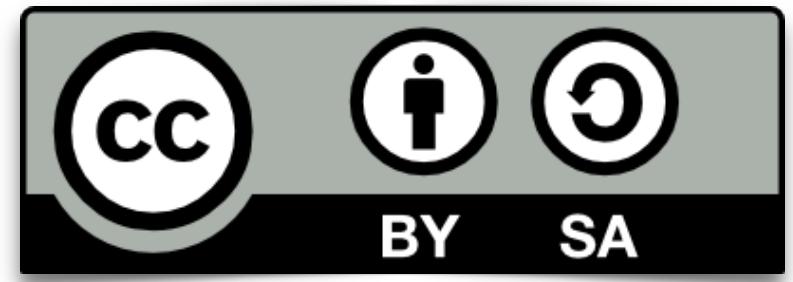


Dr. Paula González Avalos

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# DATA VISUALIZATION & STORYTELLING

# INTRODUCTION

Current state of data visualization & storytelling in science.



**Sean Carroll** 

@seanmcarroll

Science is not opposed to storytelling. Science is a \*genre\* of storytelling. Stories of the real world, inspired by observations thereof.

2:56 PM - 15 Jul 2013

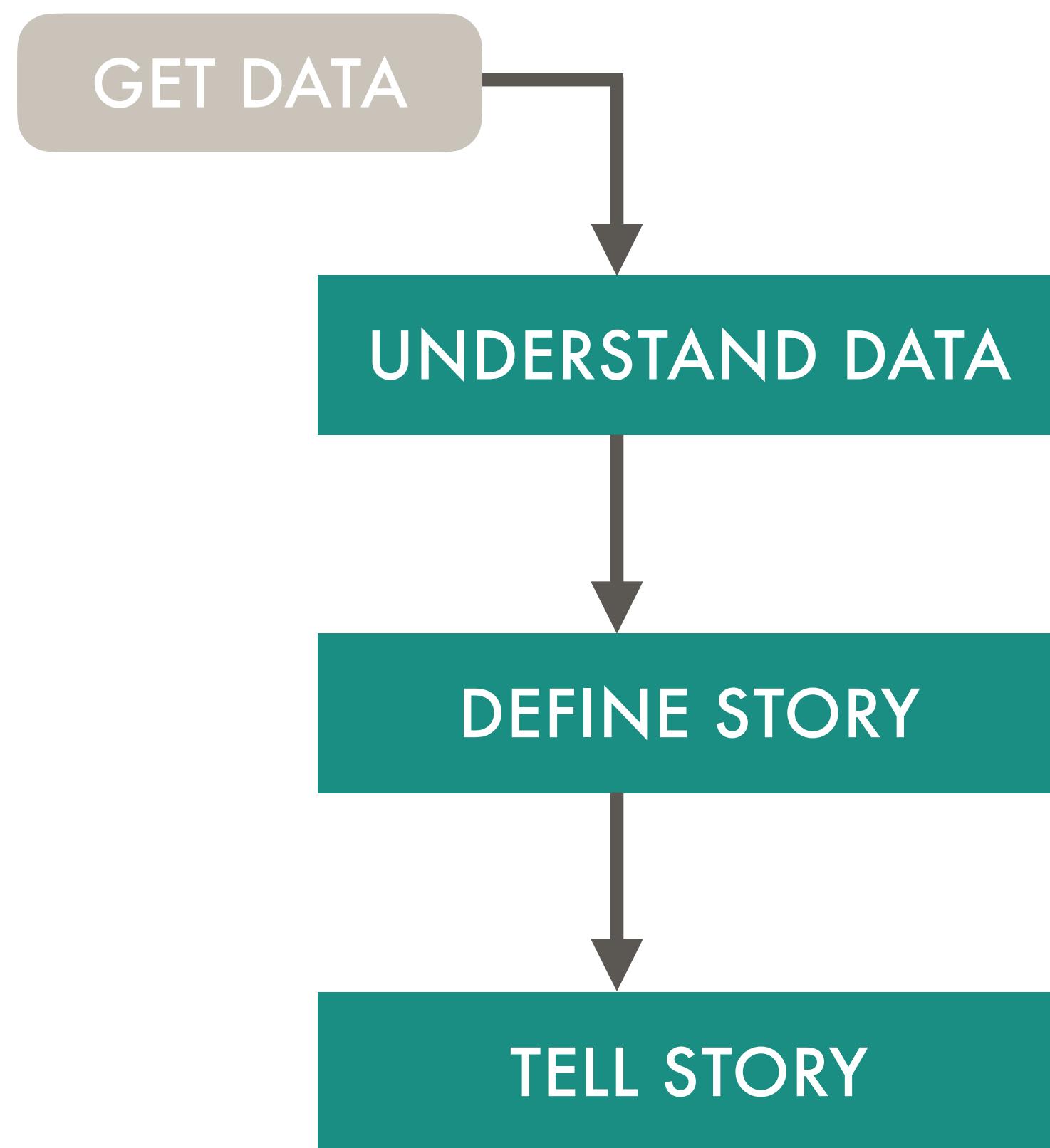
4

75

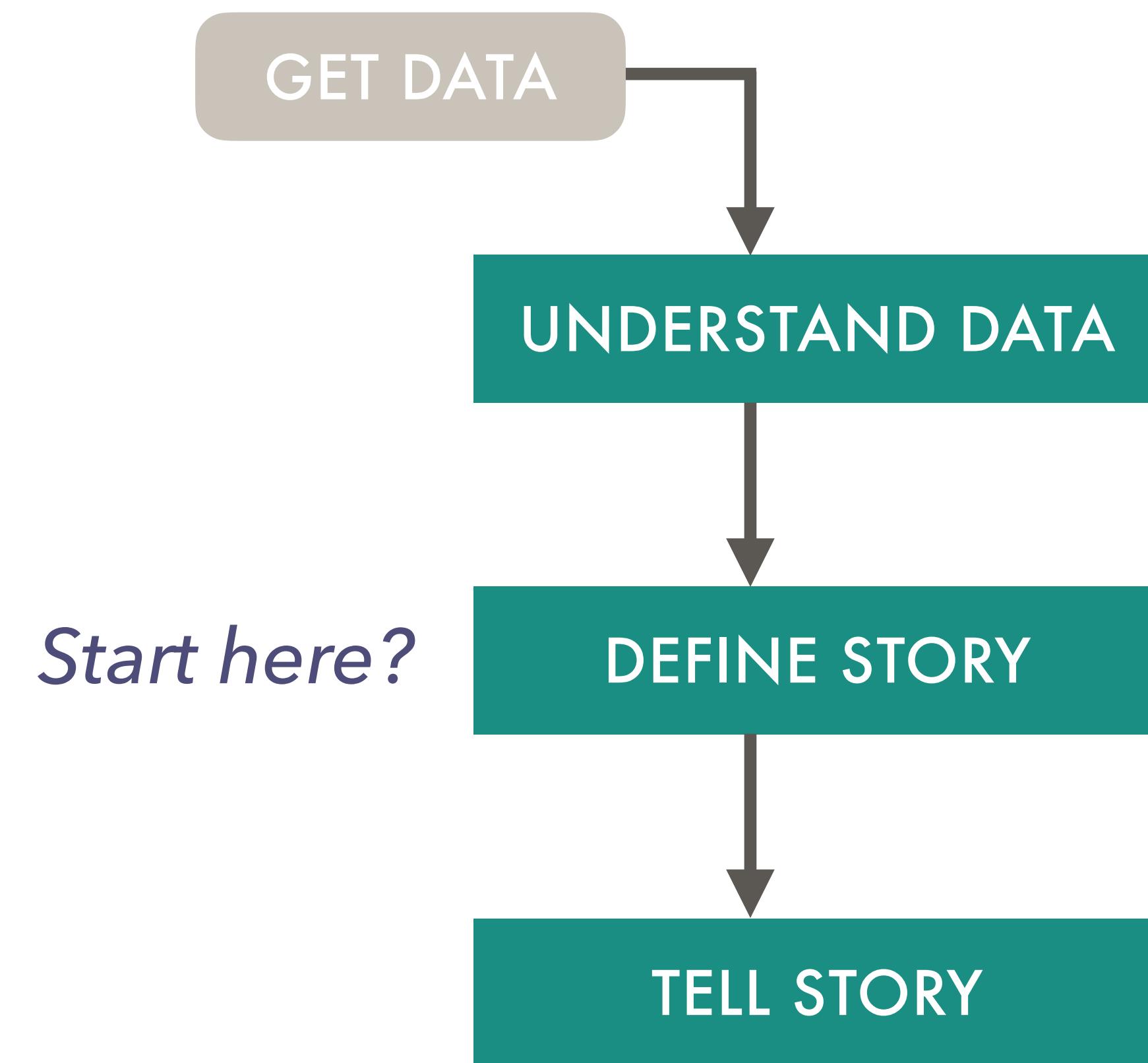
39

**SCIENTIFIC COMMUNICATION**  
**= DATA STORYTELLING**

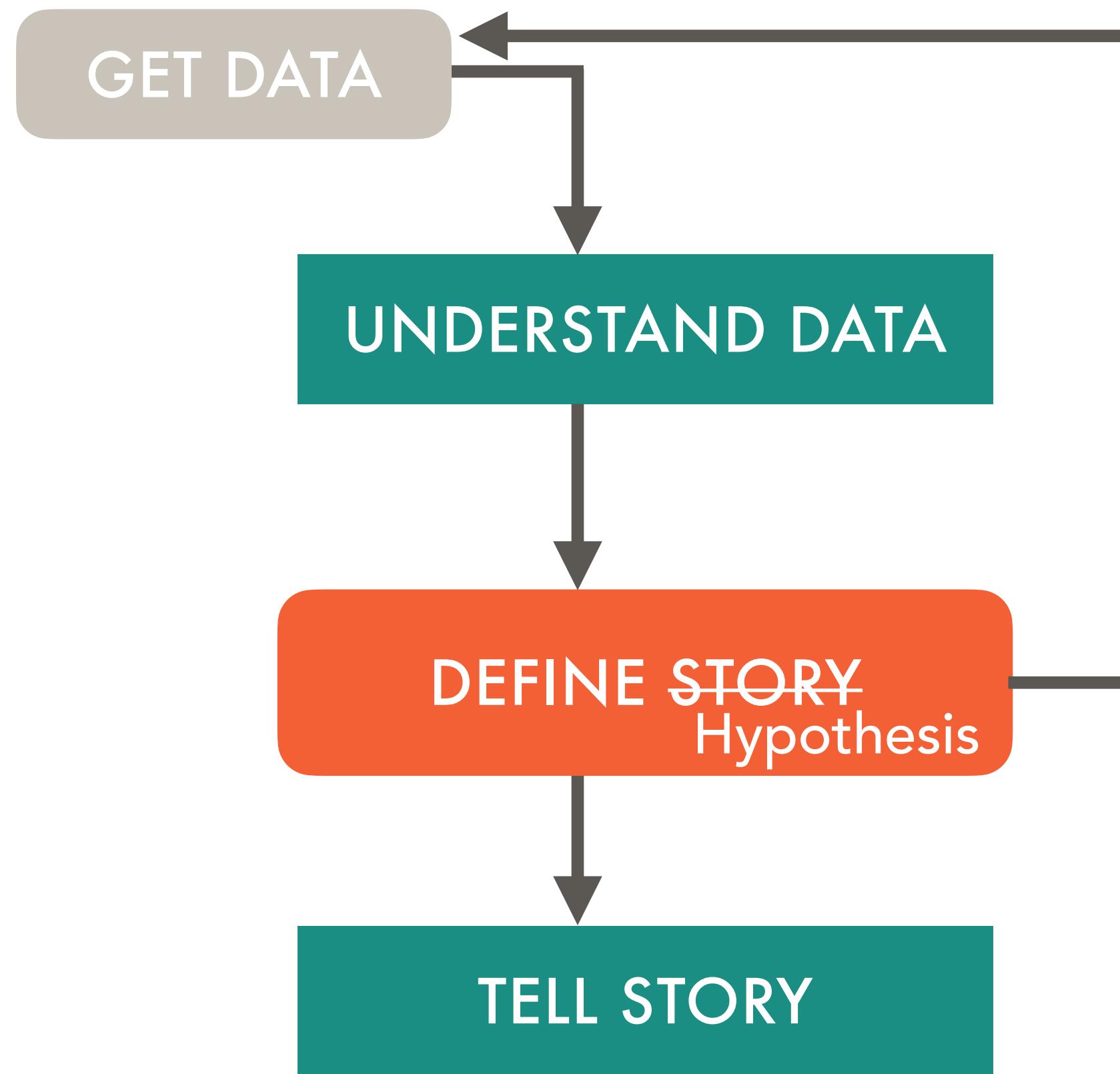
