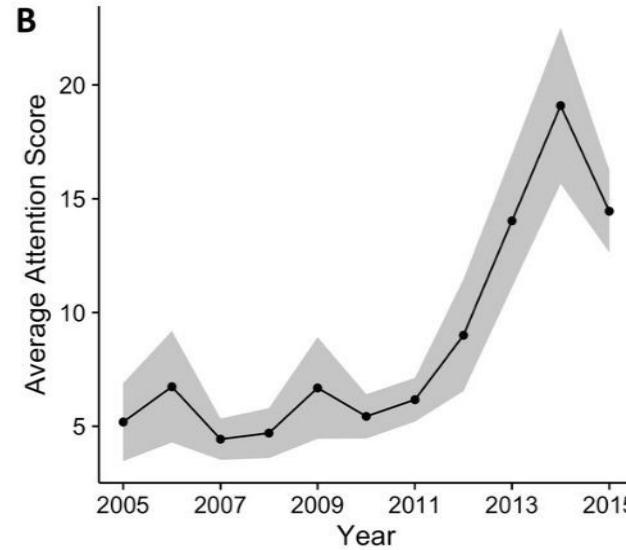
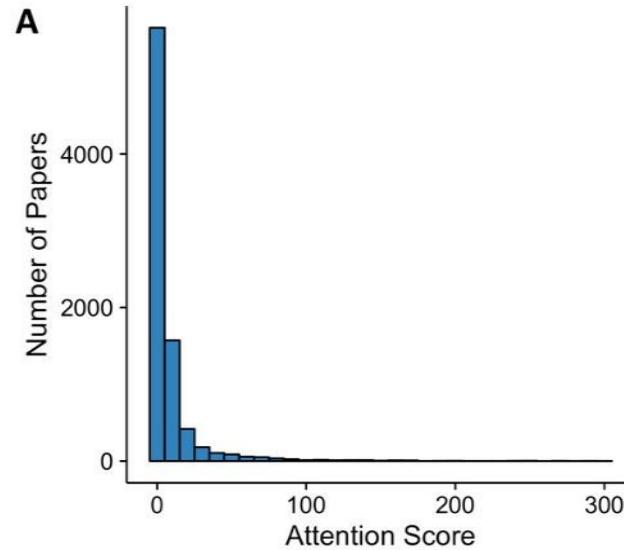
We thank I. Giora for laboratory assistance; Mary Juanas for seeds, and Herb Isside for greenhouse care. Funding for this project was provided by the Department of Thunkology. (If you want to clutter your poster with annoying logos, shrink them down so that they fit in the margins and aren't crowding text too much. Note that people's titles are omitted...*obliges me TML*.)

Further information

More tips than you'd ever want can be found on "Designing conference posters," at <http://colinpurrington.com/tips/academe/posterdesign>. (Note the URL will be stripped of academic hyperlinks when you copy/paste it into a poster; you can do that by right-clicking and removing hyperlinks.) This file and contents copyright Colin Purrington. Free for people to link to and use, but not for plagiarizing, adapting, or hosting elsewhere (thanks!).

EGOISTIC

3. Good communication increases your likelihood of getting a job

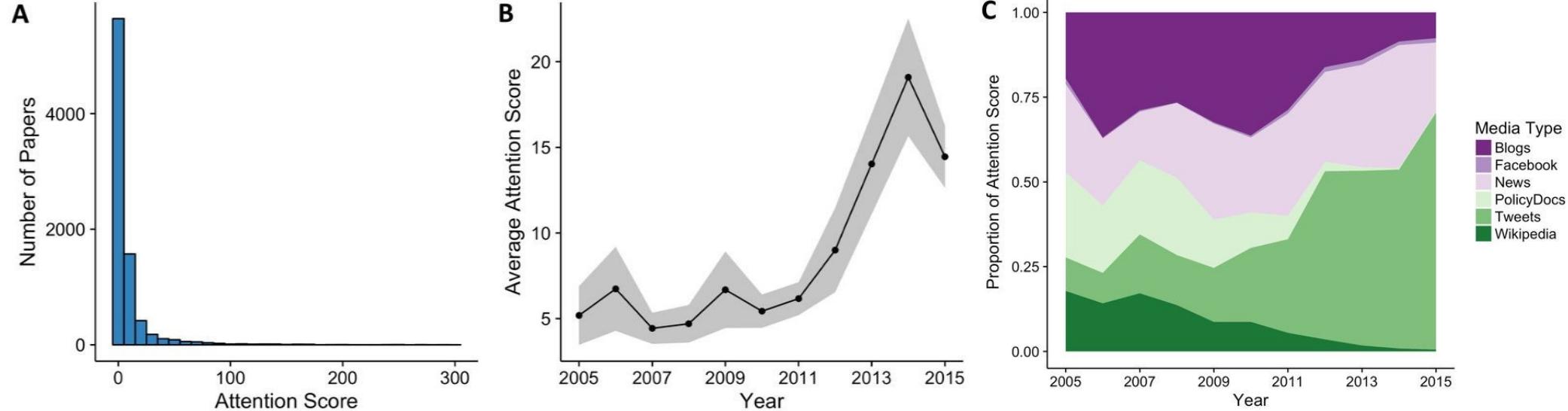


<https://peerj.com/articles/4564/>

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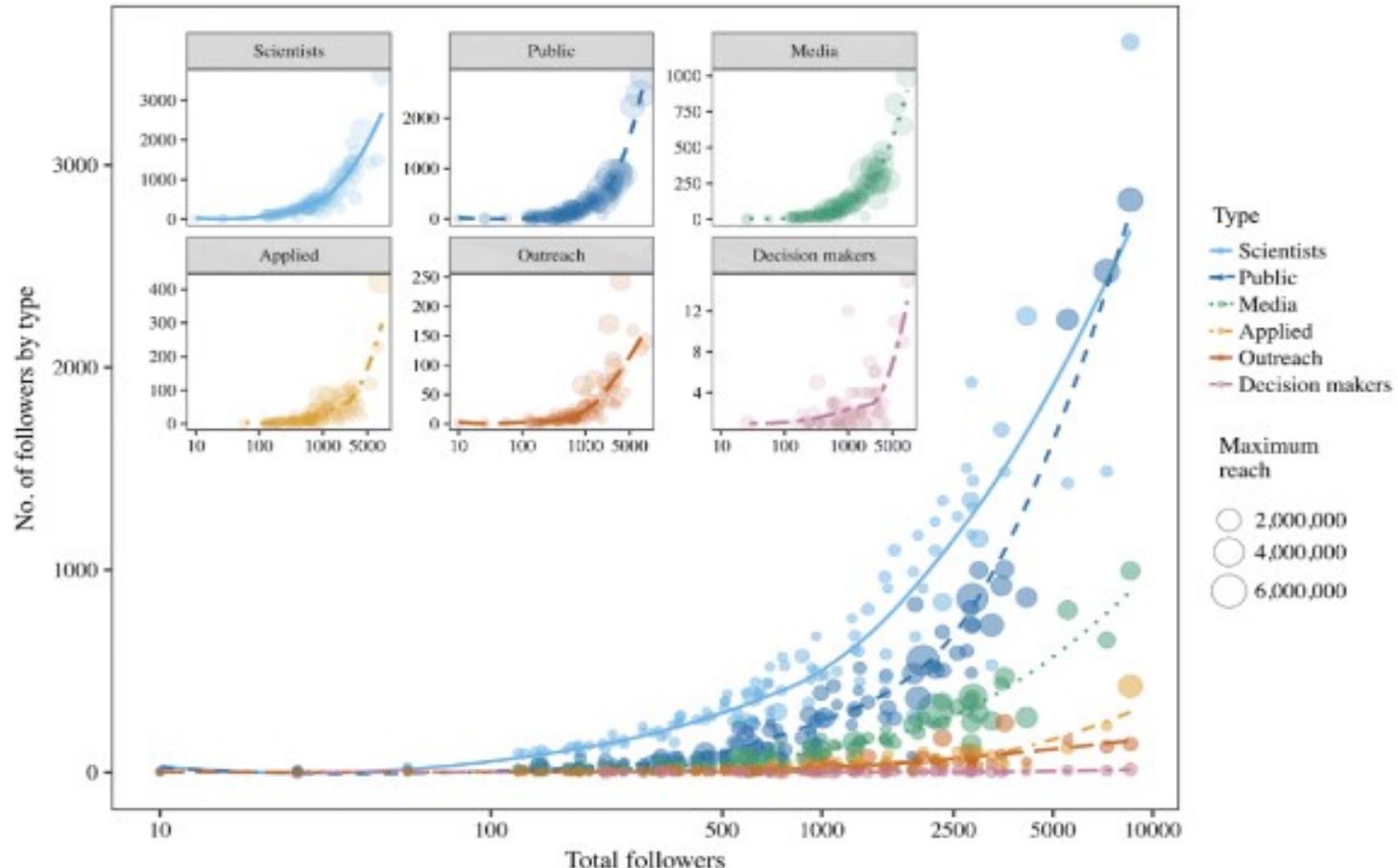


<https://peerj.com/articles/4564/>

WHY SHOULD YOU CARE

EGOISTIC

4. Good communication increases your likelihood of getting to the “right person”



WHY SHOULD YOU CARE

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4. Good communication increases your likelihood of getting to the “right person”

WHY SHOULD YOU CARE



EGOISTIC

4. Good communication increases your likelihood of getting to the “right person”



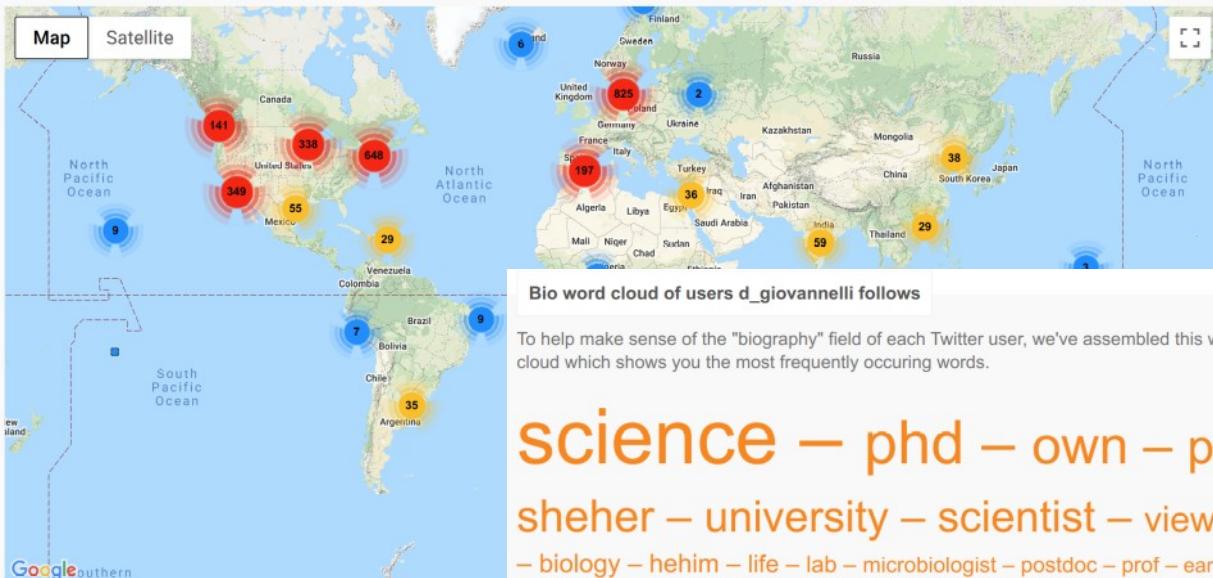
WHY SHOULD YOU CARE



@d giovannelli

EGOISTIC

4. Good communication increases your likelihood of getting to the “right person”



Two word bio cloud

phd student – assistant professor – microbial ecology –
phd candidate – microbial ecologist – associate professor – climate change – research scientist – assst
prof – evolutionary biologist – research fellow – deep sea – data science – marine biologist – planetary scientist – extreme environments – own sheher – postdoctoral fellow – state university – environmental microbiology – science writer – environmental microbiologist – earth sciences – postdoctoral researcher – data scientist

WHY SHOULD YOU CARE



EGOISTIC

4. Good communication increases your likelihood of getting to the “right person”



Michael Eisen 
56.9K Tweets

 Following

Michael Eisen 
@mbeisen

I study how flies are made & how fungi control their behavior. I fight to make science open and fair. EIC of eLife. He/him. My conflicts bit.ly/2uC3FNF

⌚ 37° 14' 6" N, 115° 48' 40" W ⌚ michaeleisen.org Joined February 2009

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 Followed by Foad.Fahmide, BacteriaVsPhage!, and 826 others you follow

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[← Michael Eisen](#)  56.9K Tweets



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[← Karen Lloyd](#) 3,979 Tweets



Following

Karen Lloyd

@archaearama Follows you

Deep subsurface microbiologist, runner, laugher, wife and parent. She/her/hey-you

📍 Knoxville, TN 📅 Joined November 2012

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WHY SHOULD YOU CARE



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Michael Eisen

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Karen Lloyd

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@archaearama Follows you

Deep subsurface microbiologist, runner, laugher, wife and parent. She/her/hey-you

📍 Knoxville, TN Joined November 2012

1,393 Following 4,143 Followers

WHY SHOULD YOU CARE

Amelia Barber @frau_dr_barber · Dec 1

LAST CALL! 🎤 Applications due Thursday for this #phdposition (as well as two others) in **microbial** science. More info @ microverse-cluster.de/en/jobs.html

Amelia Barber @frau_dr_barber · Oct 29

We've got an open #PhDposition studying bioinformatics and the ecology of human-pathogenic fungi. More information at [@LeibnizHKI](http://jsmc-phd.de/vacant-position...) @JSMC_Info @microverse_exc

Show this thread

PhD Student in Microbiology & Bioinformatics

Research Areas: Bioinformatics, metagenomics, microbial ecology

The field of study:

The successful candidate will investigate how environmental fungi cause human disease using genomic, transcriptomic, and metagenomic approaches. The main foci of the project are:

- Defining metagenomic communities and microbial interaction networks involving human-pathogenic fungi.
- Delineating shared and niche-specific patterns among ecological and human-associated environments.

Required Qualifications:

- Master's degree in bioinformatics, microbiology, biochemistry, computer science, or a related discipline.
- Knowledge and expertise in the analysis of biological high-throughput data and statistical methods.
- Experience with programming (Python, Perl, R, or C++).
- Good communication skills in English.

Contact: Amelia.E.Barber@uni-jena.de Applications due December 3 apply.jsmc.uni-jena.de

4 3 1 ↑

Martin_Taubert @taubert_martin · Nov 13

I'm looking for a PhD candidate to join my group @[microverse_exc](#) to establish #**microbial** cocultures using metabolic labeling and microfluidics techniques! #**PhDposition** #**phdchat**

Please retweet!

Open PhD position: Targeted 'fishing' for microbial in ion part

Join the Microverse as a PhD in Targeted 'fishing' fo... Martin Taubert, Junior Research Group Leader at Balance of the Microverse is looking for a PhD ... youtube.com

1 43 32 1 ↑



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5. Leads to higher citations and invites

WHY SHOULD YOU CARE

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5. Leads to higher citations and invites

Invites to conferences



WHY SHOULD YOU CARE

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5. Leads to higher citations and invites

Invites to conferences



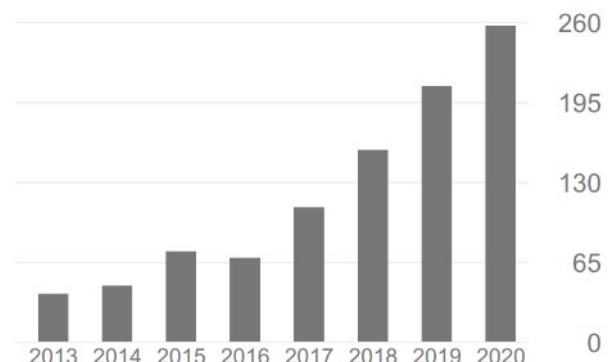
**Gordon Research
Conferences**

Frontiers of Science



More citations

	All	Since 2015
Citations	1046	880
h-index	16	14
i10-index	20	19



WHY SHOULD YOU CARE

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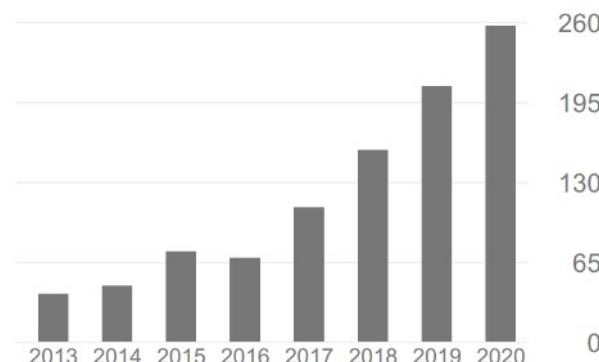
5. Leads to higher citations and invites

Invites to conferences



More citations

	All	Since 2015
Citations	1046	880
h-index	16	14
i10-index	20	19



Better evaluation



Evaluation of Research Quality



Valutazione Qualità della Ricerca

WHY SHOULD YOU CARE

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

EXAMPLES OF BAD VISUALIZATION

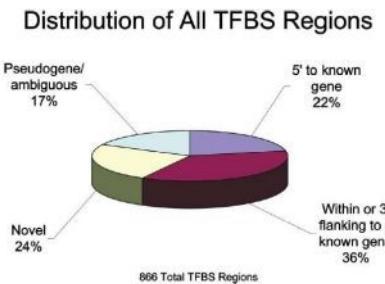
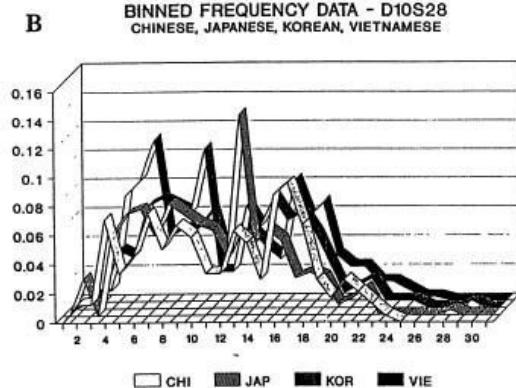
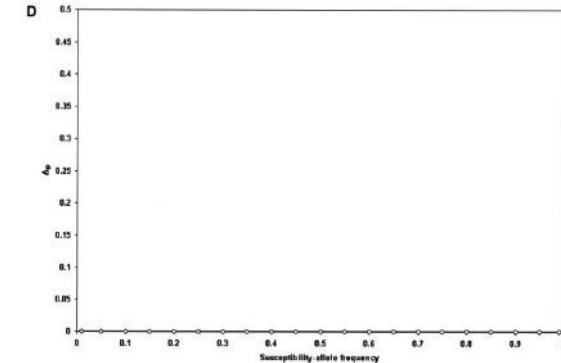
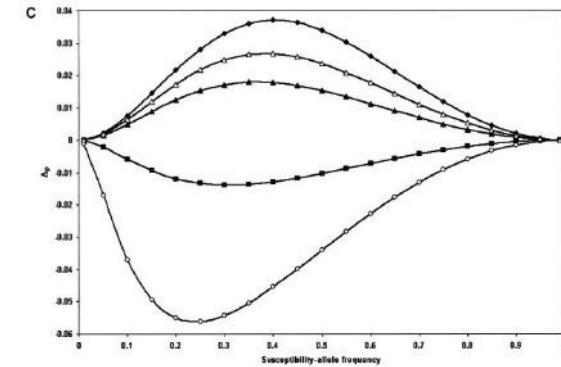
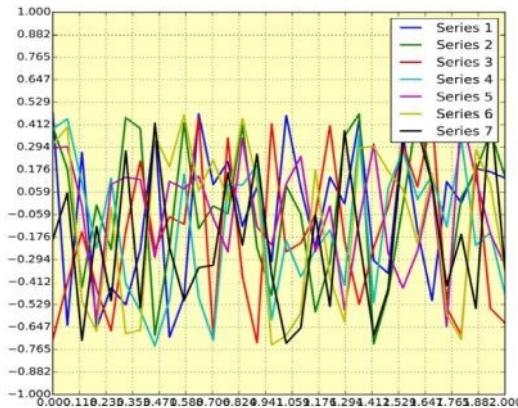
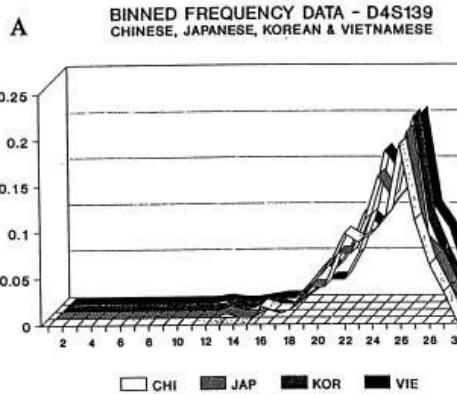


Figure 1. Classification of TFBS Regions
TFBS regions for Sp1, cMyc, and p53 were classified based upon proximity to annotations (RefSeq, Sanger hand-curated annotations, and UniProt/SwissProt) and to novel or unassigned predicted genes. The proximity was calculated from the center of each TFBS region. TFBS regions were classified as follows: within 5 kb of the 5' most exon of a gene, within 5 kb of the 3' terminal exon, or within a gene, novel or outside of any annotation, and pseudogene/ambiguous (TFBS overlapping or containing pseudogenes, or TFBS regions limited to chromosome 22, or TFBS regions falling into more than one of the above categories).

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

https://www.biostat.wisc.edu/~kbroman/topten_worstgraphs/

KEY CONCEPT 1. JUNK CHARTS

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 1. JUNK CHARTS

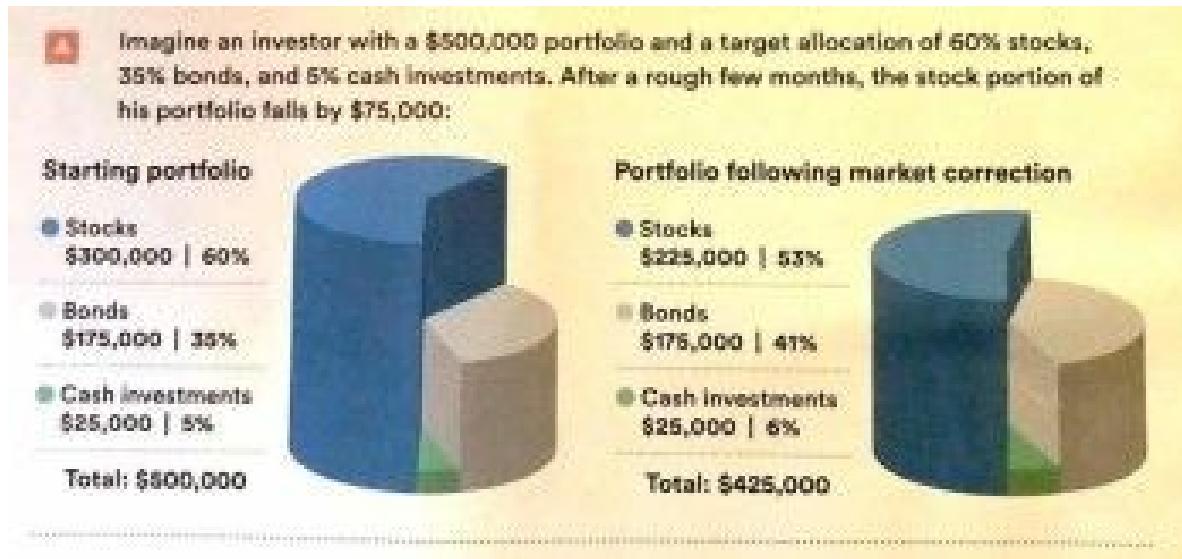
<https://junkcharts.typepad.com/>



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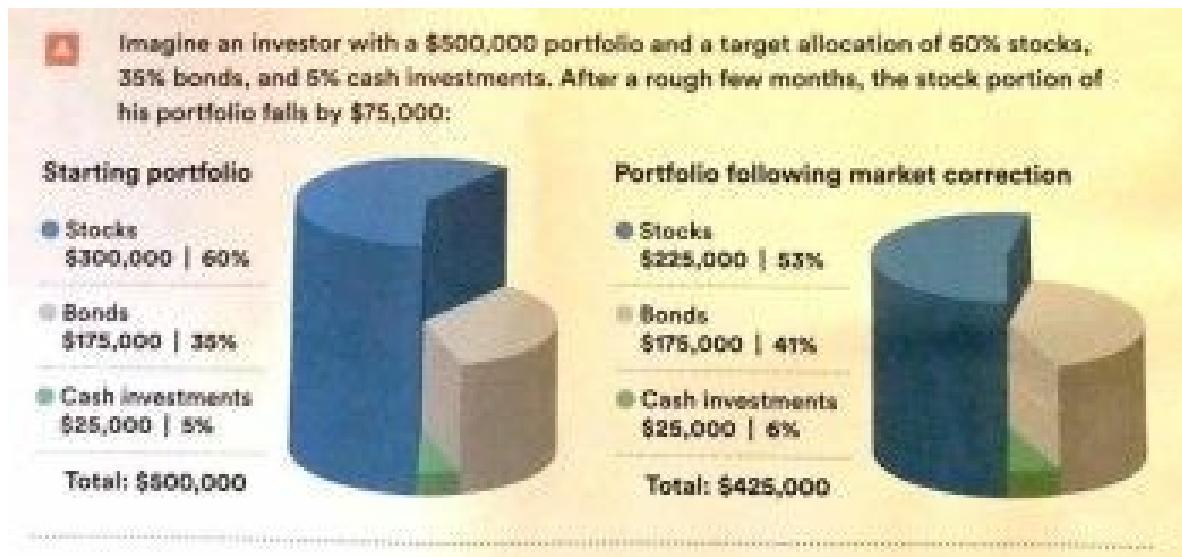
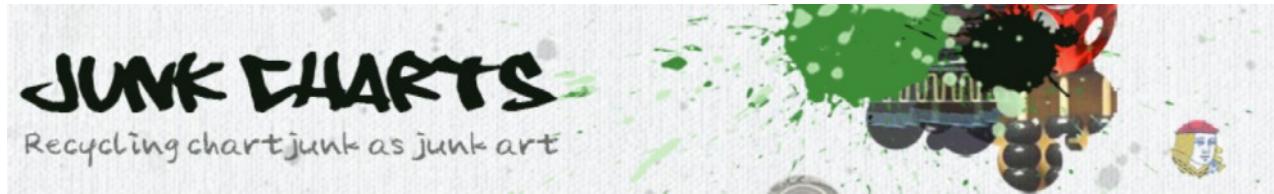


Trading house, Charles Schwab

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 1. JUNK CHARTS

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Trading house, Charles Schwab

This portfolio suffered a substantial loss because of its high allocation to stocks.



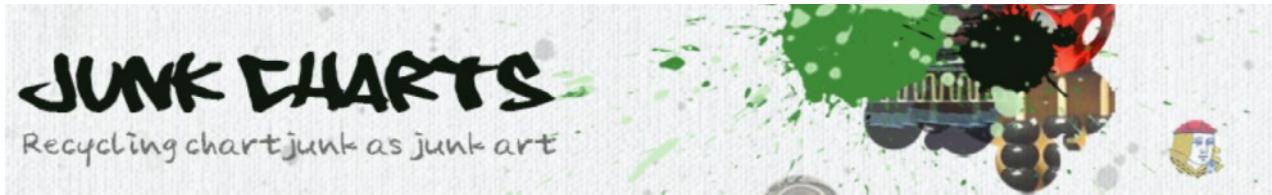
Adapted from Charles Schwab

Kaiser Fung / JunkCharts

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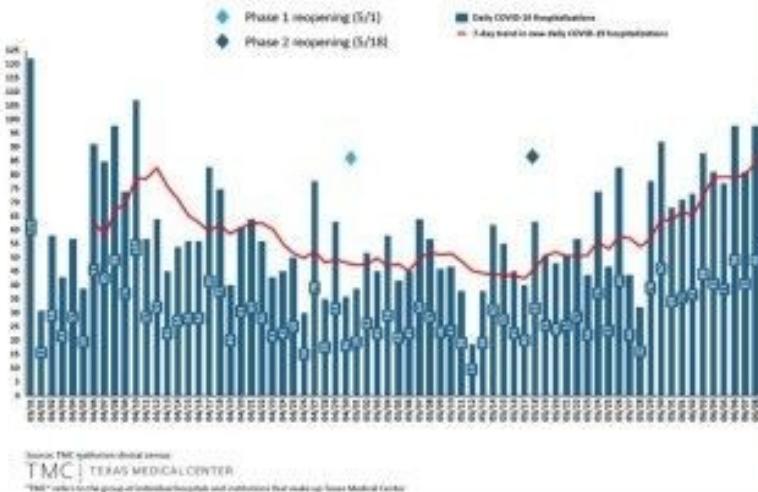
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TMC DAILY NEW COVID-19 HOSPITALIZATIONS

ICU & Med Surg hospitalizations



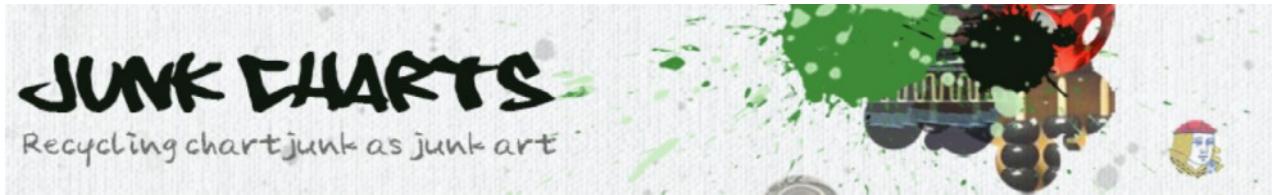
Hospital admissions due to Covid-19 in Texas



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

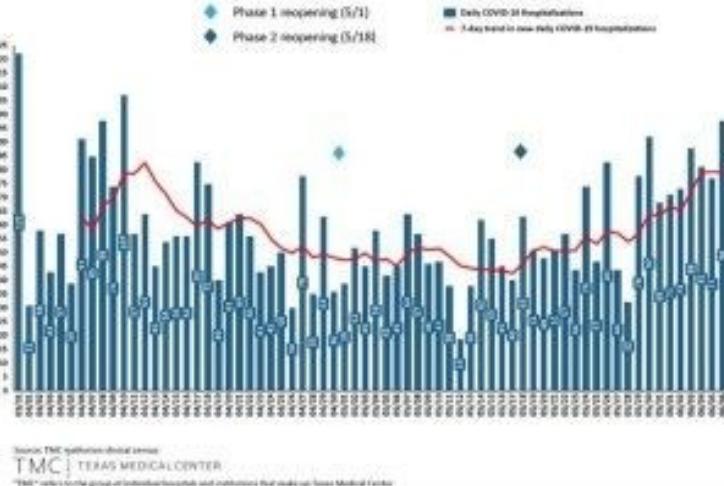
KEY CONCEPT 1. JUNK CHARTS

<https://junkcharts.typepad.com/>



TMC DAILY NEW COVID-19 HOSPITALIZATIONS

ICU & Med Surg hospitalizations



Hospital admissions due to Covid-19 in Texas

Monitoring threshold:

Threshold is exceeded by the occurrence of a positive 7-day average growth

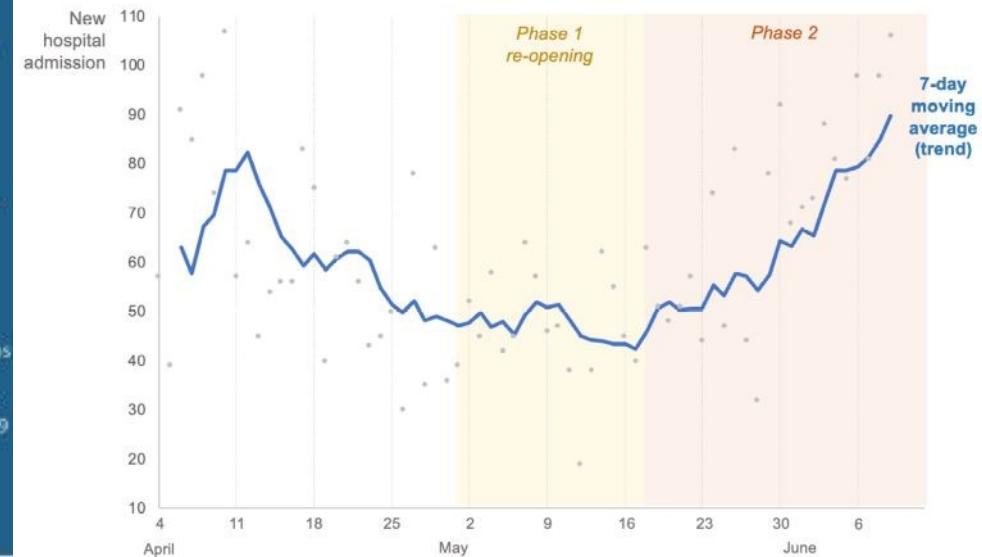
Current status:

4.5% average growth in the COVID-19 daily hospitalizations trend

Notes:

While new daily cases may fluctuate for a variety of reasons (e.g., testing), the daily hospitalization trend shows an objective view of how COVID-19 impacts hospital systems

After **Phase 2 re-opening**, Texas has seen a rise in new admissions to ICU and Med. Surg. in hospitals.

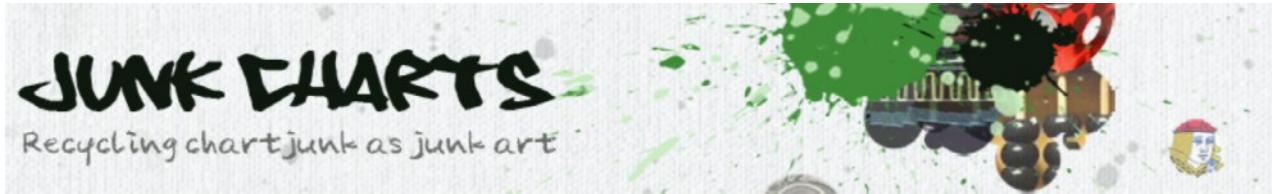


Kaiser Fung / JunkCharts

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

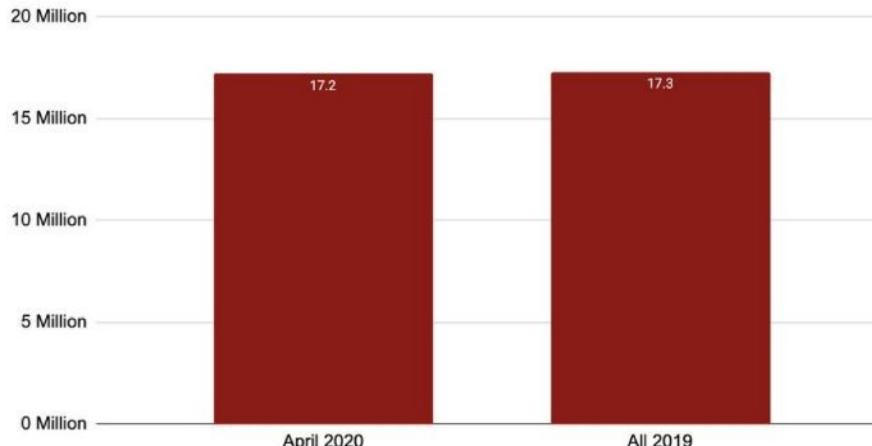
KEY CONCEPT 1. JUNK CHARTS

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Number of People Flowing from Employed to Unemployed

Our job-based health care system uninsures people constantly.

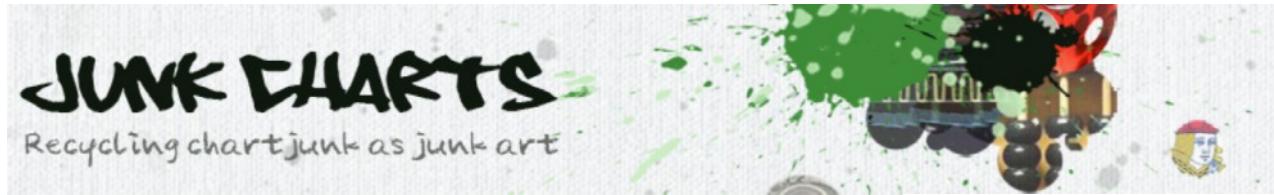


People's Policy Project, evolution of unemployment during covid

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

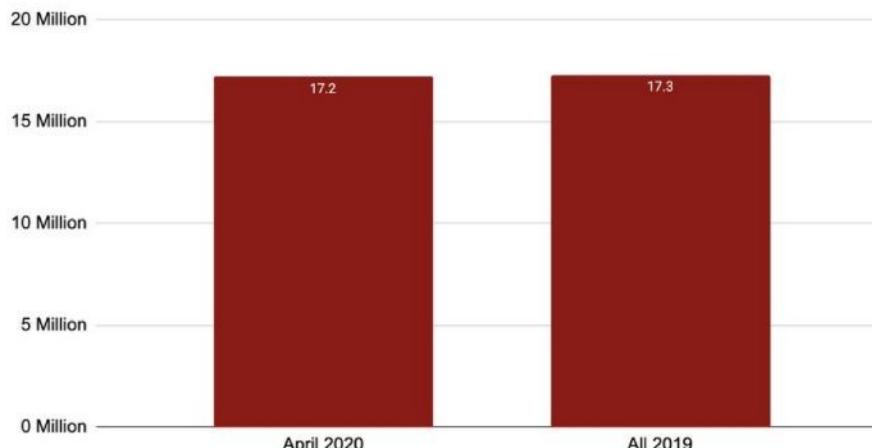
KEY CONCEPT 1. JUNK CHARTS

<https://junkcharts.typepad.com/>



Number of People Flowing from Employed to Unemployed

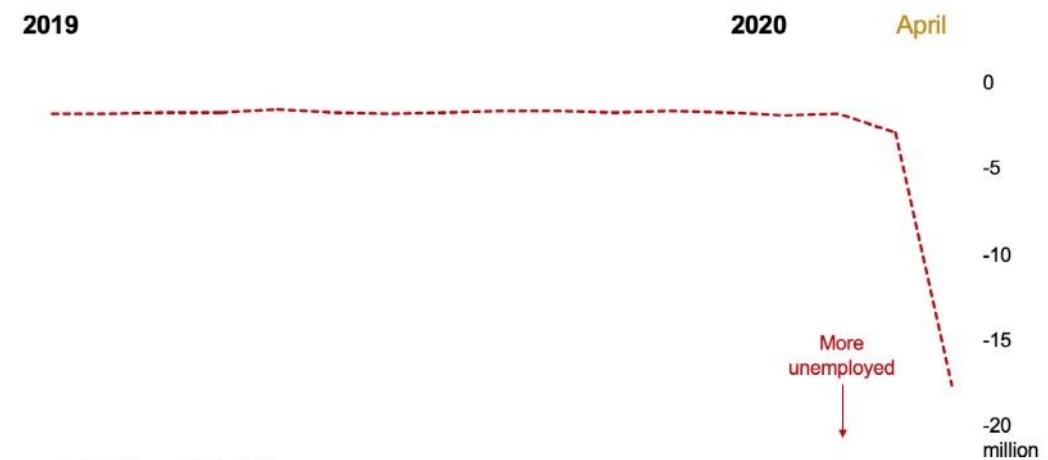
Our job-based health care system uninsures people constantly.



People's Policy Project, evolution of unemployment during covid

Employed Americans Becoming Unemployed

The exits held steady during 2019, and then sank to 1/12 during April 2020

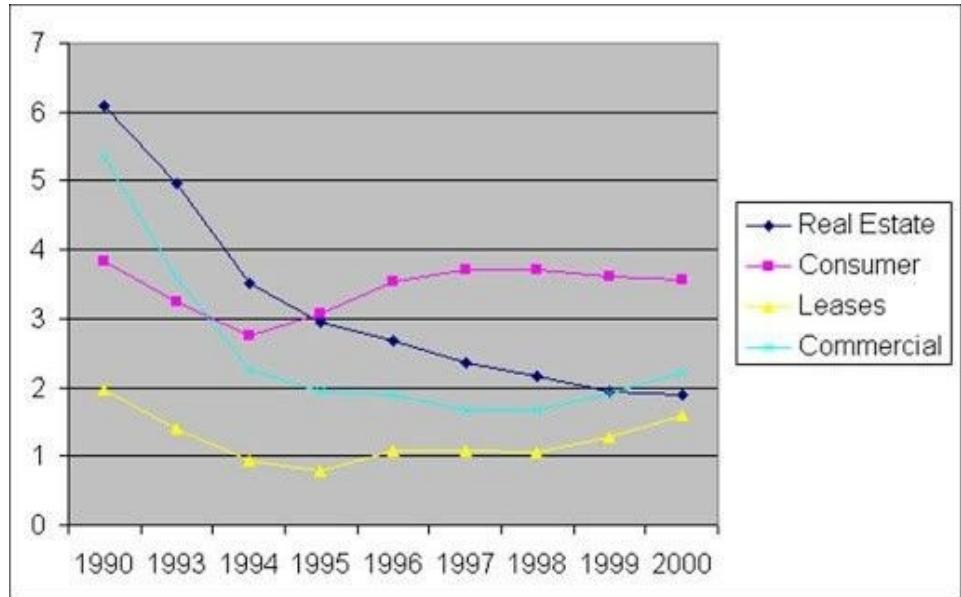


EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 2. EXCEL IS EVIL

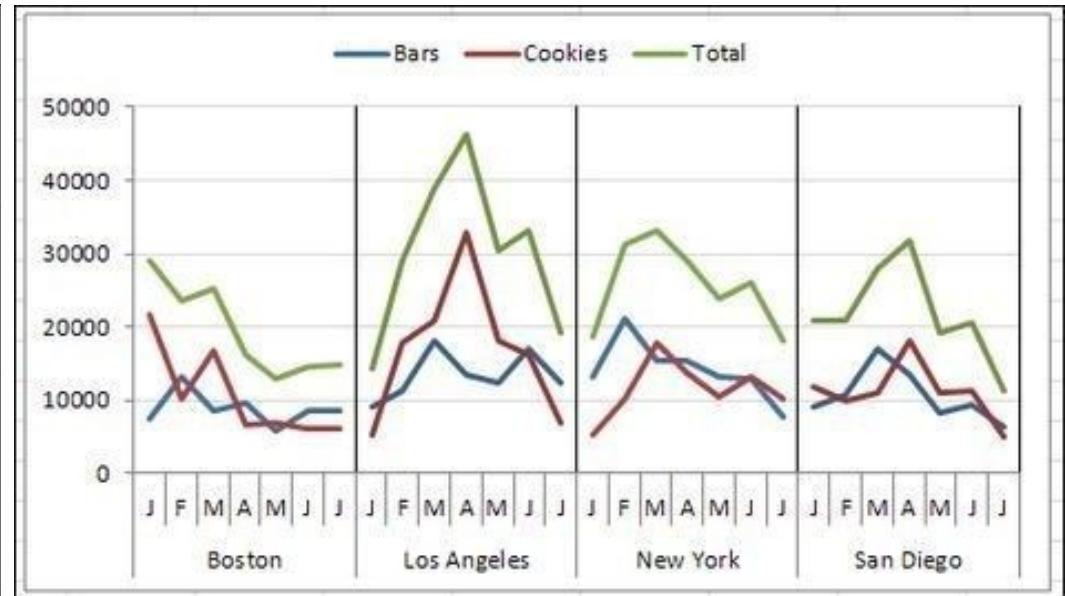
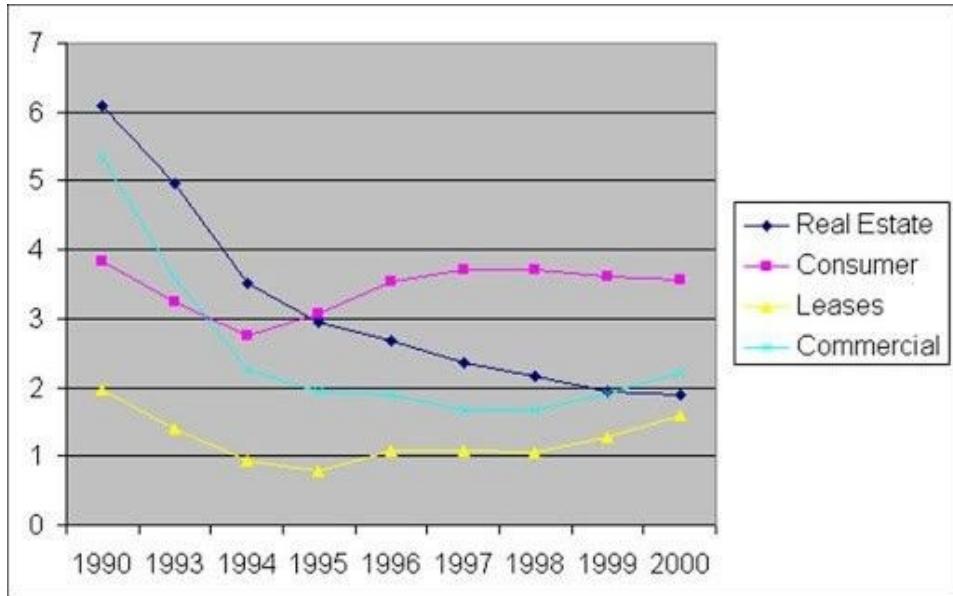
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 2. EXCEL IS EVIL



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 2. EXCEL IS EVIL



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 2. EXCEL IS EVIL

EDWARD TUFTE

09.01.2003 12:00 PM

PowerPoint Is Evil

Power Corrupts. PowerPoint Corrupts Absolutely.

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

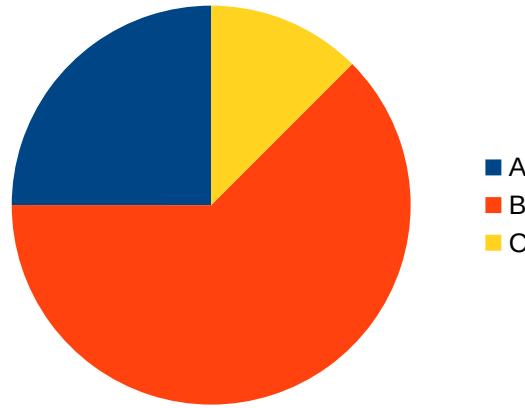
KEY CONCEPT 3. AVOID PIE CHARTS!

	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

Exp. C1



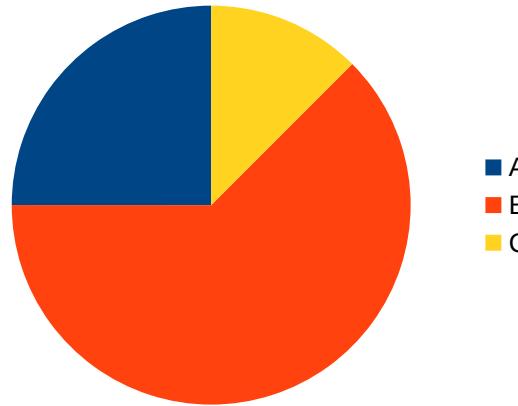
■ A
■ B
■ C

	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

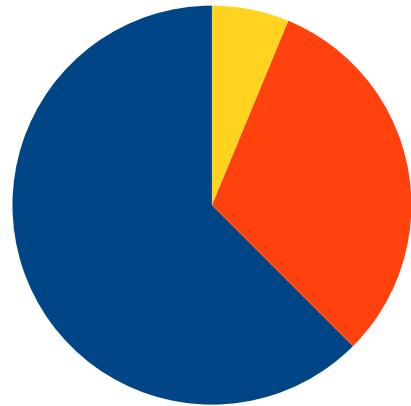
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

Exp. C1



Exp. C2

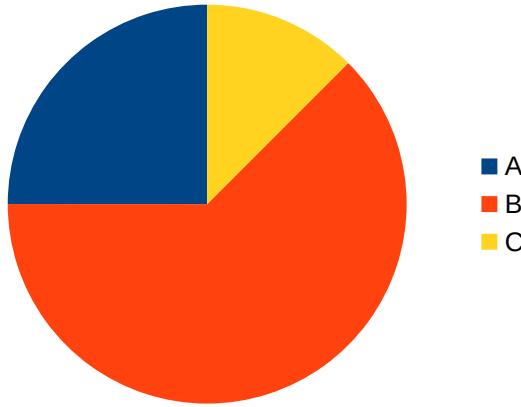


	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

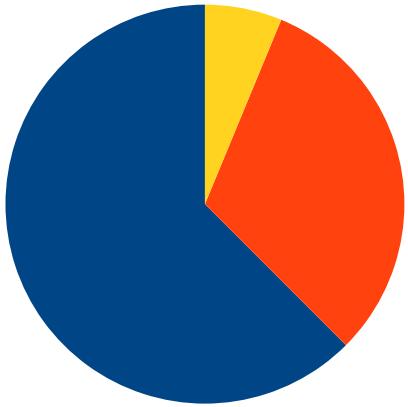
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

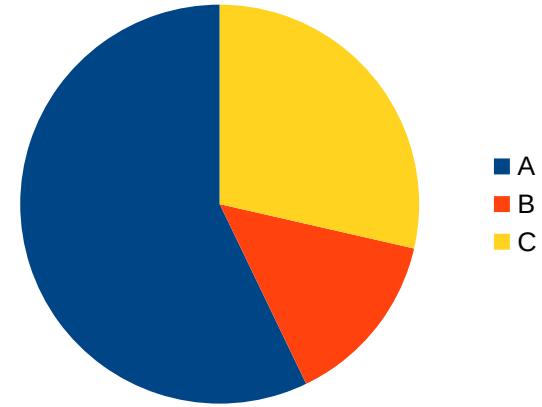
Exp. C1



Exp. C2



Exp. C3

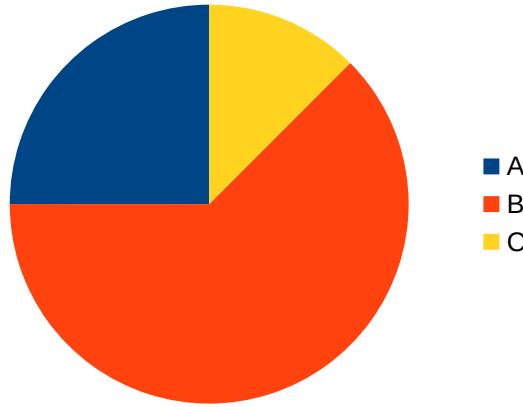


	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

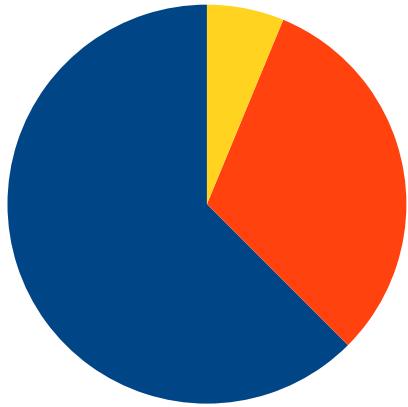
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

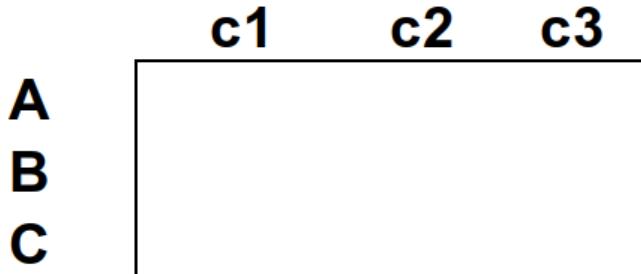
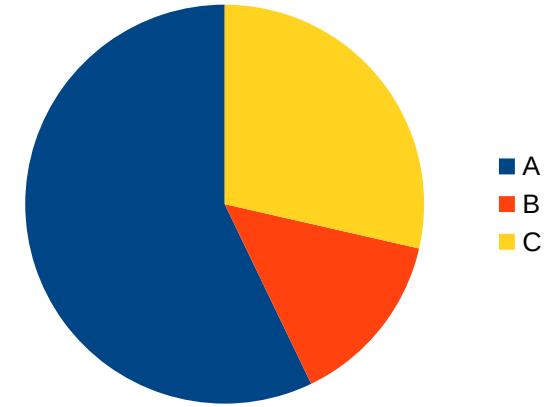
Exp. C1



Exp. C2



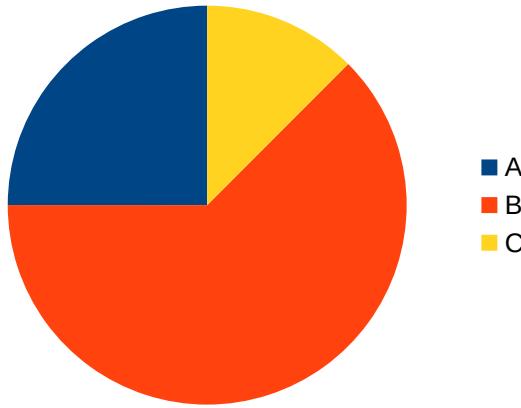
Exp. C3



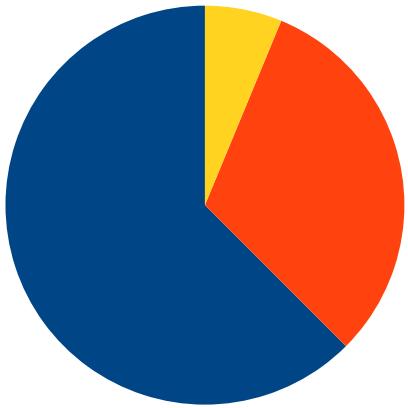
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

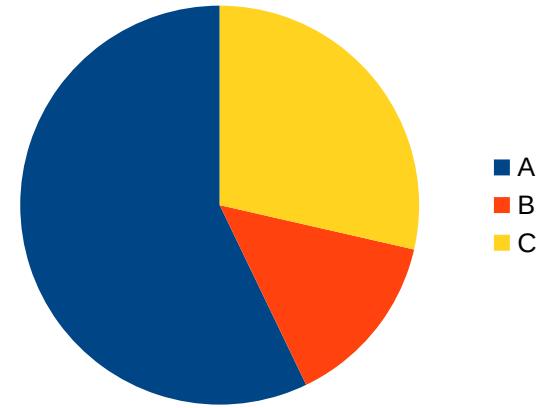
Exp. C1



Exp. C2



Exp. C3



c1 c2 c3

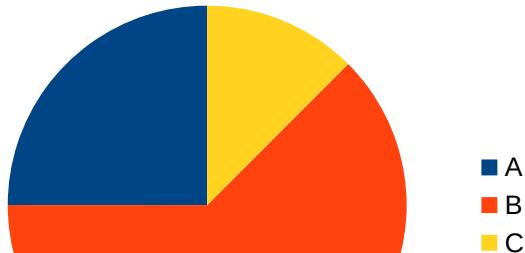
A
B
C

A - C2 > C3 > C1

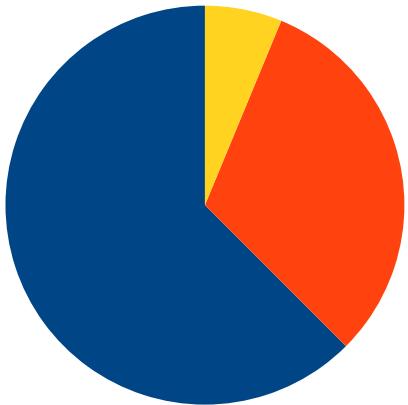
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KEY CONCEPT 3. AVOID PIE CHARTS!

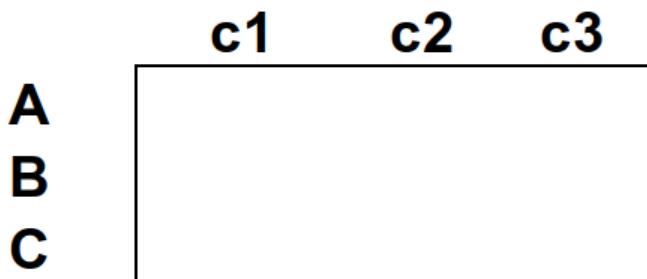
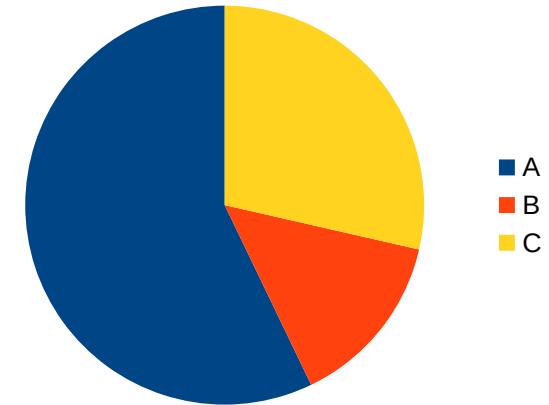
Exp. C1



Exp. C2



Exp. C3



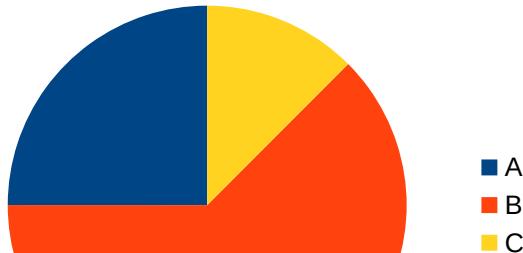
A - $c_2 > c_3 > c_1$

B - $c_1 > c_2 > c_3$

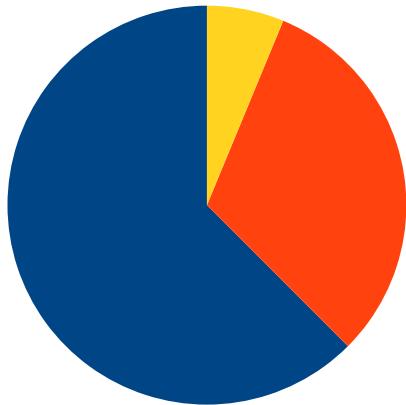
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

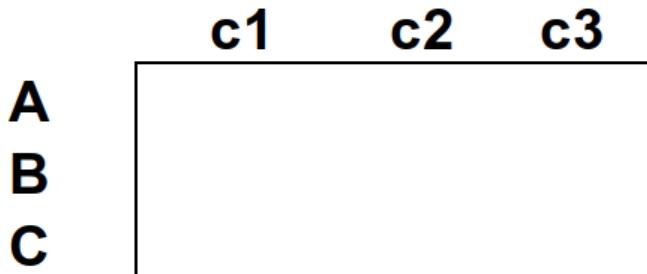
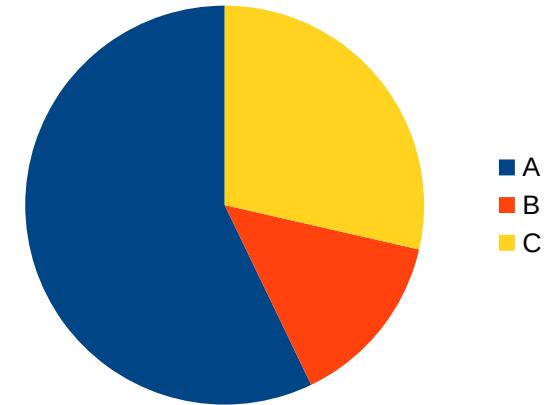
Exp. C1



Exp. C2



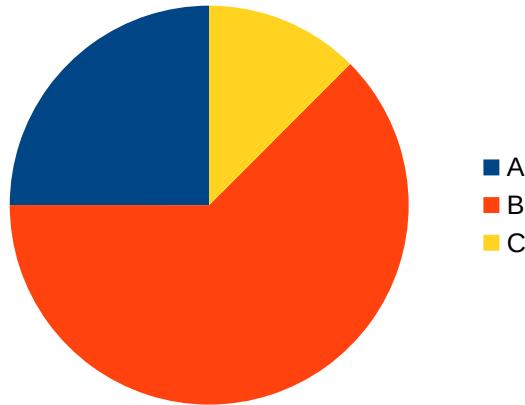
Exp. C3



A - $C_2 > C_3 > C_1$
B - $C_1 > C_2 > C_3$
C - $C_3 > C_1 > C_2$

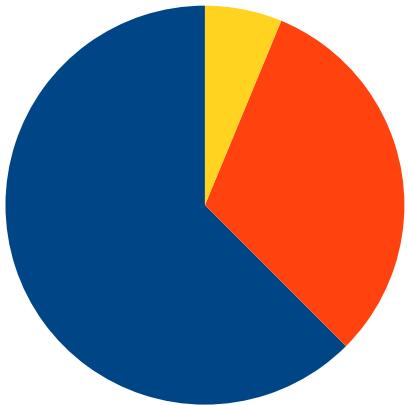
KEY CONCEPT 3. AVOID PIE CHARTS!

Exp. C1



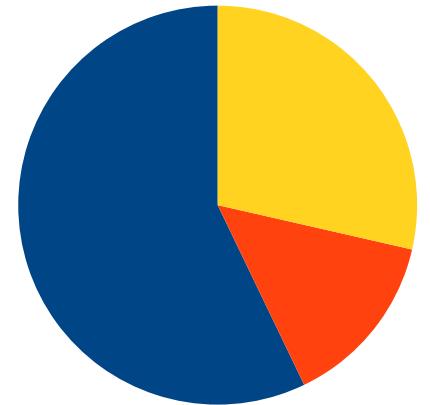
■ A
■ B
■ C

Exp. C2



■ A
■ B
■ C

Exp. C3



■ A
■ B
■ C

	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

A - C2 > C3 > C1

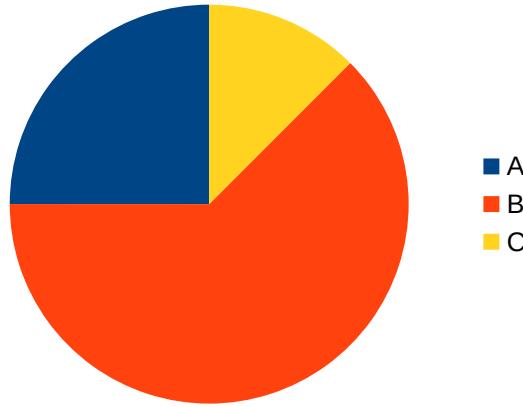
B - C1 > C2 > C3

C - C3 > C1 > C2

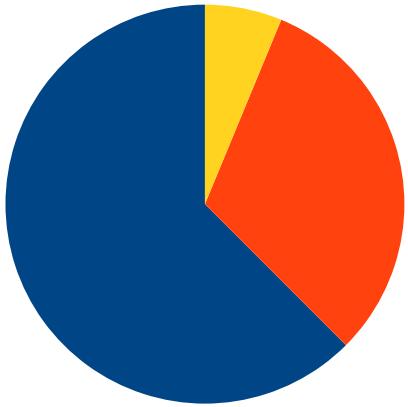
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

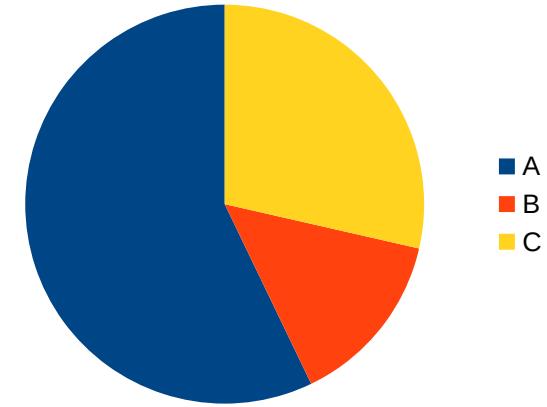
Exp. C1



Exp. C2



Exp. C3



	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

A - C2 > C3 > C1

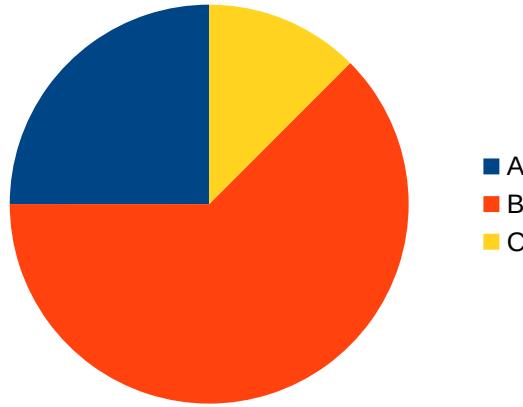
B - C1 > C2 > C3

C - C3 > C1 > C2

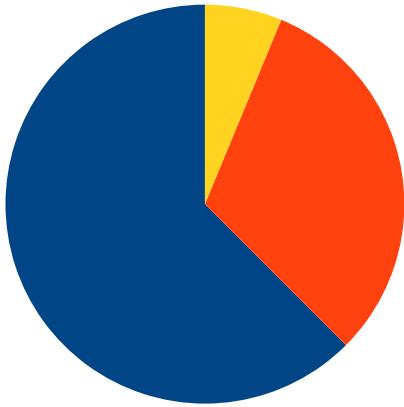
A - C3 > C2 = C1

KEY CONCEPT 3. AVOID PIE CHARTS!

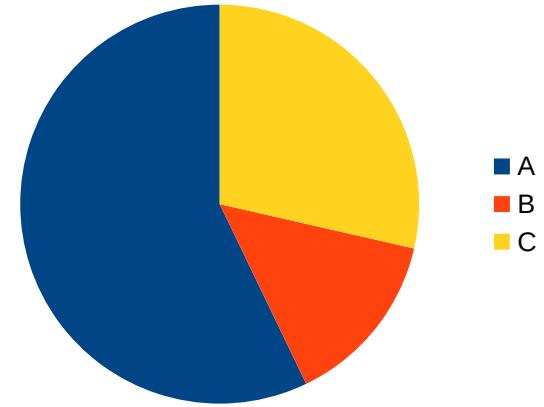
Exp. C1



Exp. C2



Exp. C3



	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

$$\text{A} - \text{C2} > \text{C3} > \text{C1}$$

$$\text{B} - \text{C1} > \text{C2} > \text{C3}$$

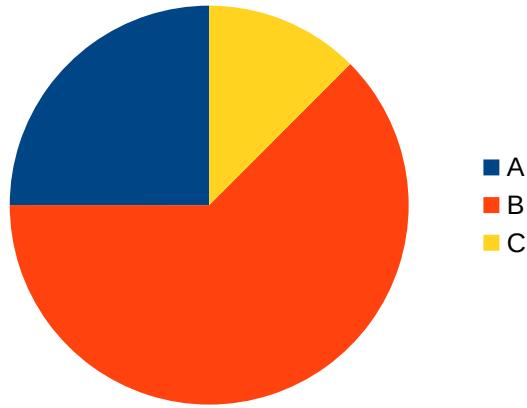
$$\text{C} - \text{C3} > \text{C1} > \text{C2}$$

$$\text{A} - \text{C3} > \text{C2} = \text{C1}$$

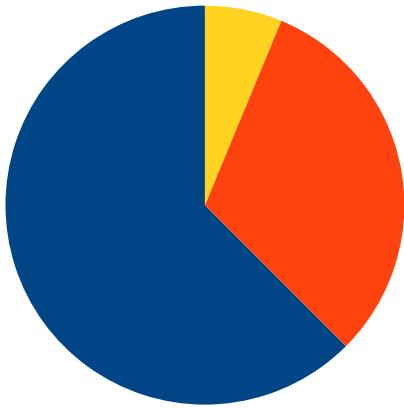
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

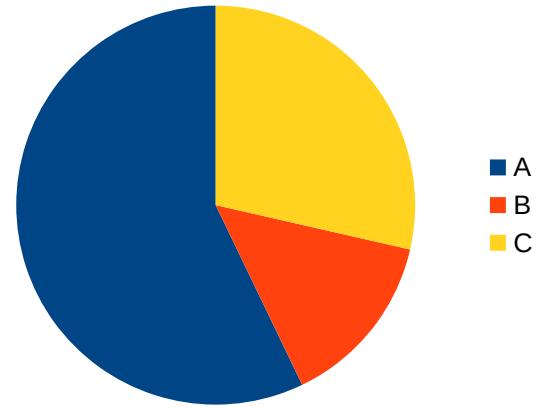
Exp. C1



Exp. C2



Exp. C3



	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

~~A - C2 > C3 > C1~~

~~B - C1 > C2 > C3~~

~~C - C3 > C1 > C2~~

A - C3 > C2 = C1

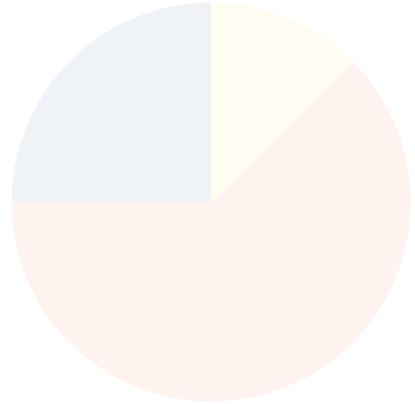
B - C1 = C2 >> C3

C - C3 = C1 = C2

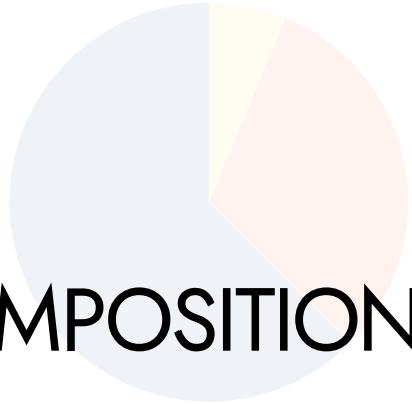
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 3. AVOID PIE CHARTS!

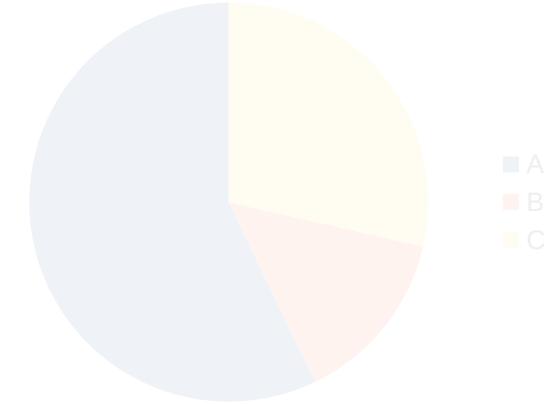
Exp. C1



Exp. C2



Exp. C3



COMPOSITIONALITY

	c1	c2	c3
A	10	50	10
B	25	25	2.5
C	5	5	5

~~A - C3 > C2 > C1~~

~~B - C1 > C2 > C3~~

~~C - C3 > C1 > C2~~

A - C2 > C2 = C1

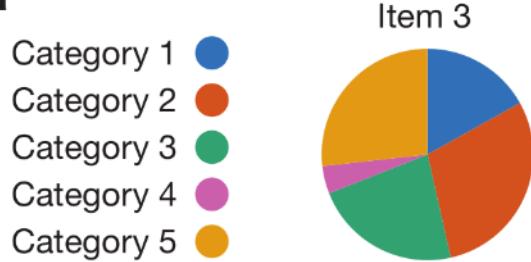
B - C1 = C2 >> C3

C - C3 = C1 = C2

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 4. CHART TYPE MATTERS!

a

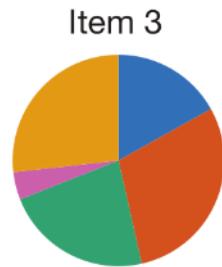


EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

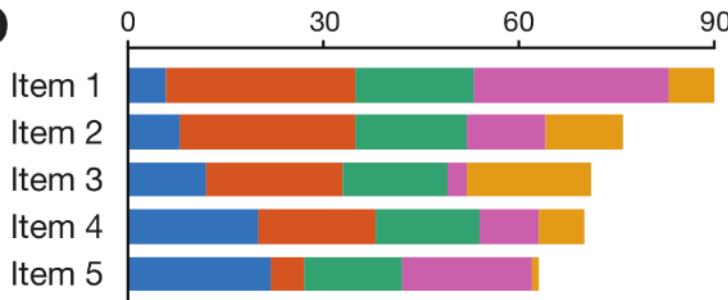
KEY CONCEPT 4. CHART TYPE MATTERS!

a

- Category 1 ●
- Category 2 ●
- Category 3 ●
- Category 4 ●
- Category 5 ●



b



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

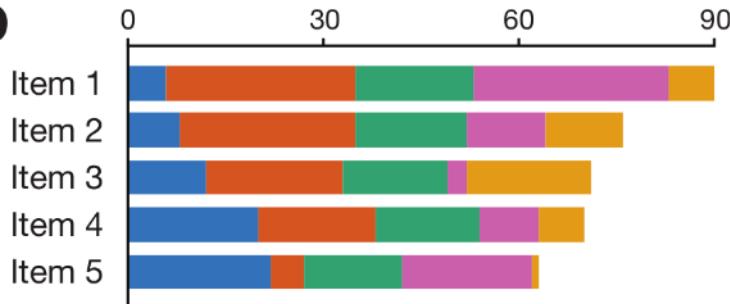
KEY CONCEPT 4. CHART TYPE MATTERS!

a

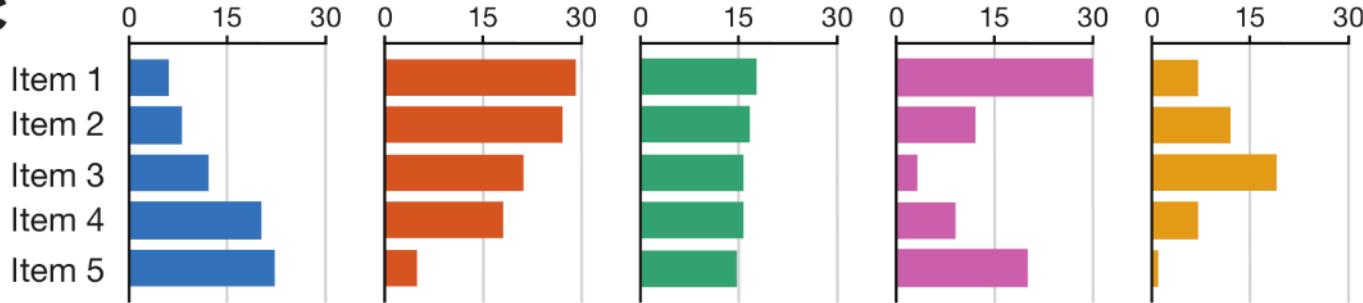
- Category 1 ●
- Category 2 ●
- Category 3 ●
- Category 4 ●
- Category 5 ●



b



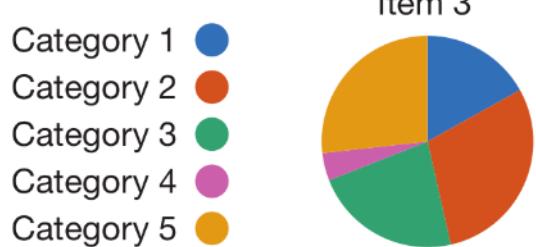
c



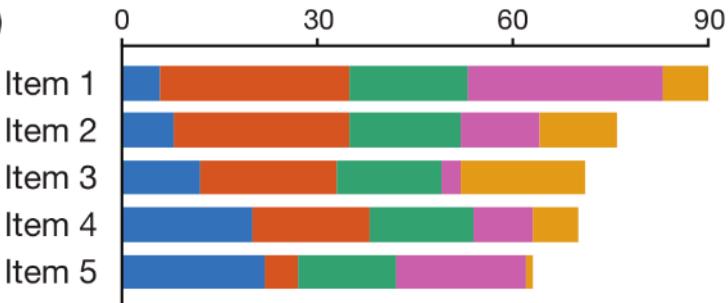
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 4. CHART TYPE MATTERS!