# HOW TO CREATE STORIES WITH DATA



# HOW TO CREATE STORIES WITH DATA

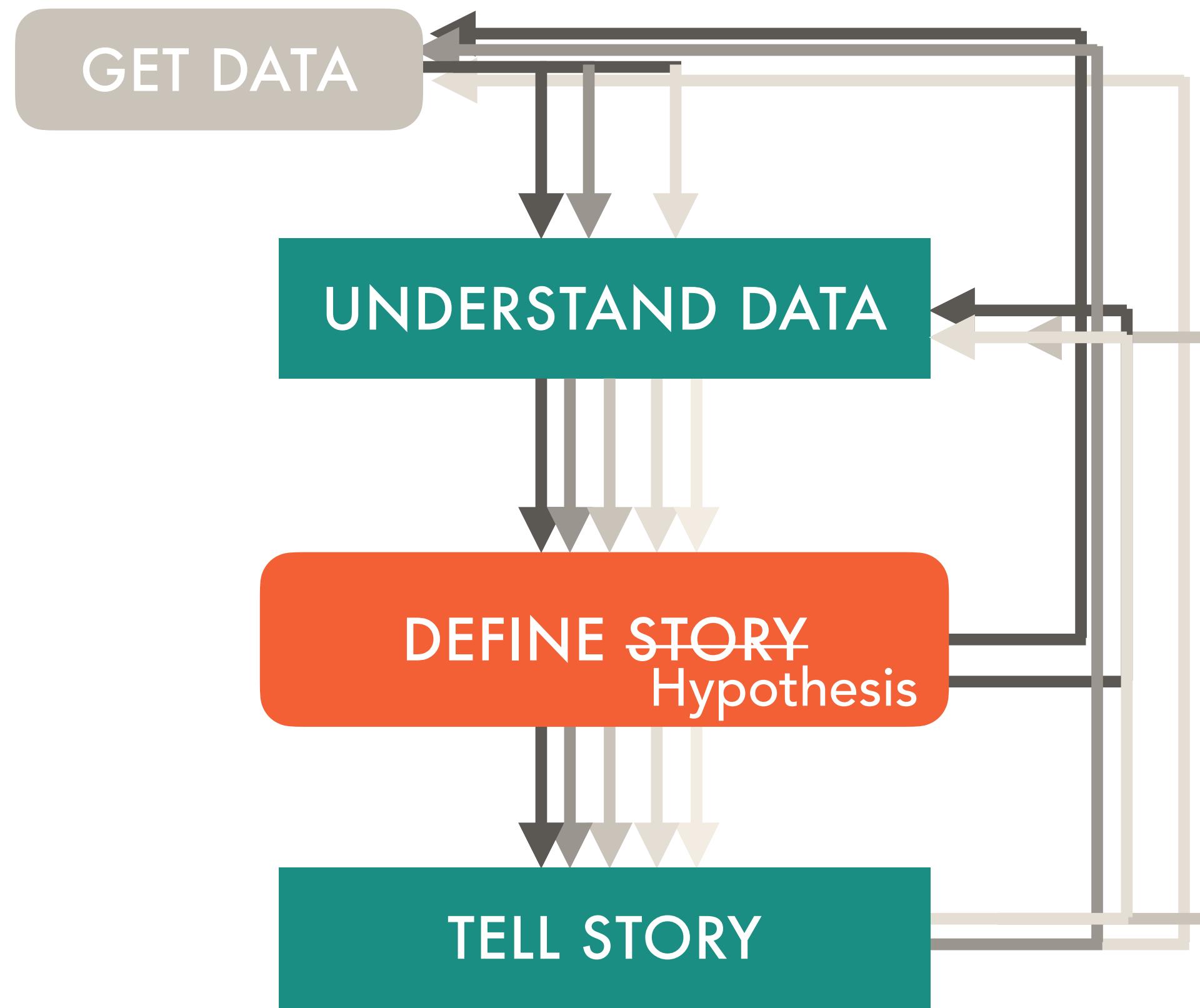


# HOW TO CREATE STORIES WITH DATA



# HOW TO DO SCIENCE

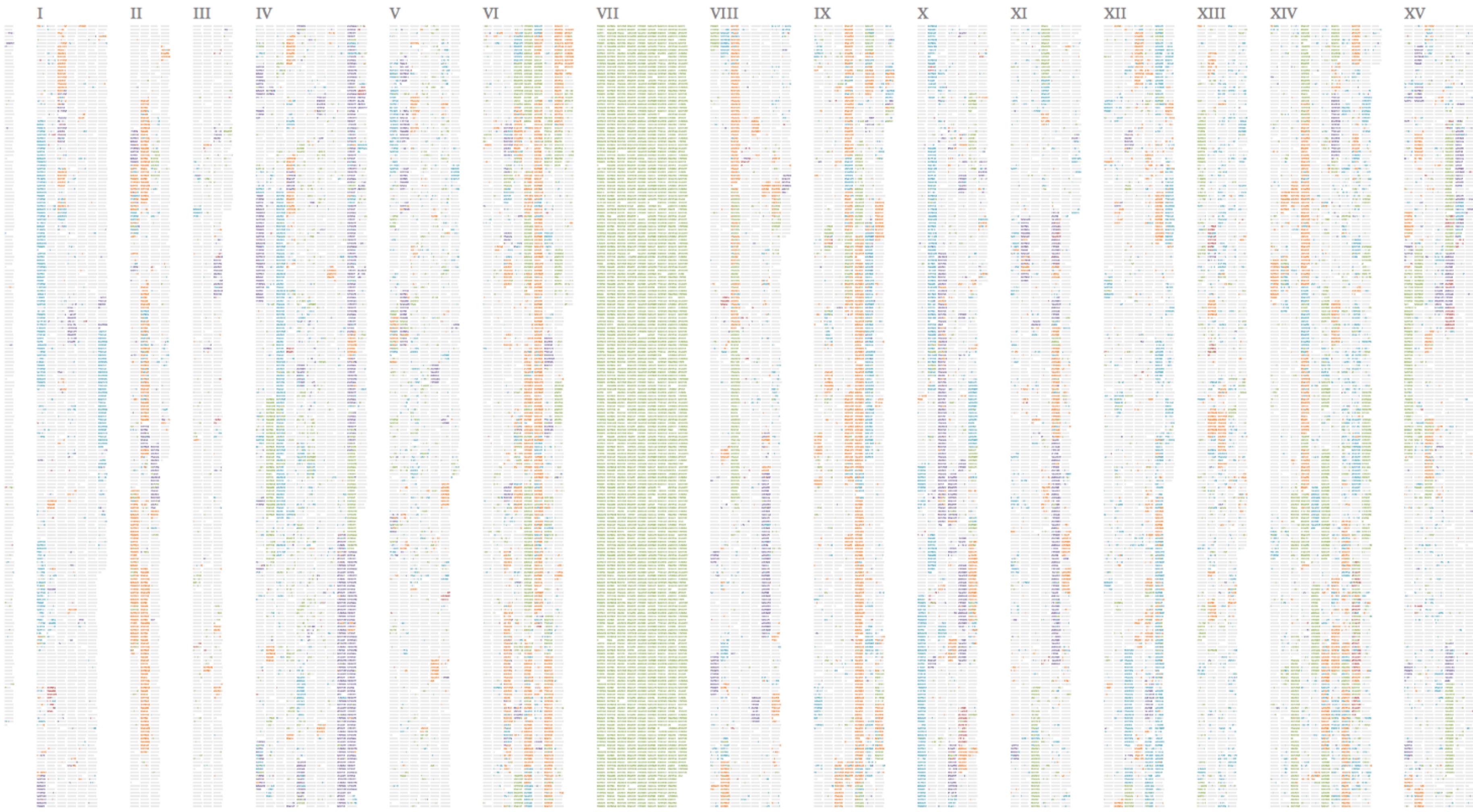
# HOW TO CREATE STORIES WITH DATA



## HOW TO DO SCIENCE

ON THE ORIGIN OF SPECIES

13 YEARS OF GETTING THE STORY RIGHT



First Edition (1859)

Second Edition (1860)

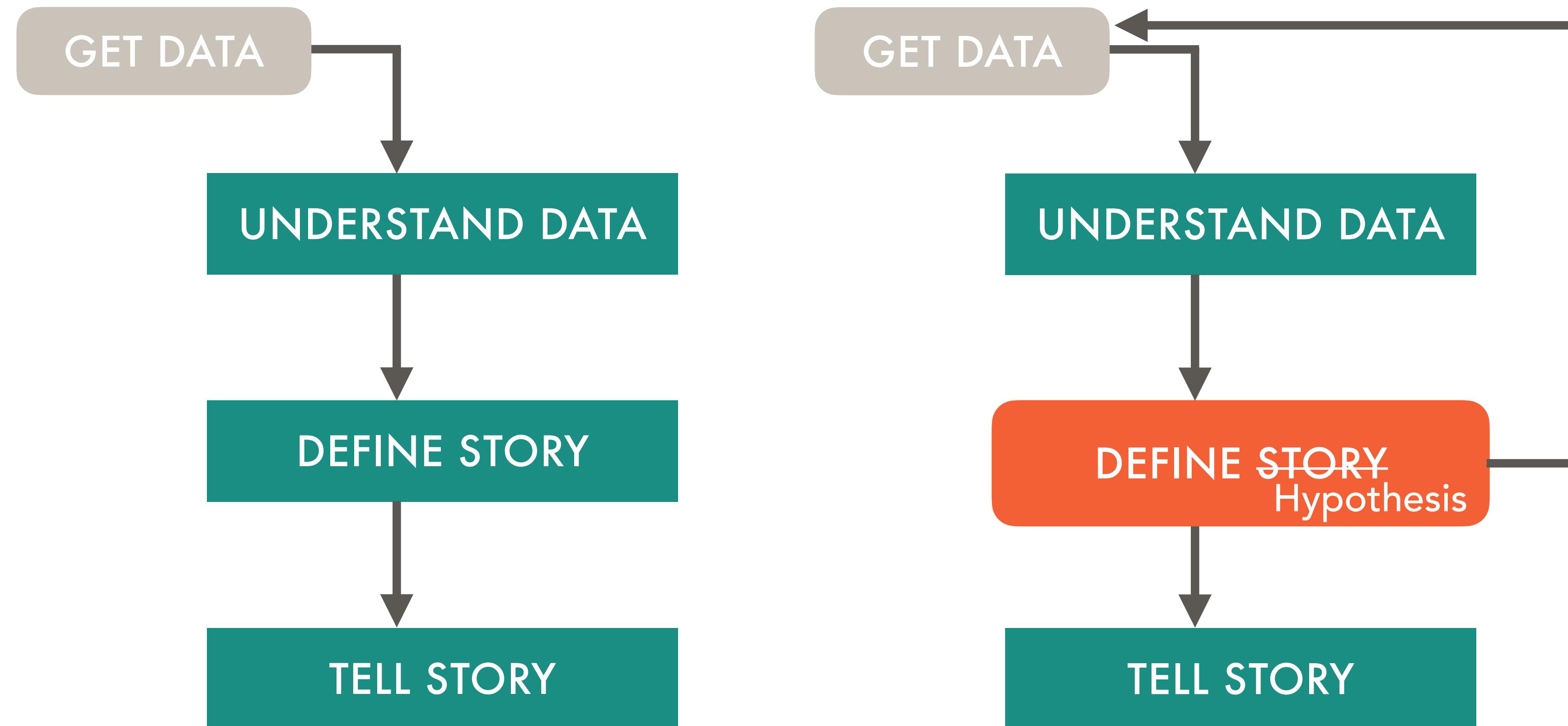
Third Edition (1861)

Fourth Edition (1866)

Fifth Edition (1869)

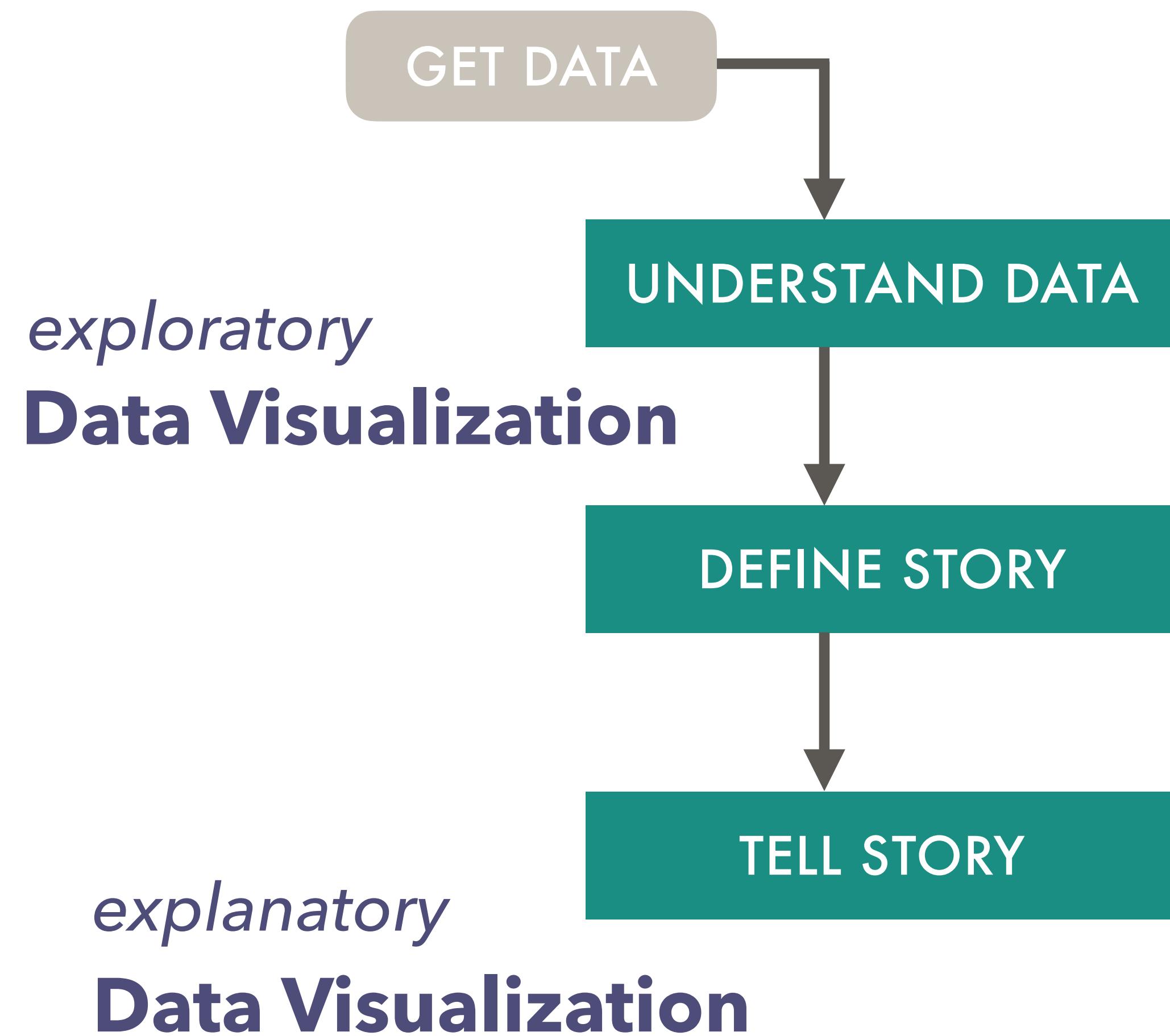
Sixth Edition (1872)

# HOW TO CREATE STORIES WITH DATA



## HOW TO DO SCIENCE

# HOW TO CREATE STORIES WITH DATA



# What is **Data Visualization**?

*refers to the techniques used to communicate*

**data** by **encoding** it as **visual** objects

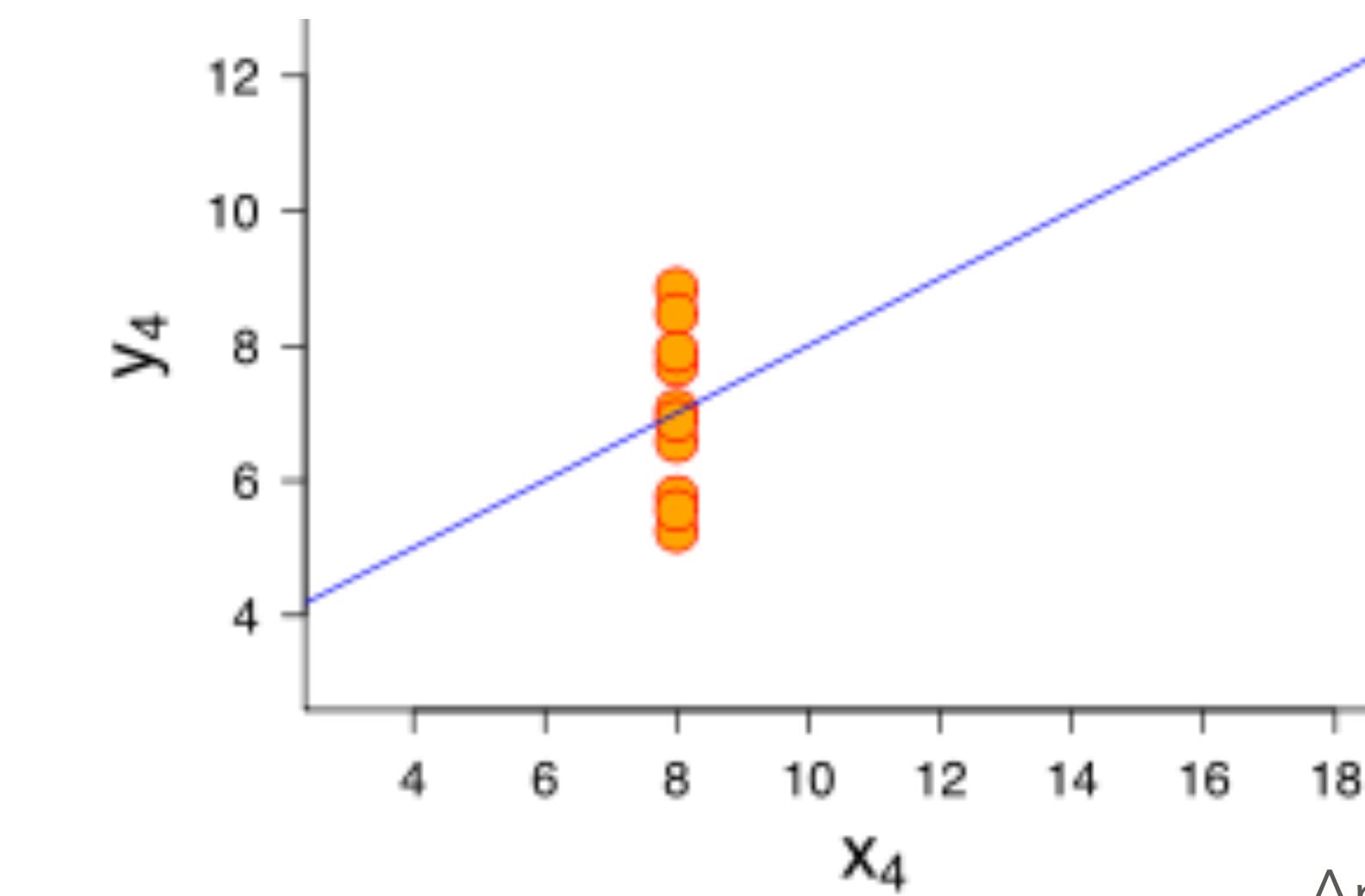
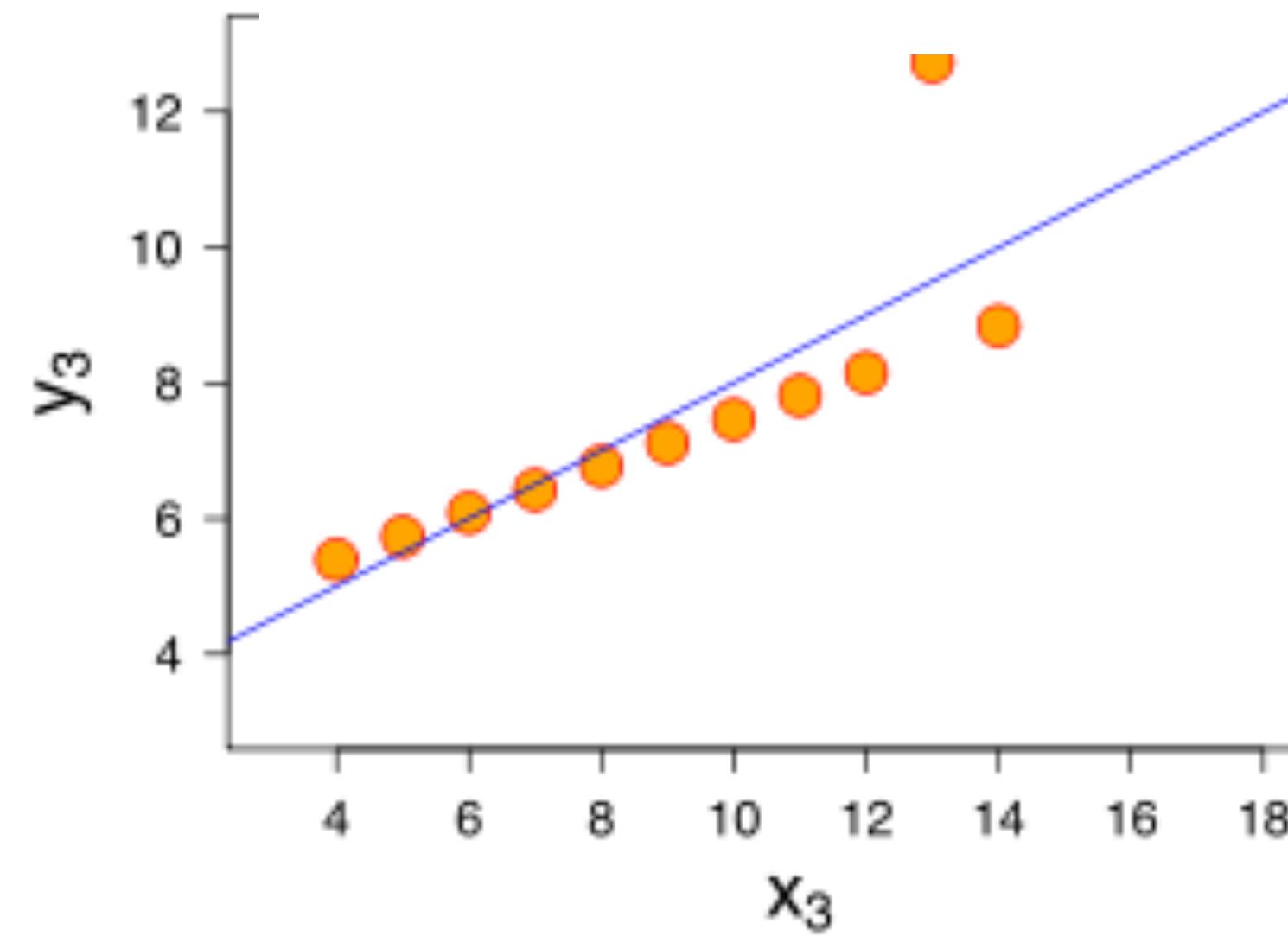
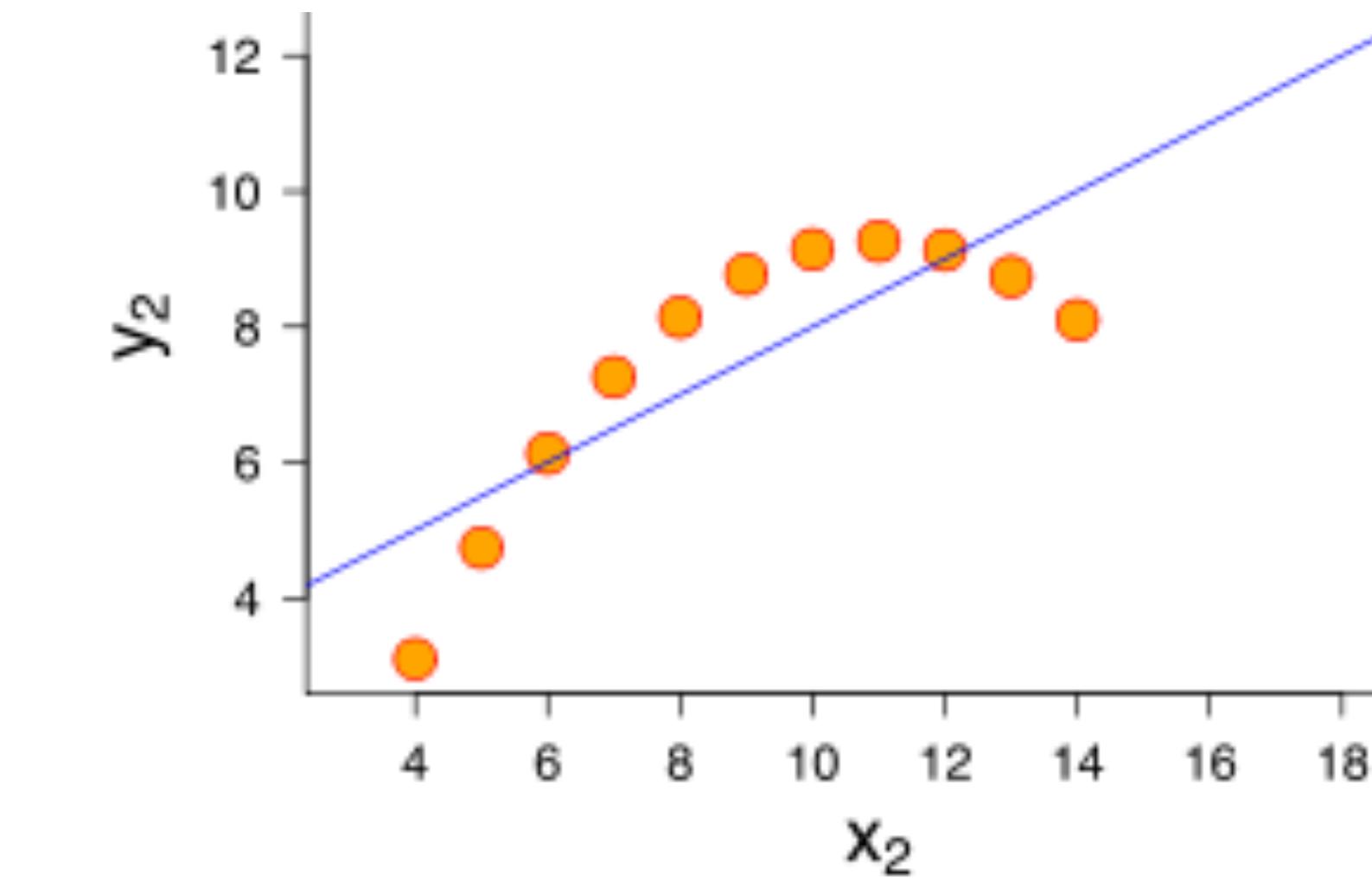
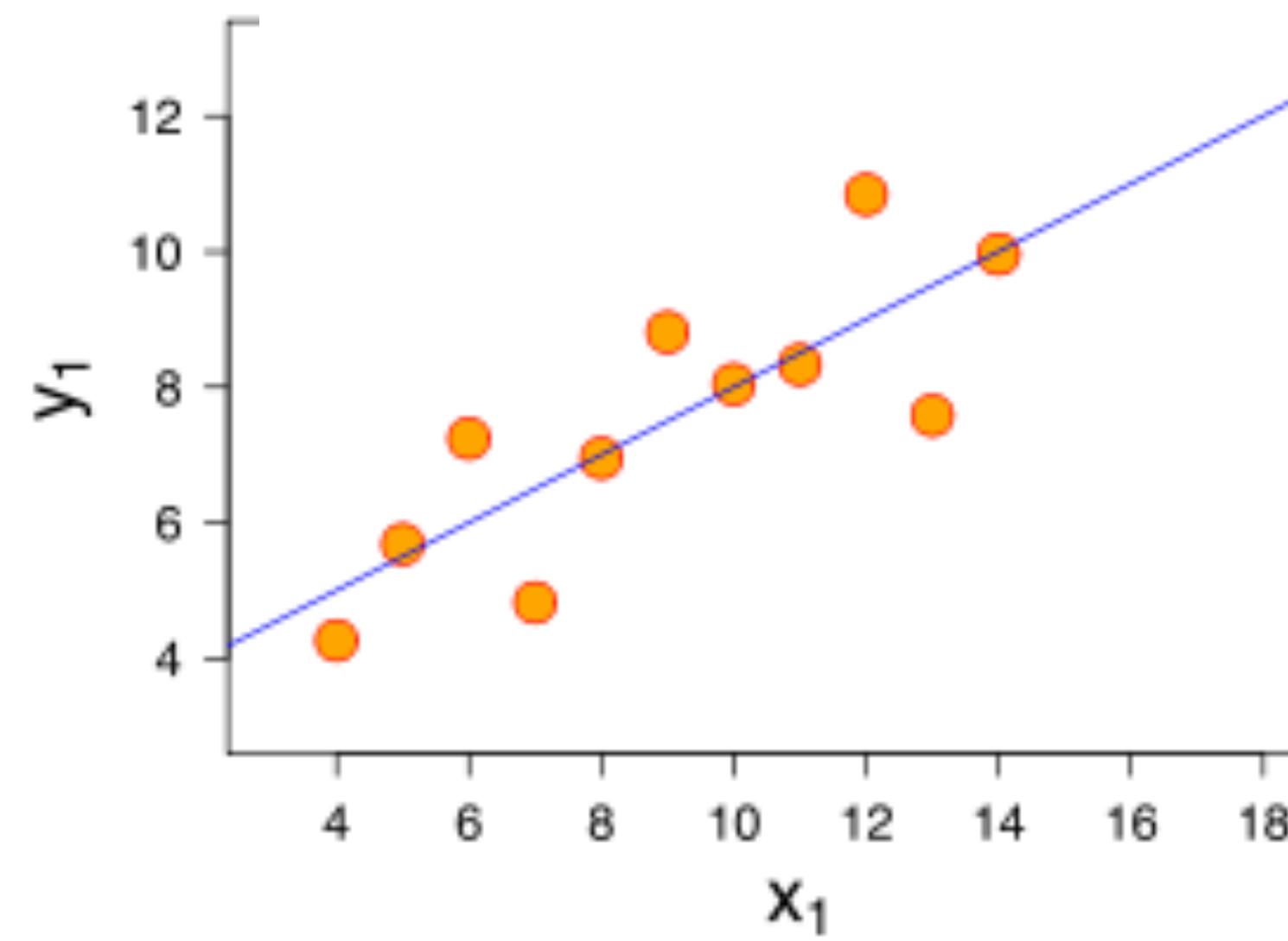
gives ***shapes*** to ***numbers***

# DATA VISUALIZATION GIVES SHAPE TO NUMBERS

x1	y1			x2	y2		
10.0	8.04			10.0	9.14		
8.0	6.95			8.0	8.14		
13.0	7.58	<b>mean x</b>	9.0	13.0	8.74	<b>mean x</b>	9.0
9.0	8.81	<b>sd x</b>	11.0	9.0	8.77	<b>sd x</b>	11.0
11.0	8.33			11.0	9.26		
14.0	9.96	<b>mean y</b>	7.5	14.0	8.10	<b>mean y</b>	7.5
6.0	7.24	<b>sd y</b>	4.1	6.0	6.13	<b>sd y</b>	4.1
4.0	4.26	<b>xy correlation</b>	0.8	4.0	3.10	<b>xy correlation</b>	0.8
12.0	10.84	<b>linear regression</b>	$y = 3.0 + 0.5x$	12.0	9.13	<b>linear regression</b>	$y = 3.0 + 0.5x$
7.0	4.82			7.0	7.26		
5.0	5.68			5.0	4.74		

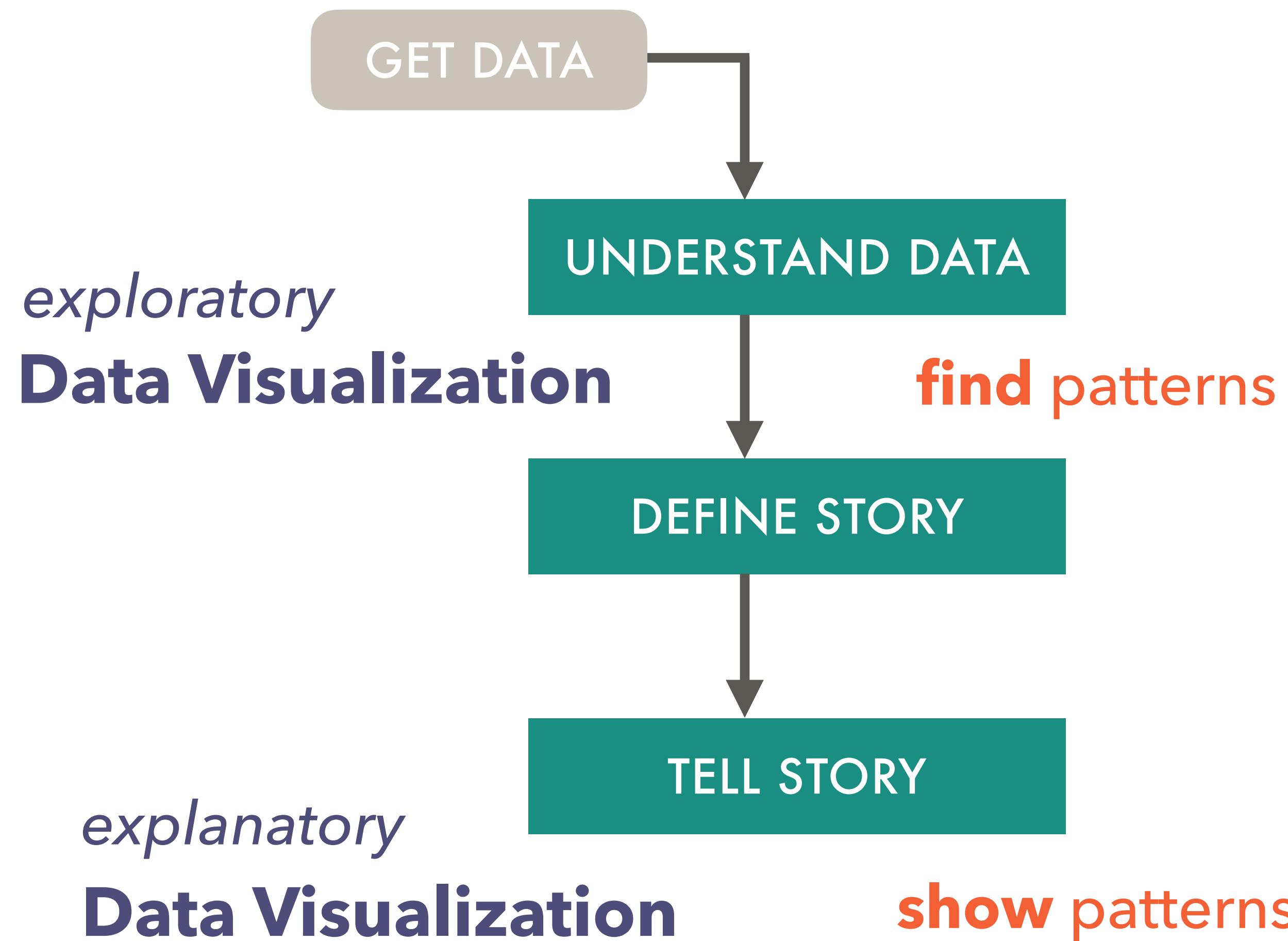
x3	y3			x4	y4		
10.0	7.46			8.0	6.58		
8.0	6.77			8.0	5.76		
13.0	12.74	<b>mean x</b>	9.0	8.0	7.71	<b>mean x</b>	9.0
9.0	7.11	<b>sd x</b>	11.0	8.0	8.84	<b>sd x</b>	11.0
11.0	7.81	<b>mean y</b>	7.5	8.0	8.47	<b>mean y</b>	7.5
14.0	8.84	<b>sd y</b>	4.1	8.0	7.04	<b>sd y</b>	4.1
6.0	6.08	<b>xy correlation</b>	0.8	8.0	5.25	<b>xy correlation</b>	0.8
4.0	5.39	<b>linear regression</b>	$y = 3.0 + 0.5x$	19.0	12.50	<b>linear regression</b>	$y = 3.0 + 0.5x$
12.0	8.15			8.0	5.56		
7.0	6.42			8.0	7.91		
5.0	5.73			8.0	6.89		