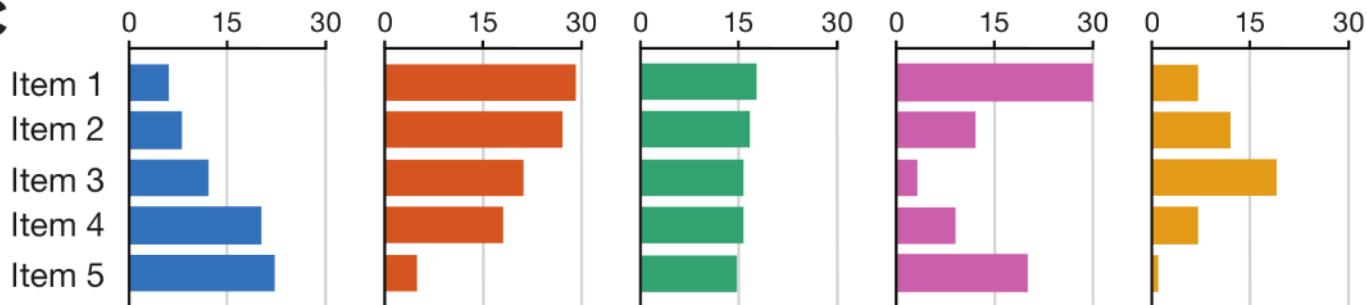
a



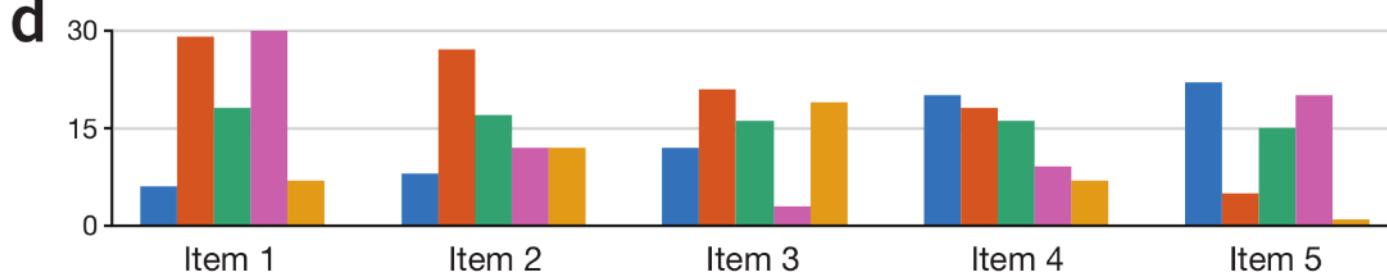
b



c

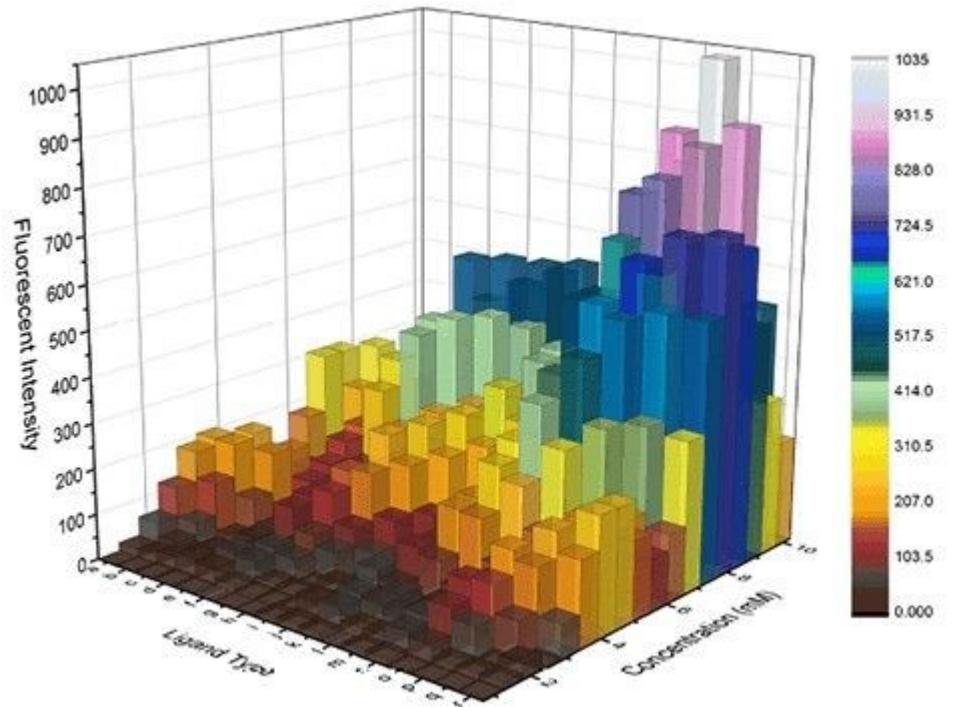


d



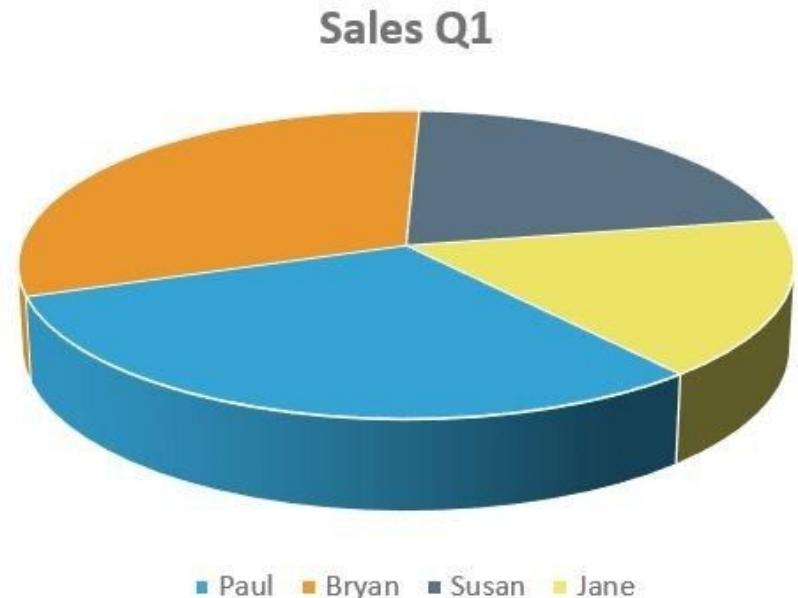
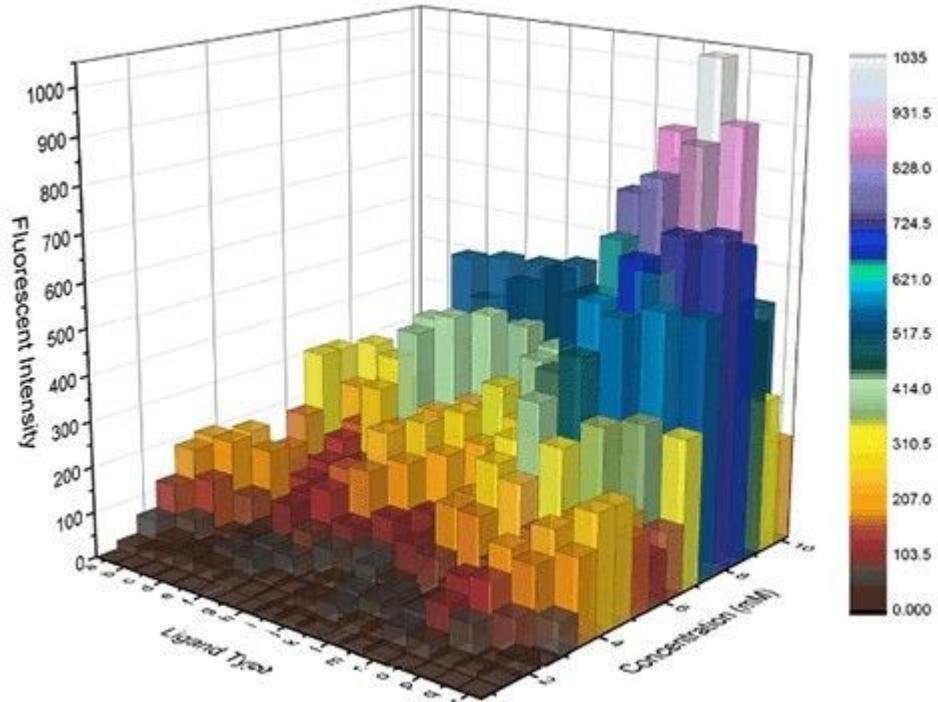
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 5. AVOID UNNECESSARY 3D



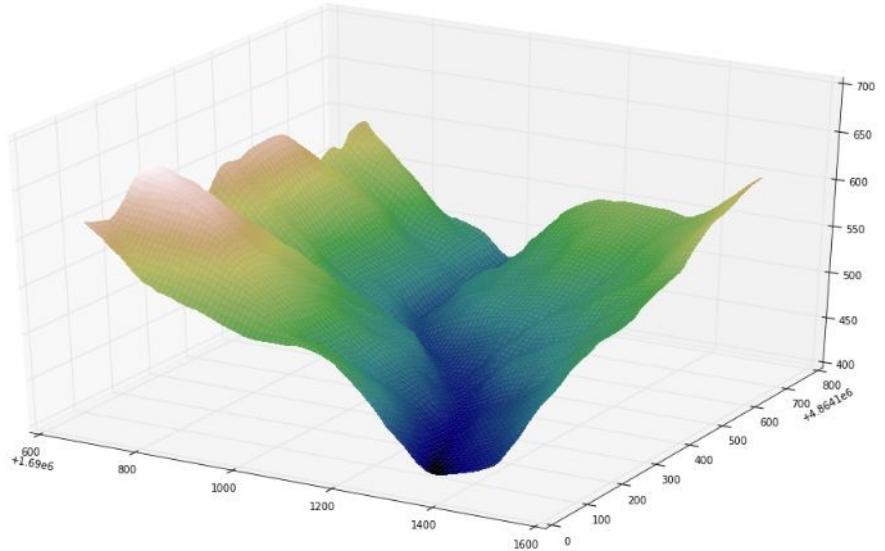
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 5. AVOID UNNECESSARY 3D



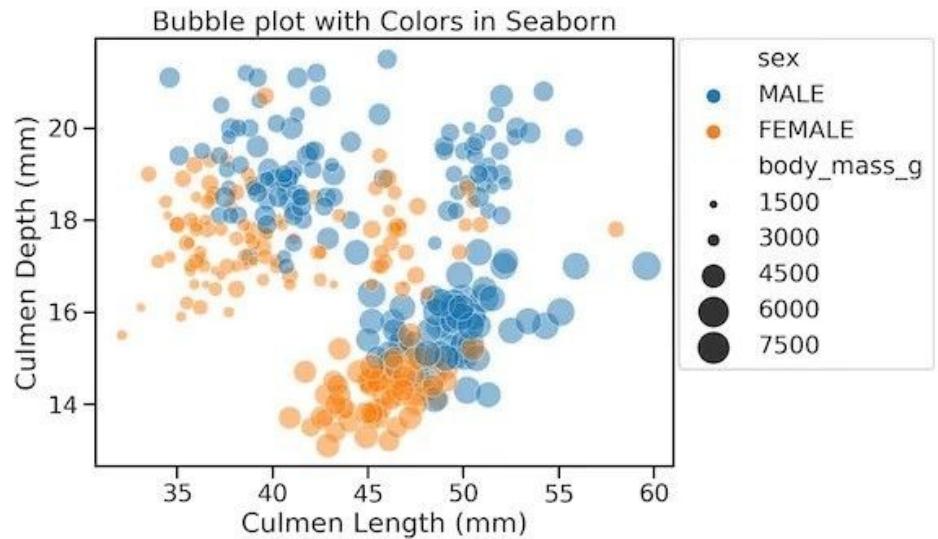
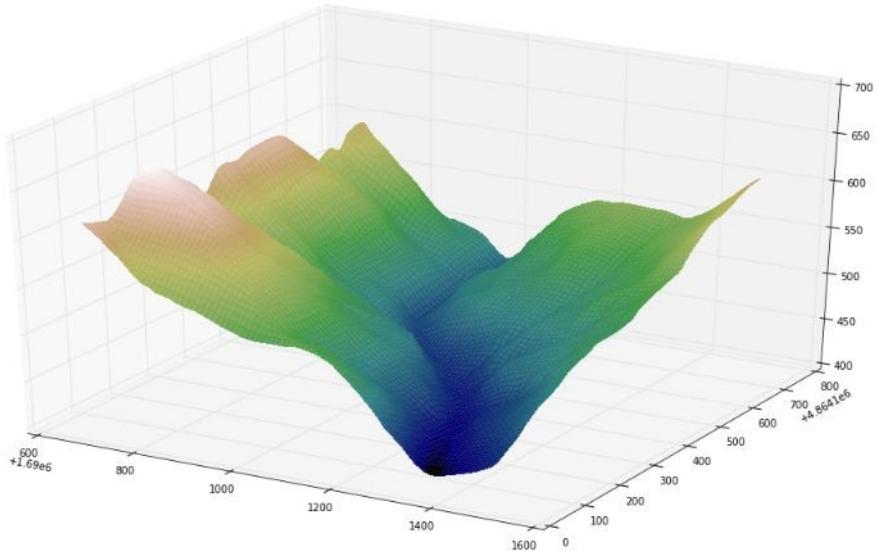
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 6. MULTIPLE DIMENSIONS IN 2D



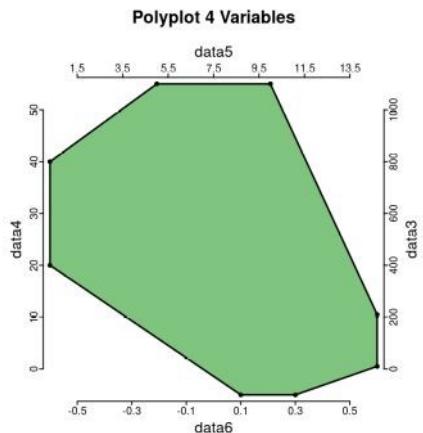
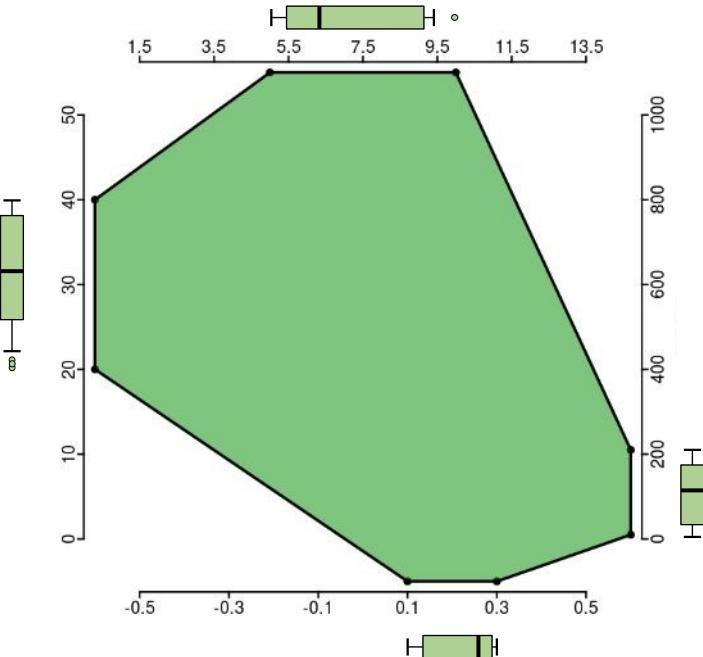
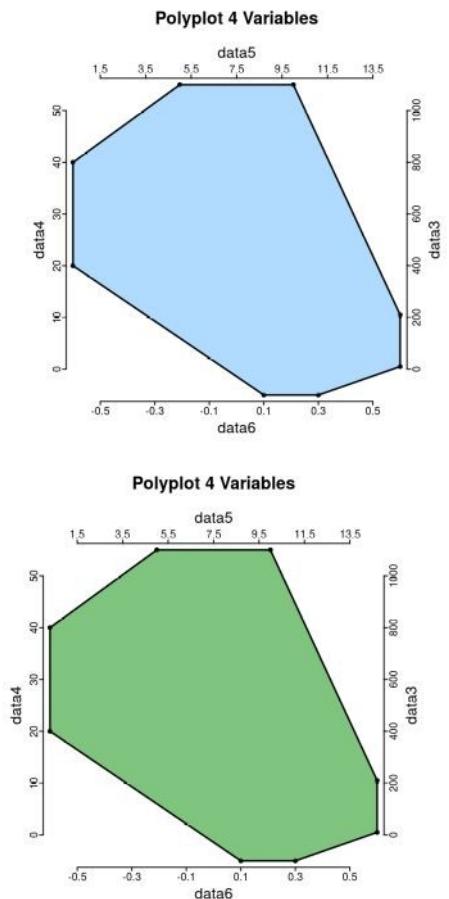
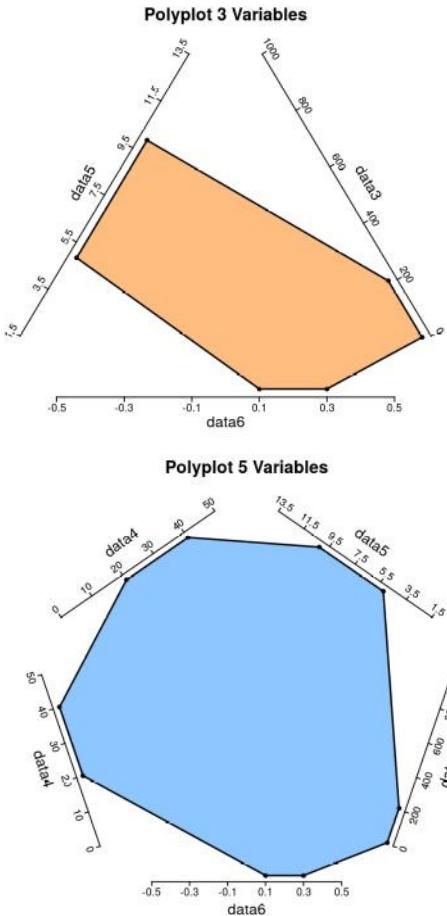
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 6. MULTIPLE DIMENSIONS IN 2D



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

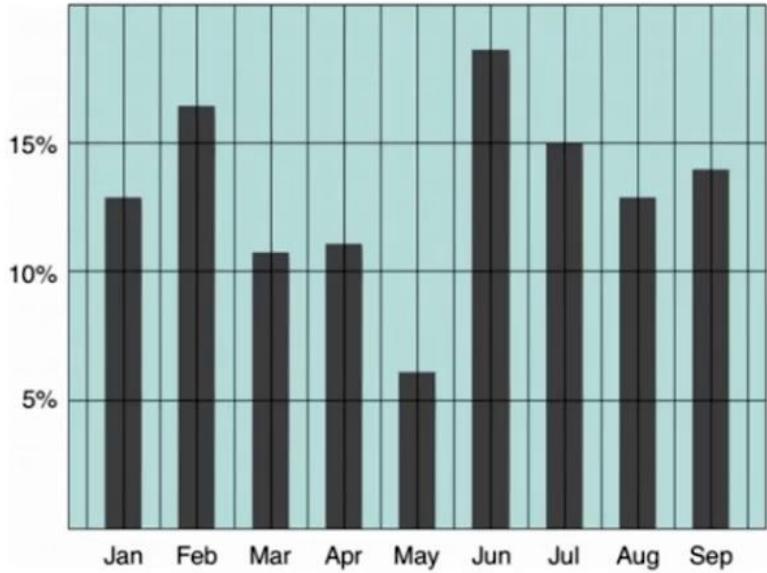
KEY CONCEPT 6. MULTIPLE DIMENSIONS IN 2D



Giovannelli et al., 2020. Polygons plot.
<https://giovannellilab.github.io/polygonsplot/>

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

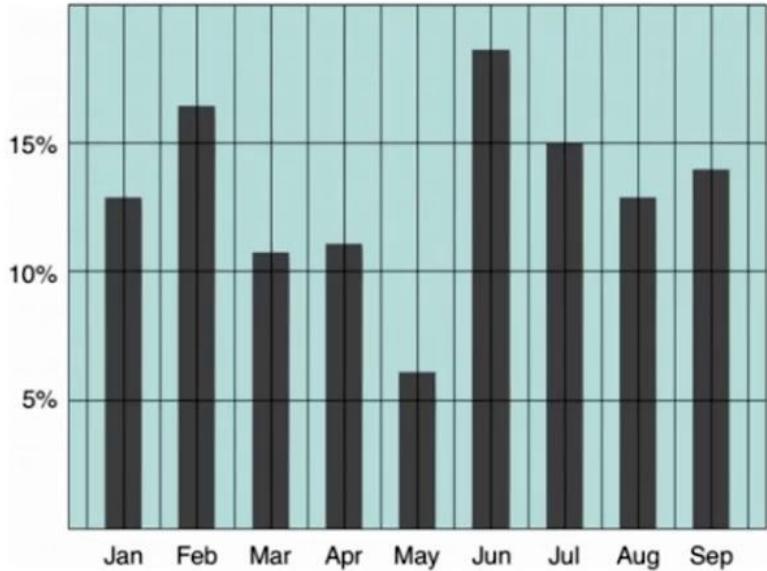
KEY CONCEPT 7. INCREASE DATA TO INK RATIO



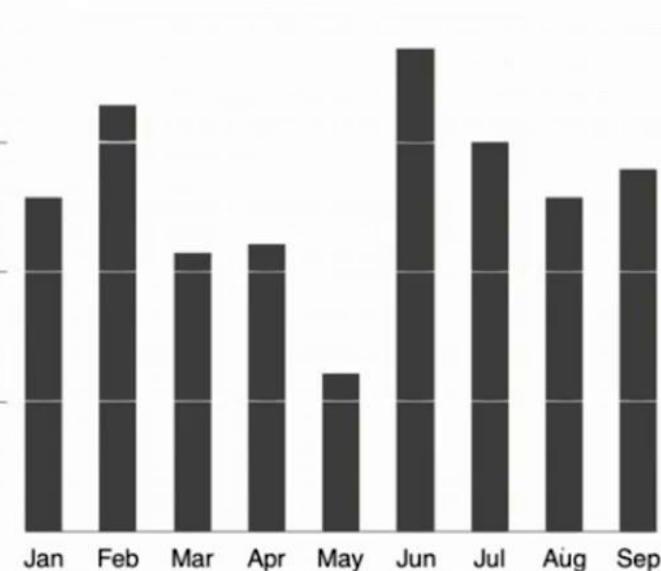
low data-ink ratio

EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 7. INCREASE DATA TO INK RATIO



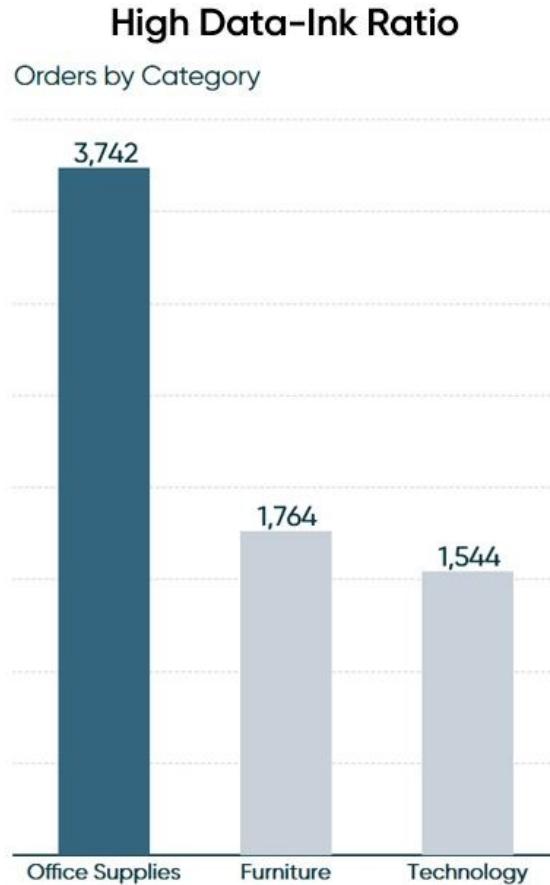
low data-ink ratio



high data-ink ratio

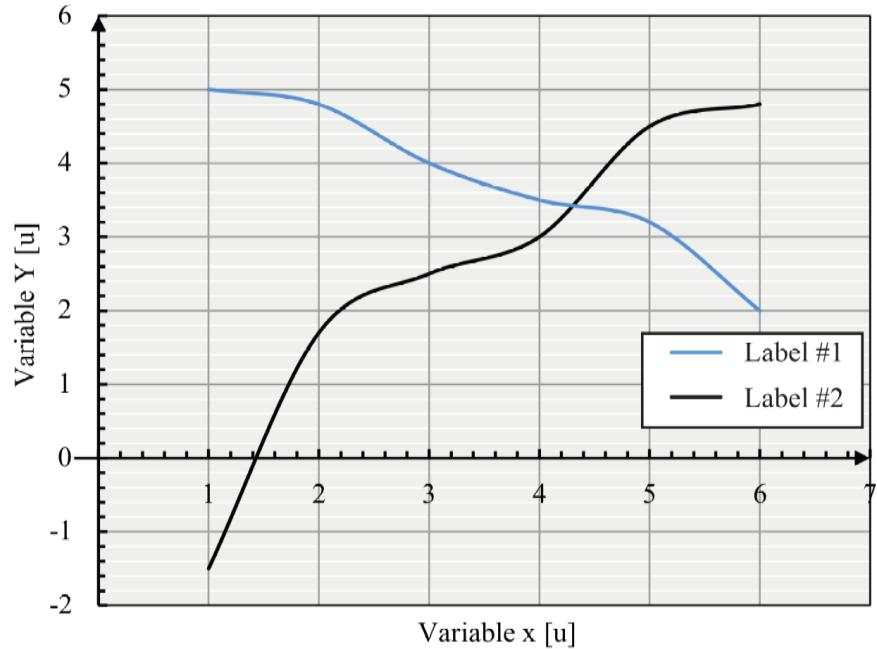
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 7. INCREASE DATA TO INK RATIO



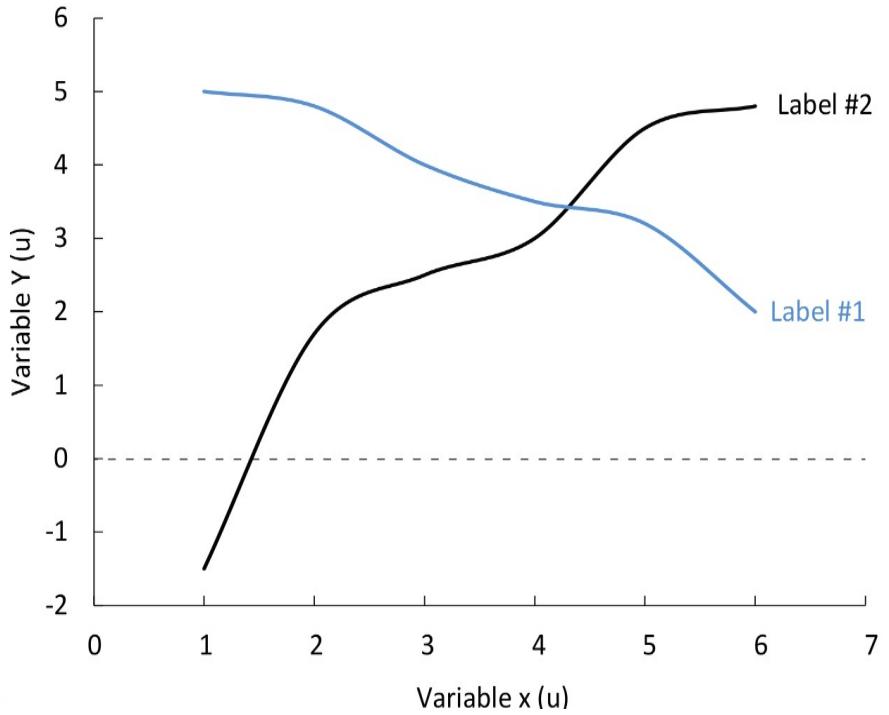
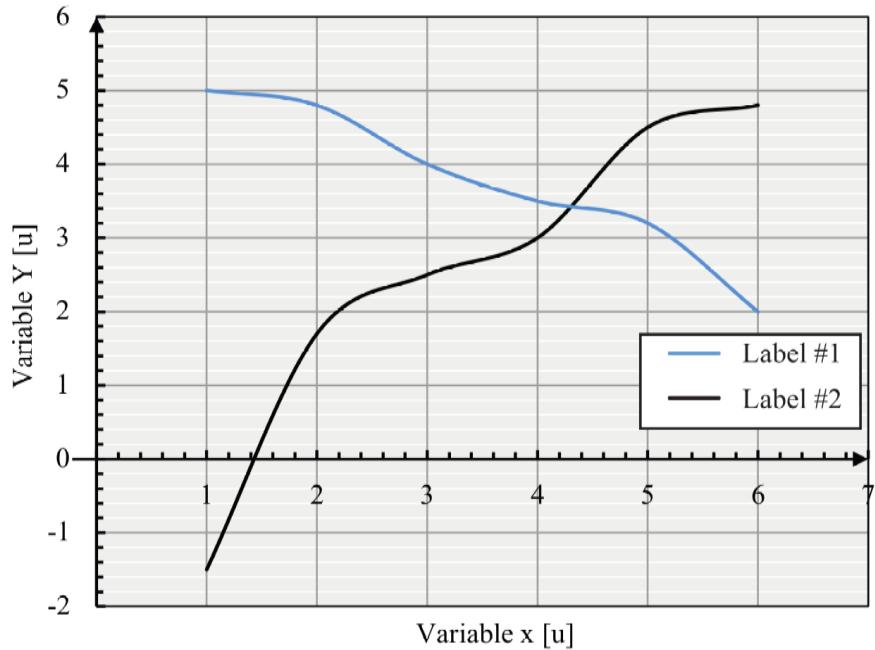
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 8. AVOID CLUTTER



EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

KEY CONCEPT 8. AVOID CLUTTER



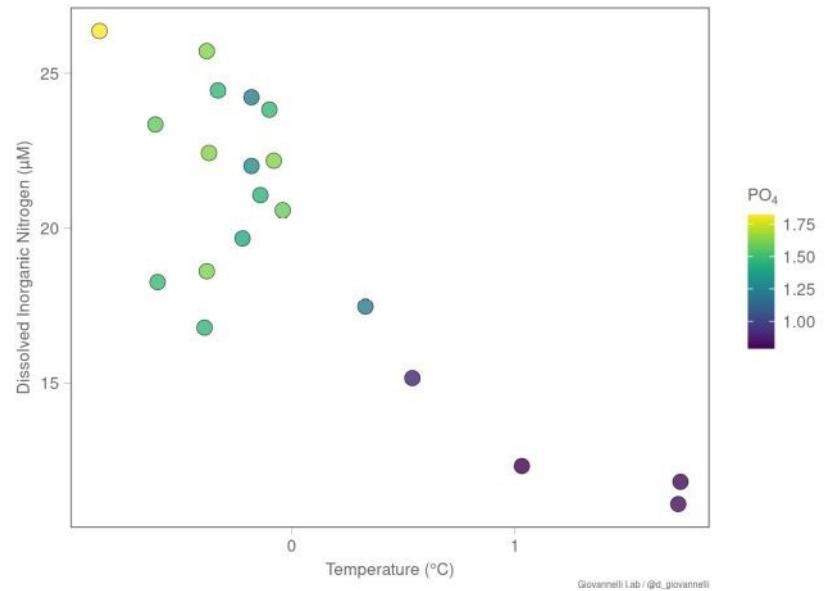
EXAMPLES OF BAD DATA VISUALIZATION AND OF TO AVOID IT

DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

TYPES OF SCIENTIFIC VISUALIZATIONS

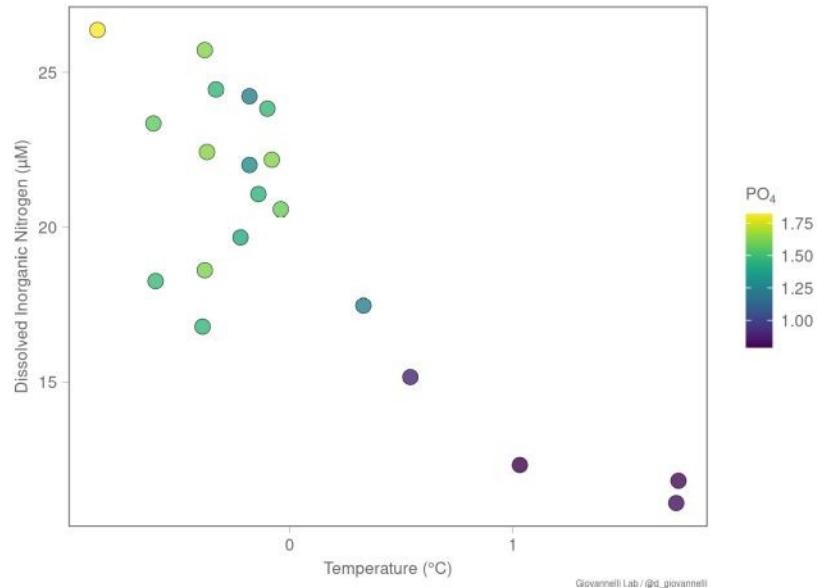
DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

TYPES OF SCIENTIFIC VISUALIZATIONS

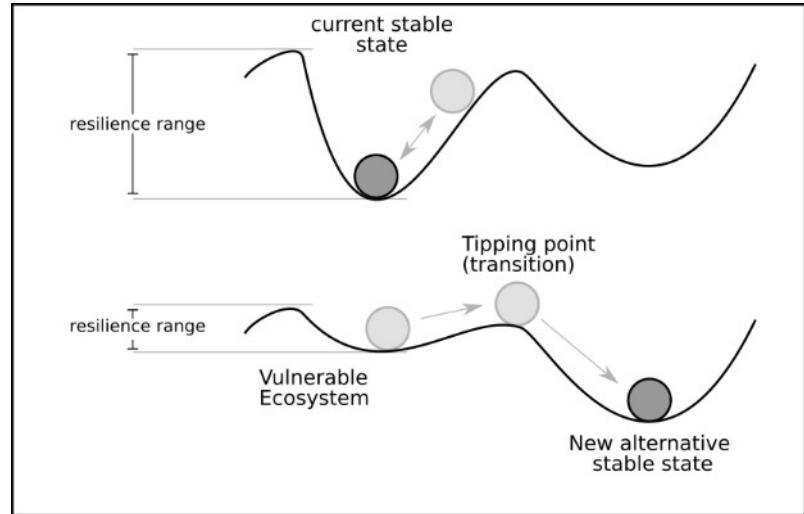


DATA

TYPES OF SCIENTIFIC VISUALIZATIONS



DATA



CONCEPTS

THE M.A.D.E. PRINCIPLES

M

A

D

E

THE M.A.D.E. PRINCIPLES

MESSAGE – Do you have a clear message you want to convey?

A

D

E

THE M.A.D.E. PRINCIPLES

MESSAGE – Do you have a clear message you want to convey?

AUDIENCE – Is the visual appropriate for the target audience?

D

E

THE M.A.D.E. PRINCIPLES

MESSAGE – Do you have a clear message you want to convey?

AUDIENCE – Is the visual appropriate for the target audience?

DESIGN – Have you followed good design principles?

E

THE M.A.D.E. PRINCIPLES

MESSAGE – Do you have a clear message you want to convey?

AUDIENCE – Is the visual appropriate for the target audience?

DESIGN – Have you followed good design principles?

EVALUATION – Have you tested it with the audience?

THE M.A.D.E. PRINCIPLES

Ask yourself three questions:

1. What **message** do I want to convey?
2. Who is my audience and what is my audience's **prior knowledge**?
3. What information is **essential** to communicate the message to my audience in a rigorous, transparent and exhaustive way?

THE M.A.D.E. PRINCIPLES

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EXPLORING DATA VISUALLY: ANSCOMBE'S QUARTET

I		II		III		IV	
x	y	x	y	x	y	x	y
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
13	7.58	13	8.74	13	12.74	8	7.71
9	8.81	9	8.77	9	7.11	8	8.84
11	8.33	11	9.26	11	7.81	8	8.47
14	9.96	14	8.10	14	8.84	8	7.04
6	7.24	6	6.13	6	6.08	8	5.25
4	4.26	4	3.10	4	5.39	19	12.5
12	10.84	12	9.13	12	8.15	8	5.56
7	4.82	7	7.26	7	6.42	8	7.91
5	5.68	5	4.74	5	5.73	8	6.89

EXPLORING DATA VISUALLY: ANSCOMBE'S QUARTET

I		II		III		IV		Property	Value
x	y	x	y	x	y	x	y		
10	8.04	10	9.14	10	7.46	8	6.58	Mean	9
8	6.95	8	8.14	8	6.77	8	5.76	Variance x	11
13	7.58	13	8.74	13	12.74	8	7.71	Mean of y	7.5
9	8.81	9	8.77	9	7.11	8	8.84	Variance of y	4.125
11	8.33	11	9.26	11	7.81	8	8.47	Pearson Correlation r^2	0.816
14	9.96	14	8.10	14	8.84	8	7.04	Linear regression line	
6	7.24	6	6.13	6	6.08	8	5.25	$y = 3 + 0.5x$	
4	4.26	4	3.10	4	5.39	19	12.5		
12	10.84	12	9.13	12	8.15	8	5.56		
7	4.82	7	7.26	7	6.42	8	7.91		
5	5.68	5	4.74	5	5.73	8	6.89		

EXPLORING DATA VISUALLY: ANSCOMBE'S QUARTET

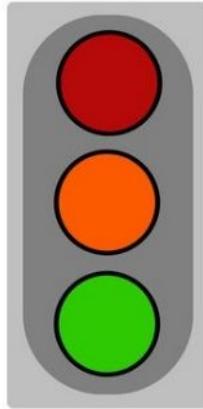
I	II	III	IV	Property	Value		
x	y	x	y	x	y	x	y
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
13	7.58	13	8.74	13	12.74	8	7.71
9	8.81	9	8.77	9	7.11	8	8.84
11	8.33	11	9.26	11	7.81	8	8.47
14	9.96	14	8.10	14	8.84	8	7.04



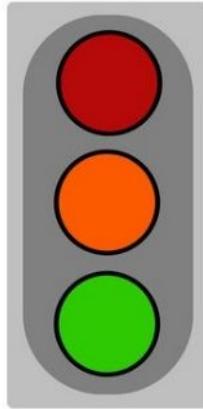
The figure consists of four separate scatter plots arranged horizontally. Plot I shows a linear relationship with points roughly at (10, 8), (8, 7), (13, 9), (9, 8), (11, 9), and (14, 10). Plot II shows a non-linear, U-shaped curve with points roughly at (10, 9), (8, 8), (13, 12), (9, 7), (11, 9), and (14, 8). Plot III shows a single vertical column of points from y=7 to y=13. Plot IV shows a single horizontal row of points from x=8 to x=14.