# DATA VISUALIZATION GIVES SHAPE TO NUMBERS

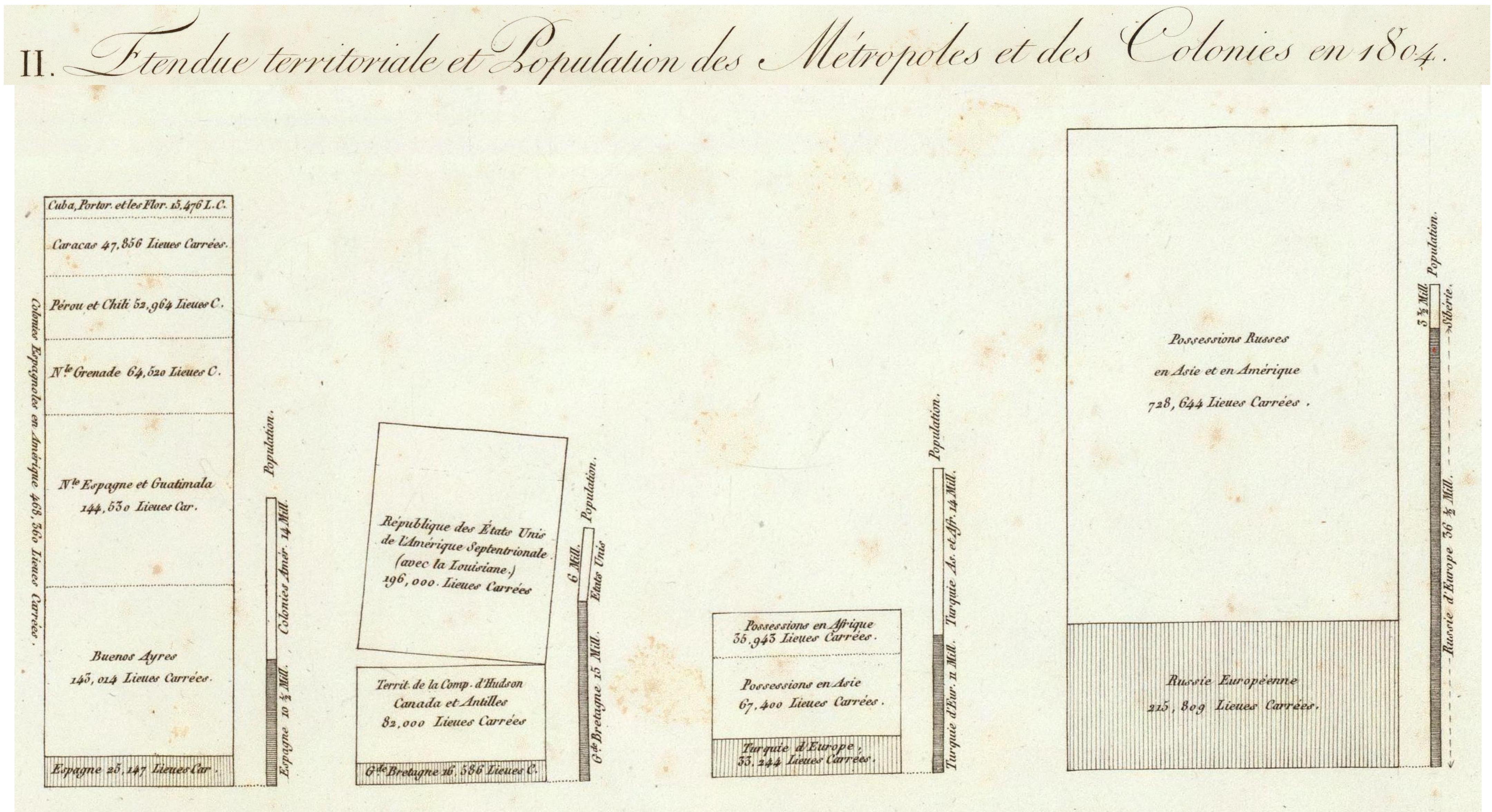


Anscombe, 1973

# HOW TO CREATE STORIES WITH DATA



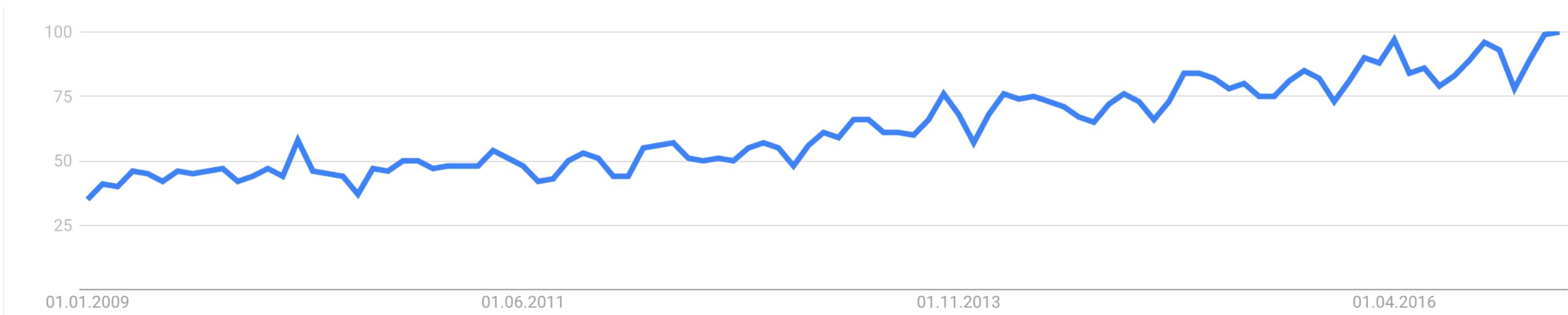
# DATA VISUALIZATION IS NOT NEW



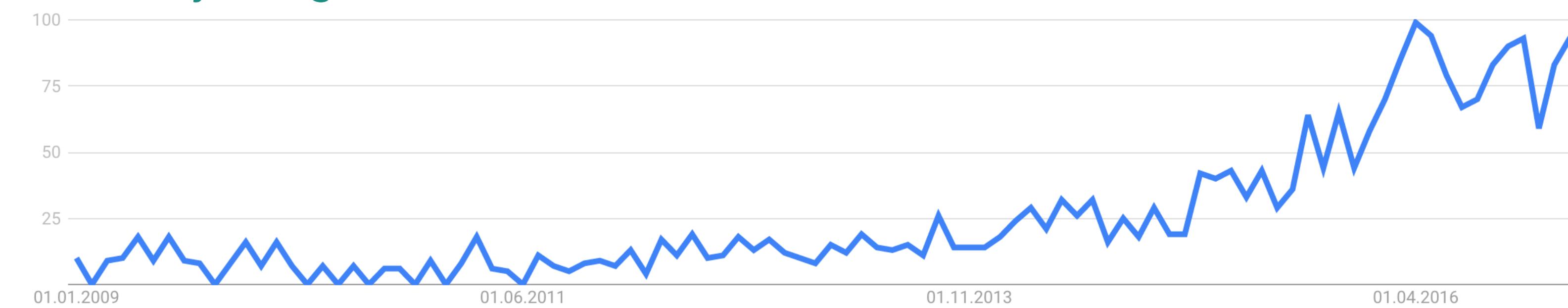
# Alexander von Humboldt, 1804

# DATA VISUALIZATION IS TRENDING

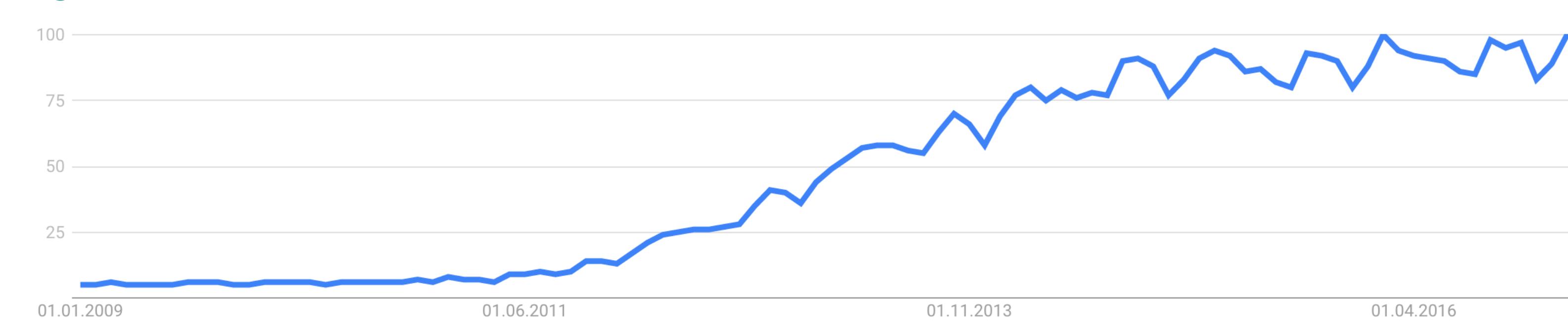
## Data Visualization



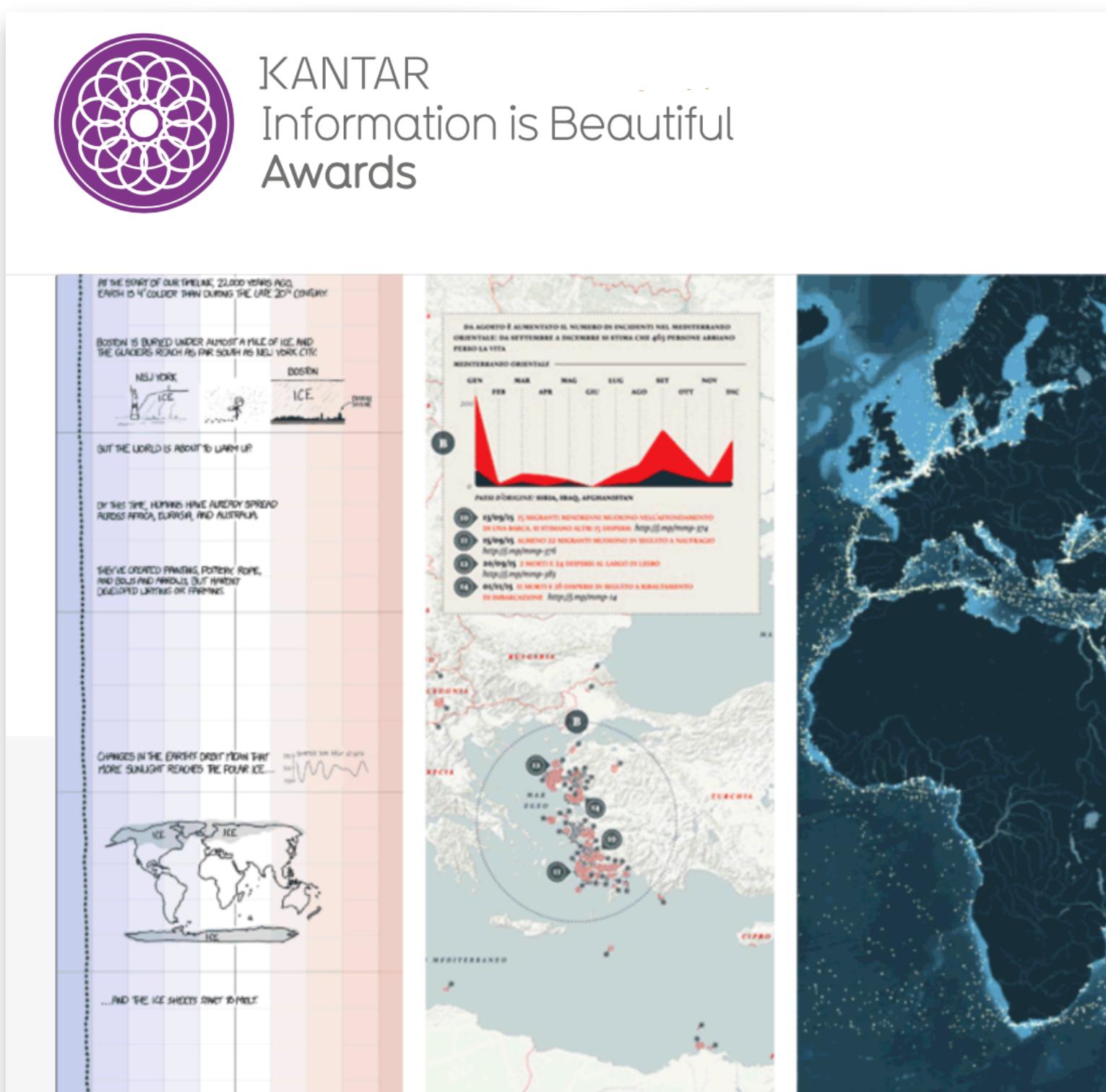
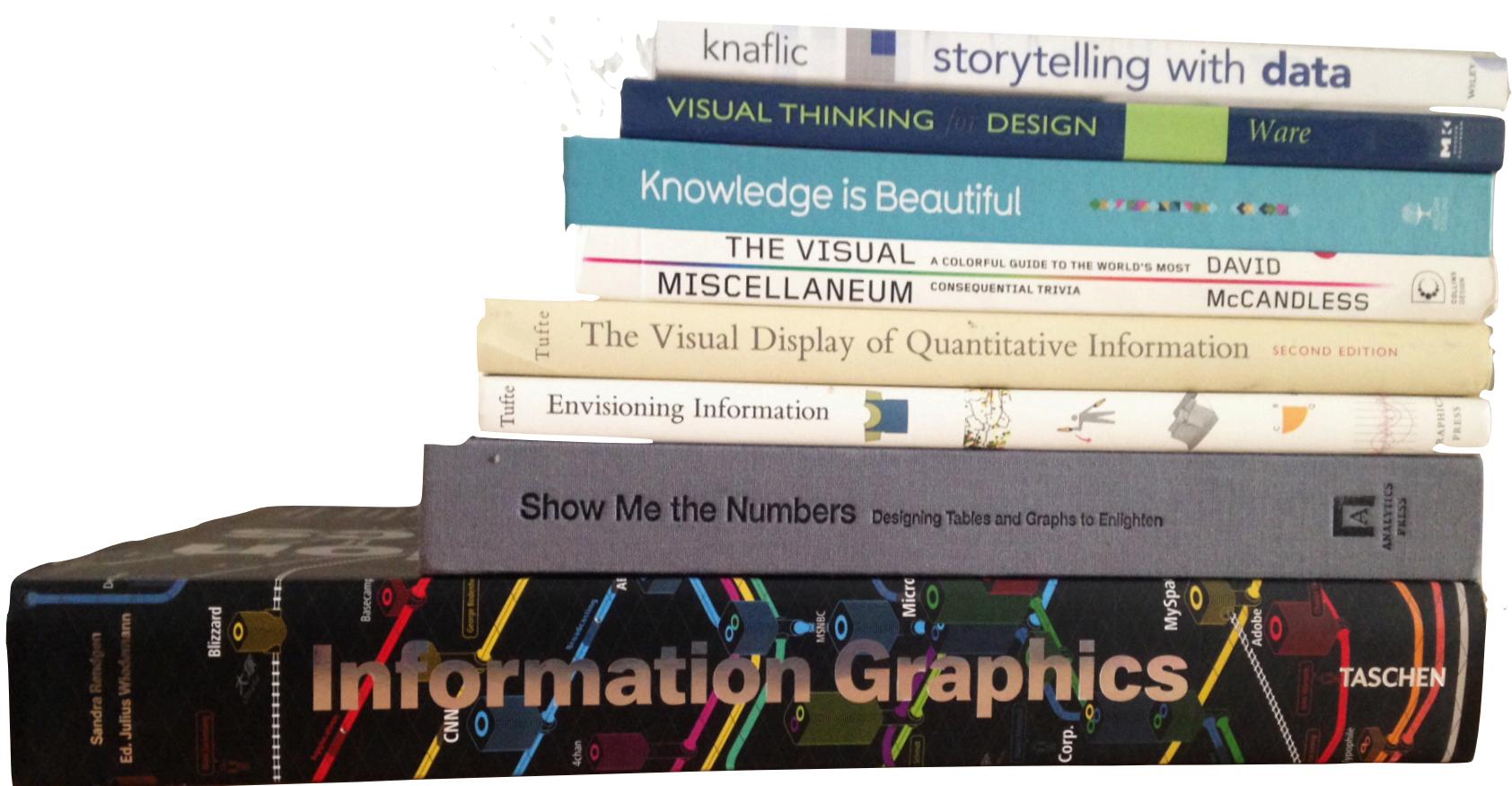
## Data Storytelling



## Big data



# DATA VISUALIZATION IS TRENDING



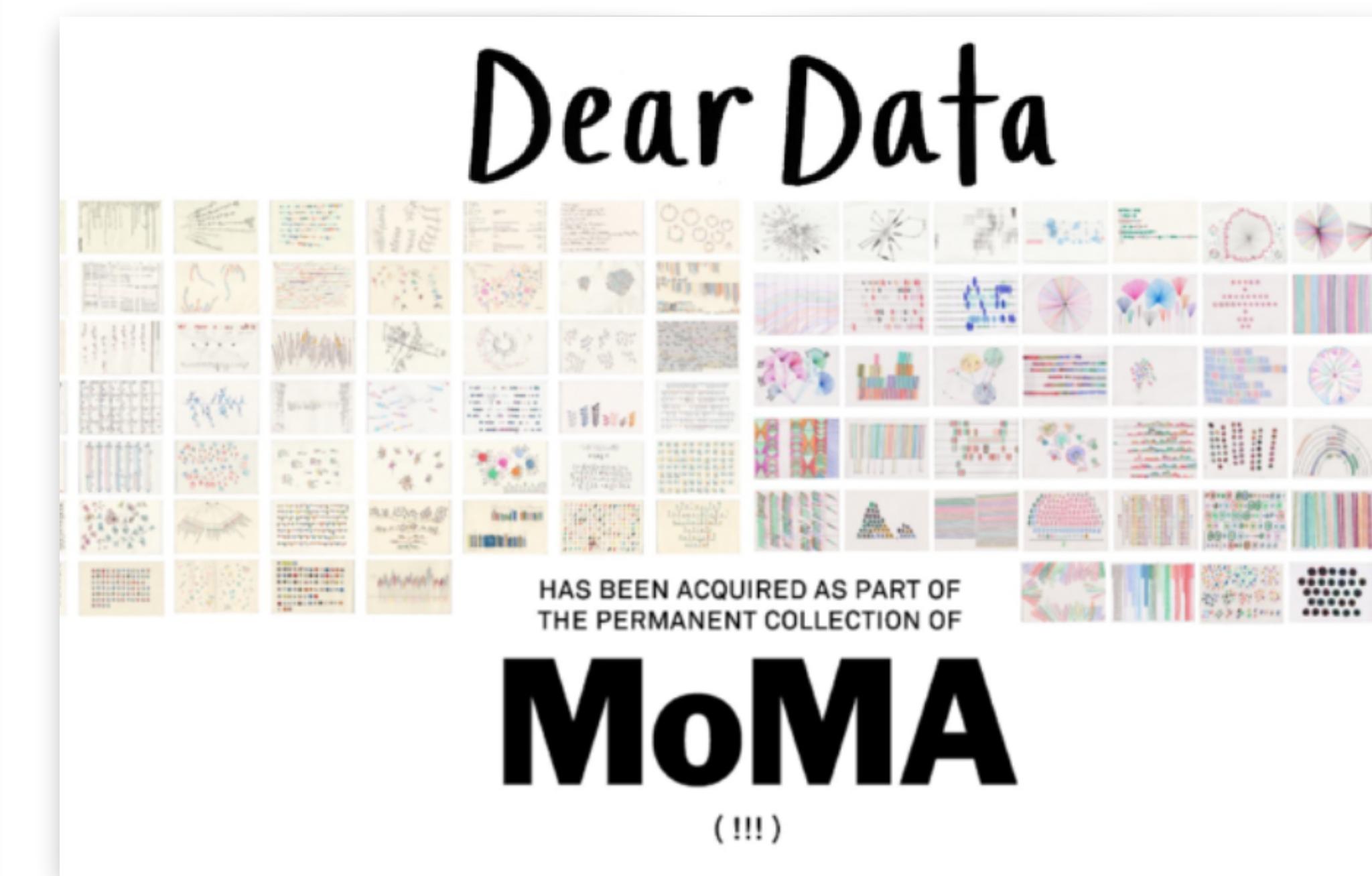
## The 38 best tools for data visualization

By Brian Suda, Sam Hampton-Smith February 07, 2017 Web design

Plotly  
Raw  
D3.js  
Chart.js  
Tableau

R: ggplot2  
Python: seaborn  
Matlab

...



# DATA VISUALIZATION IS EVERYWHERE

## Information+ keynotes



**Reuben Fischer-Baum & Chiqui Esteban**

Reuben Fischer-Baum is an Assignment Editor on the Washington Post graphics team, focused on politics and sports. Chiqui Esteban is the Post's Graphics Director. This award-winning team builds visually-driven stories for an ever-expanding number of platforms, experimenting with new storytelling techniques to help readers make sense of the news. Reuben previously worked at FiveThirtyEight and Gawker Media. Chiqui previously worked at National Geographic, The Boston Globe, La Voz de Galicia, Diario de Cadiz, Publico and lainformacion.com.

Journalism



**Ron Morrison**

Ron Morrison is a designer, artist, and researcher working across the fields of human geography, digital technology, and urbanism. They investigate how the unassimilable complicates race and geographic space as fixed and knowable. From building open source platforms to upend solitary confinement to crafting community based archives to combat gentrification, their work explores cartographies of slow violence, cybernetics, and blackness. Their work was implemented in the US, Ghana, Colombia, Ethiopia, Italy and featured at AIA New York, UN World Urban Forum, and Tribeca Film Festival. They are currently an Annenberg PhD fellow at the University of Southern California in Los Angeles.

Art



**Sandra Rendgen**

Sandra Rendgen is an independent author and researcher with a particular focus on data visualization, interactive media and the history of infographics. Her academic background is in art history and cultural theory. In collaboration with Taschen Publishing, she released "Information Graphics" (2012) and "Understanding the World" (2014). Currently she is working on two new books about the history of data visualization and information graphics.

History/Philosophy

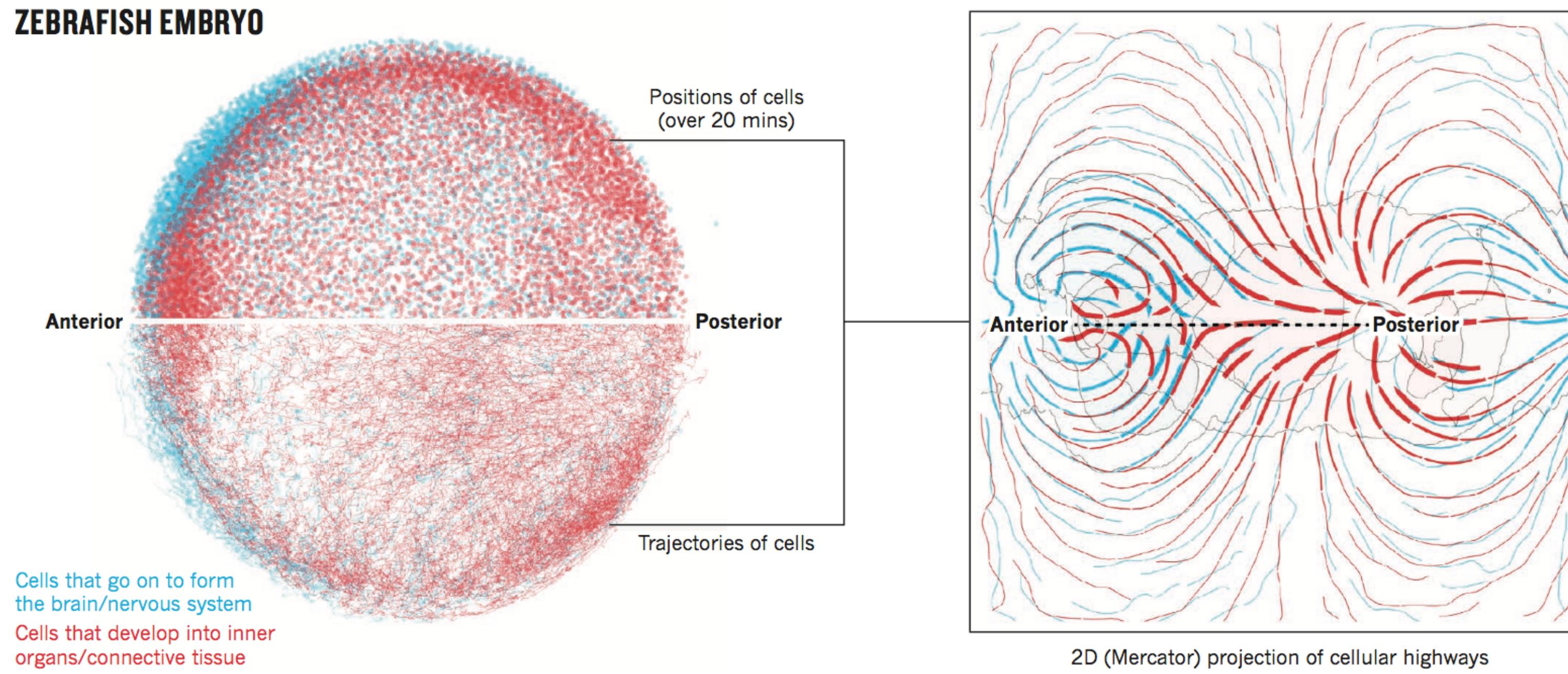
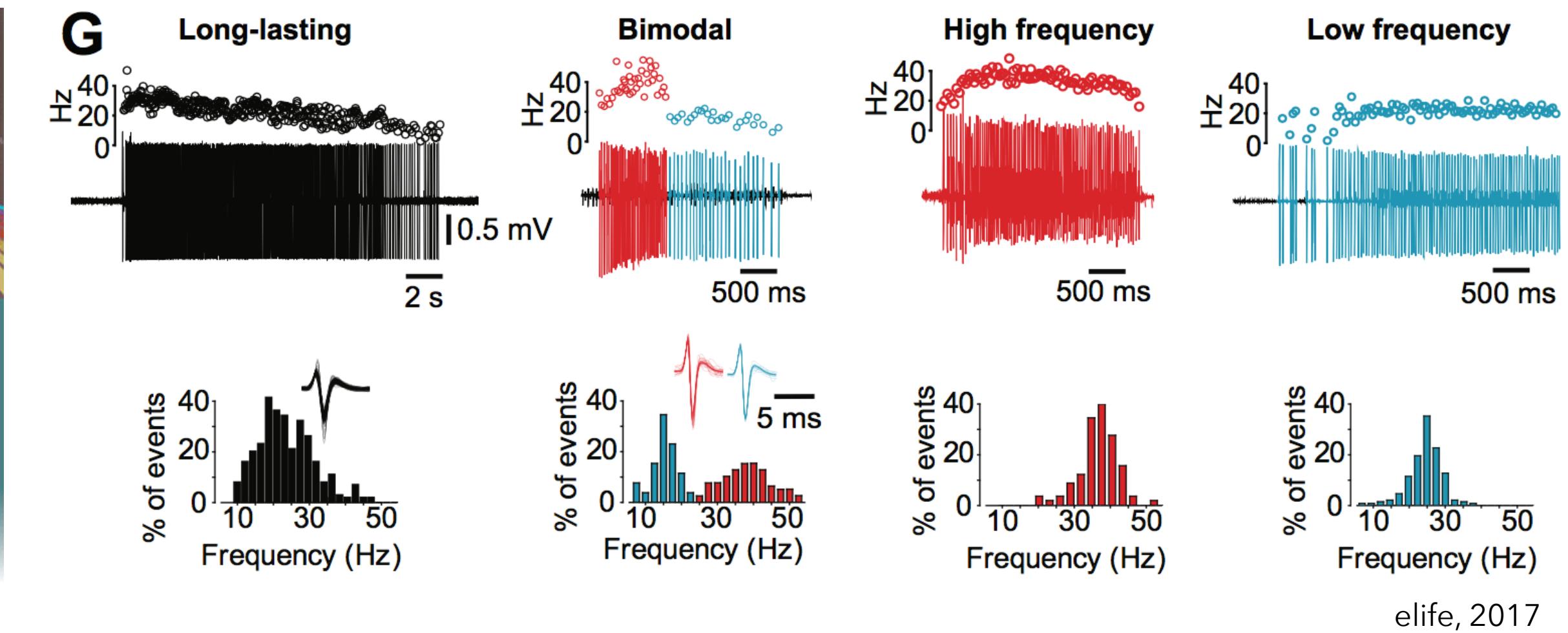


**Fernanda Viégas & Martin Wattenberg**

Fernanda Viégas and Martin Wattenberg co-lead Google's PAIR (People+AI Research) initiative, part of Google Brain. Their work in machine learning focuses on transparency and interpretability, as part of a broad agenda to improve human/AI interaction. They are well known for their contributions to social and collaborative visualization, and the systems they've created are used daily by millions of people. Their visualization-based artwork has been exhibited worldwide, and is part of the permanent collection of Museum of Modern Art in New York.

Machine learning research

# SCIENCE IS TRYING TO KEEP UP (STAND 2018)



The 'flow' of cells in a developing zebrafish embryo, seen in 3D microscopy data (left) and as a 2D projection (right).

# SCIENCE IS REALLY KEEPING UP (STAND 2019)



## 2019

### Program

#### ▼ Wednesday, 13/03/2019

08:30 - 09:20	Registration
09:20 - 09:30	Opening remarks & retrospective ( <a href="#">Sean O'Donoghue</a> )
09:30 - 10:30	<b>Keynote:</b> Data visualization and data science ( <a href="#">Hadley Wickham</a> )
10:30 - 11:00	Coffee Break



Chief Scientist  
at RStudio

### DATA SCIENCE WITH THE TIDYVERSE

- [ggplot2](#) for visualising data.
- [dplyr](#) for manipulating data.
- [tidyverse](#) for tidying data.
- [stringr](#) for working with strings.
- [lubridate](#) for working with date/times.

### DATA IMPORT

- [readr](#) for reading .csv and fwf files.
- [readxl](#) for reading .xls and .xlsx files.
- [haven](#) for SAS, SPSS, and Stata files.
- [httr](#) for talking to web APIs.
- [rvest](#) for scraping websites.
- [xml2](#) for importing XML files.

### SOFTWARE ENGINEERING

- [devtools](#) for general package development.
- [roxygen2](#) for in-line documentation.
- [testthat](#) for unit testing
- [pkgdown](#) to create beautiful package websites

# SCIENCE IS REALLY KEEPING UP (STAND 2019)

## VISUALIZING BIOLOGICAL DATA **VIZBI**

# 2019

### Program

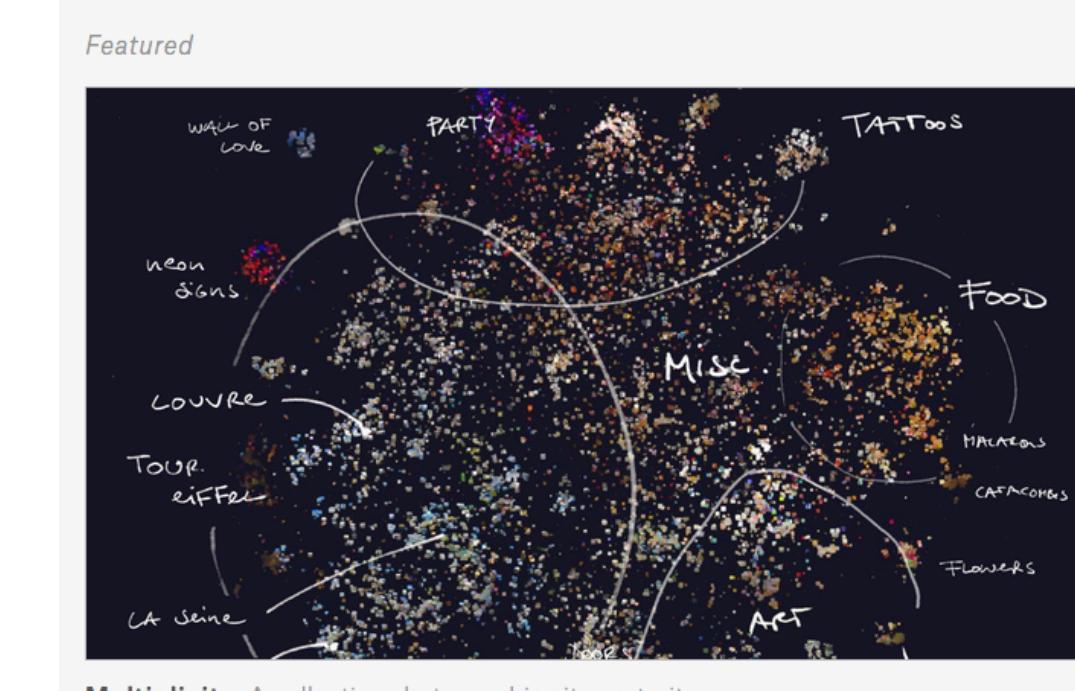
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10:30 - 11:00	Coffee Break