THE CONVENTIONS

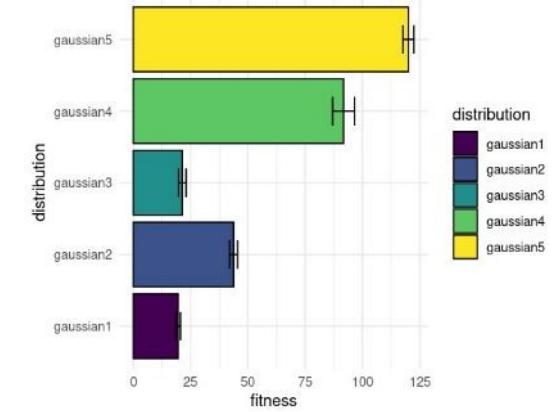
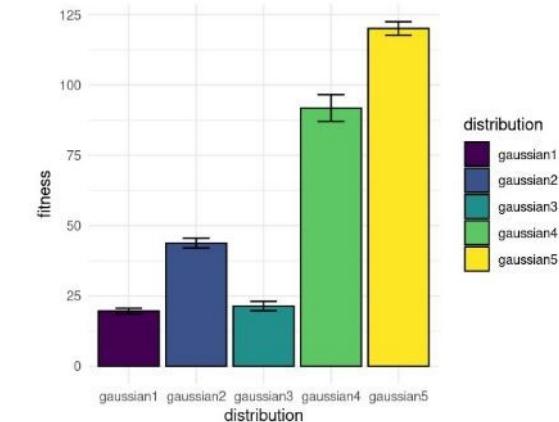
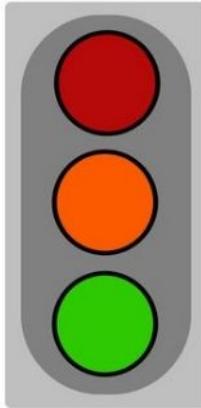
THE CONVENTIONS



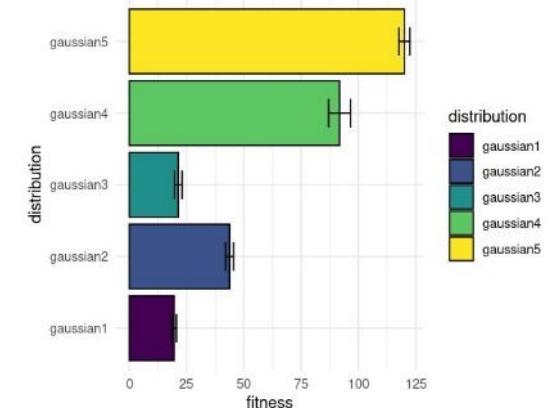
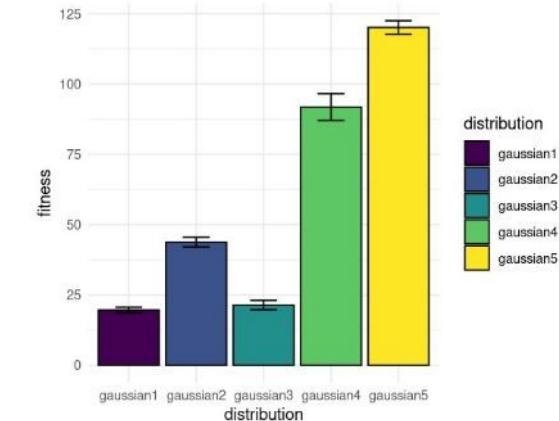
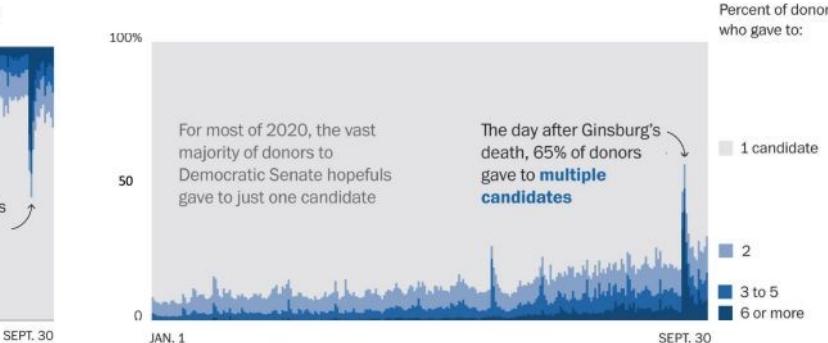
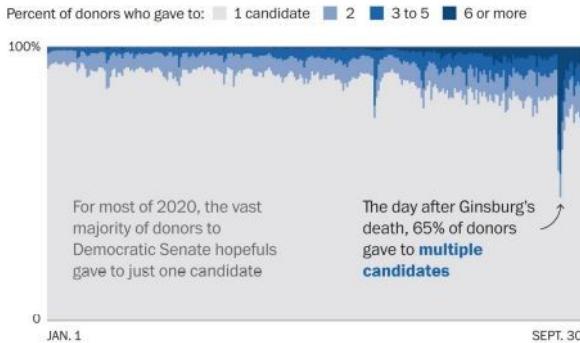
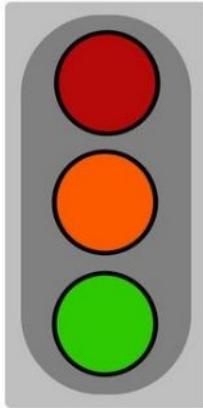
THE CONVENTIONS



THE CONVENTIONS



THE CONVENTIONS



DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

GESTALT PRINCIPLES

DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

GESTALT PRINCIPLES

Gestalt psychology or gestaltism is a school of psychology that emerged in Austria and Germany in the early twentieth century based on work by Max Wertheimer, Wolfgang Köhler, and Kurt Koffka.

GESTALT PRINCIPLES

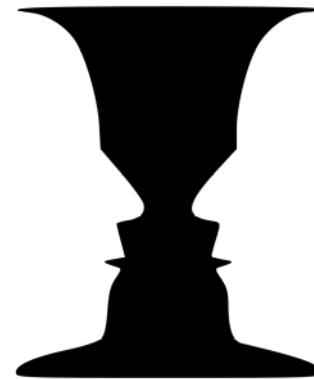
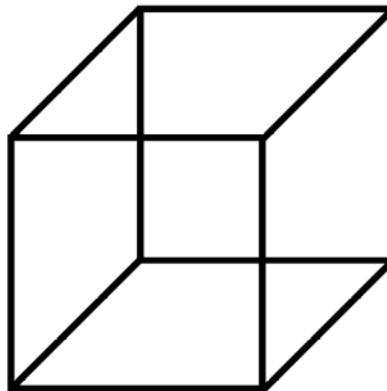
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There are six individual principles commonly associated with gestalt theory: **similarity, continuation, closure, proximity, figure/ground, and symmetry & order** (also called prägnanz).

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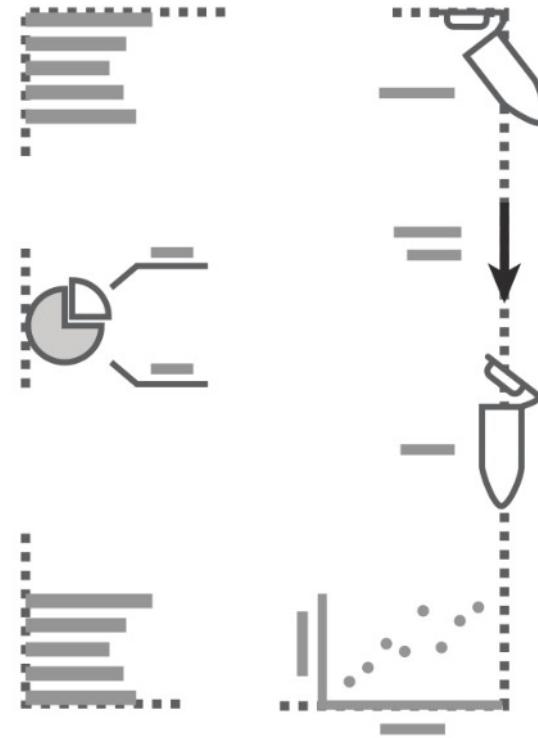
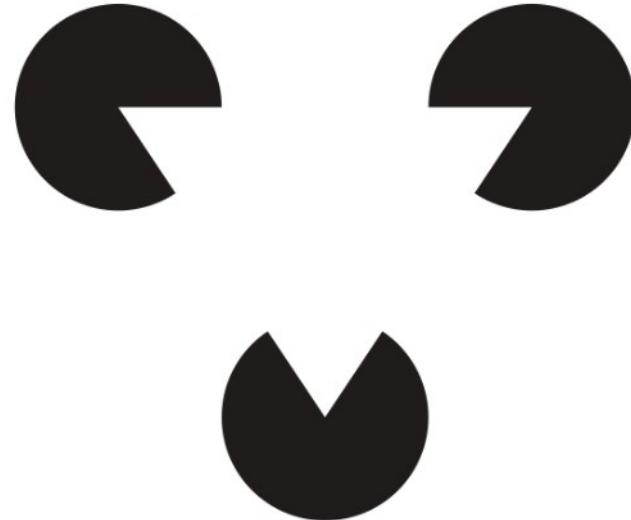


Wong, Krzywinski and coauthors. 2011-2013.

GESTALT PRINCIPLES



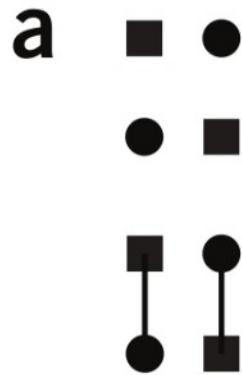
GESTALT PRINCIPLES



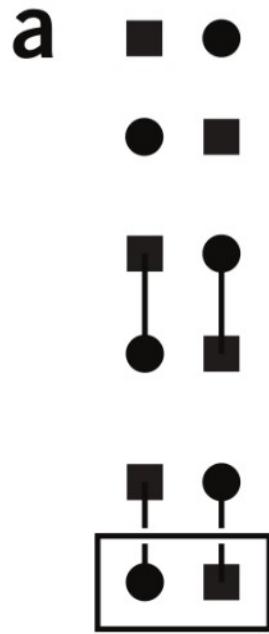
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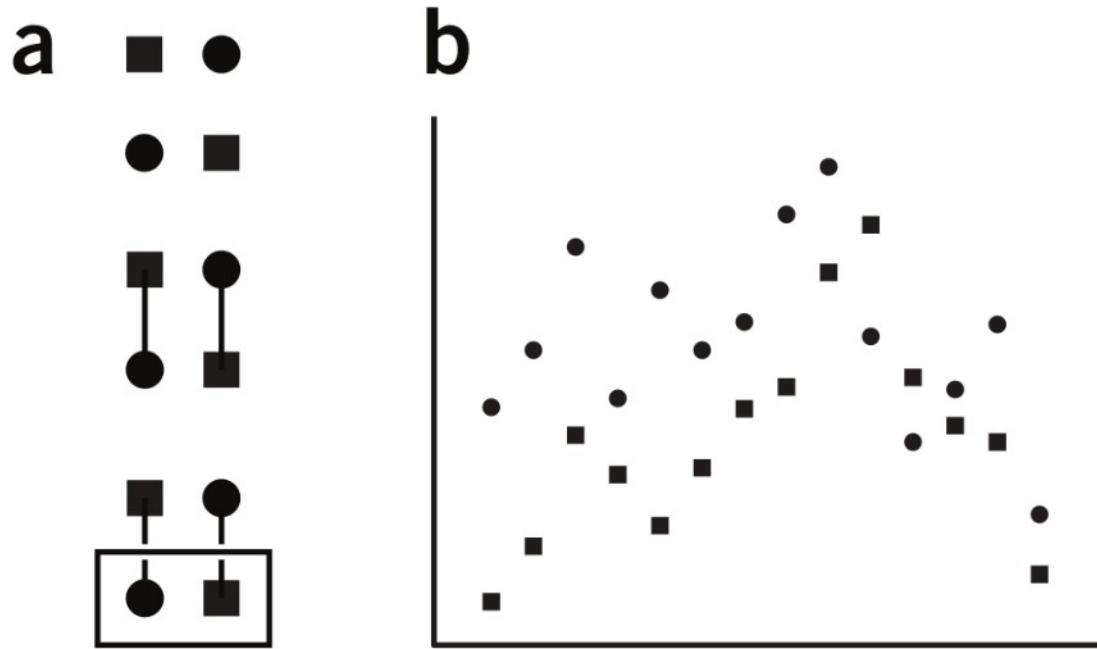
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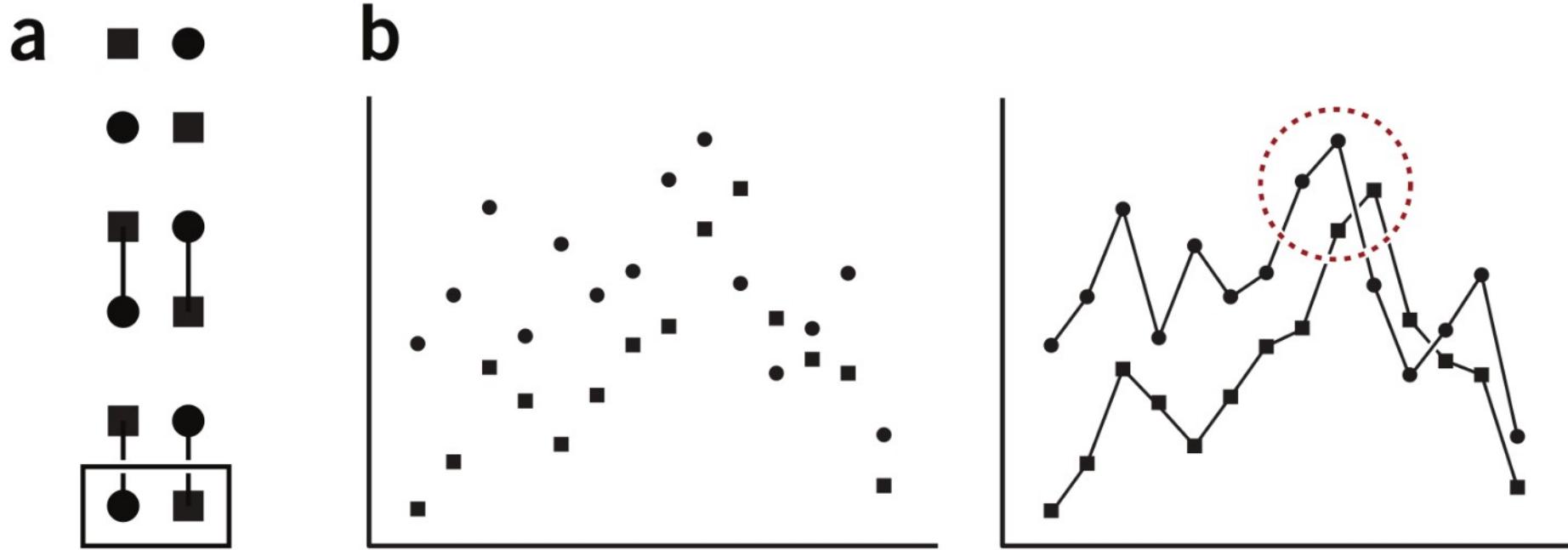
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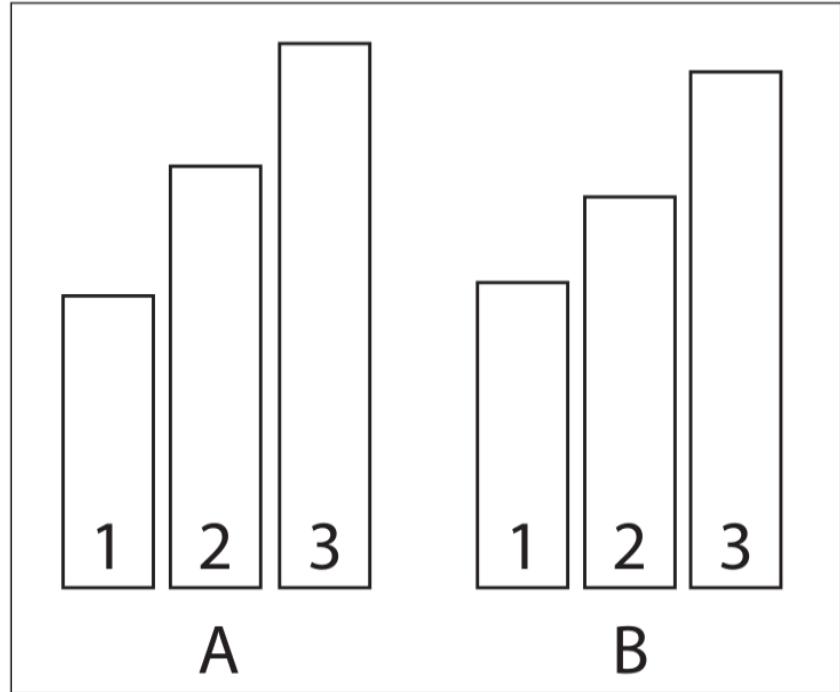
GESTALT PRINCIPLES



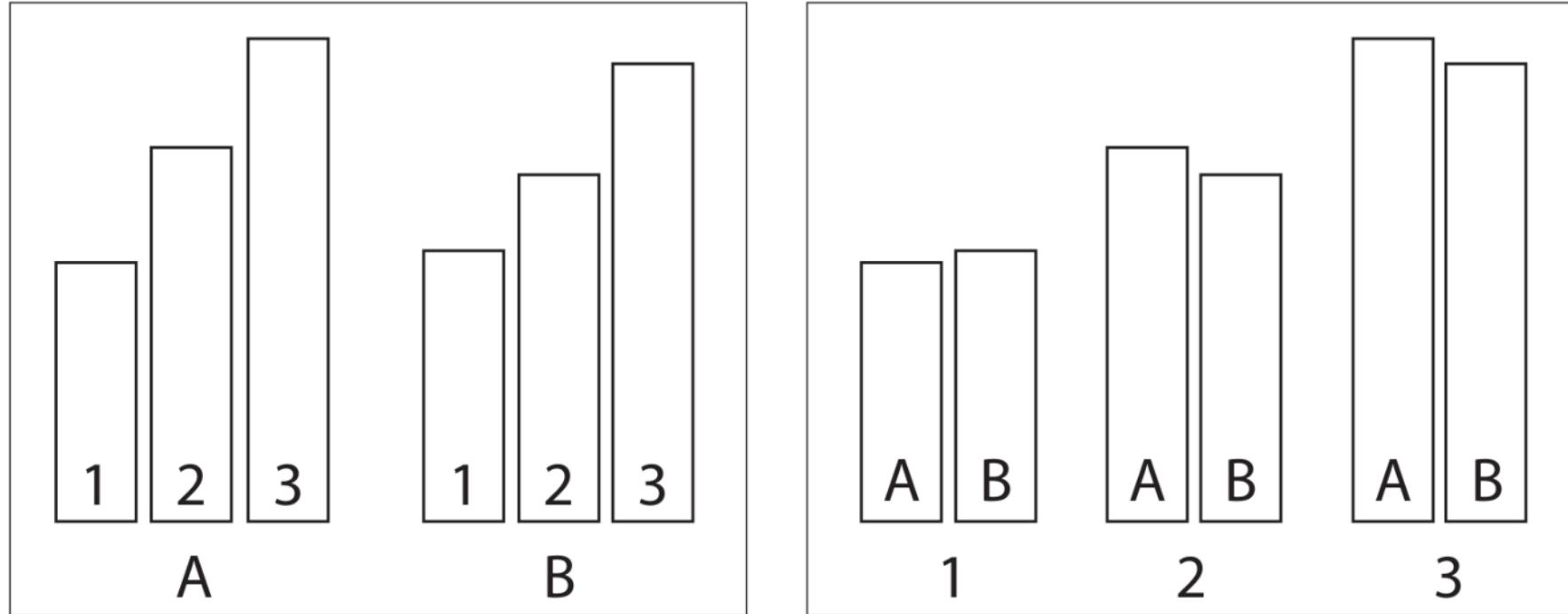
PLAYING WITH PERCEPTION

DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

PLAYING WITH PERCEPTION: GROUPING



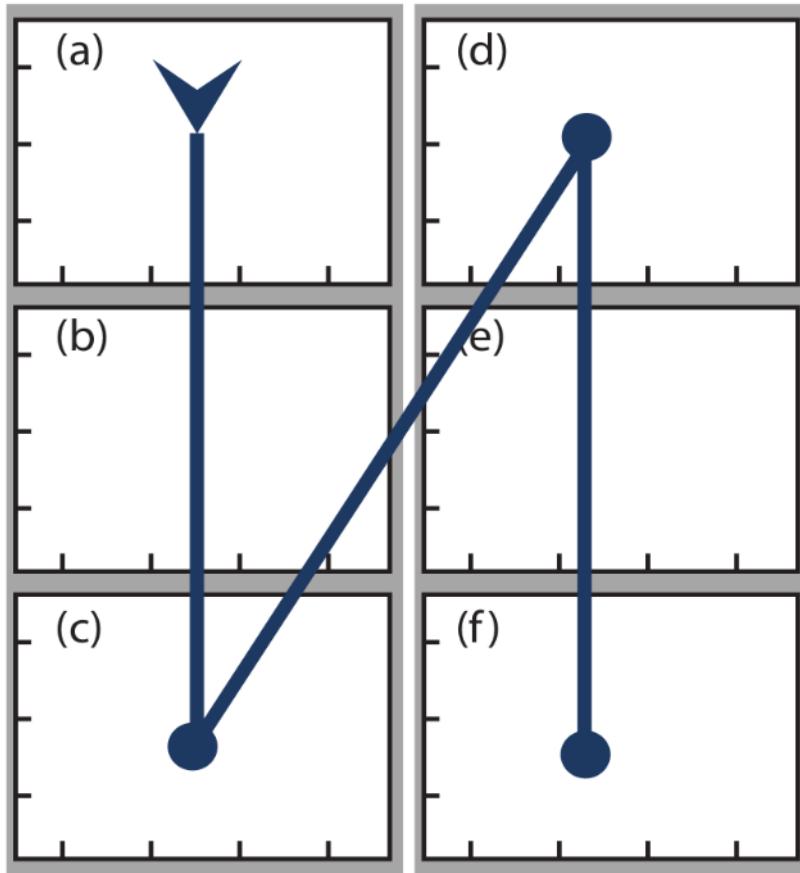
PLAYING WITH PERCEPTION: GROUPING



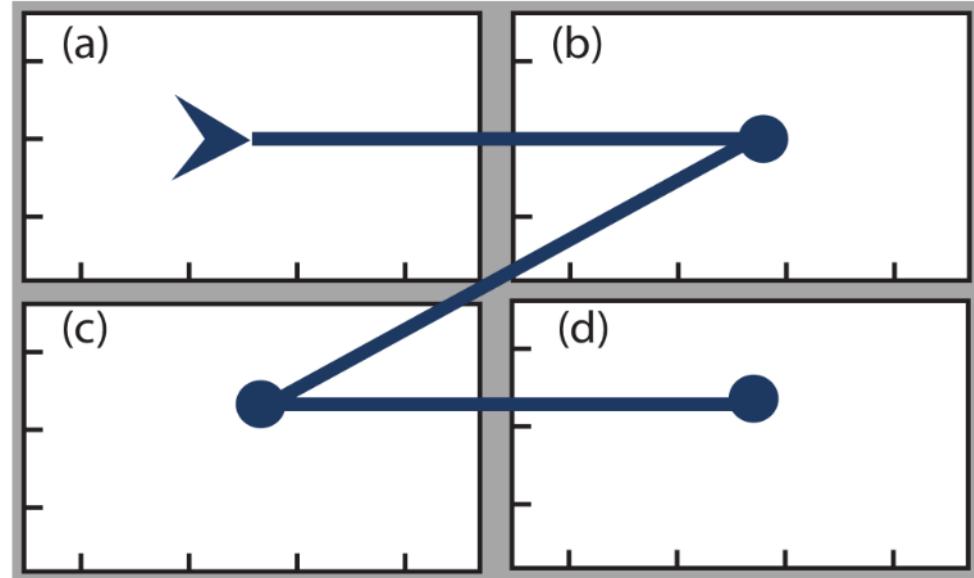
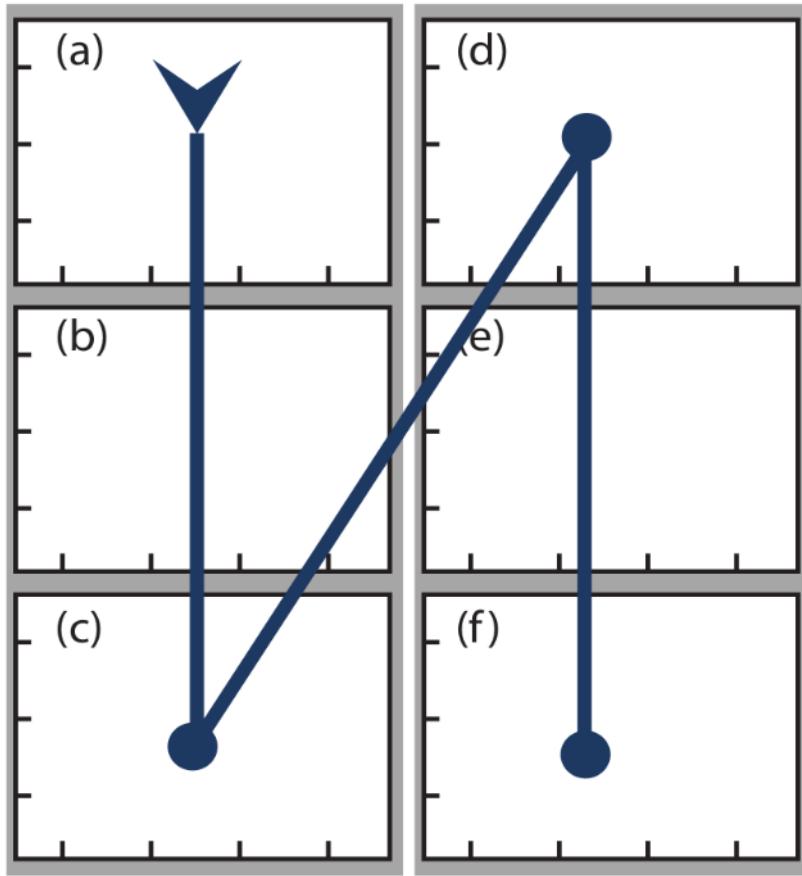
PLAYING WITH PERCEPTION: FLOW



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PLAYING WITH PERCEPTION: FLOW

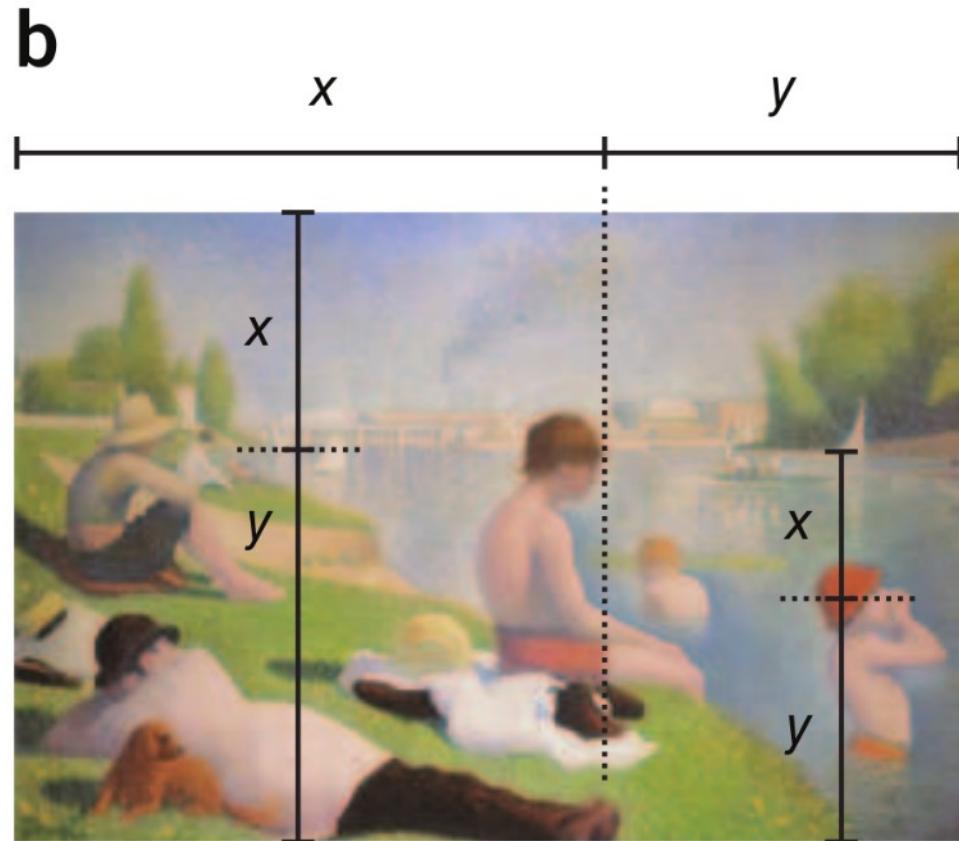
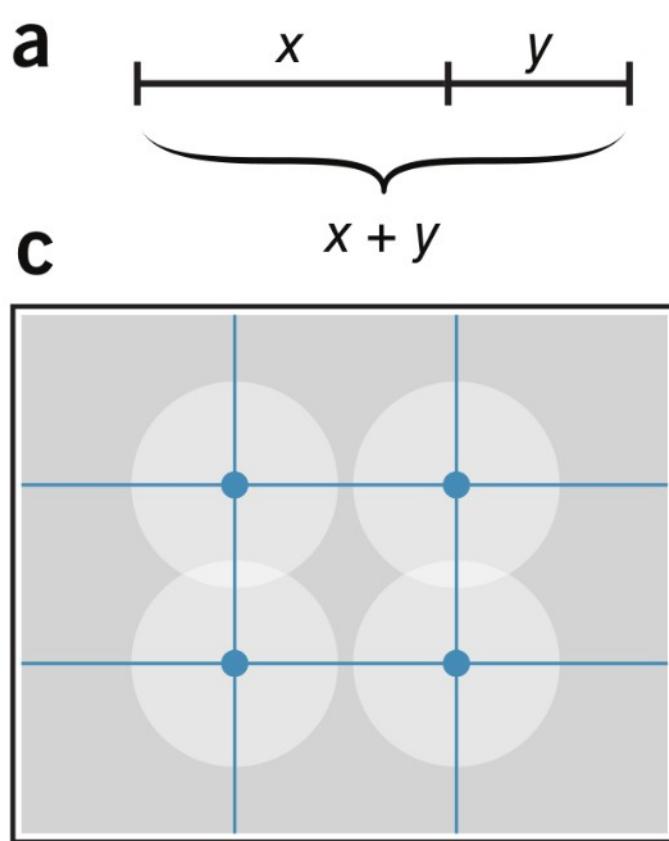


PLAYING WITH PERCEPTION: PROPORTIONS



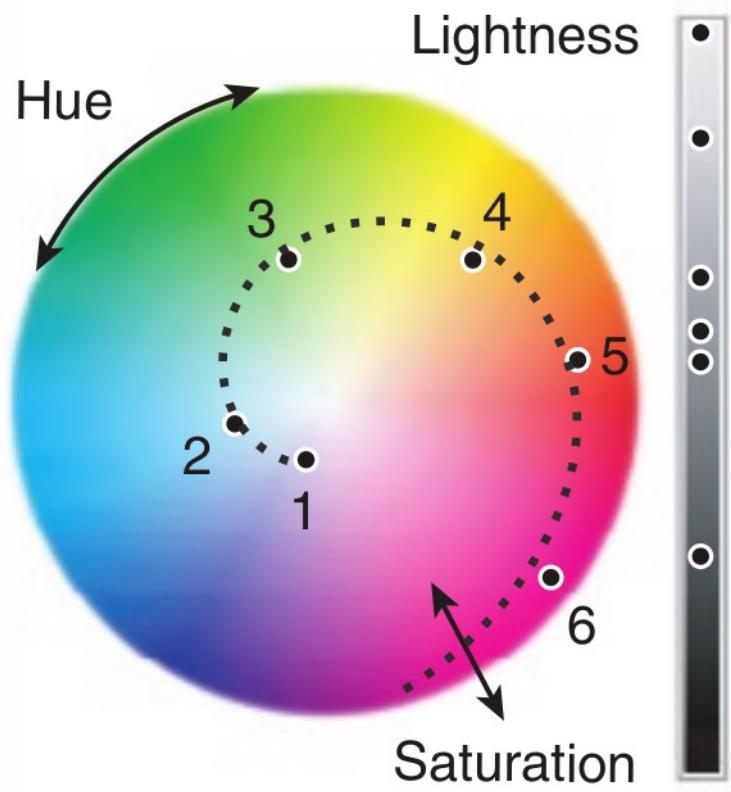
DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

PLAYING WITH PERCEPTION: PROPORTIONS

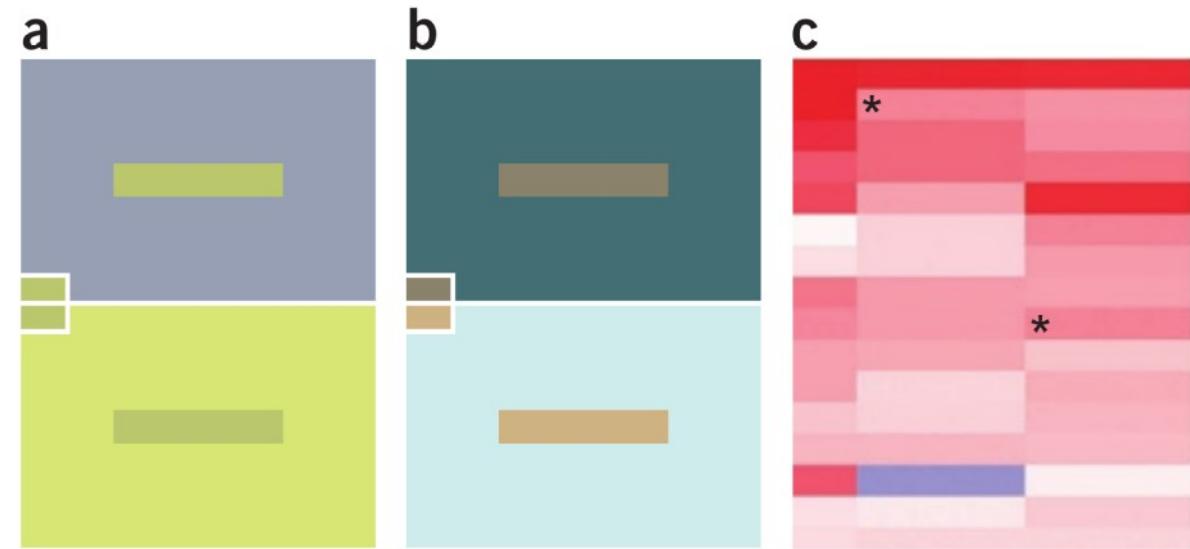
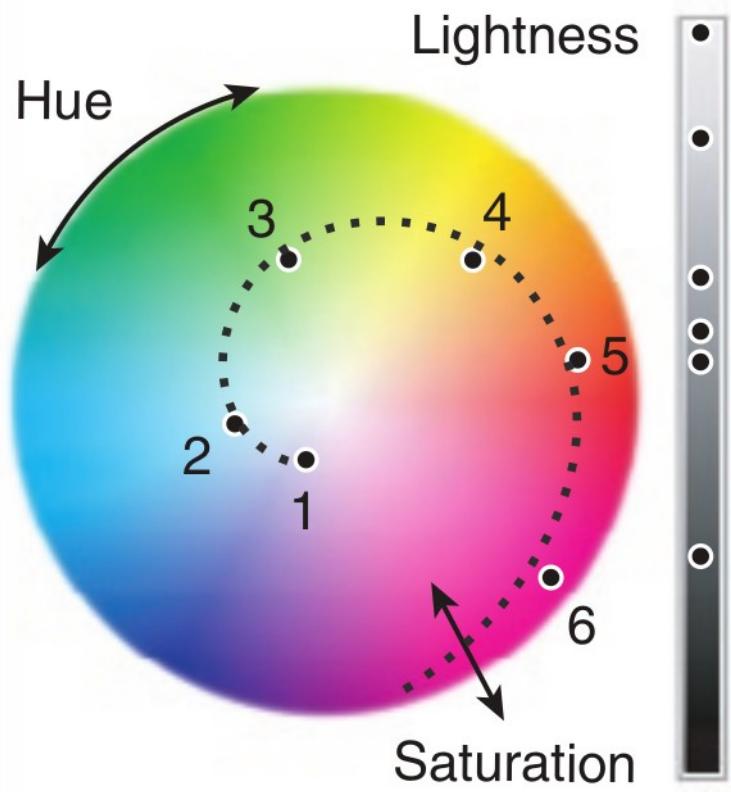