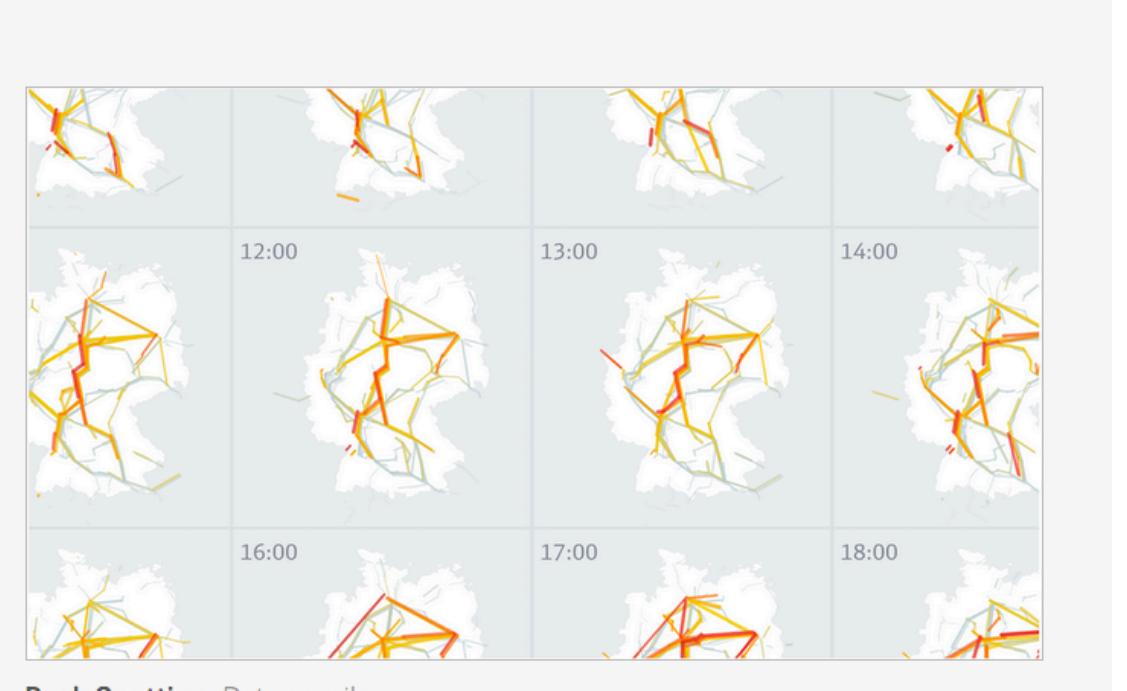
▼ Friday, 15/03/2019

09:15 - 09:30	Announcements (Organizers)
09:30 - 10:30	<b>Keynote:</b> The art and science of data visualization ( <a href="#">Moritz Stefaner</a> )
10:30 - 11:00	Coffee break

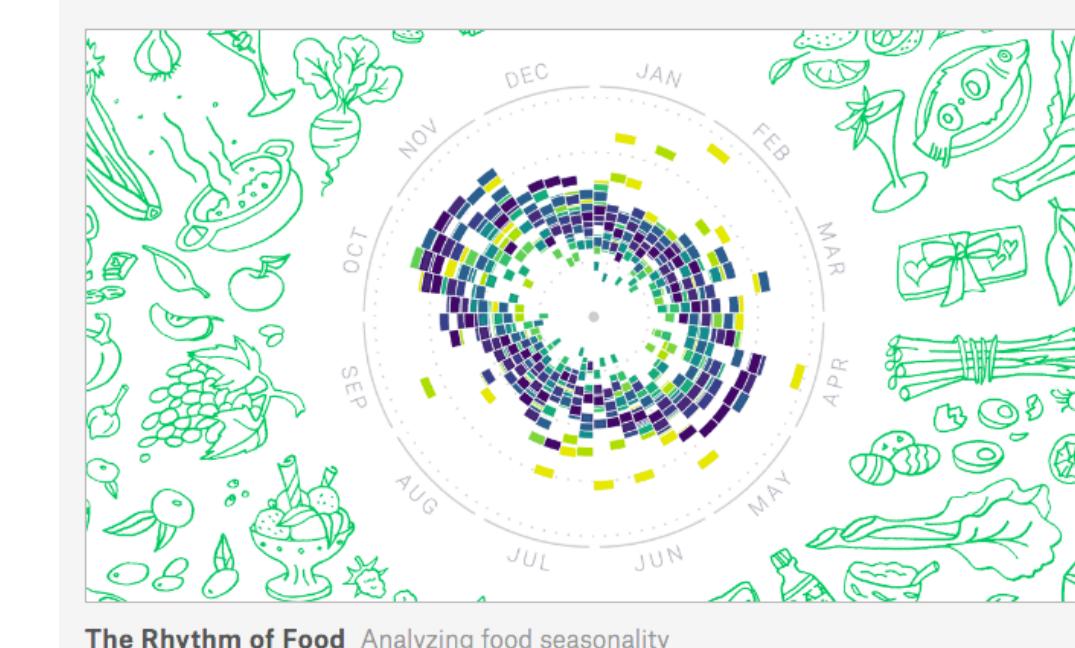
Featured



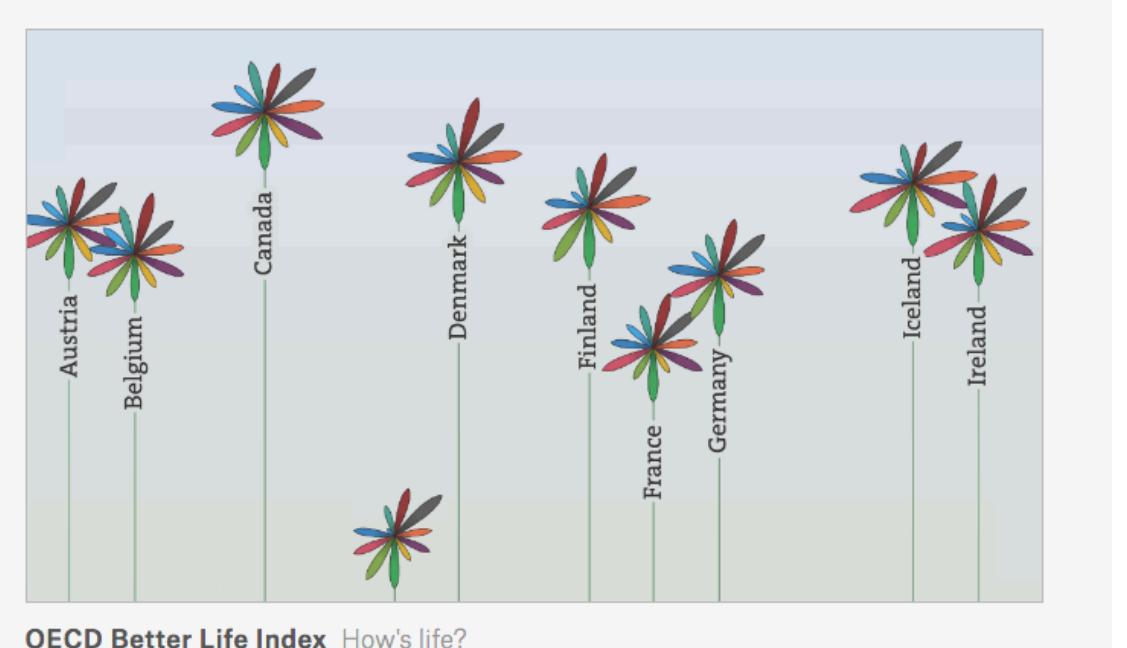
**Multiplicity** A collective photographic city portrait



**Peak Spotting** Data on rails



**The Rhythm of Food** Analyzing food seasonality

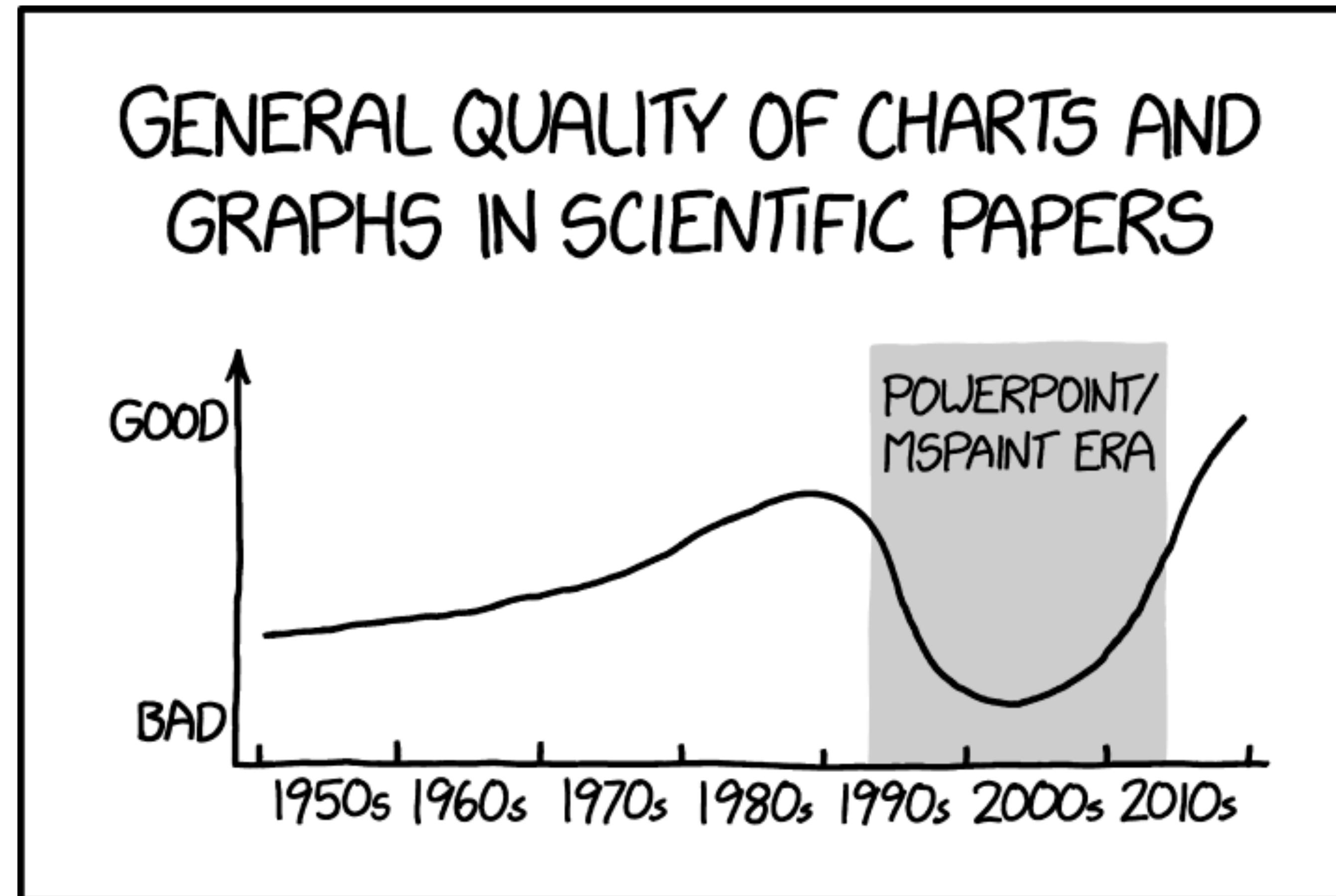


**OECD Better Life Index** How's life?

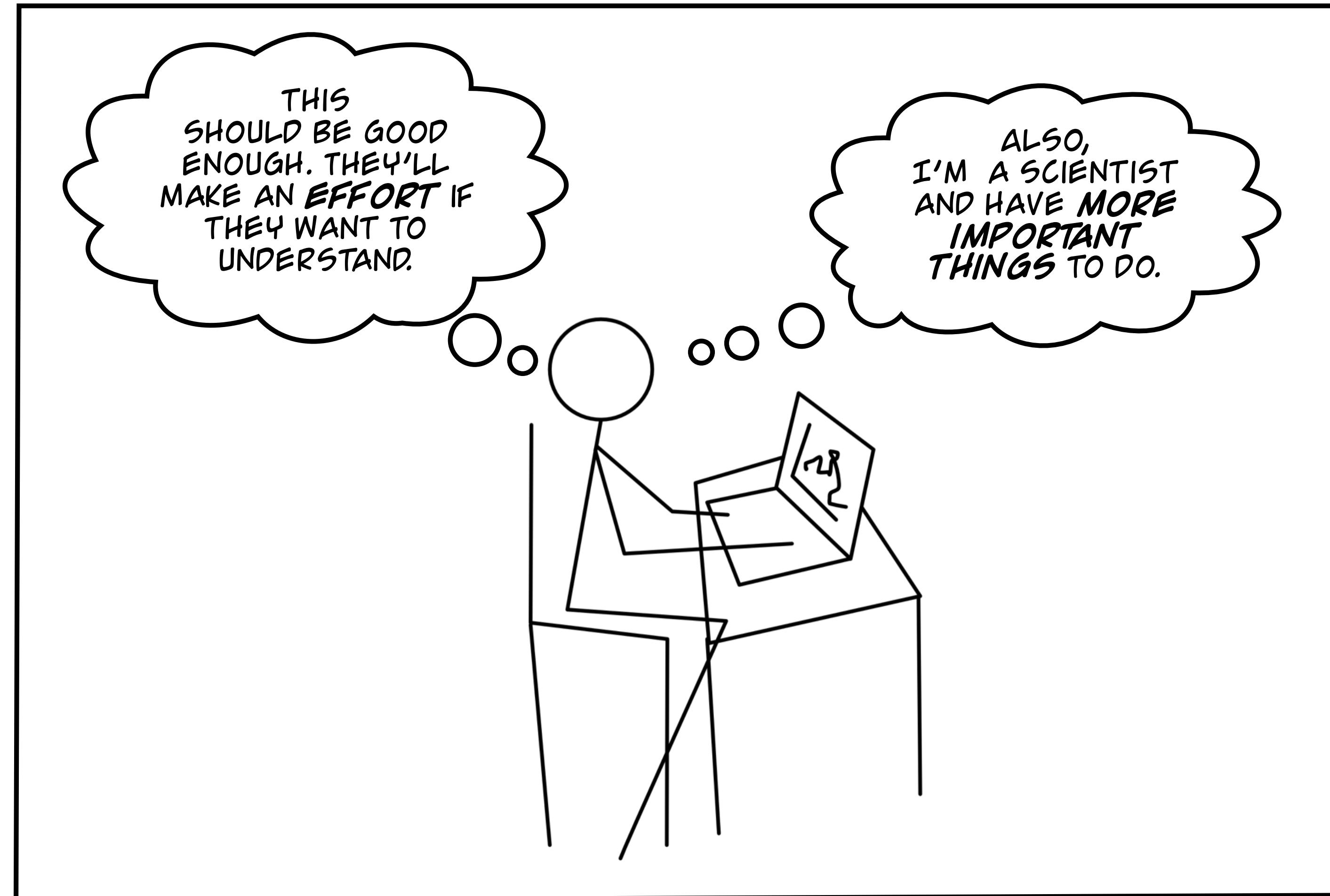


<https://truth-and-beauty.net/>

BUT IT HAS BEEN ROUGH..