COLOR

COLOR



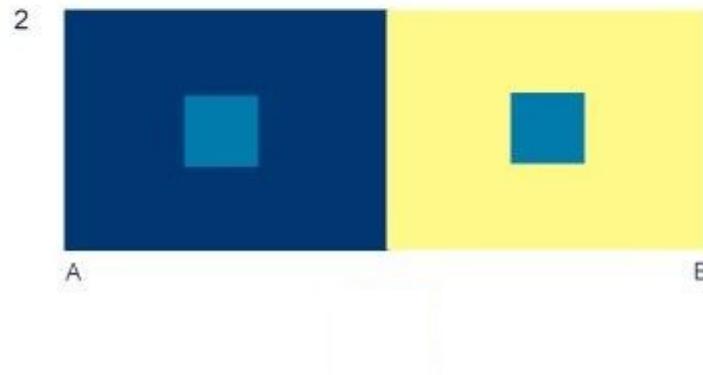
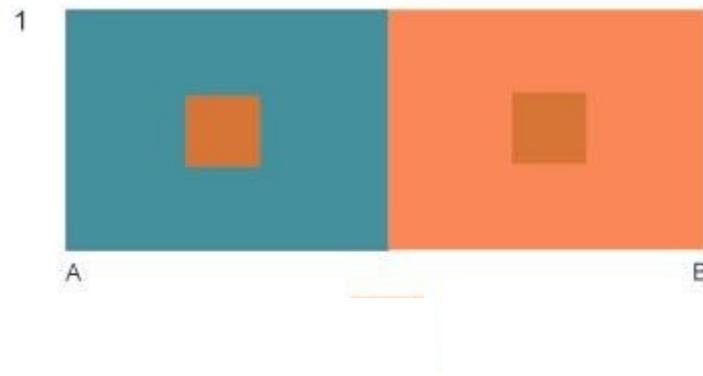
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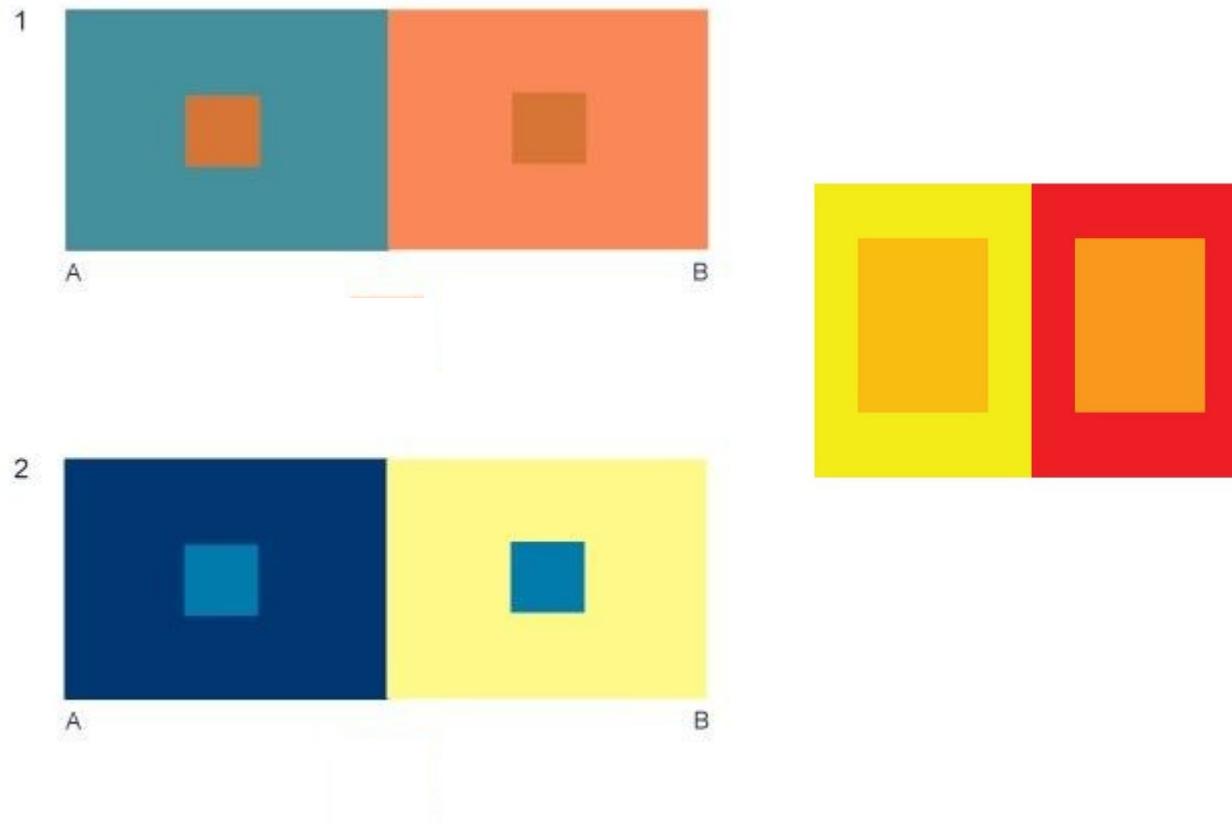
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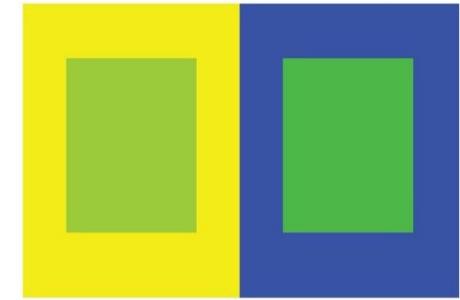
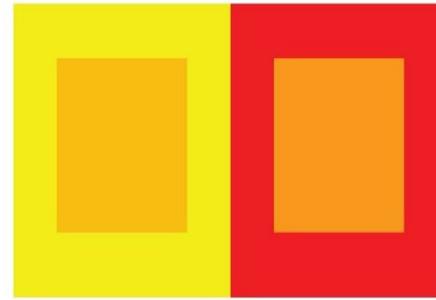
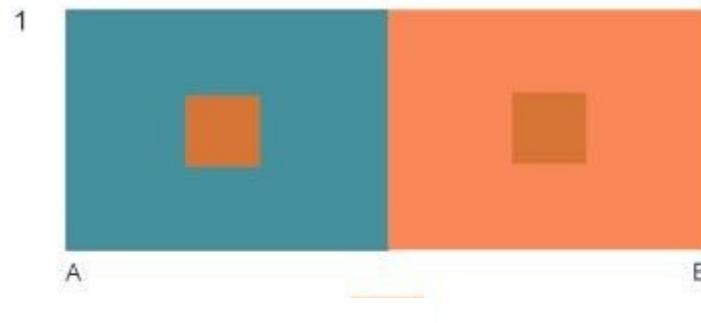
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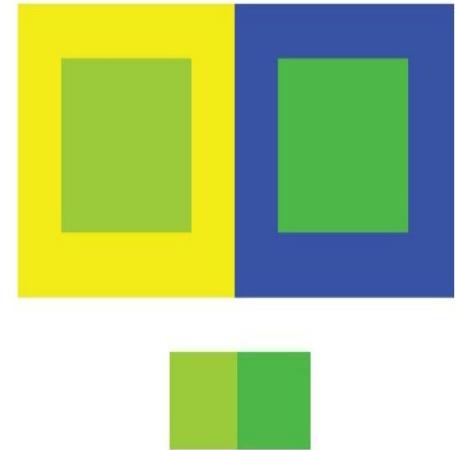
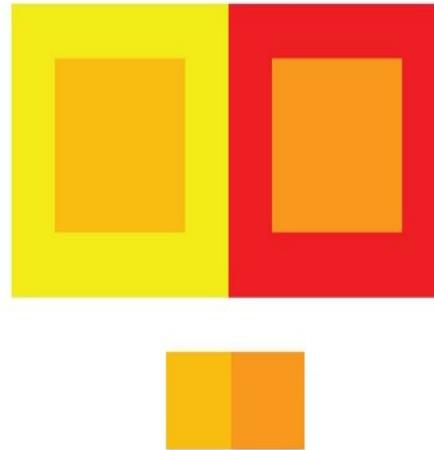
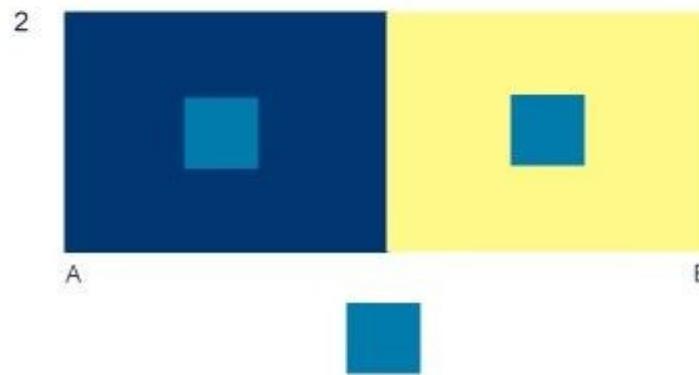
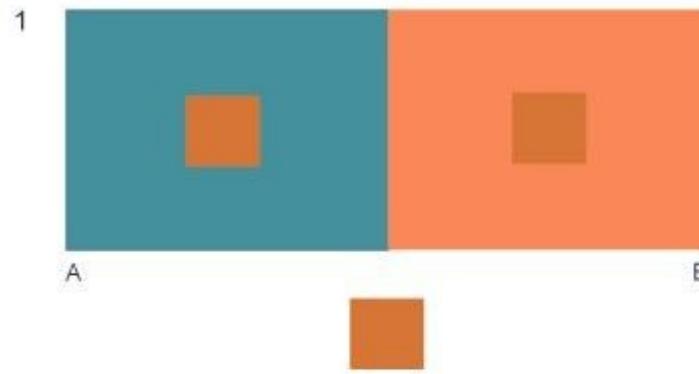
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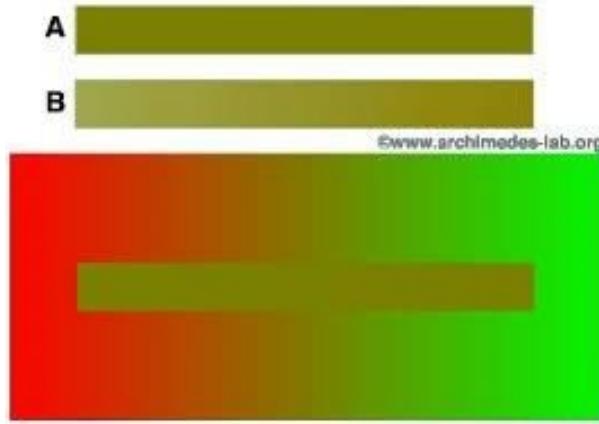
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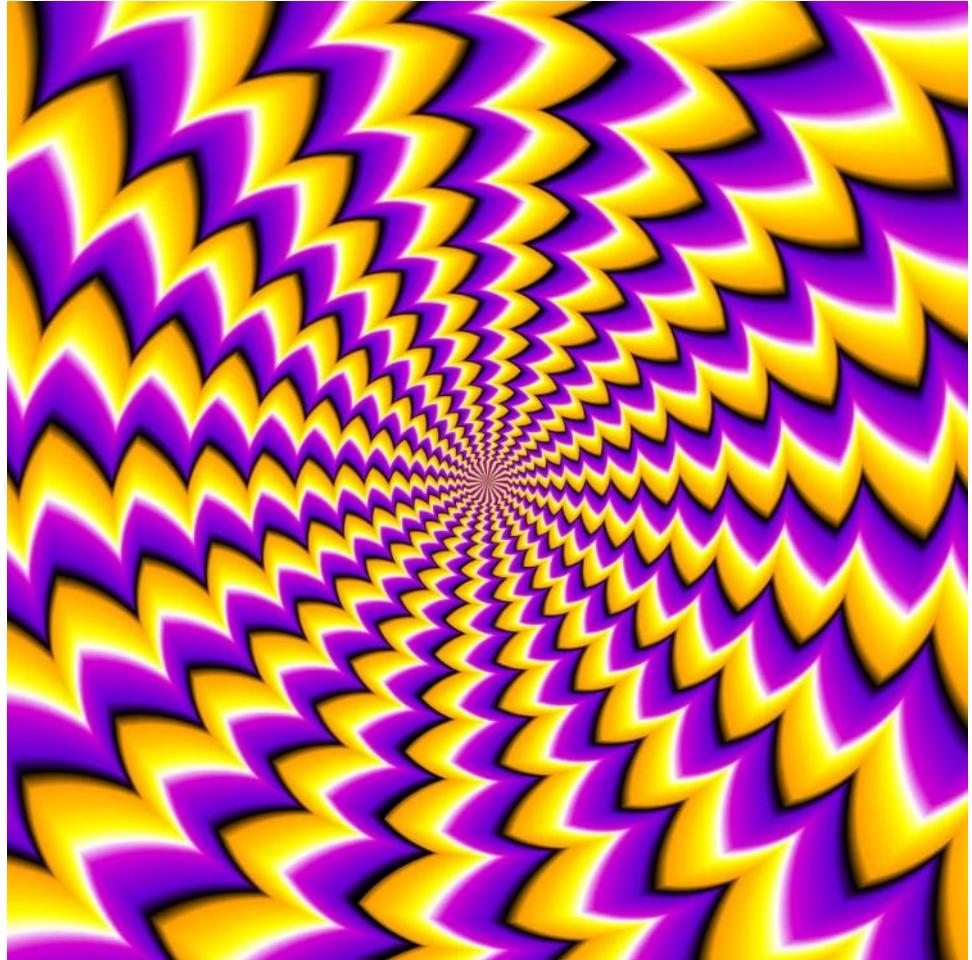
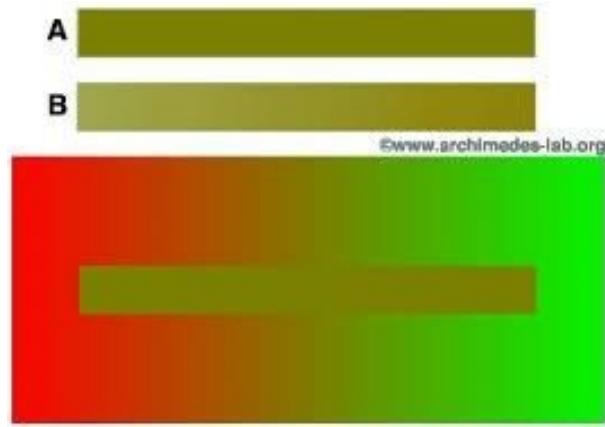
COLOR



COLOR



COLOR



COLOR

A good color palette needs to be:

Colorful, spanning as wide a palette as possible

Perceptually uniform, values close to each other have similar-appearing colors and values far away from each other have more different-appearing colors

Robust to colorblindness, so that the above properties hold true for people with common forms of colorblindness, as well as in grey scale printing

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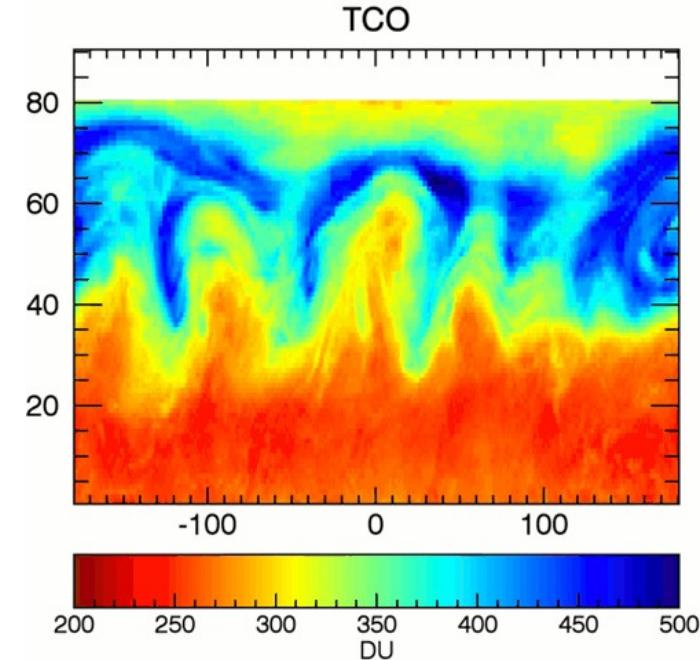
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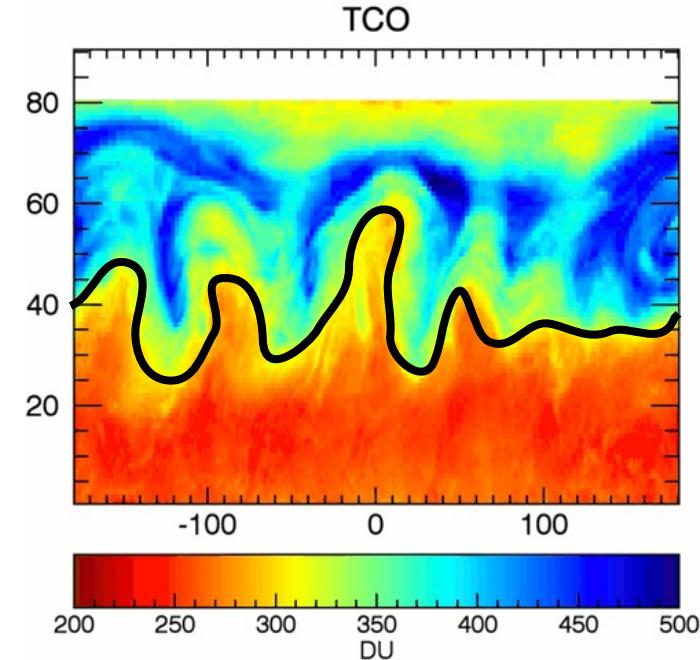
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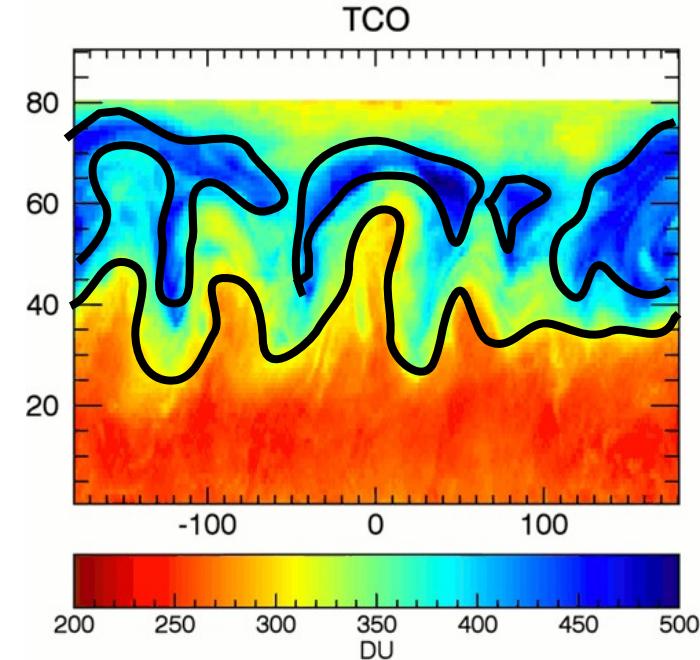
COLOR: PERCEPTUALLY UNIFORM



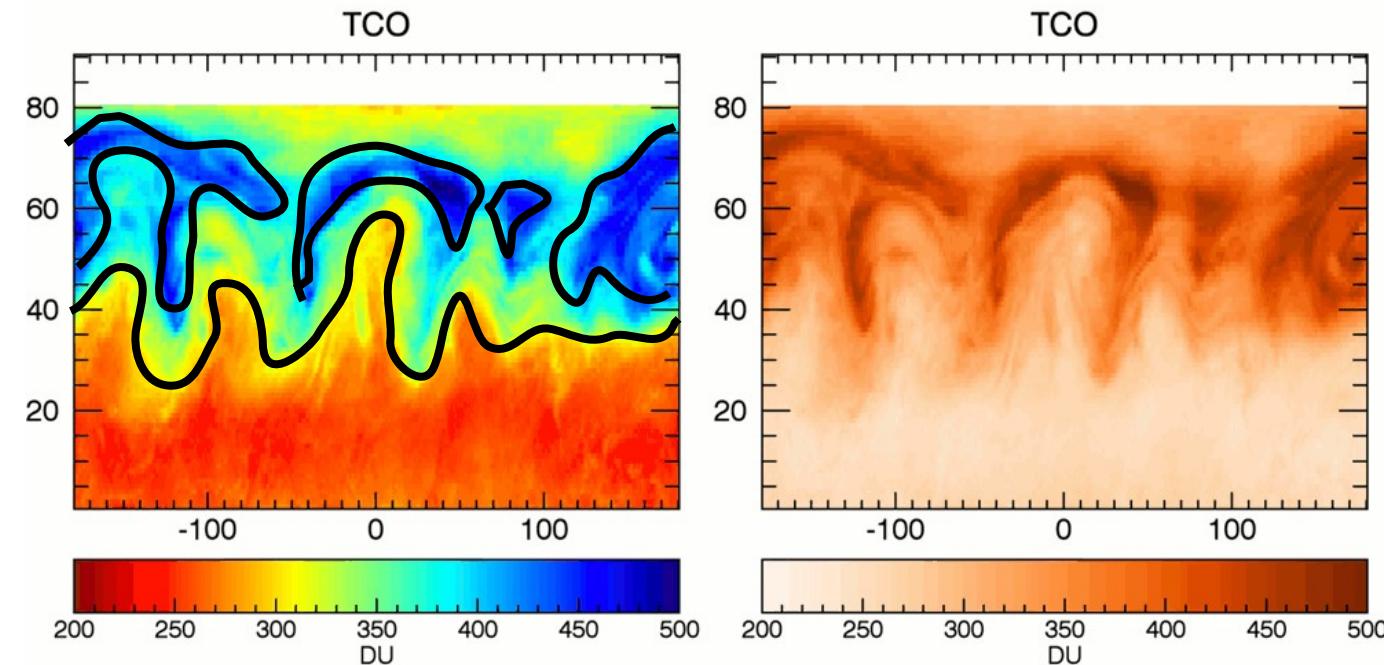
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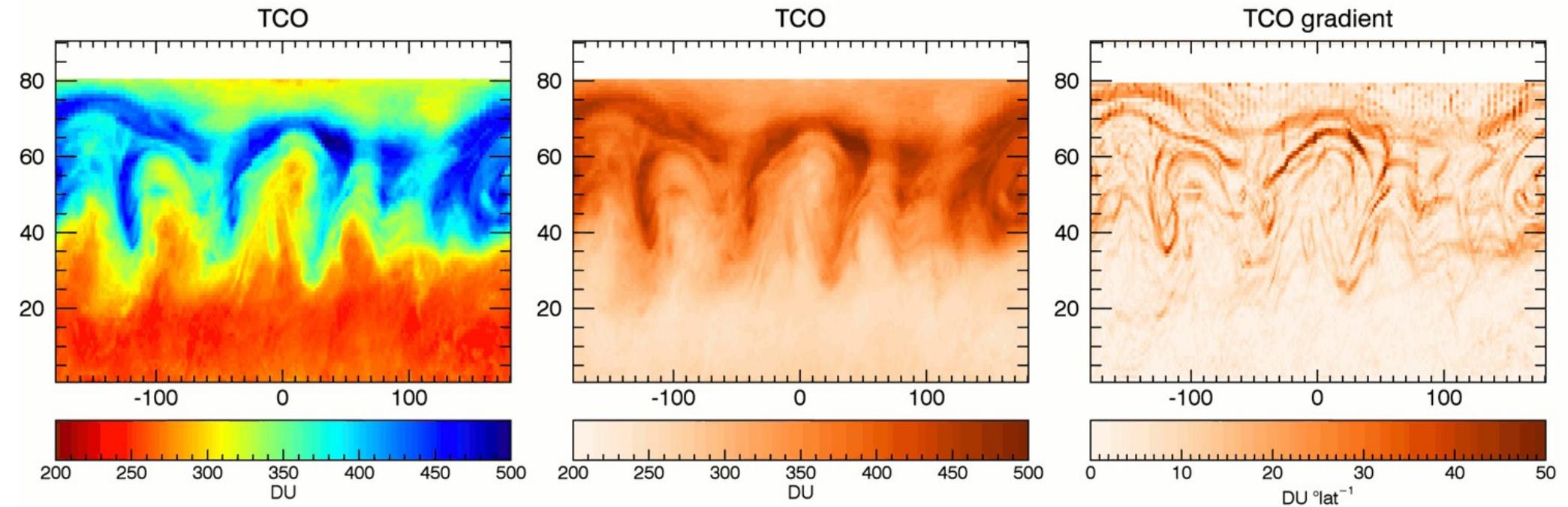
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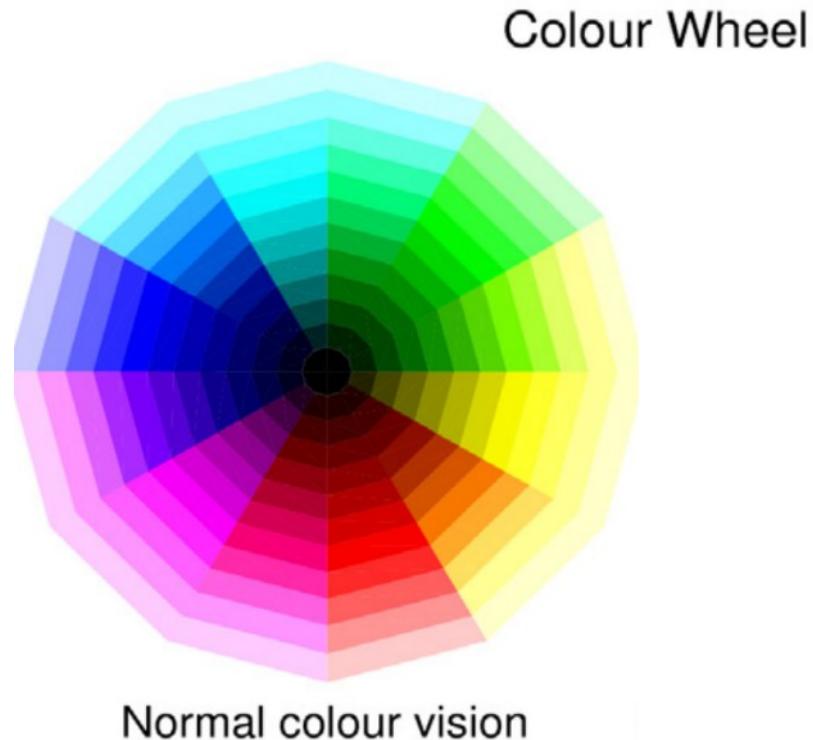
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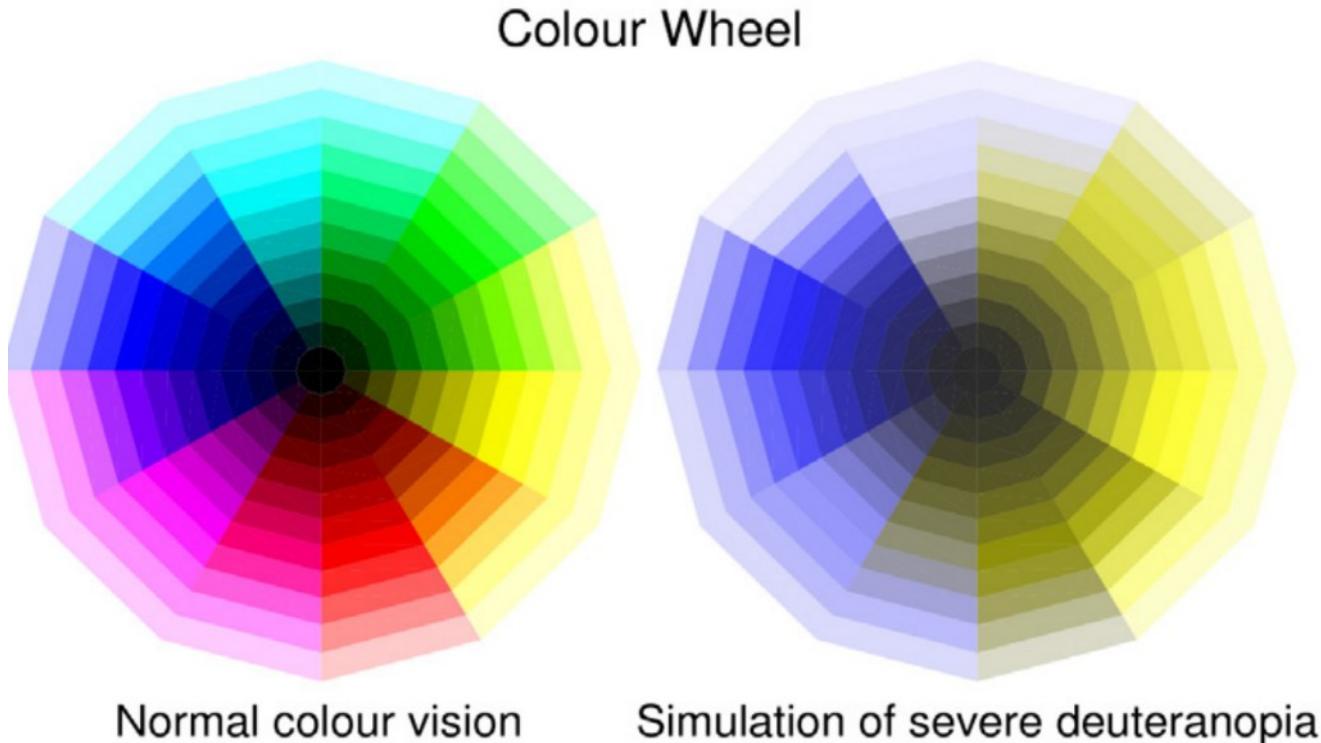
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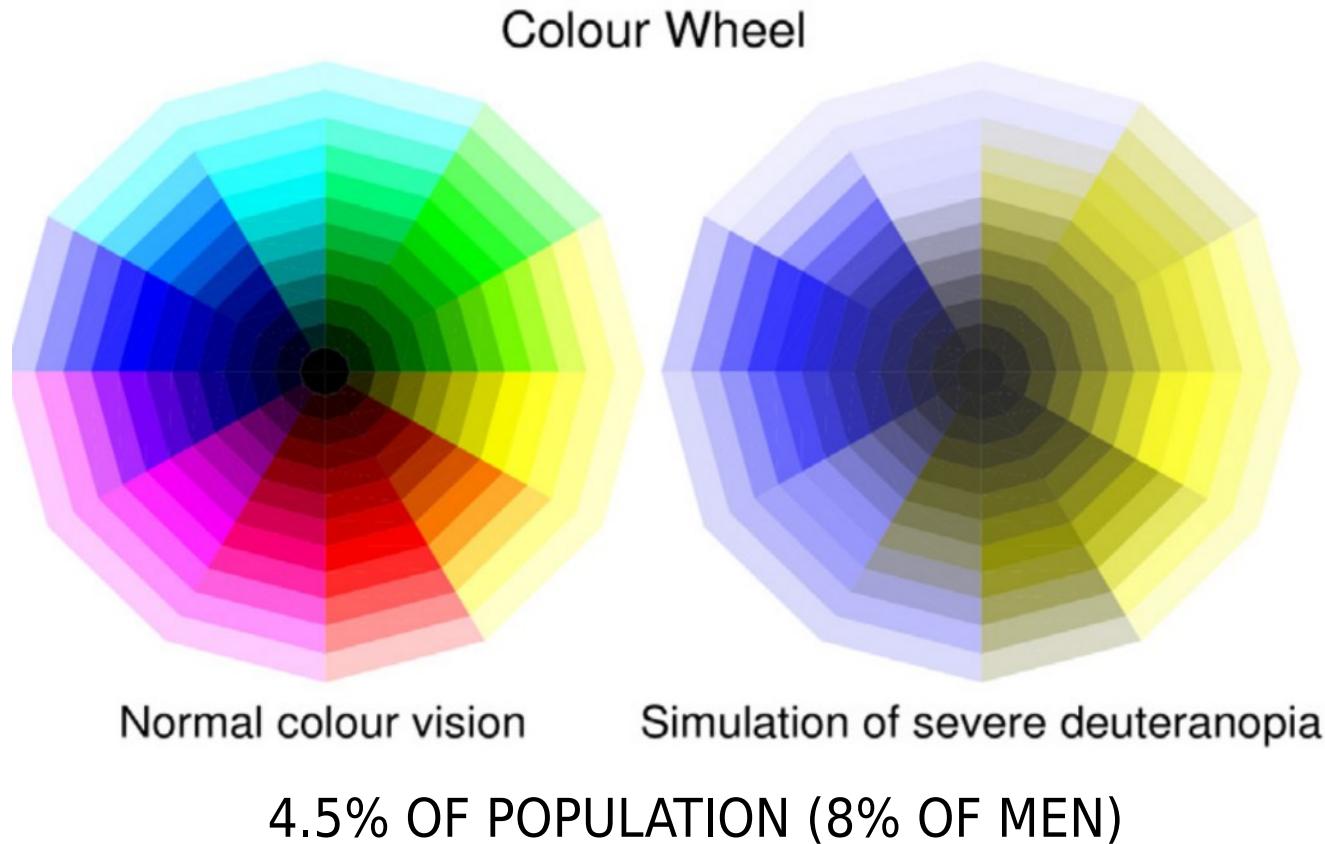
COLOR: COLOR BLINDNESS



COLOR: COLOR BLINDNESS



COLOR: COLOR BLINDNESS



COLOR



COLOR



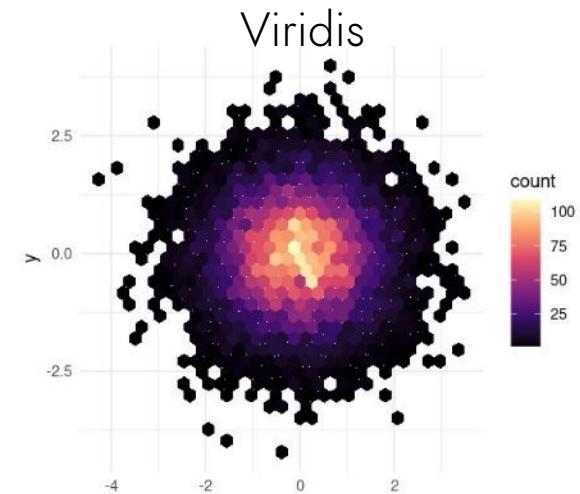
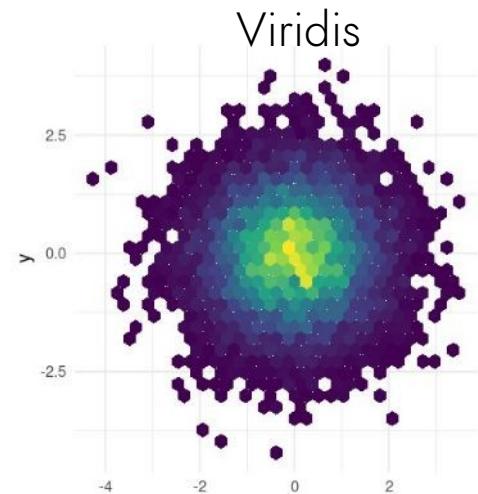
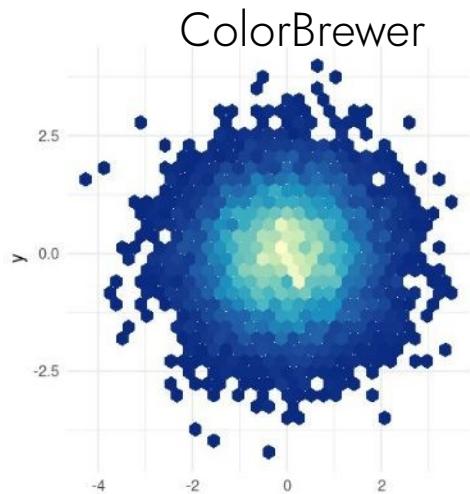
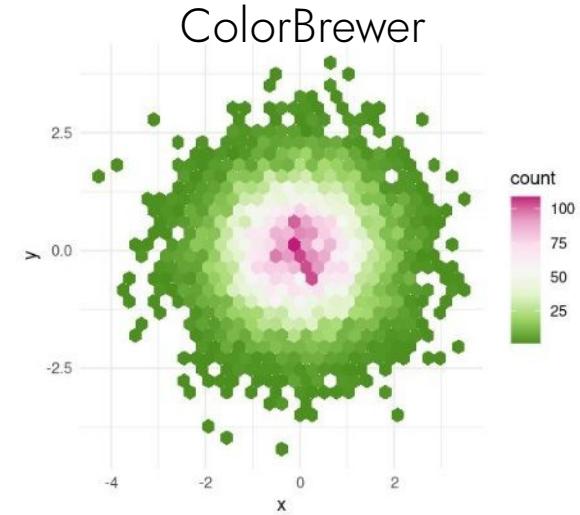
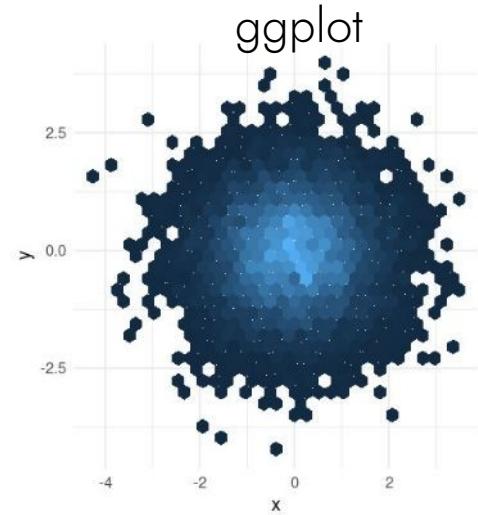
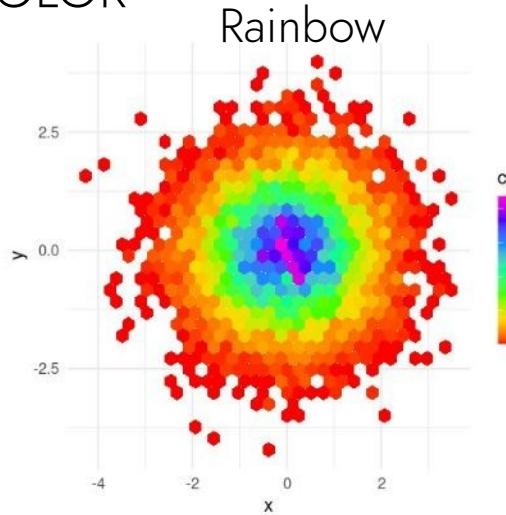
COLORBREWER 2.0
color advice for cartography

<https://colorbrewer2.org>

VIRIDIS PALETTE

<http://bit.ly/37yseMn>

COLOR



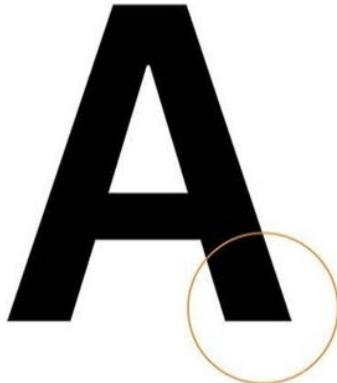
DESIGN PRINCIPLES FOR EFFECTIVE SCIENTIFIC VISUALIZATIONS

TEXT

Serif



Sans-serif

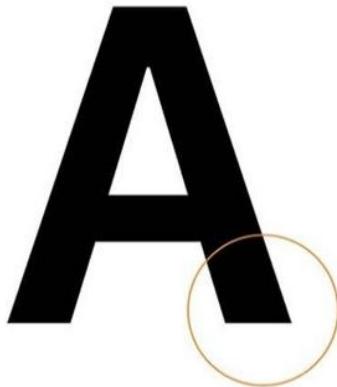


TEXT

Serif



Sans-serif



Lorem ipsum dolor sit amet, consectetur adipiscing elit. Donec rhoncus eros ac velit ultricies, nec tempus metus iaculis. Cras semper dignissim nulla ut ultrices. Quisque consectetur aliquam vulputate. Aliquam mi risus, tempus sed risus at, ullamcorper molestie lacus. Vivamus sollicitudin augue id fringilla finibus. Curabitur iaculis nunc sed enim lacinia, in molestie sapien congue. Praesent eleifend libero dolor, et rhoncus nisl hendrerit eget. Duis volutpat felis id rhoncus faucibus.