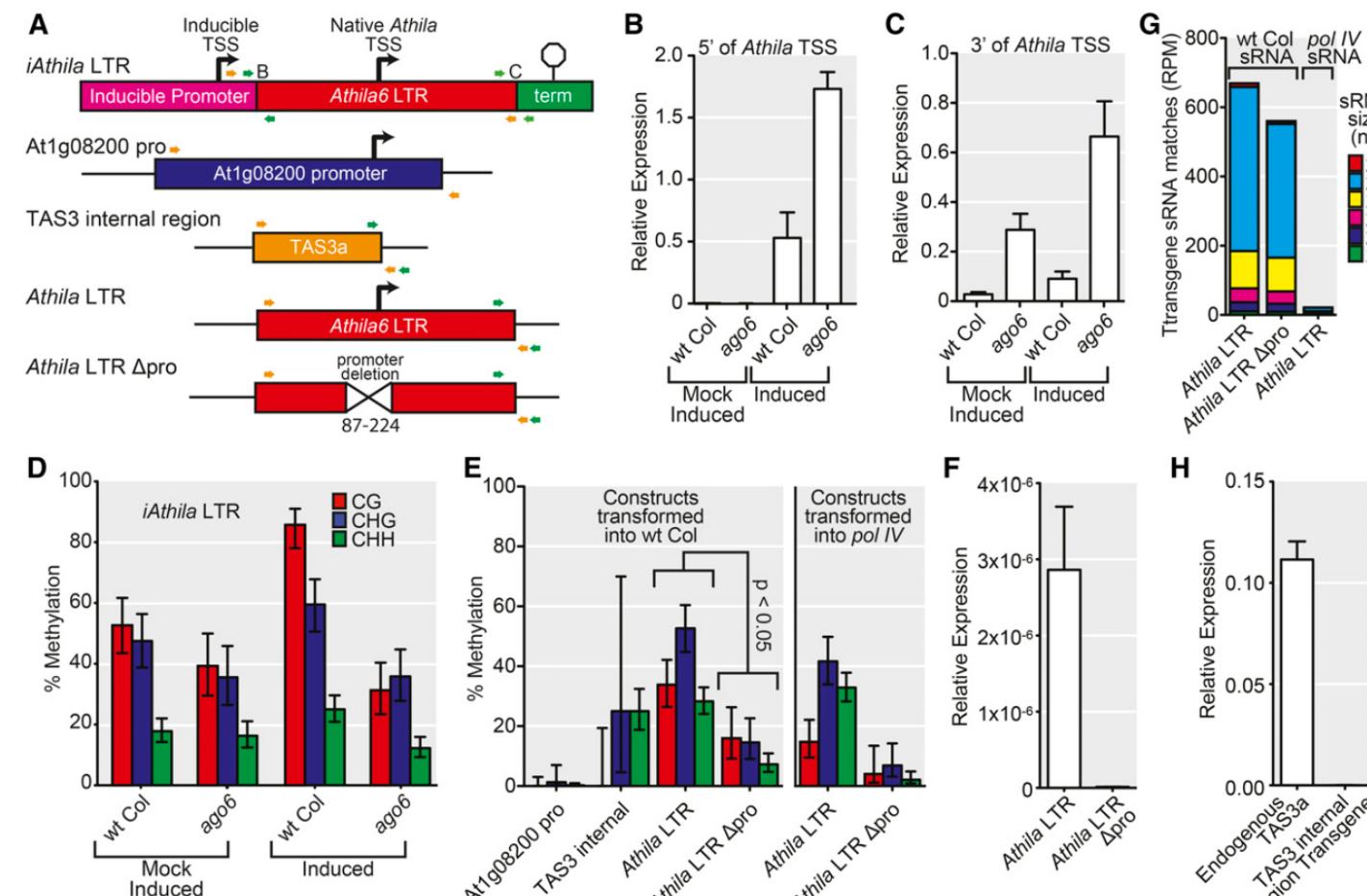
# THE STANDARDS IN SCIENCE ARE BEHIND



SCIENTIST PREPARING GRAPHS

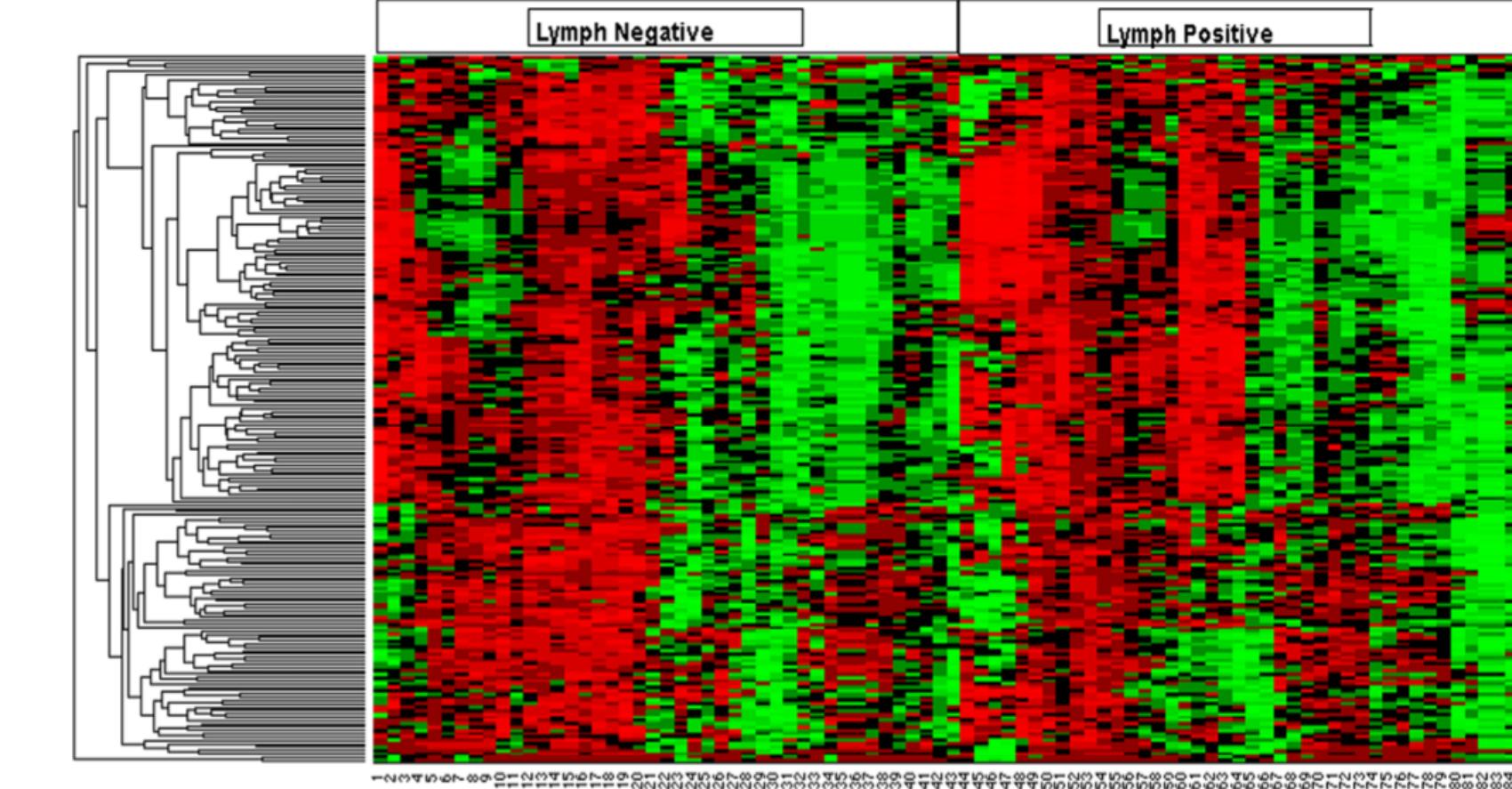
# THE STANDARDS IN SCIENCE ARE BEHIND

(over) use of bar plots for distributions



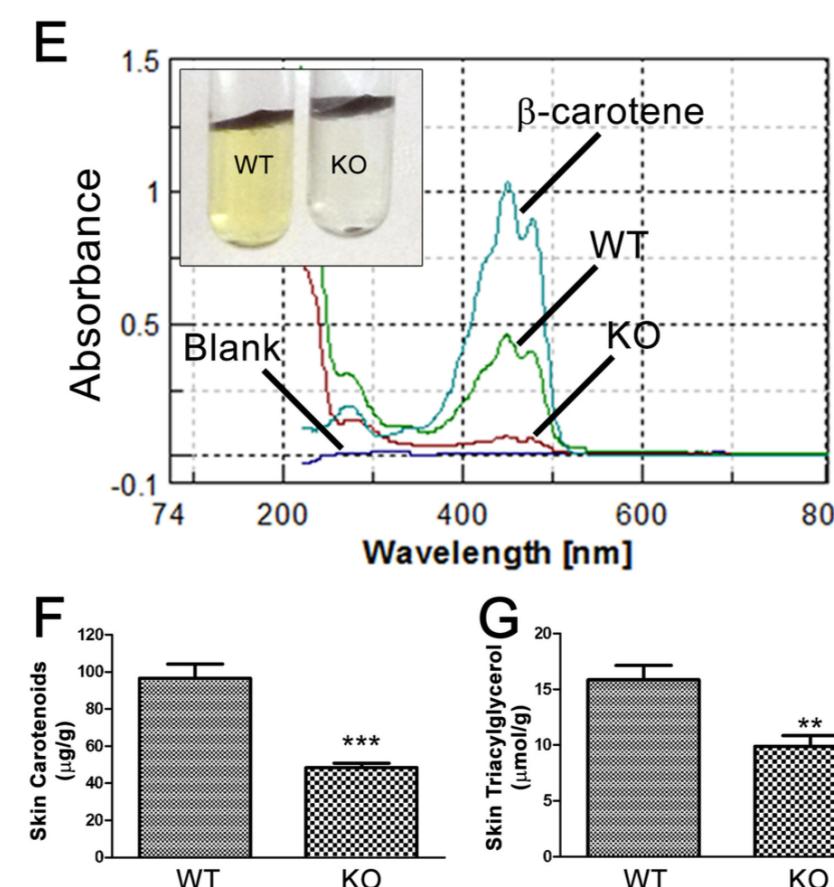
Plant Cell, 2017

improper use of color



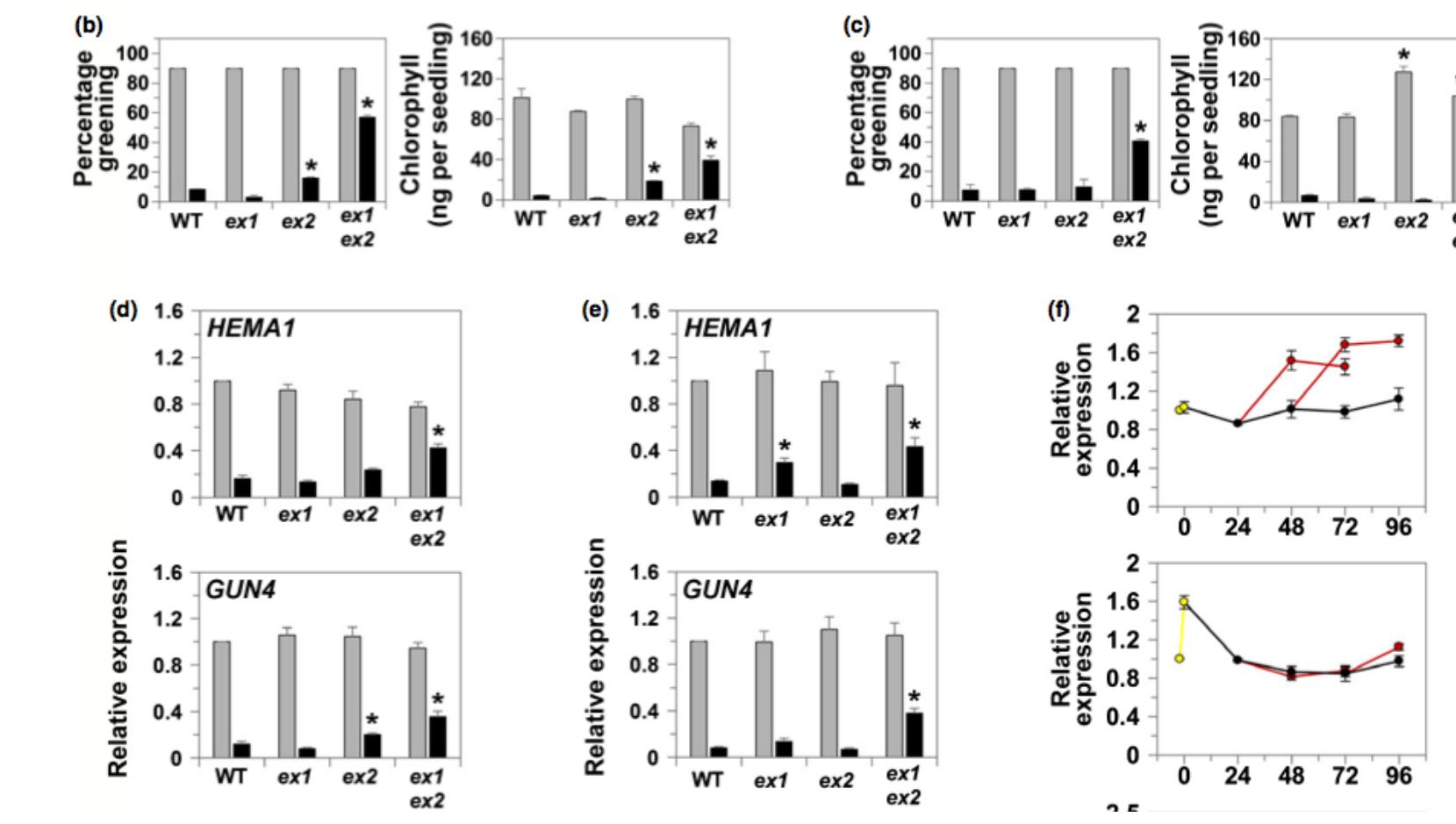
BMCgenomics, 2017

lack of graphic design literacy



elife, 2017

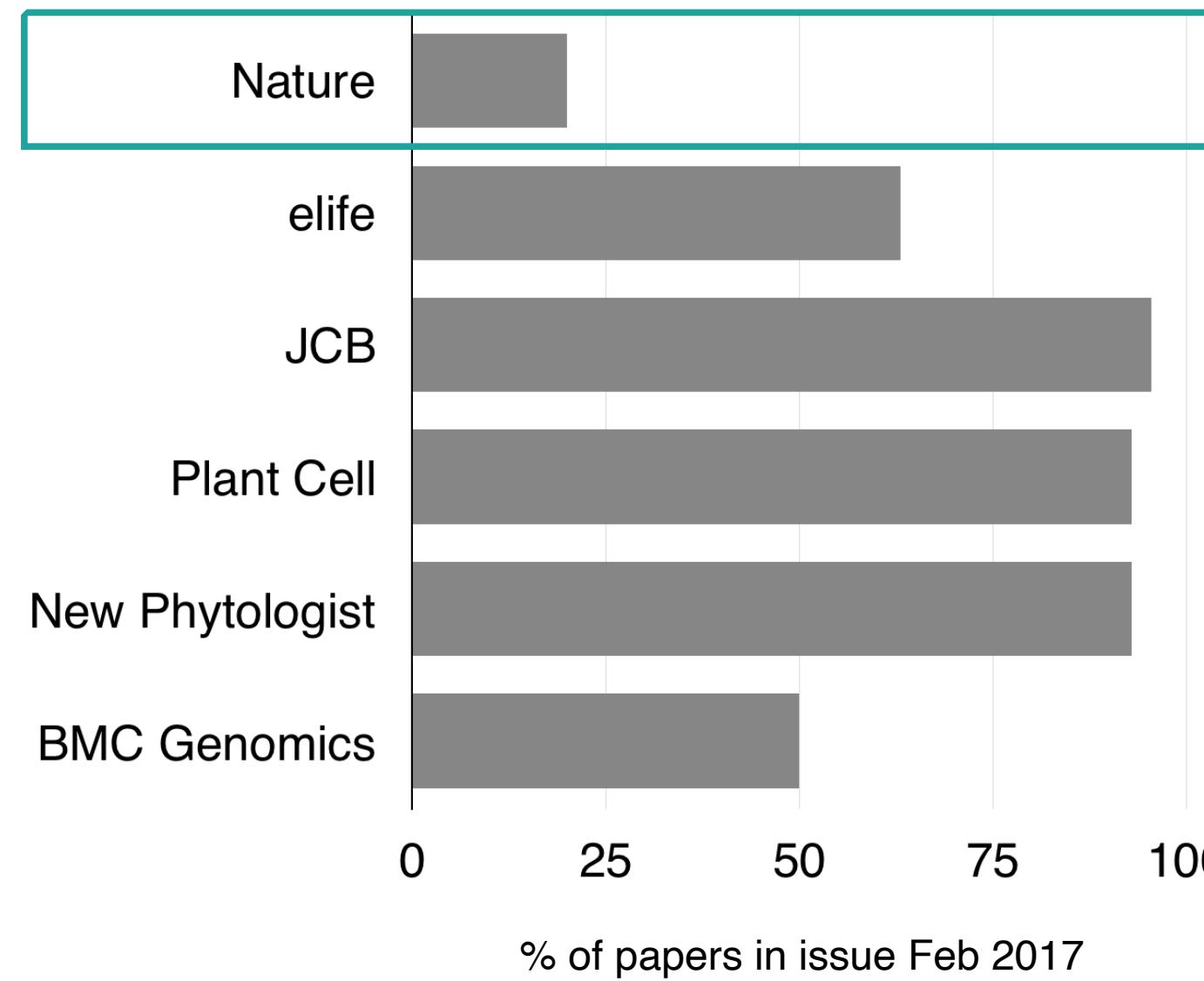
lack of creativity in charts



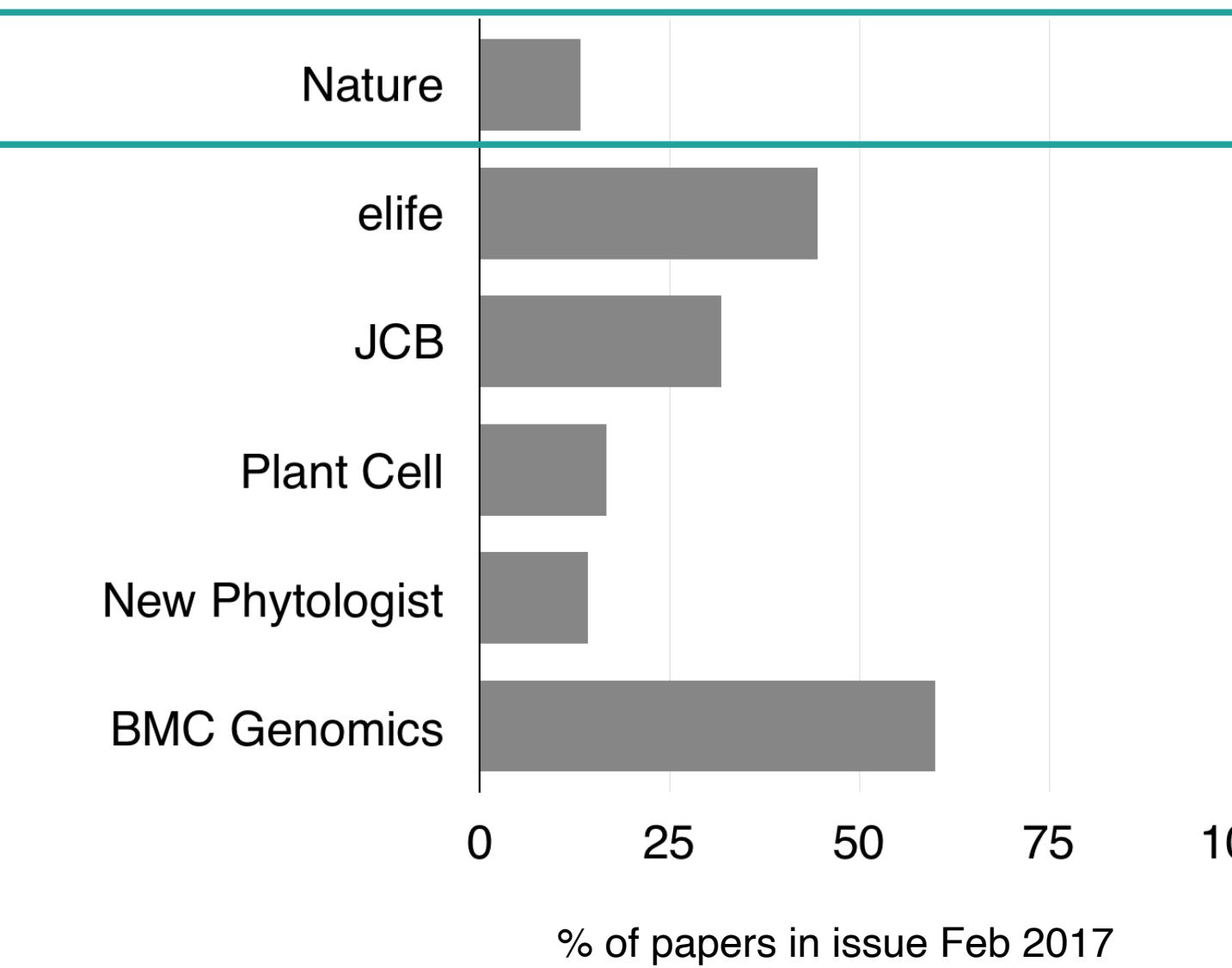
Phytologist, 2017