TEXT

Serif



Sans-serif

A

Donec ipsum dolor sit amet, consectetur adipiscing elit. Donec rhoncus eros ac velit ultricies, nec tempus metus iaculis. Cras semper dignissim nulla ut ultrices. Quisque consectetur aliquam vulputate. Aliquam mi risus, tempus sed risus at, ullamcorper molestie lacus. Vivamus sollicitudin augue id fringilla finibus. Curabitur iaculis nunc sed enim lacinia, in molestie sapien congue. Praesent eleifend libero dolor, et rhoncus nisl hendrerit eget. Duis volutpat felis id rhoncus faucibus.

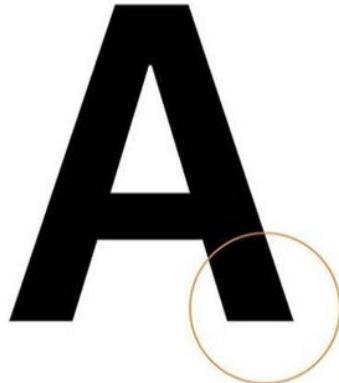
Donec roncus eros ac velit ultricies, nec tempus metus iaculis. Cras semper dignissim nulla ut ultrices. Quisque consectetur aliquam vulputate. Aliquam mi risus, tempus sed risus at, ullamcorper molestie lacus. Vivamus sollicitudin augue id fringilla finibus. Curabitur iaculis nunc sed enim lacinia, in molestie sapien congue. Praesent eleifend libero dolor, et roncus nisl hendrerit eget. Duis volutpat felis id roncus faucibus.

TEXT

Serif



Sans-serif



Arial

Sans

Futura

Comic Sans MS

Times New Romans

Serif

Garamond

Mono Space

TEXT



Serif

Sans-serif

Arial

Sans

Futura

~~Comic Sans MS~~

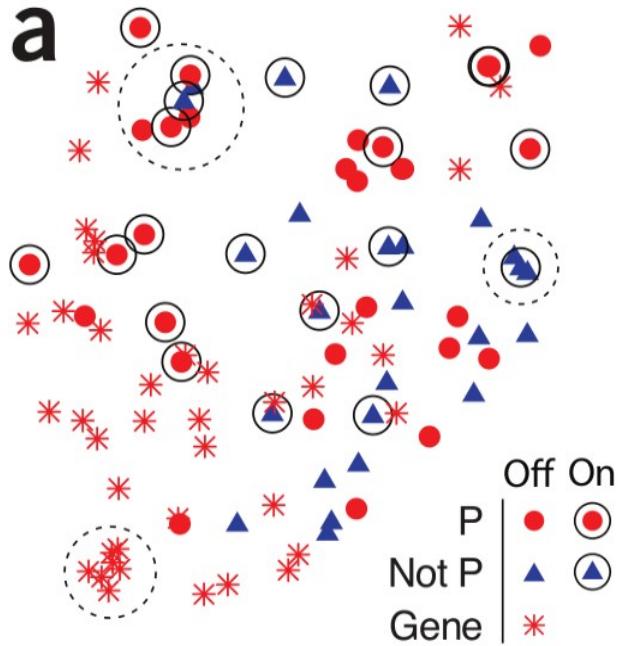
Times New Romans

Serif

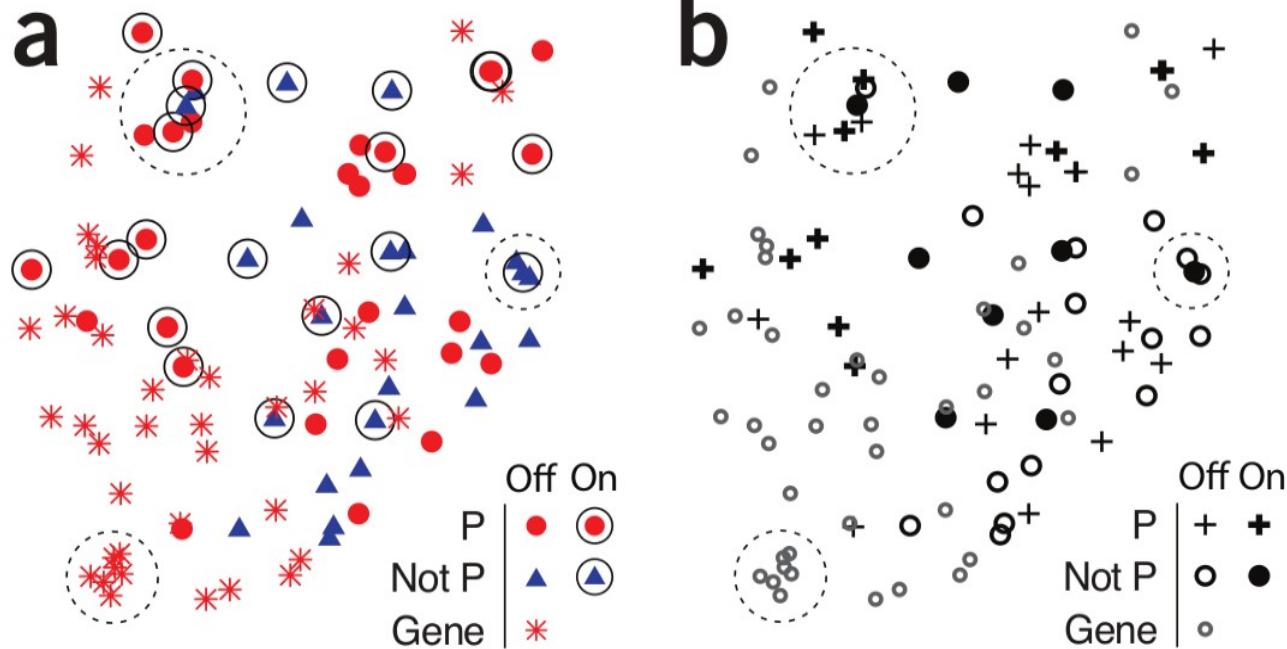
Garamond

Mono Space

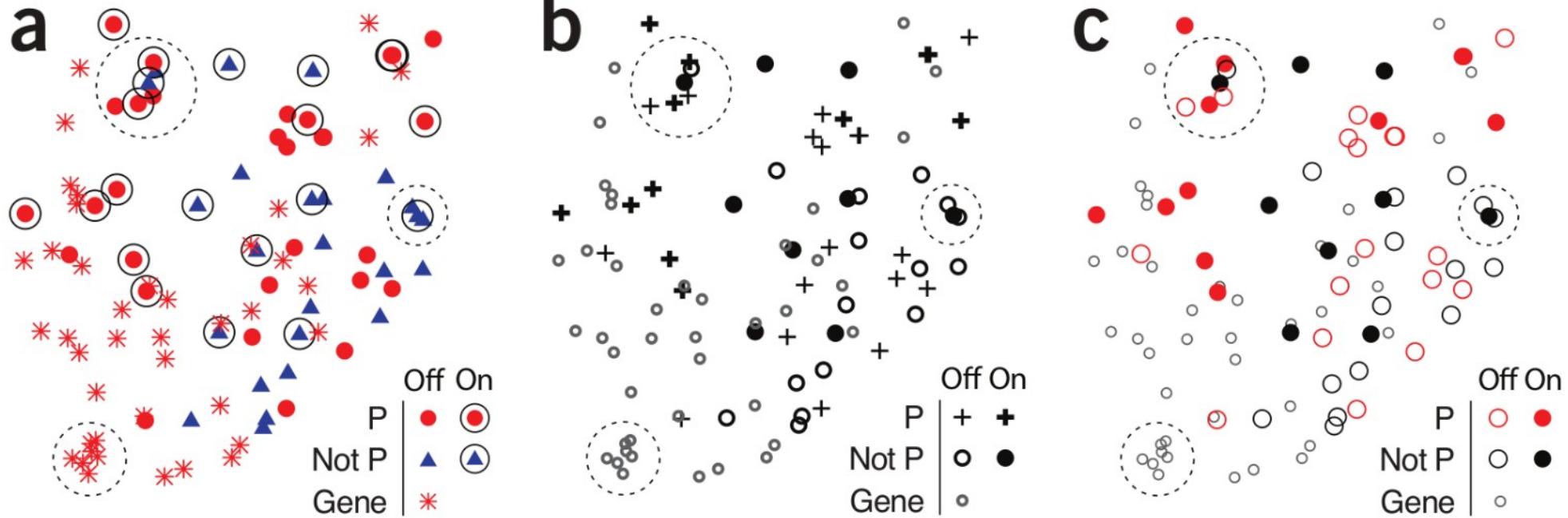
PLAYING WITH FOCUS



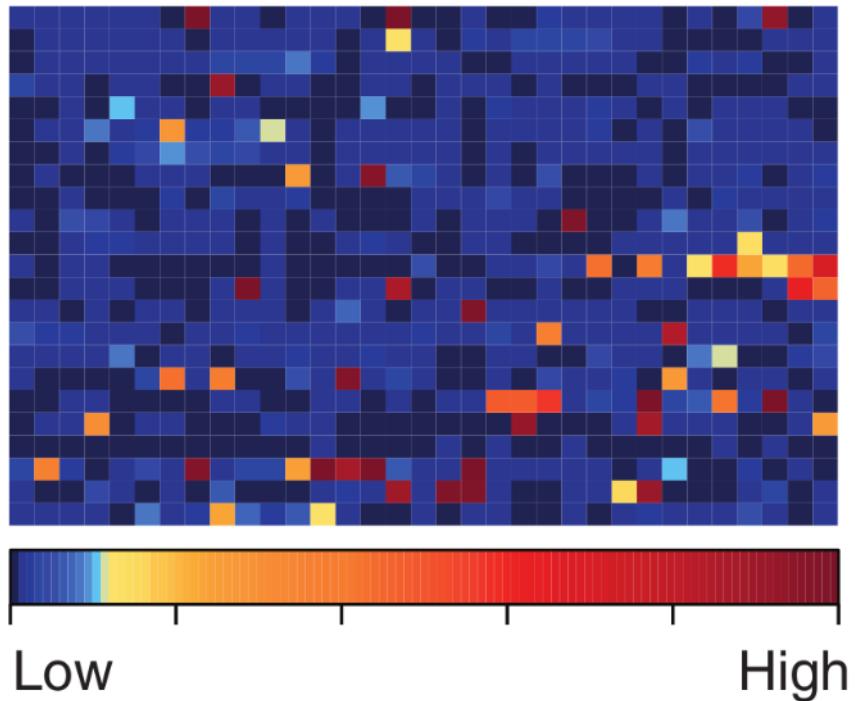
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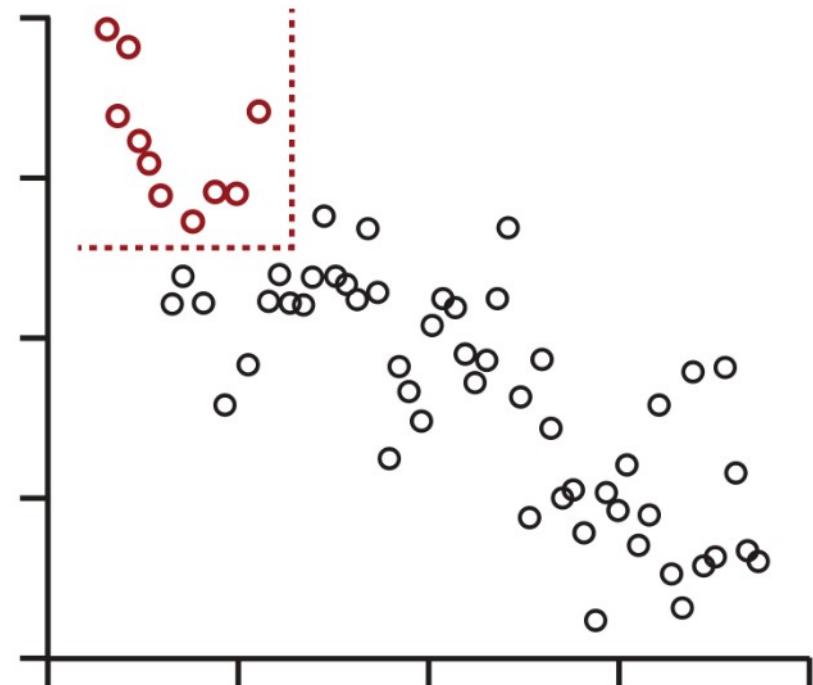
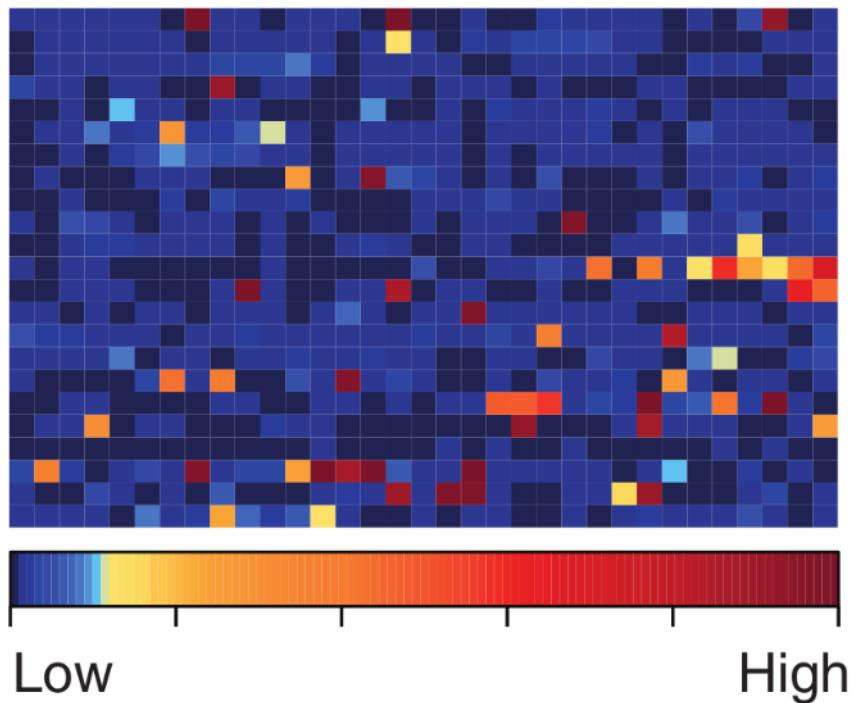
PLAYING WITH FOCUS



SALIENCE TO RELEVANCE

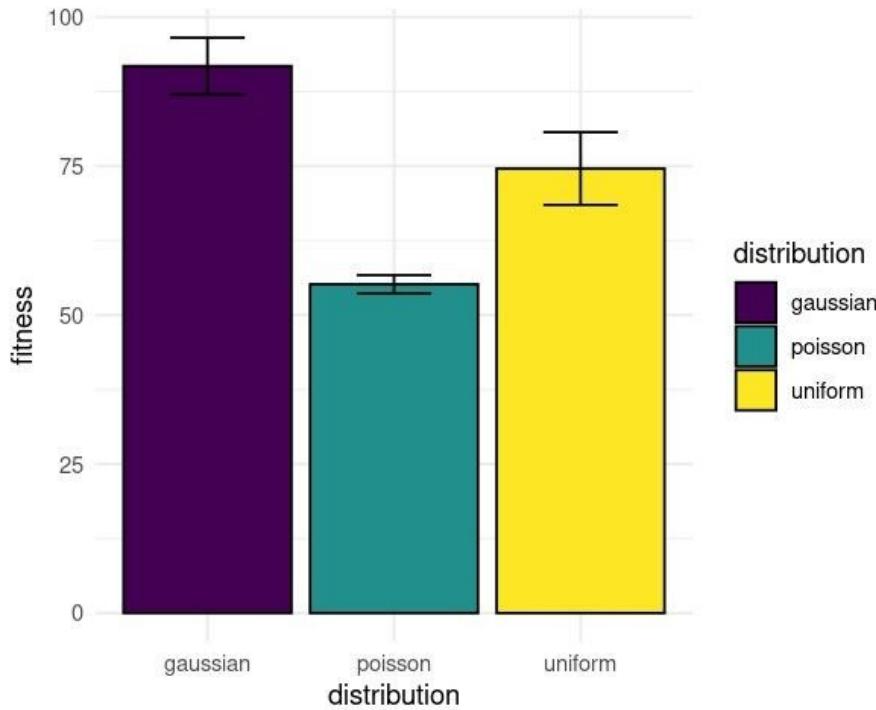


SALIENCE TO RELEVANCE

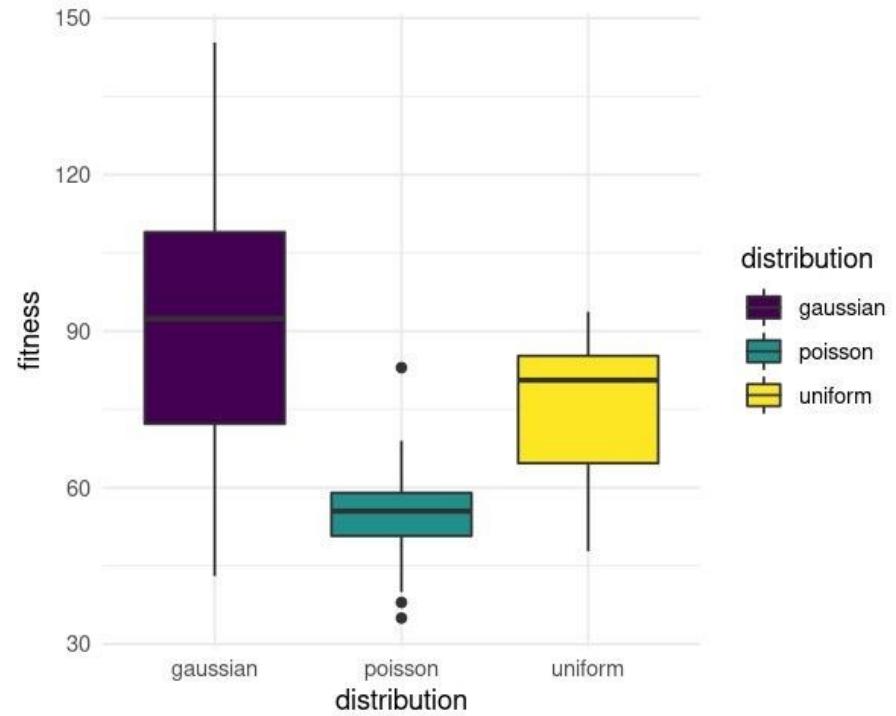
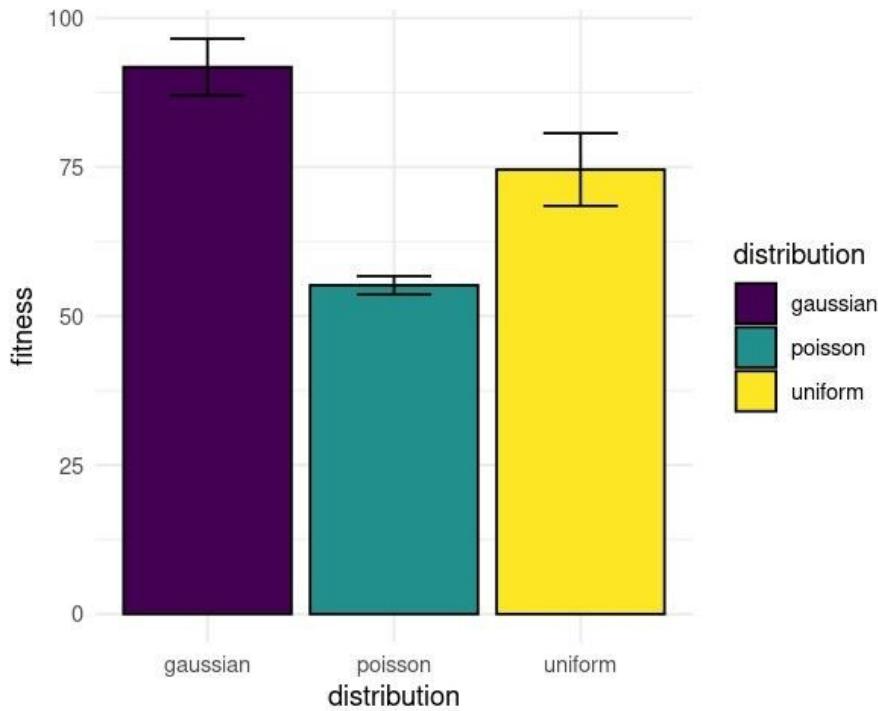


DATA DENSE CHARTS

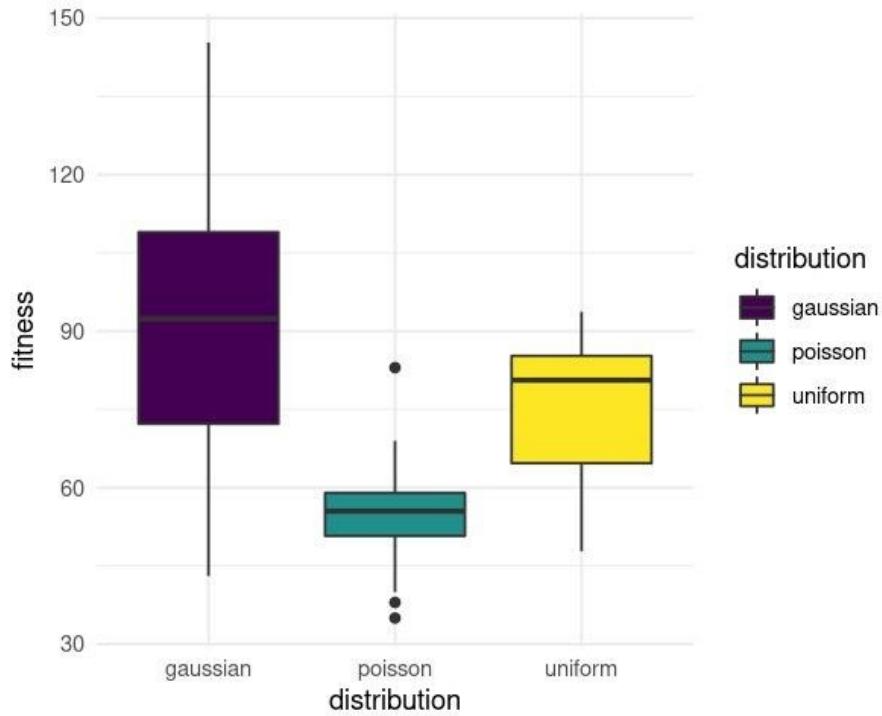
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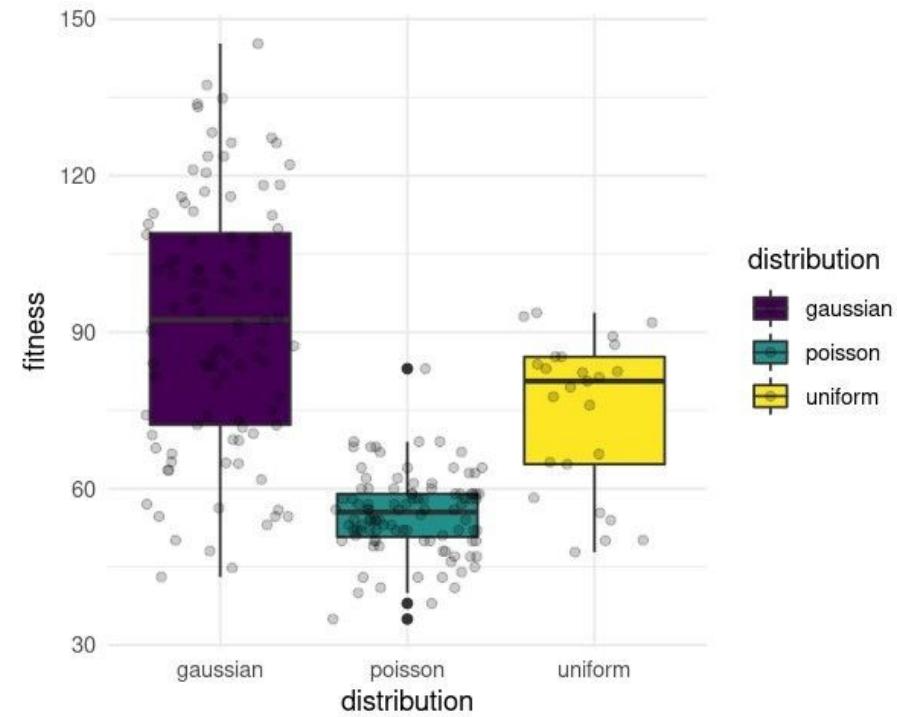
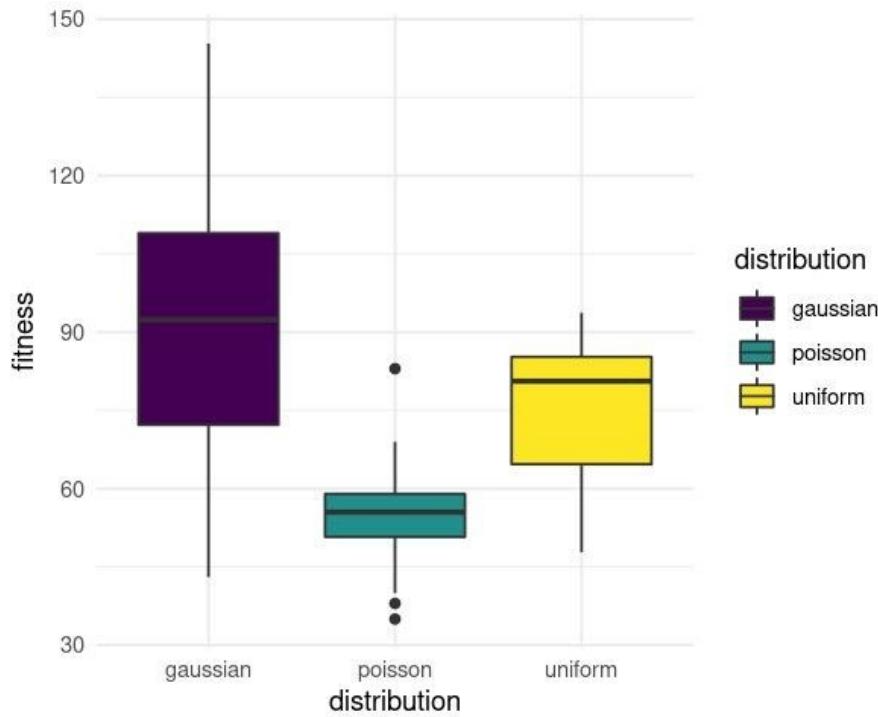
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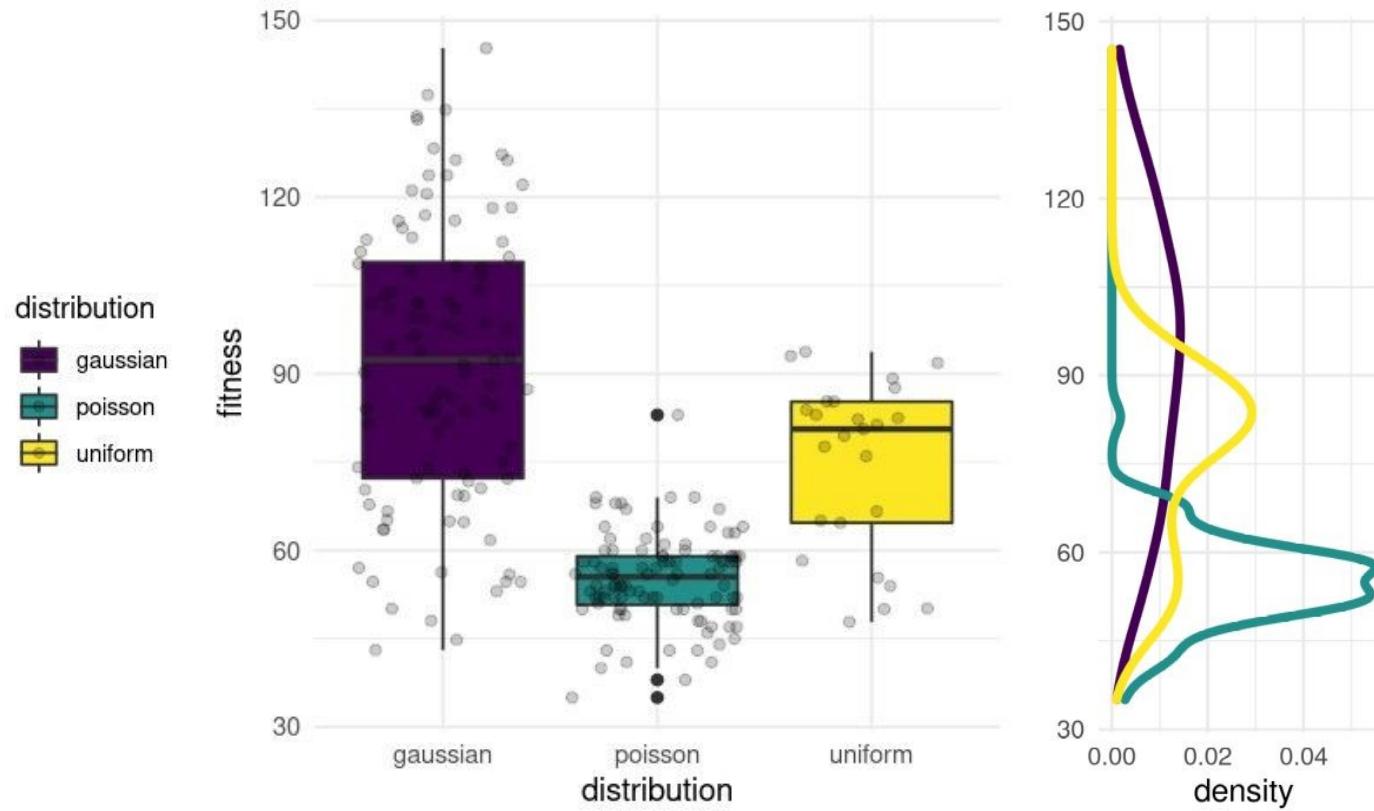
DATA DENSE CHARTS



DATA DENSE CHARTS

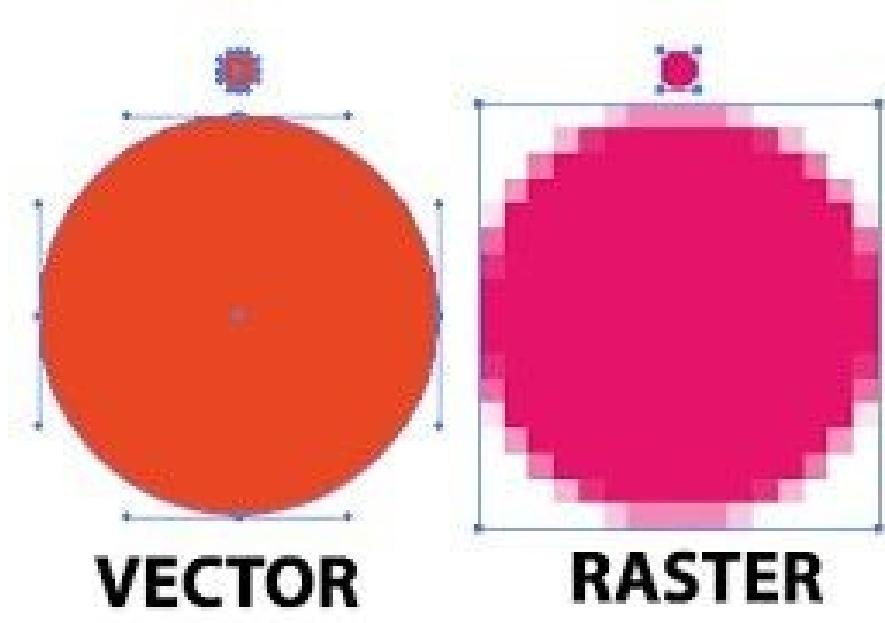


DATA DENSE CHARTS

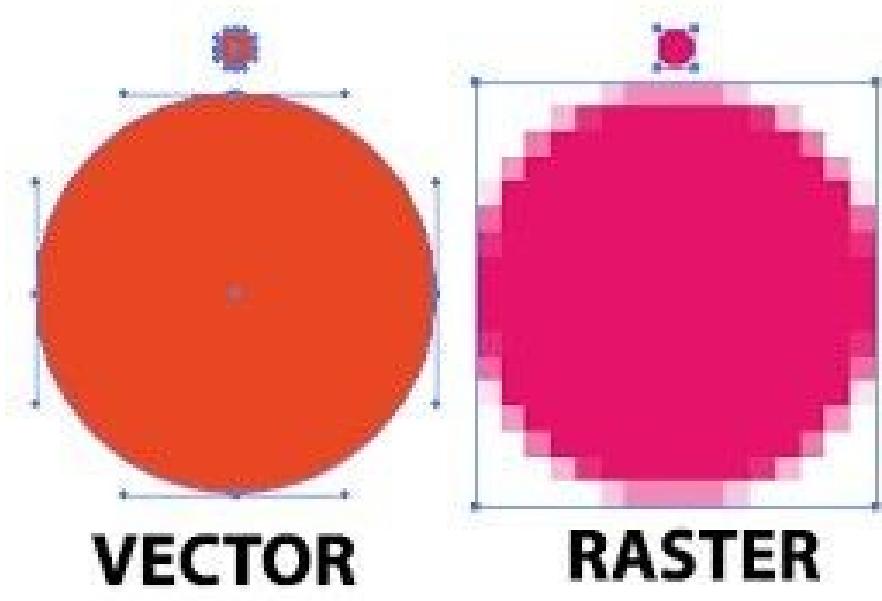


TOOLS OF THE TRADE

YET ANOTHER KEY CONCEPT: RASTER VS VECTOR



YET ANOTHER KEY CONCEPT: RASTER VS VECTOR



Raster formats:

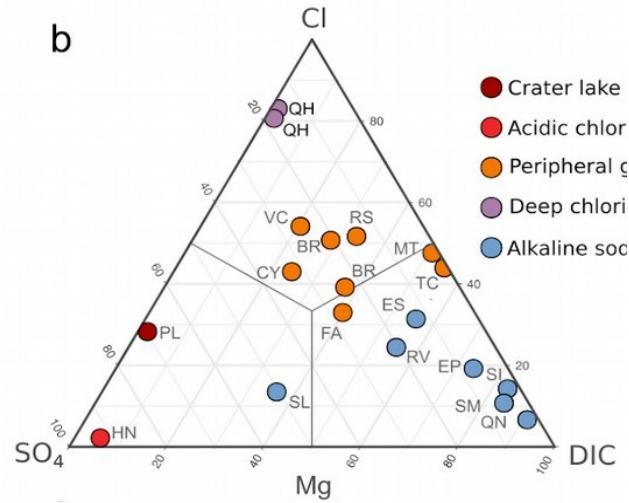
- .png
- .jpg
- .tiff
- .gif

Vector formats:

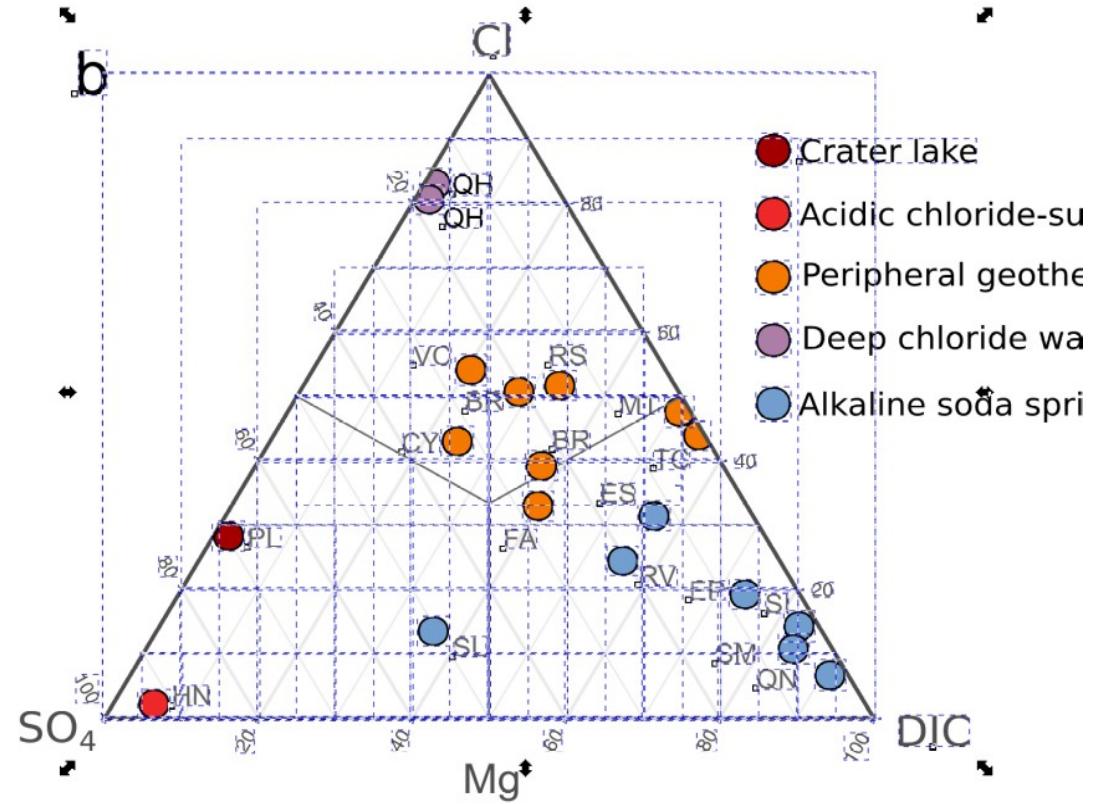
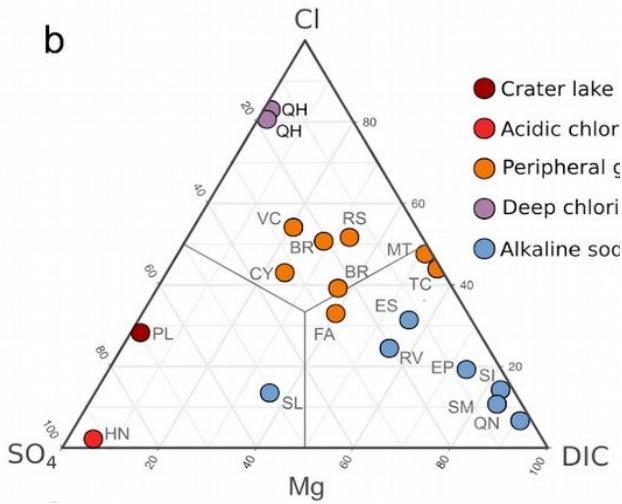
- .svg
- .pdf
- .eps

NB: Vector-type files can contain raster too!

YET ANOTHER KEY CONCEPT: VECTOR IS A MUST!



YET ANOTHER KEY CONCEPT: VECTOR IS A MUST!



TOOLS OF THE TRADE

NO NEED TO BREAK THE BANK!



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Adobe Illustrator



Adobe Photoshop



CorelDRAW

TOOLS OF THE TRADE

NO NEED TO BREAK THE BANK!



Adobe Illustrator



Adobe Photoshop



CorelDRAW

Ai
Illustrator
24,39 €/mese
IVA inclusa

Ps
Photoshop
24,39 €/mese
IVA inclusa

TOOLS OF THE TRADE

NO NEED TO BREAK THE BANK!

All the tools I'm advocating are:

Cross-platform (Windows, Mac OSX, Linux)

Open-Source

Free

Have great community support

R FOR DATA VISUALIZATION

The screenshot shows the RStudio interface. On the left, the code editor displays R code for generating a scatter plot. A tooltip for the word 'aesthetic' is open, providing definitions like 'aseptic' and 'ascetic'. Below the code is a scatter plot titled 'Scatter chart with size and color'. The x-axis is labeled 'delay' and ranges from -20 to 40. The y-axis is labeled 'count' and ranges from 0 to 40. Data points are represented by circles of varying sizes and colors, showing a positive correlation between delay and count.

```
400: ````{r, eval=FALSE}
401: # generate distance/delay scatter aesthetic
402: ggplot(delay, aes(x = dist, y = delay))
403:   geom_point(aes(size = count), alpha
404:   scale_size_area(max_size = 3)
405: ````
```

401:40 C Chunk 22 ▾ R Markdown ▾

Console Terminal × Find in Files × Jobs ×

Find Replace

Replace with: session Replace All

Results for "context" in ~/git/rsrecovr

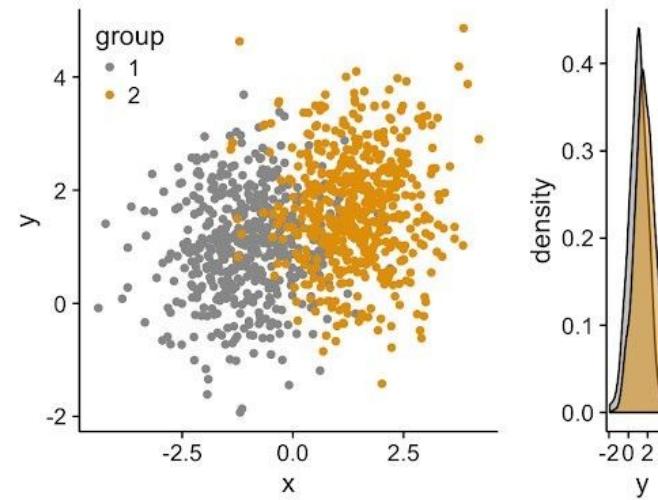
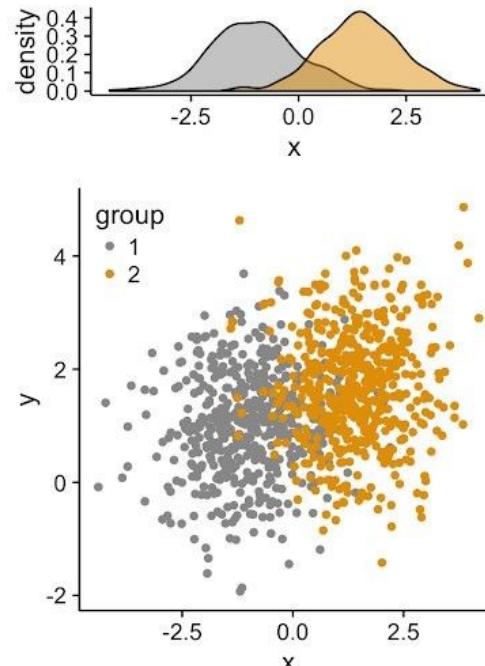
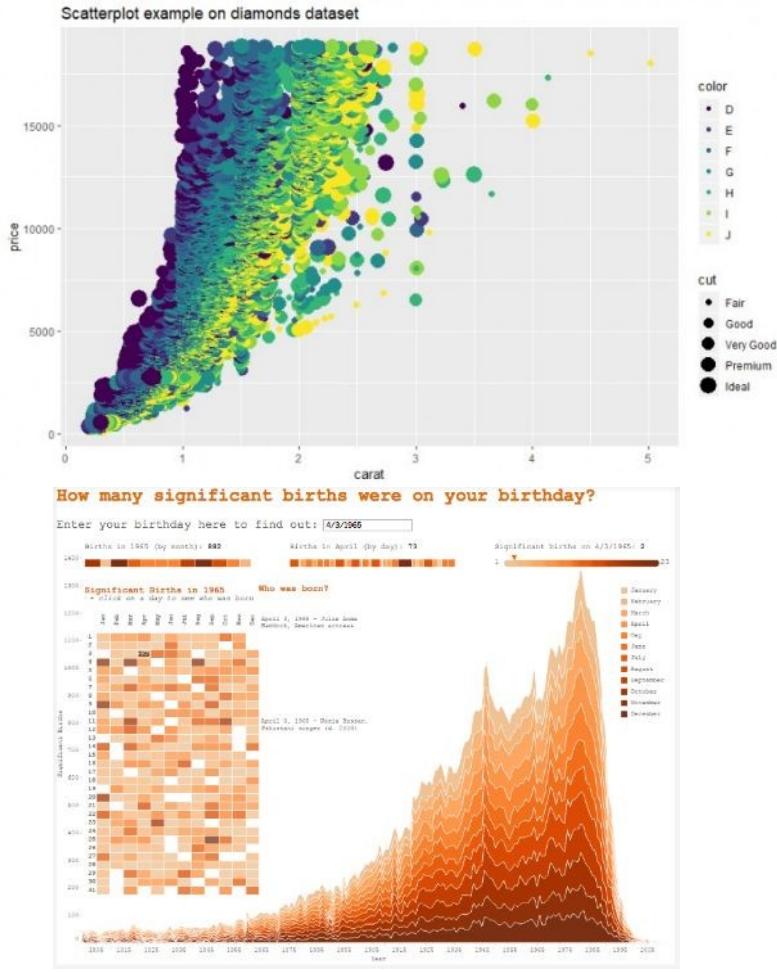
```
~/git/rsrecovr/R/all.R
37: results <- rbind(results, cbind(project = NA, contextsession = NA,
~/git/rsrecovr/R/projects.R
10: # list all the contextsession IDs
11: contextsessions <- list.files(state_folder, pattern = "^[a-zA-Z0-9].
13: # recover the sources from each contextsession
14: results <- lapply(contextsessions, function(contextsession_id) {
16:   recovered <- recovr_sessions(file.path(state_folder, contextsession_id))
21:   cbind(data.frame(contextsession = contextsession_id), recovered)
```

TOOLS OF THE TRADE



<https://rstudio.com/products/rstudio/>

THE GRAMMAR OF GRAPHICS (ggplot)

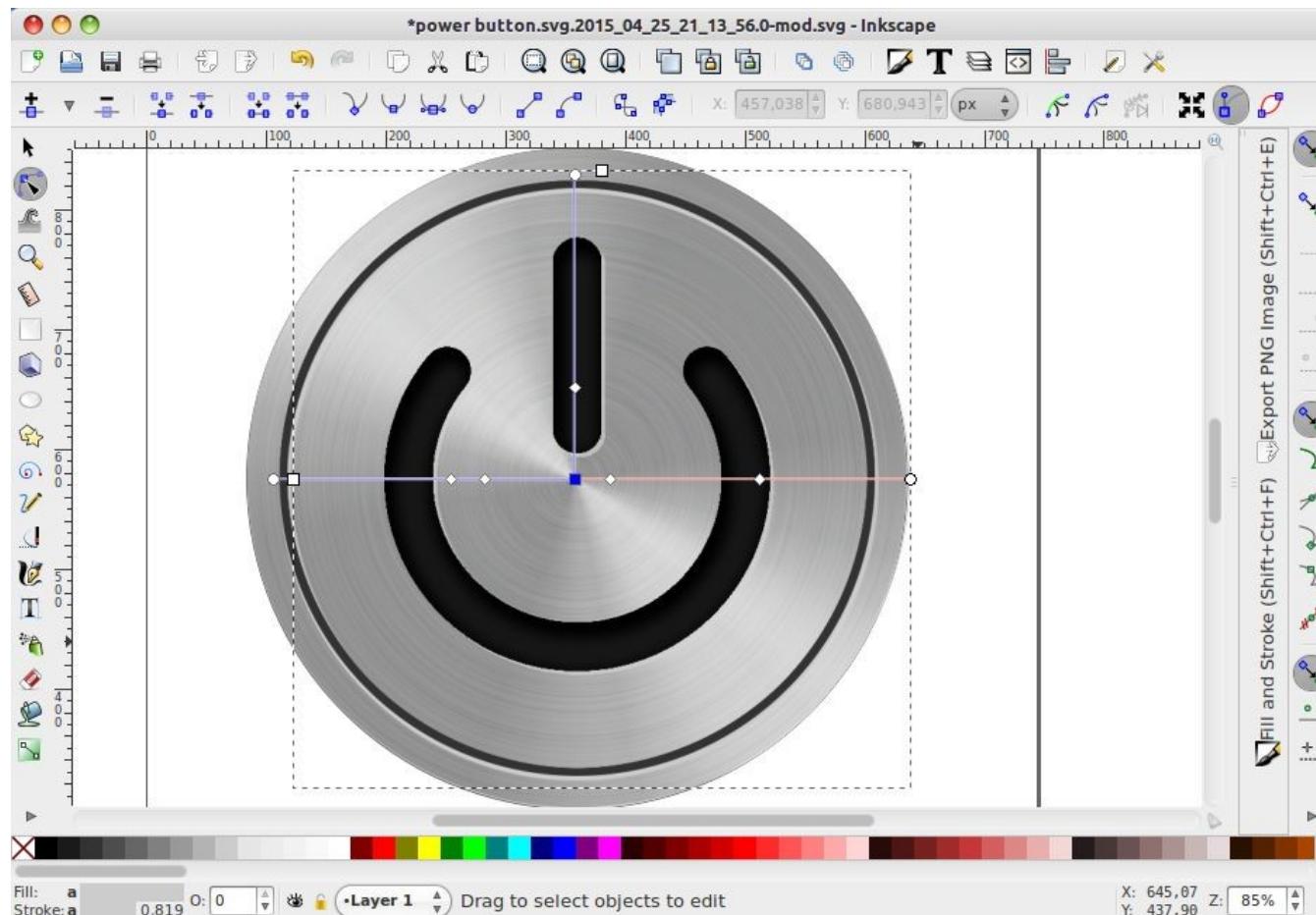


```
ggplot(dataset, aes(x, y)) +  
  geom_hex() + coord_fixed() +  
  theme_bw()
```

TOOLS OF THE TRADE

<https://ggplot2.tidyverse.org/>

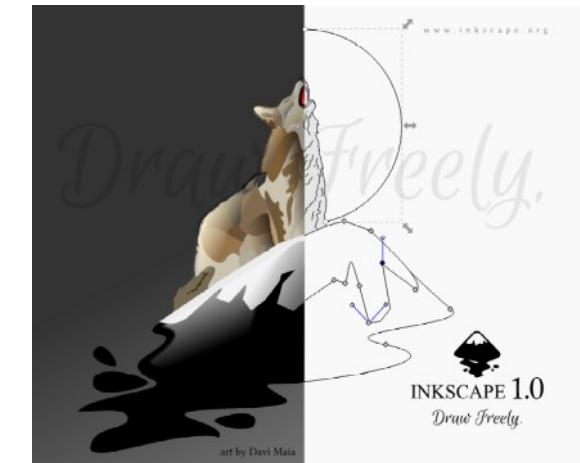
INKSCAPE



TOOLS OF THE TRADE



INKSCAPE

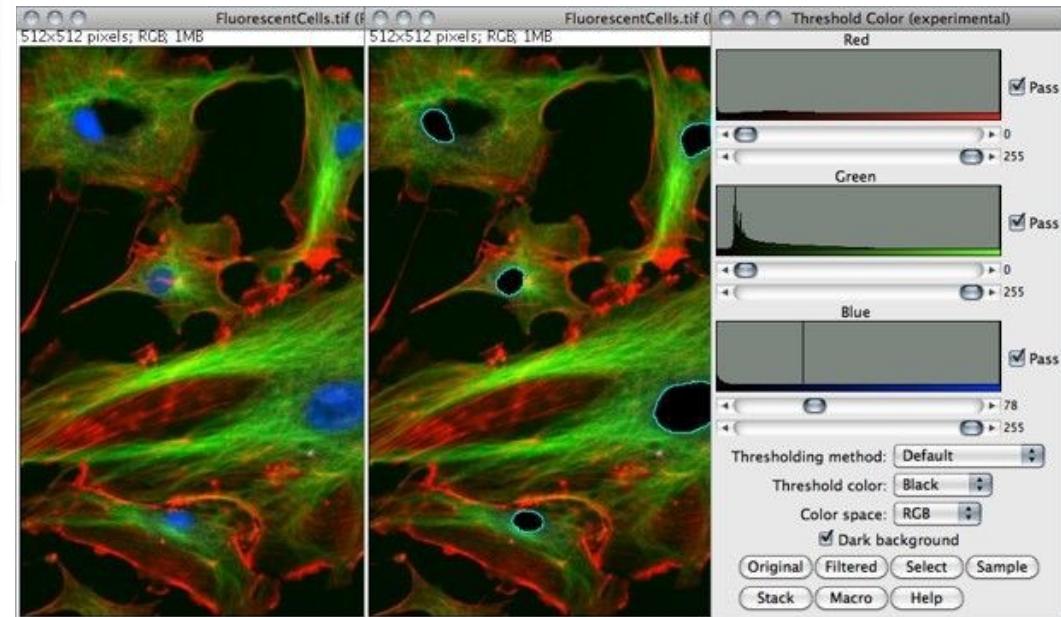
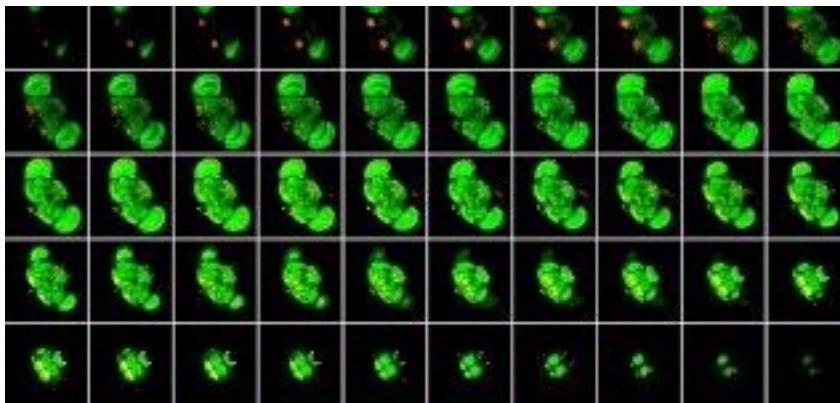
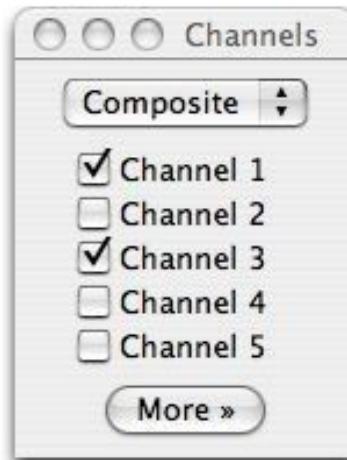
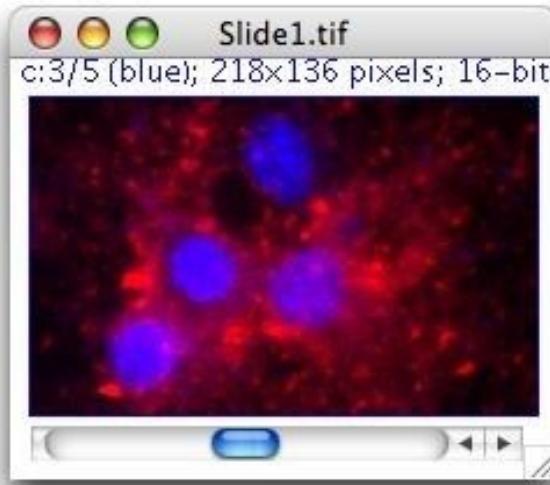


<https://inkscape.org/>

IMAGE



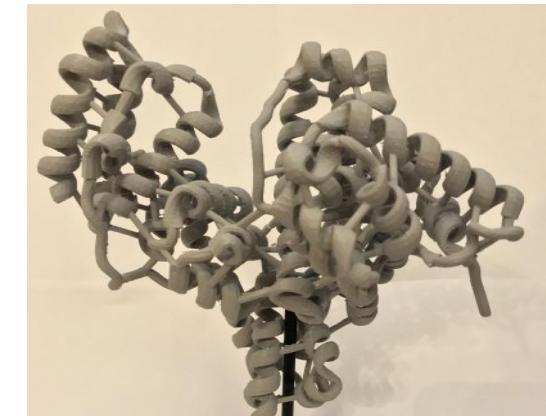
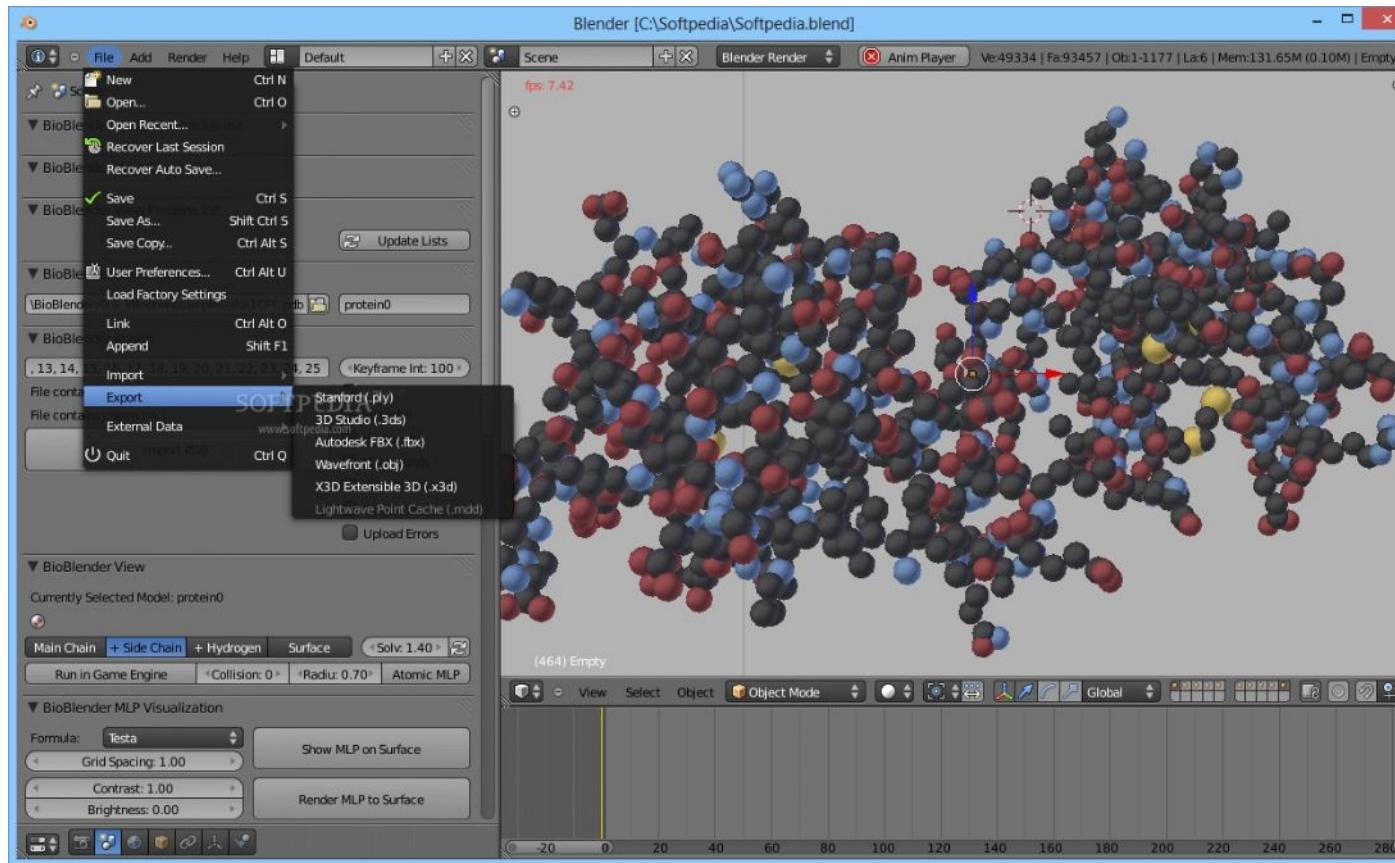
IMAGE
An open platform for scientific image analysis



TOOLS OF THE TRADE

<https://imagej.net/Fiji>

BLENDER 3D

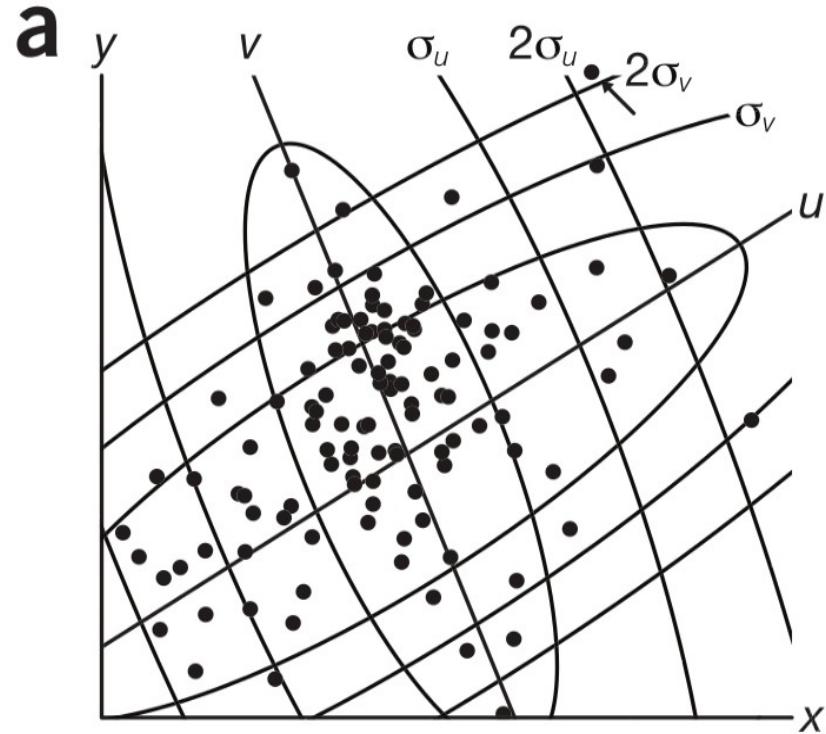


TOOLS OF THE TRADE

<https://www.blender.org/>

FROM GOOD TO GREAT (beyond the basics)

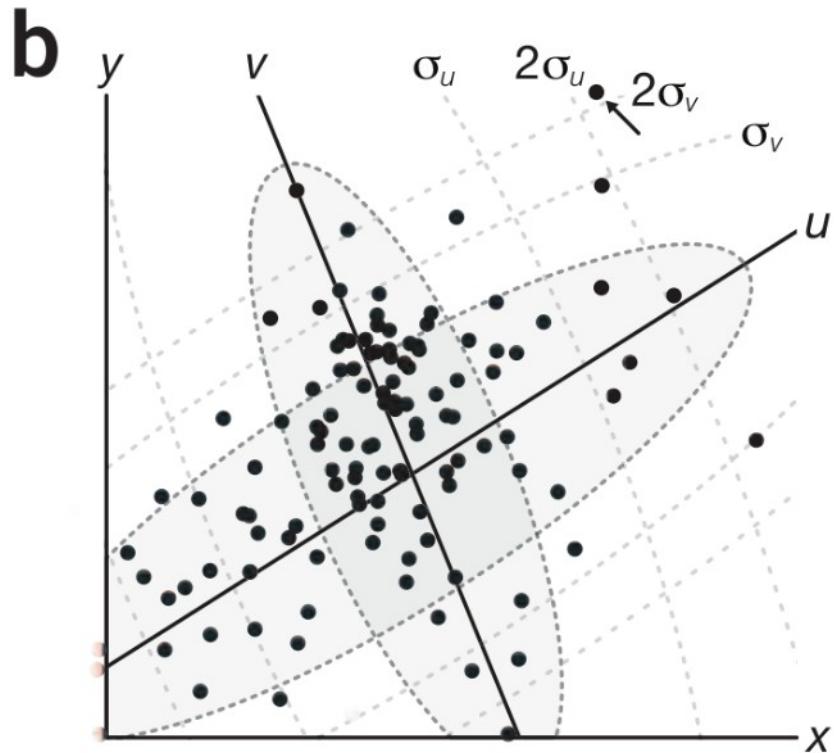
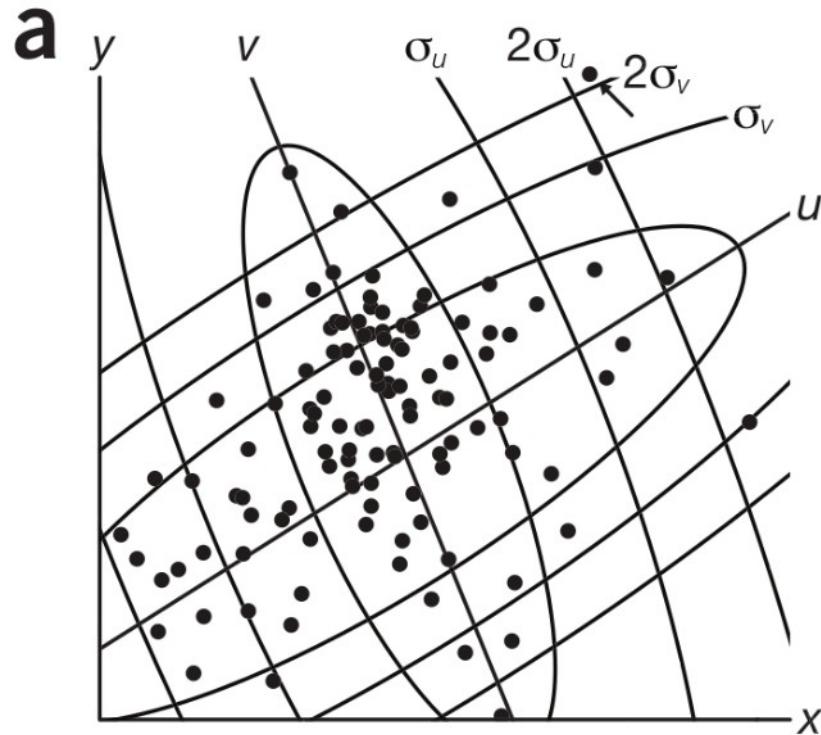
PLAYING WITH SALIENCE



FROM GOOD TO GREAT

Wong, Krzywinski and coauthors. 2011-2013.
Point of Views. *Nature Methods*

PLAYING WITH SALIENCE



FROM GOOD TO GREAT

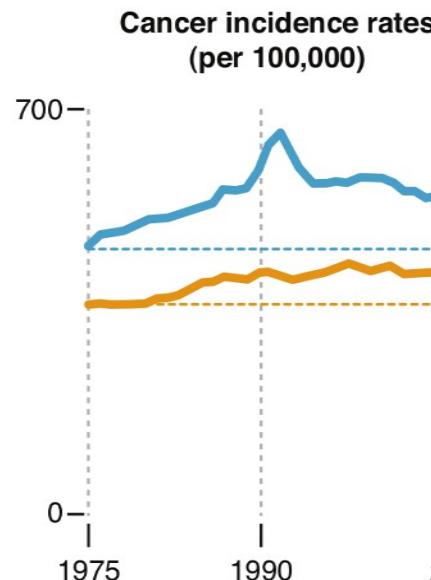
Wong, Krzywinski and coauthors. 2011-2013.
Point of Views. *Nature Methods*

STORYTELLING

Men Women

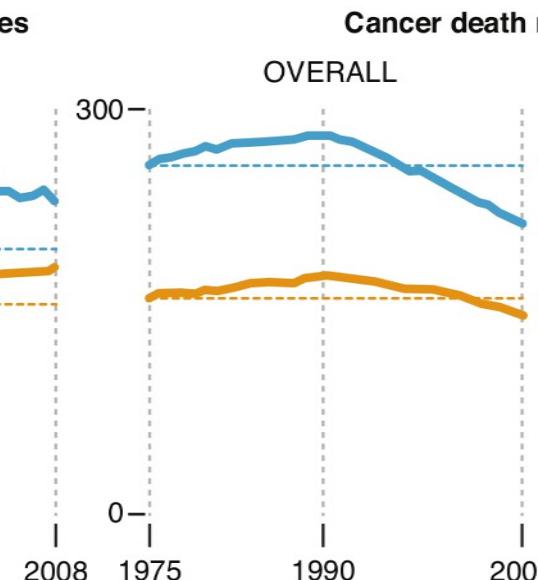
1 Increased incidence

An aging population contributes to rising incidence of cancer.



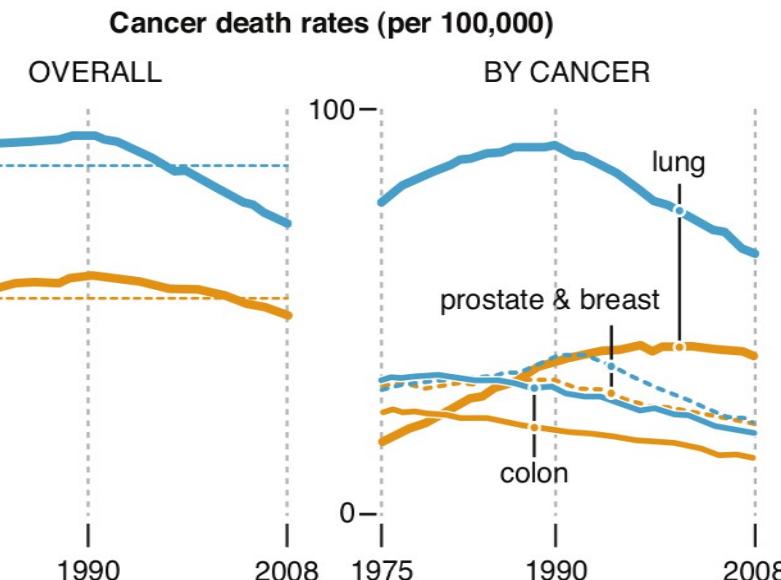
2 Fewer deaths

Cancer deaths have been dropping since 1991, especially in males.



3 Decline of lung cancer

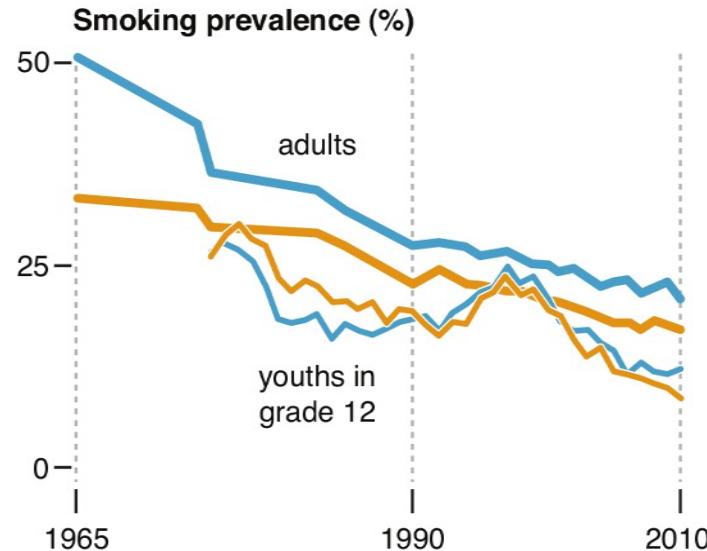
Drop in lung cancer deaths in males is the primary reason why death rates are down.



STORYTELLING

4 Decline in smoking

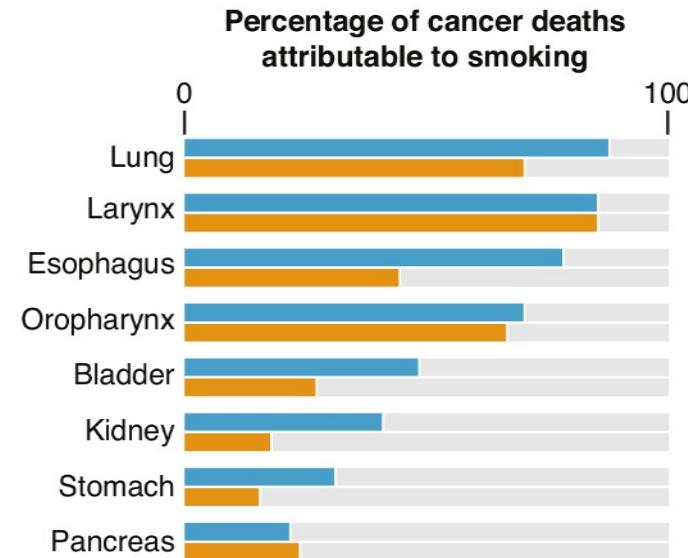
Since the 1964 first Surgeon General's report, smoking rates have been dropping. By 2010, the rate among males was down to 20%, from 50% at its peak. Among youths, rates have been on an even steeper decline since 1997.



source: American Cancer Society Cancer Statistics 2012; Monitoring the Future (University of Michigan).

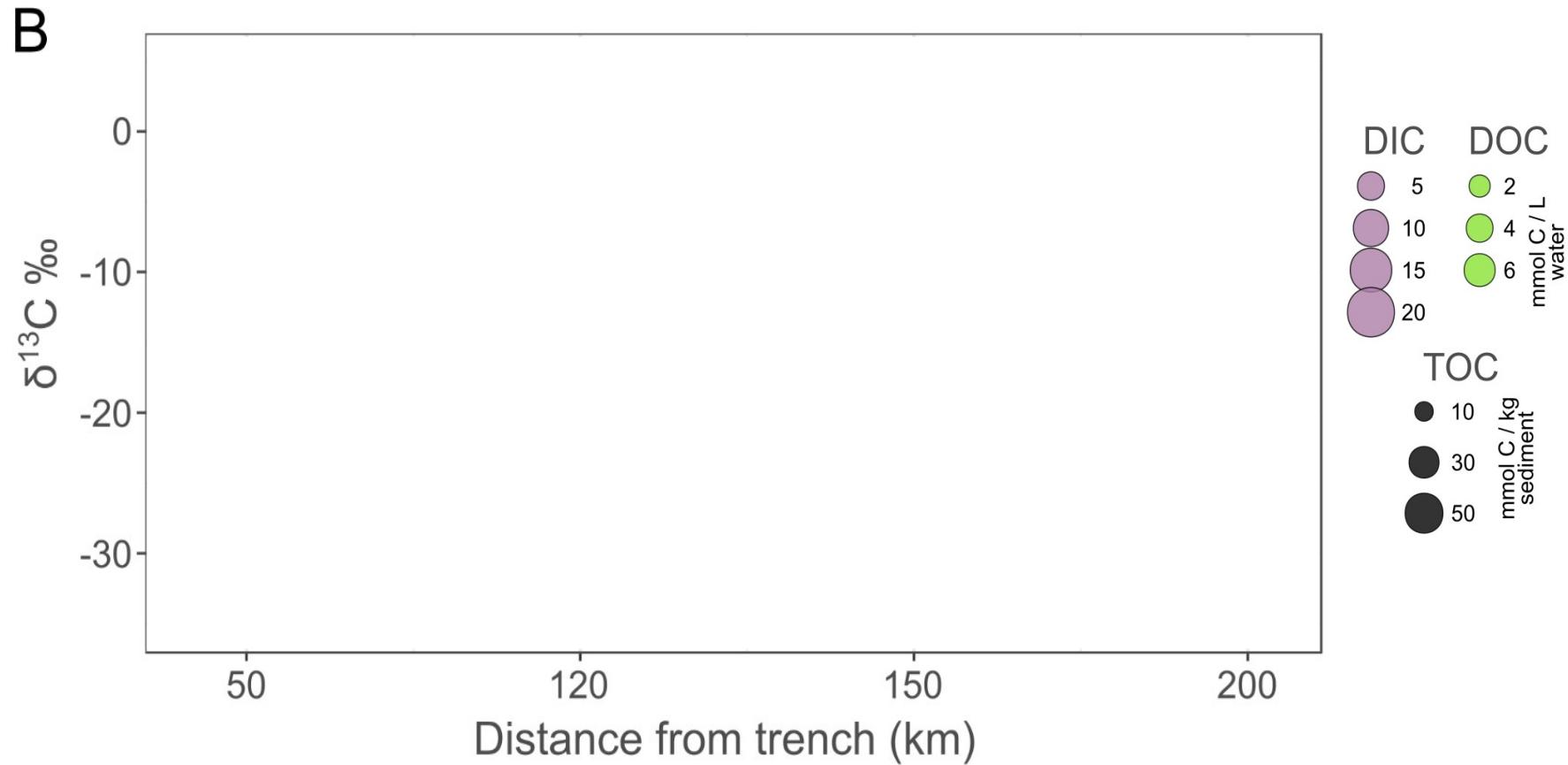
5 Impact of smoking on cancer deaths

Smoking is a major risk factor for many types of cancer and significant contributor to cancer-related deaths. It remains the single largest preventable cause of disease and premature death in the US.

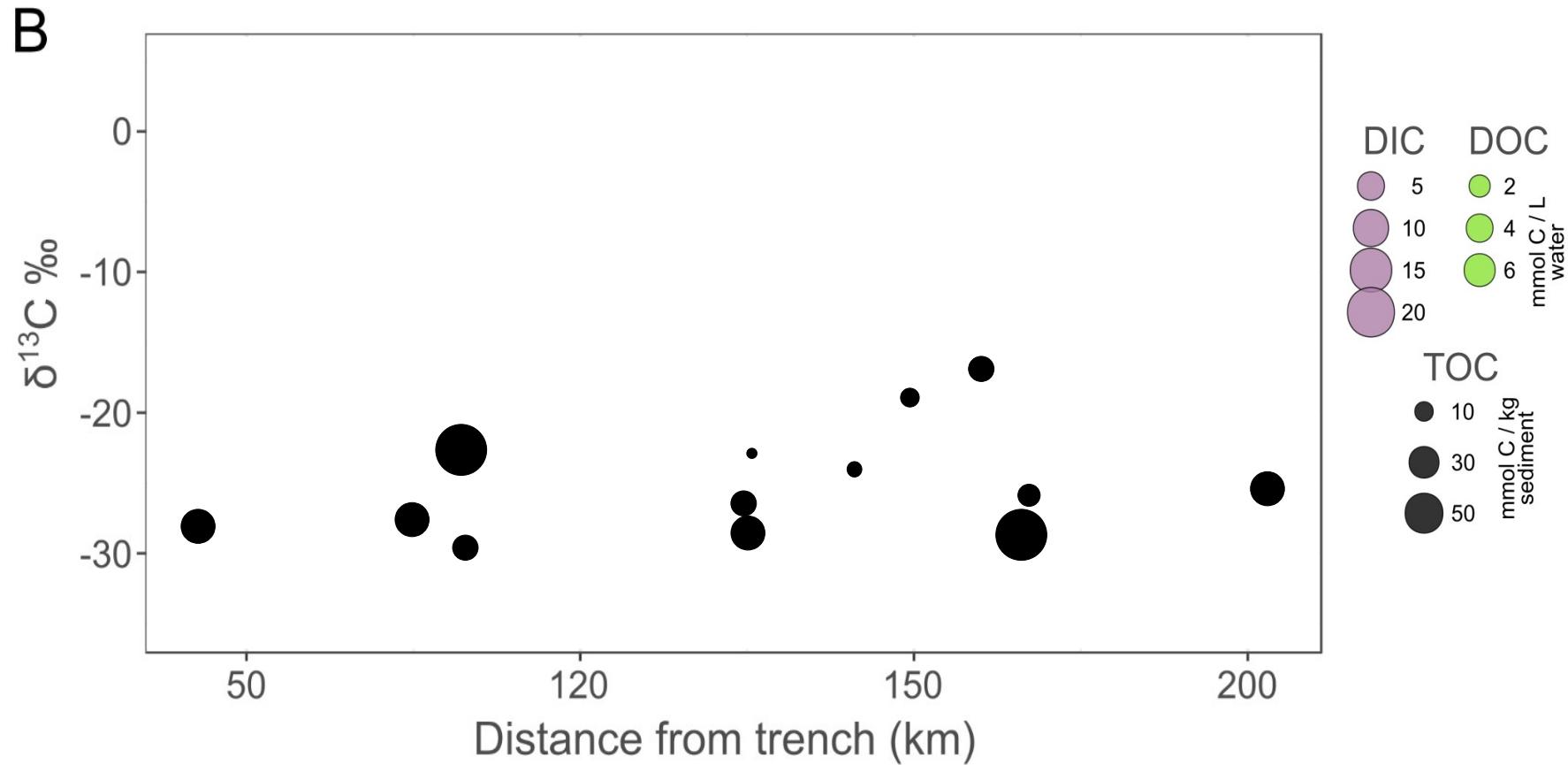


Wong, Krzywinski and coauthors. 2011-2013.
Point of Views. Nature Methods

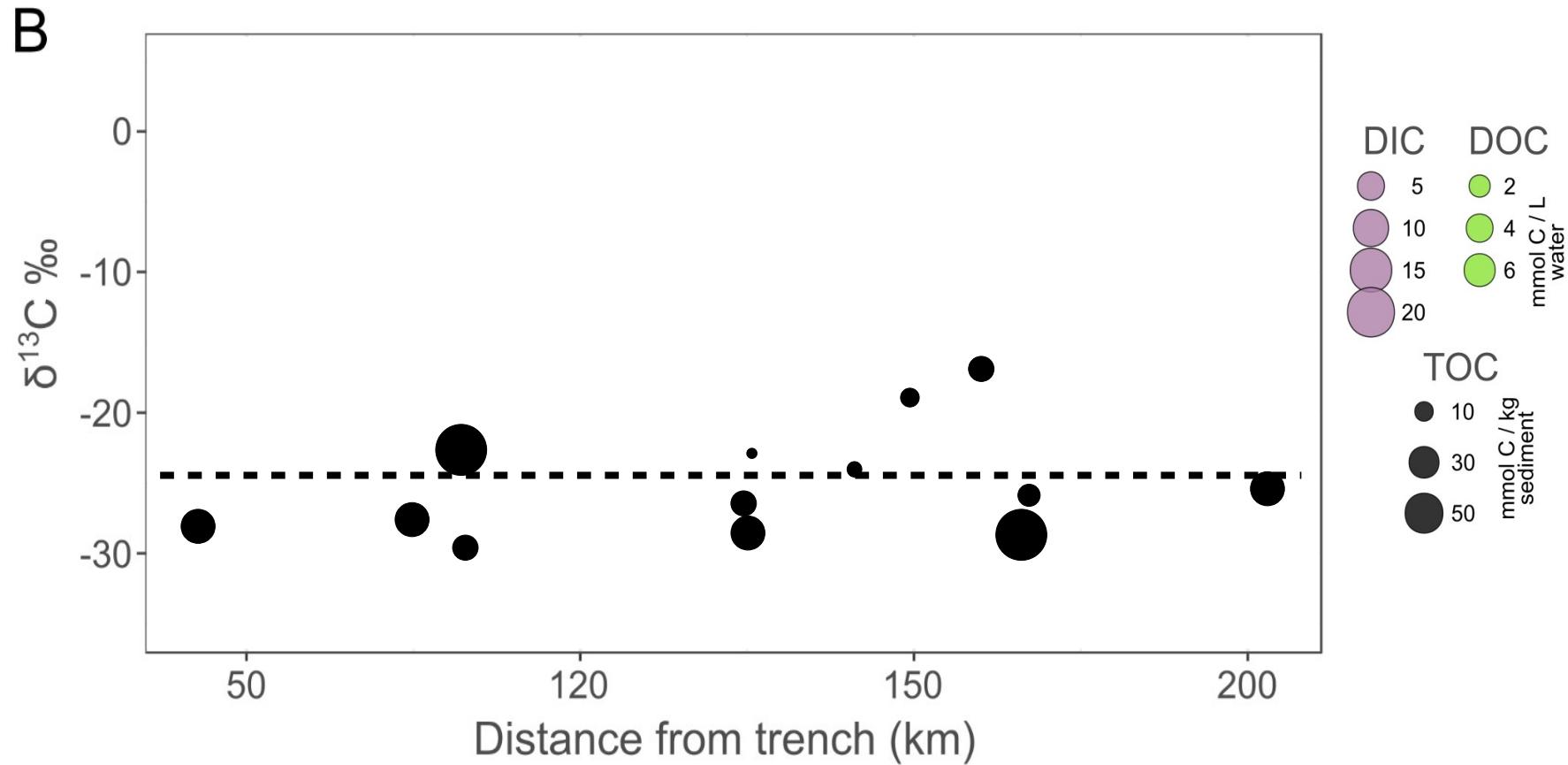
WALKING THROUGH THE MESSAGE



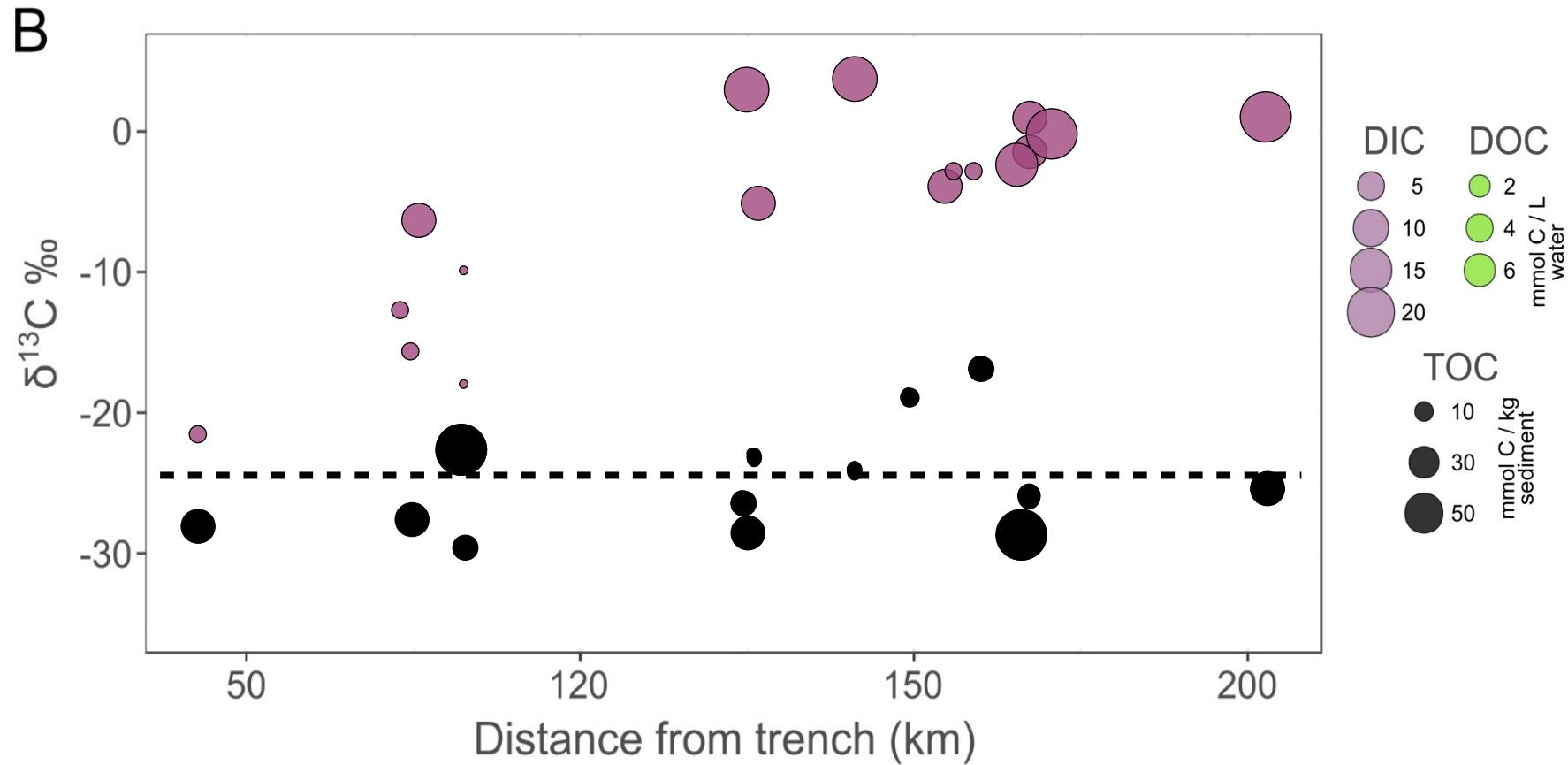
WALKING THROUGH THE MESSAGE



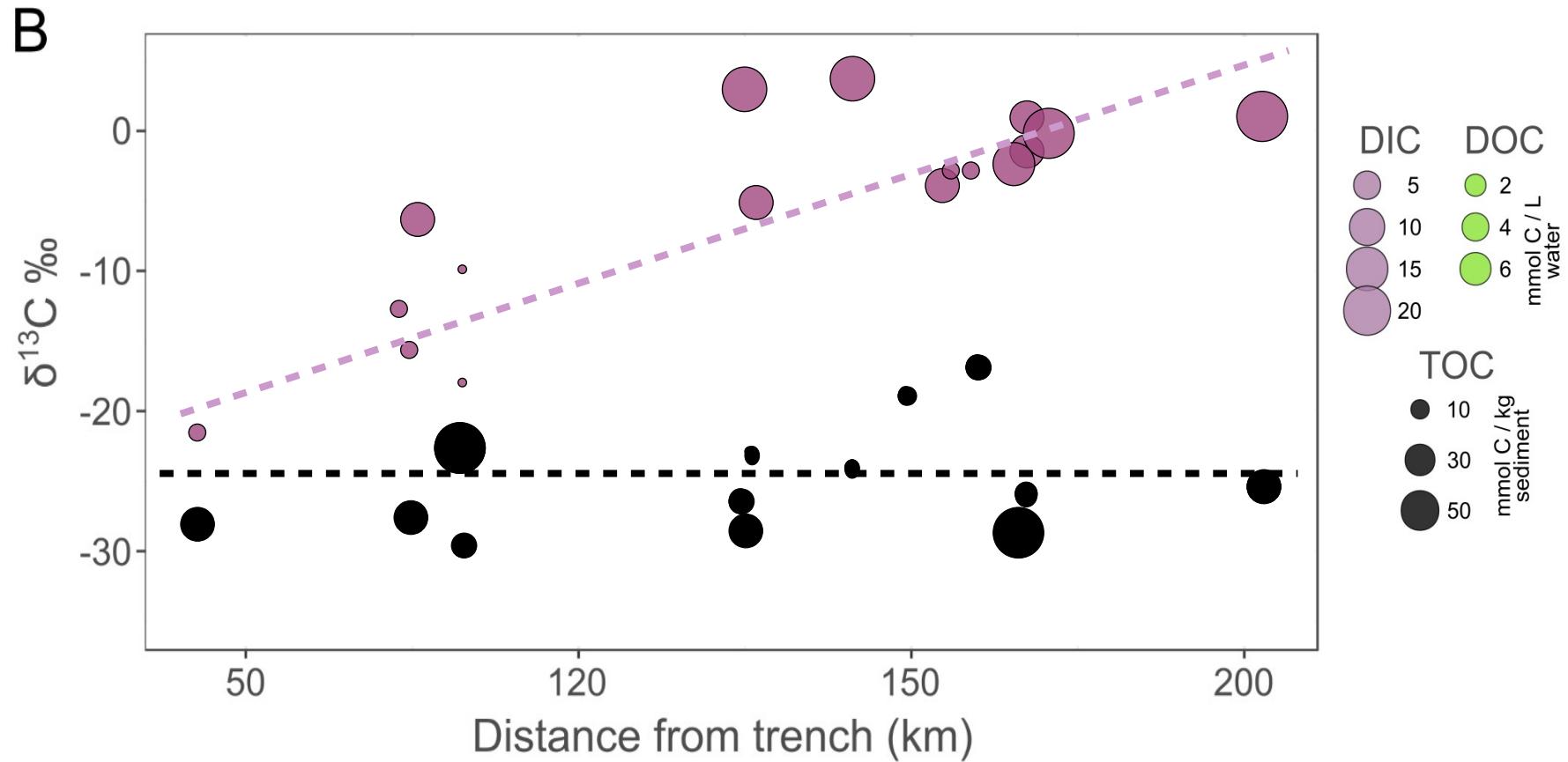
WALKING THROUGH THE MESSAGE



WALKING THROUGH THE MESSAGE

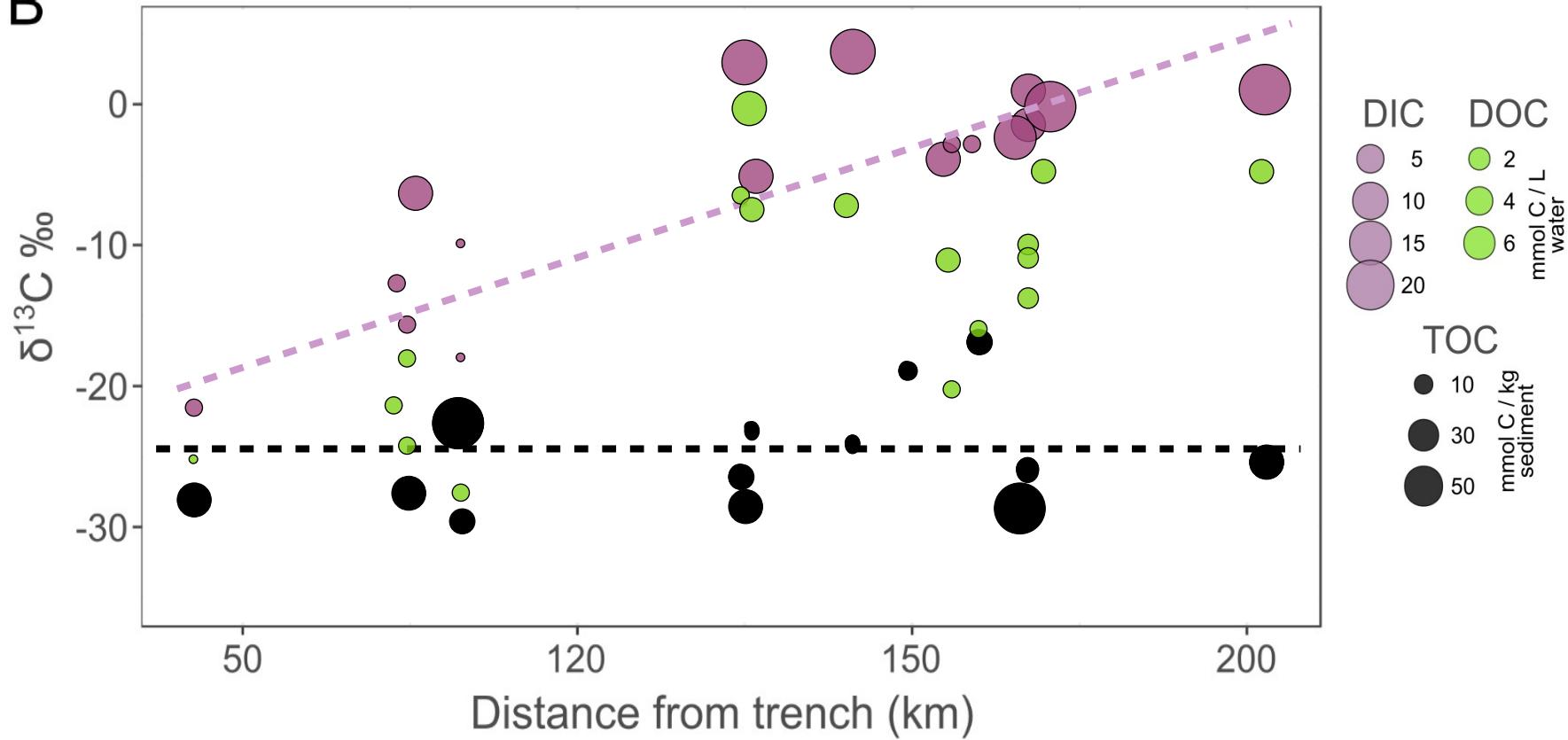


WALKING THROUGH THE MESSAGE

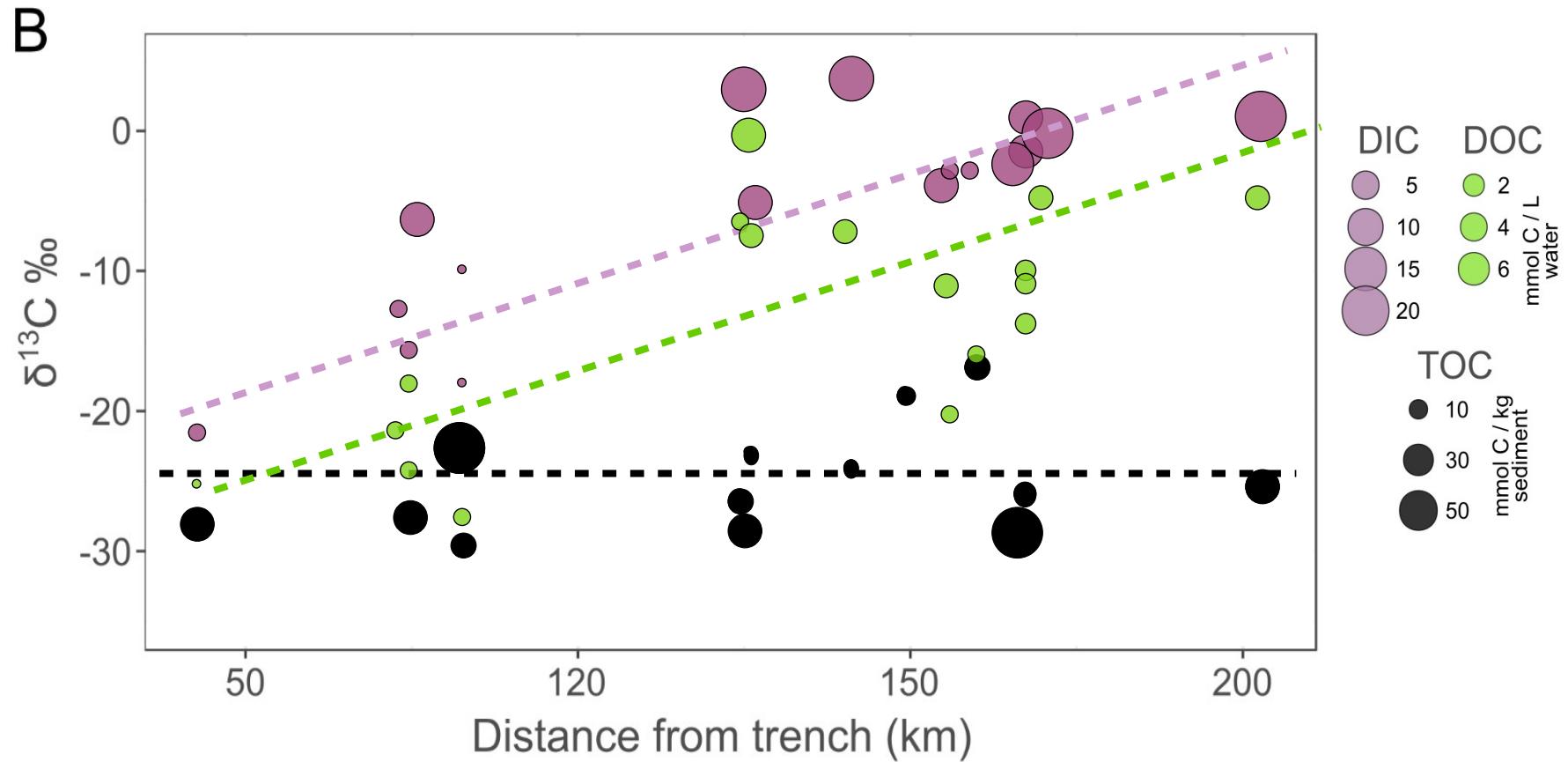


WALKING THROUGH THE MESSAGE

B

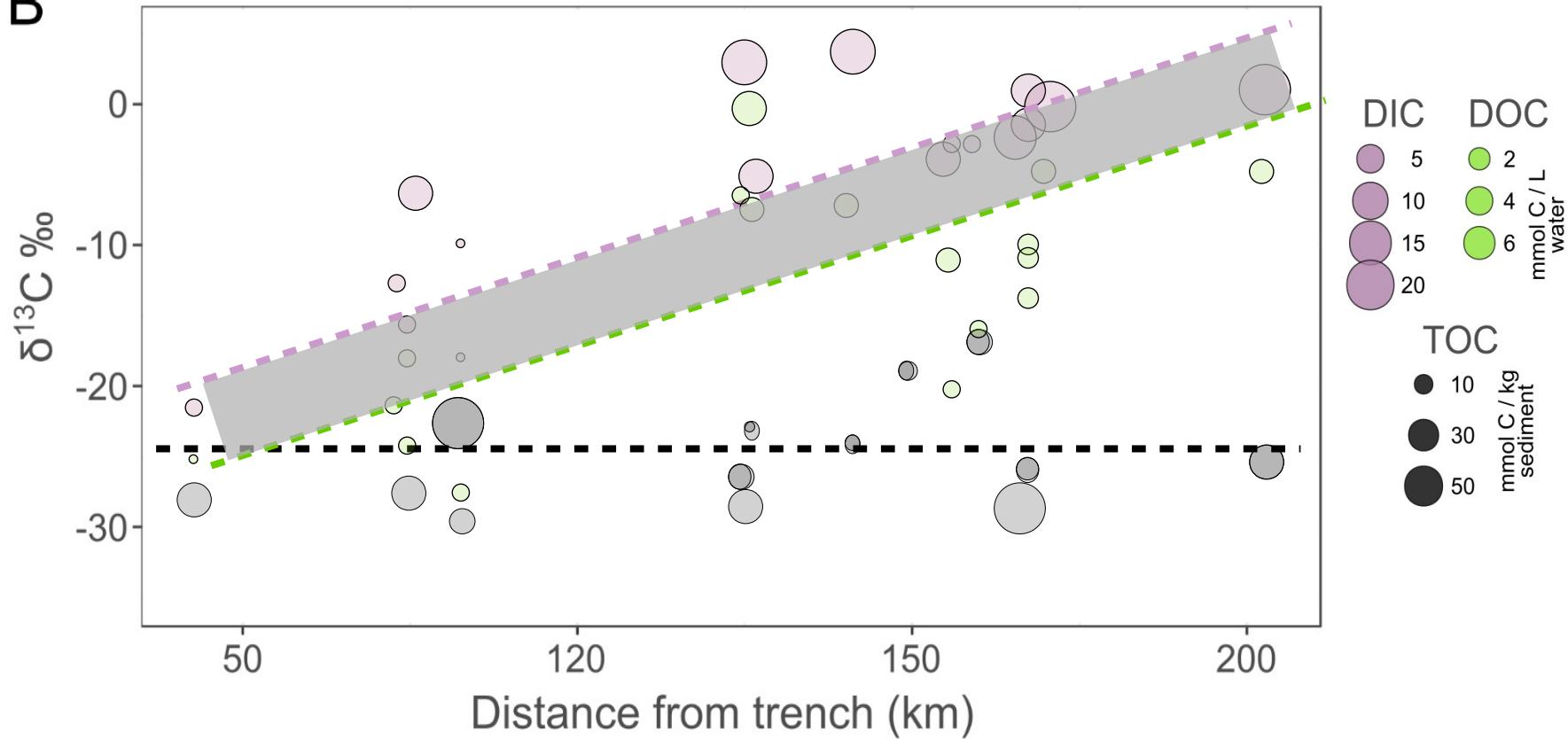


WALKING THROUGH THE MESSAGE



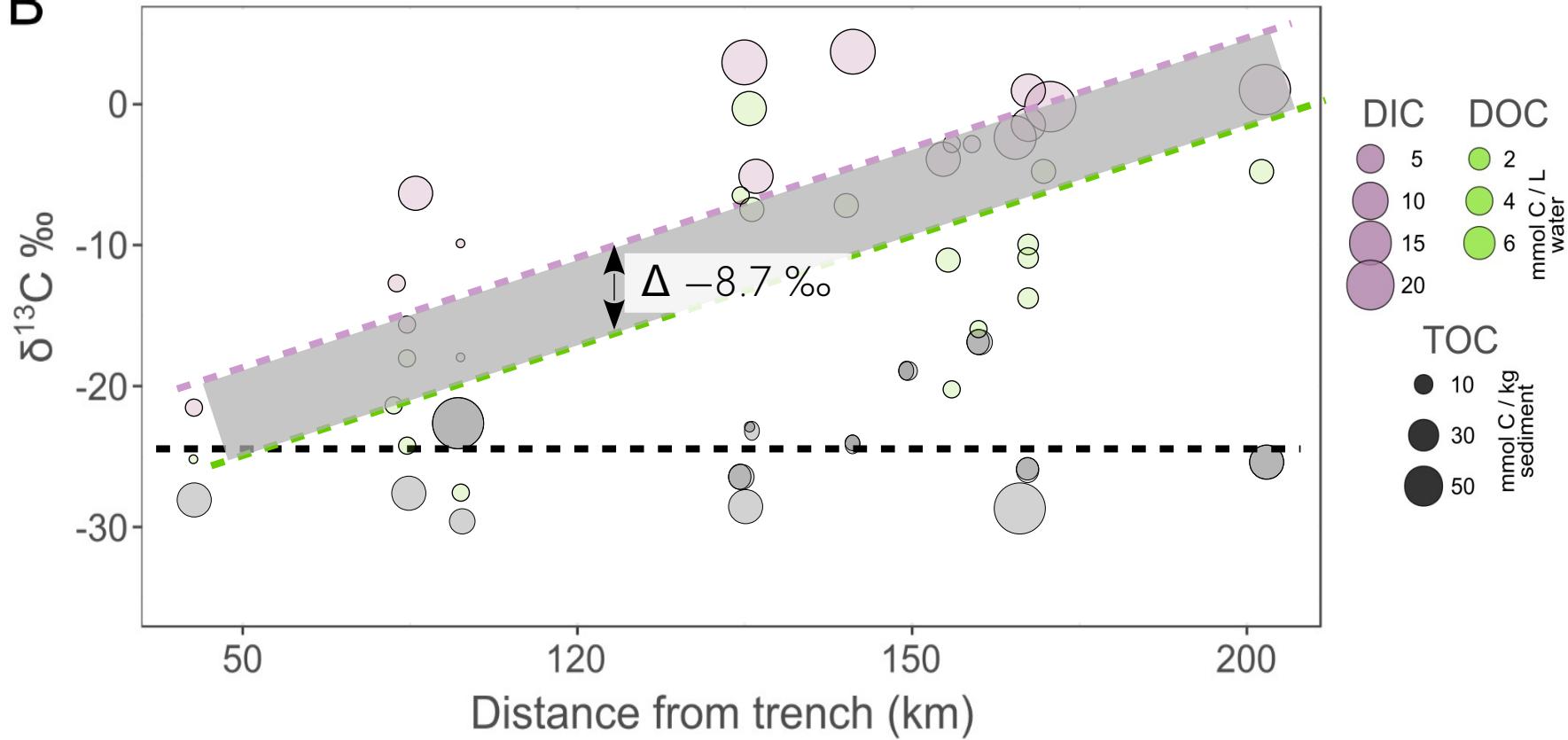
WALKING THROUGH THE MESSAGE

B

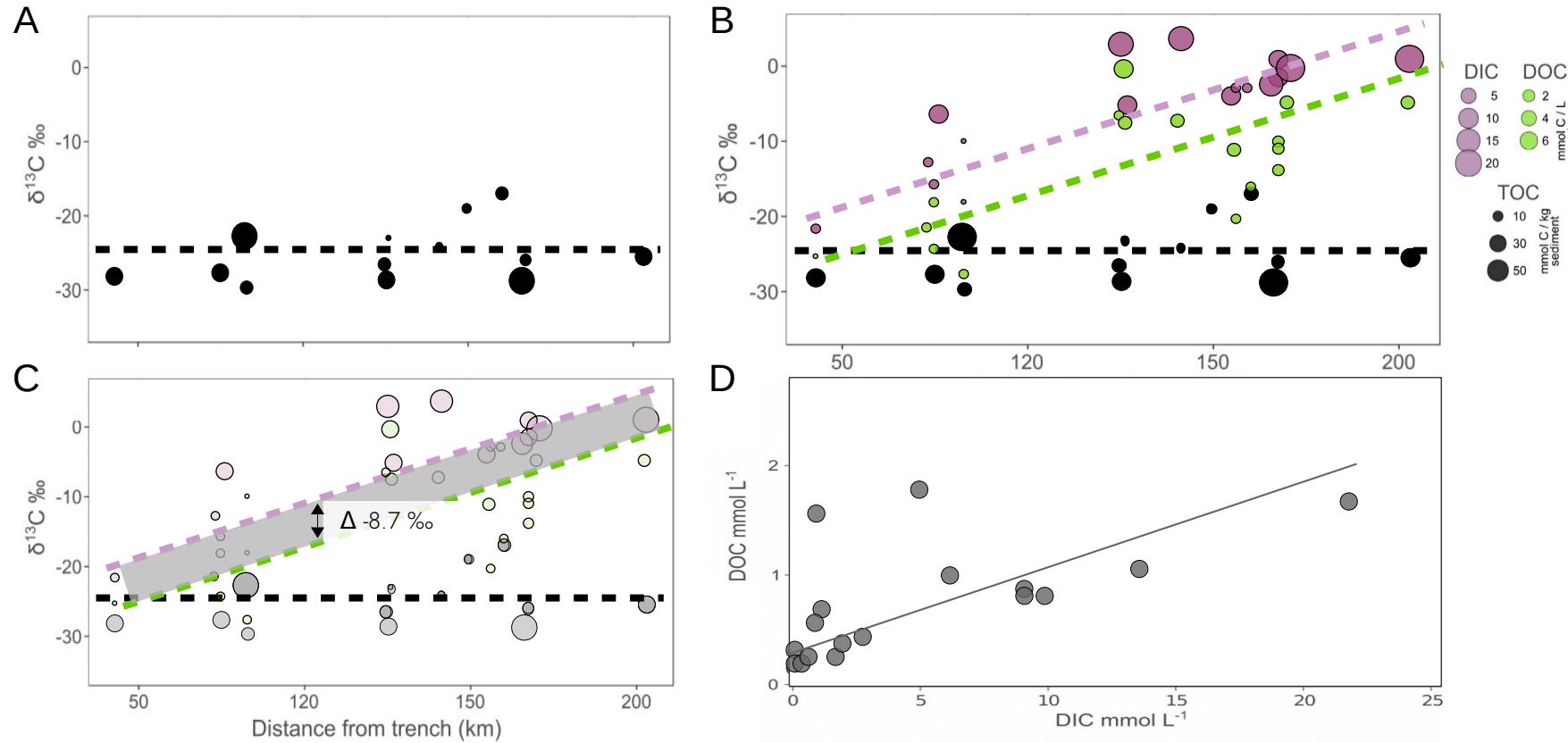


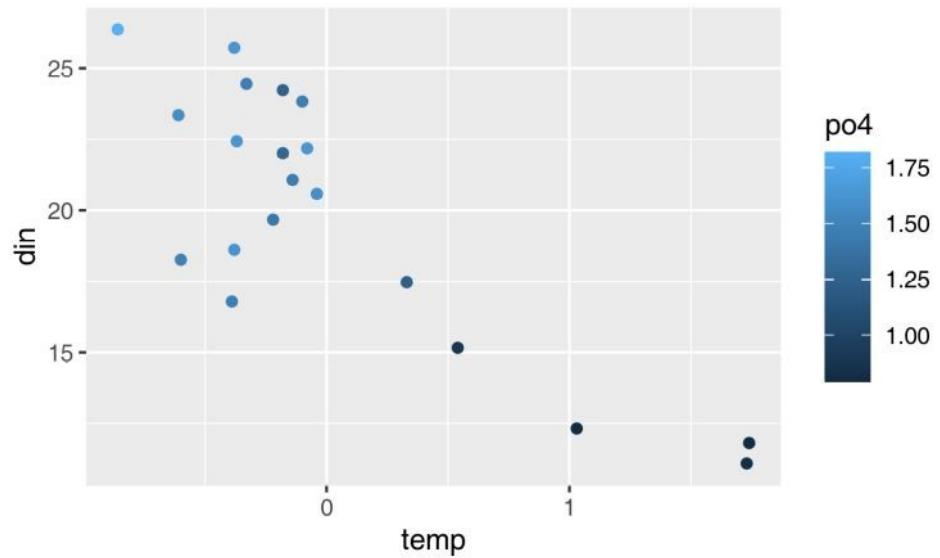
WALKING THROUGH THE MESSAGE

B

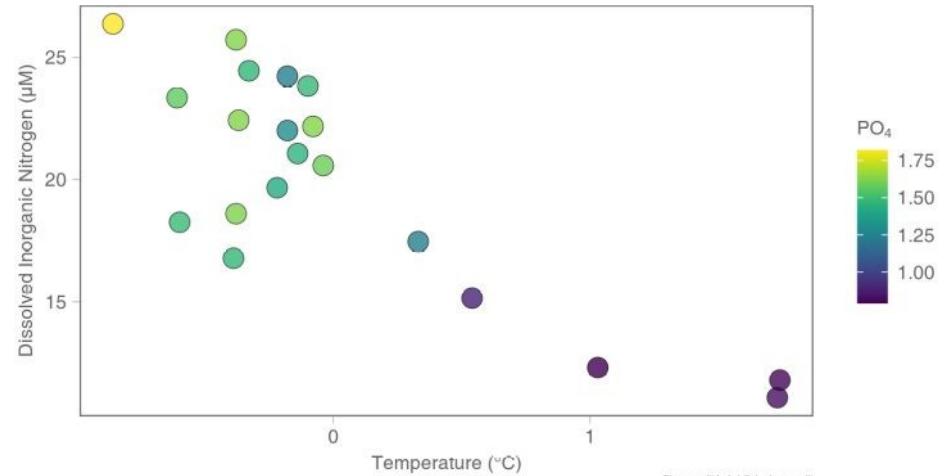


WALKING THROUGH THE MESSAGE





ggplot2 standard theme

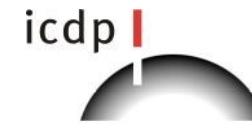


glab_theme template

http://github.com/giovannellilab/GLab_ggplot2_theme



FUNDING



donato.giovannelli@unina.it • <https://www.donatogiovannelli.com> • @d_giovannelli