# BUT THE STANDARDS IN SCIENCE ARE BEHIND

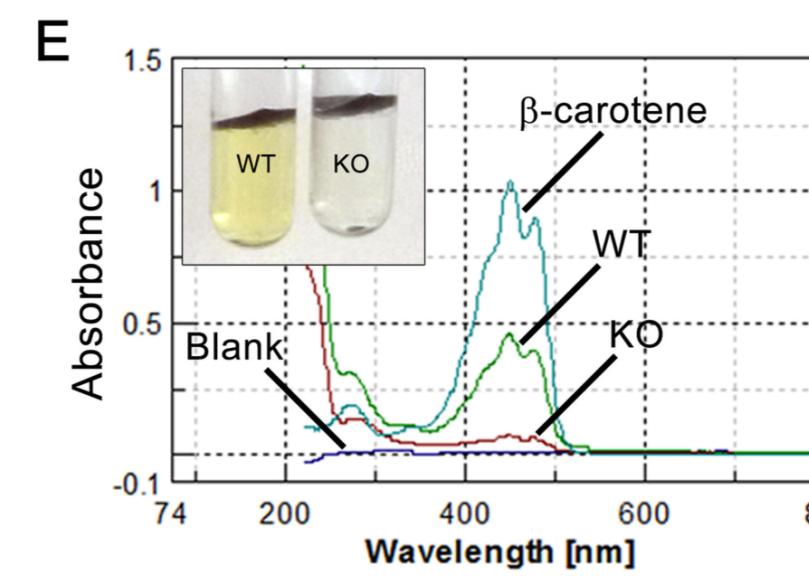
(over) use of bar plots for distributions



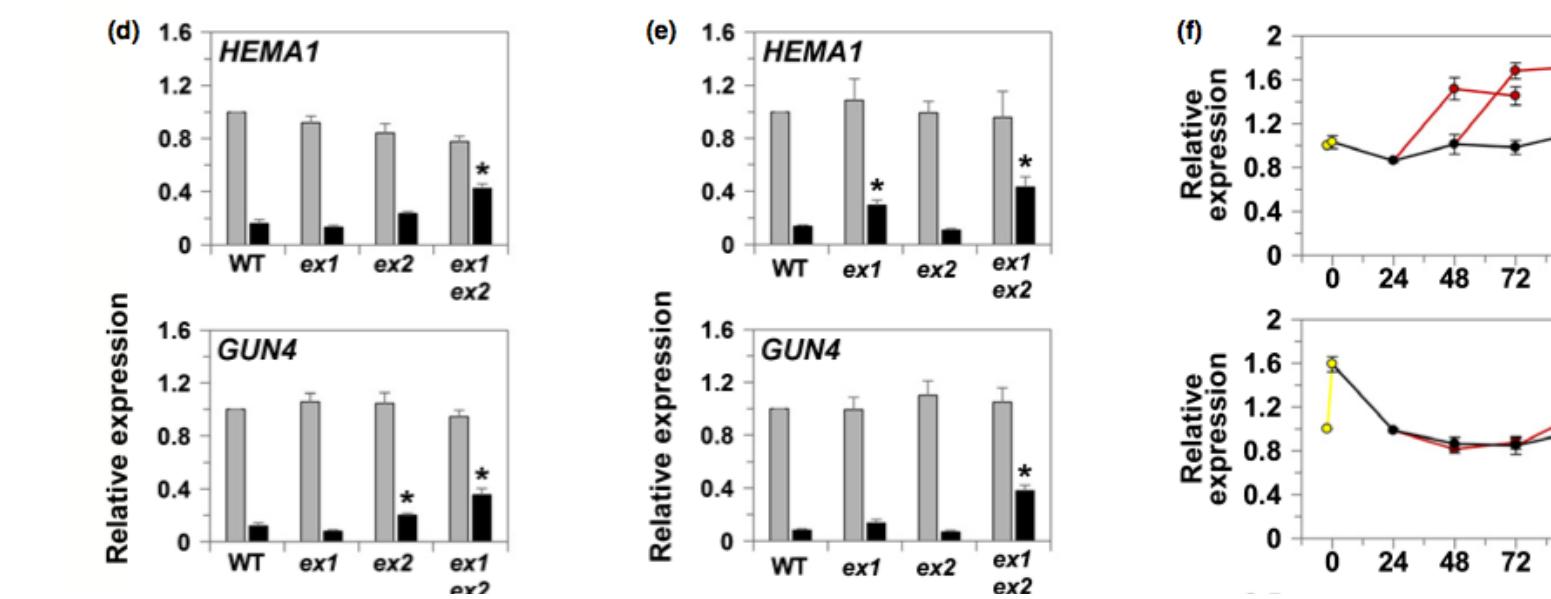
improper use of color



lack of graphic design literacy



lack of creativity in charts



AT LEAST THEY ARE HIGHER THEN ELSEWHERE

# GASTO SOCIAL

EDUCACIÓN, SANIDAD Y PROTECCIÓN SOCIAL



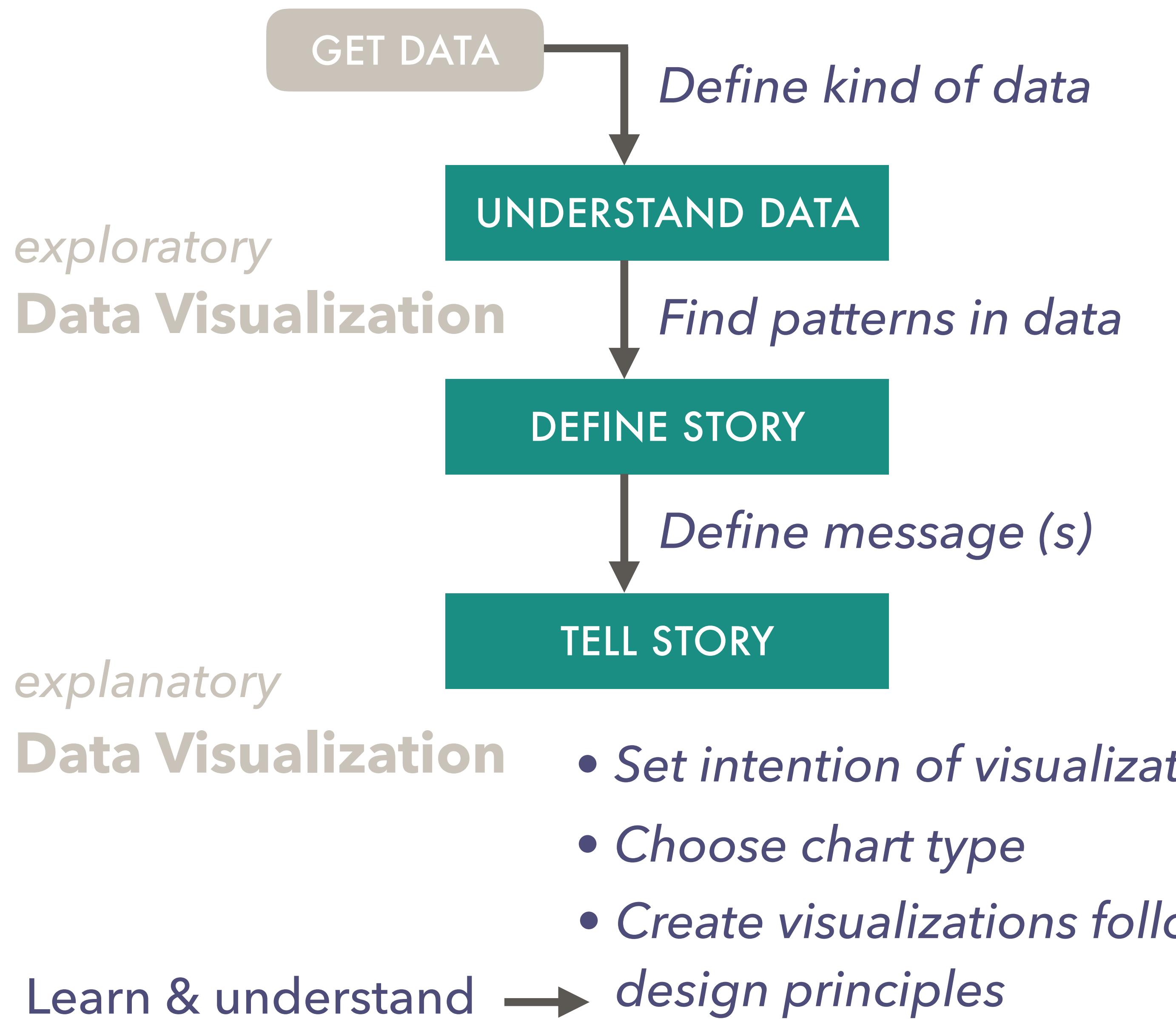
Partido Popular

@PPopular

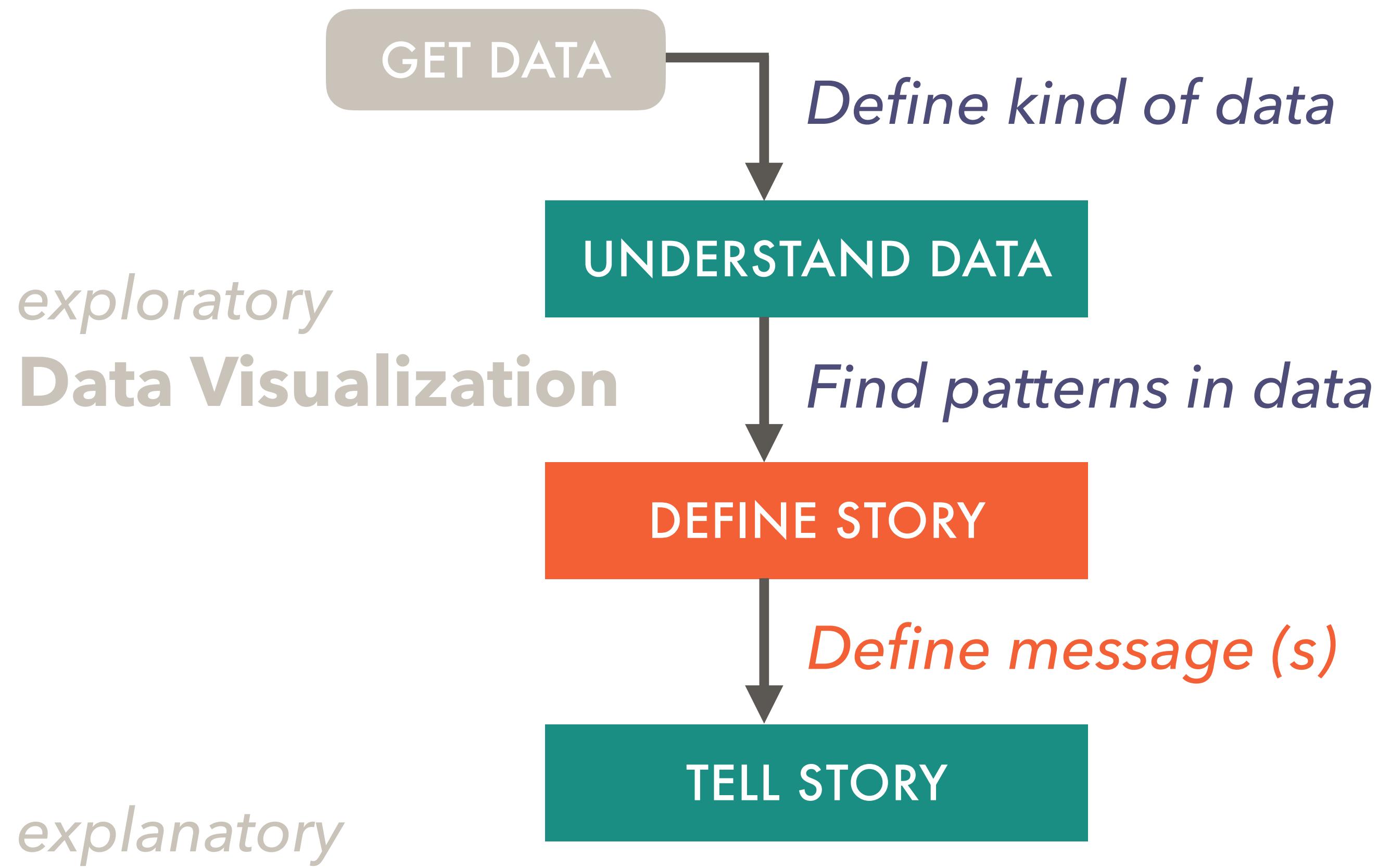
El gasto social aumenta con el Partido Popular [@pablocasado\\_](#) #elDBT



# HOW TO CREATE **GOOD** STORIES WITH DATA

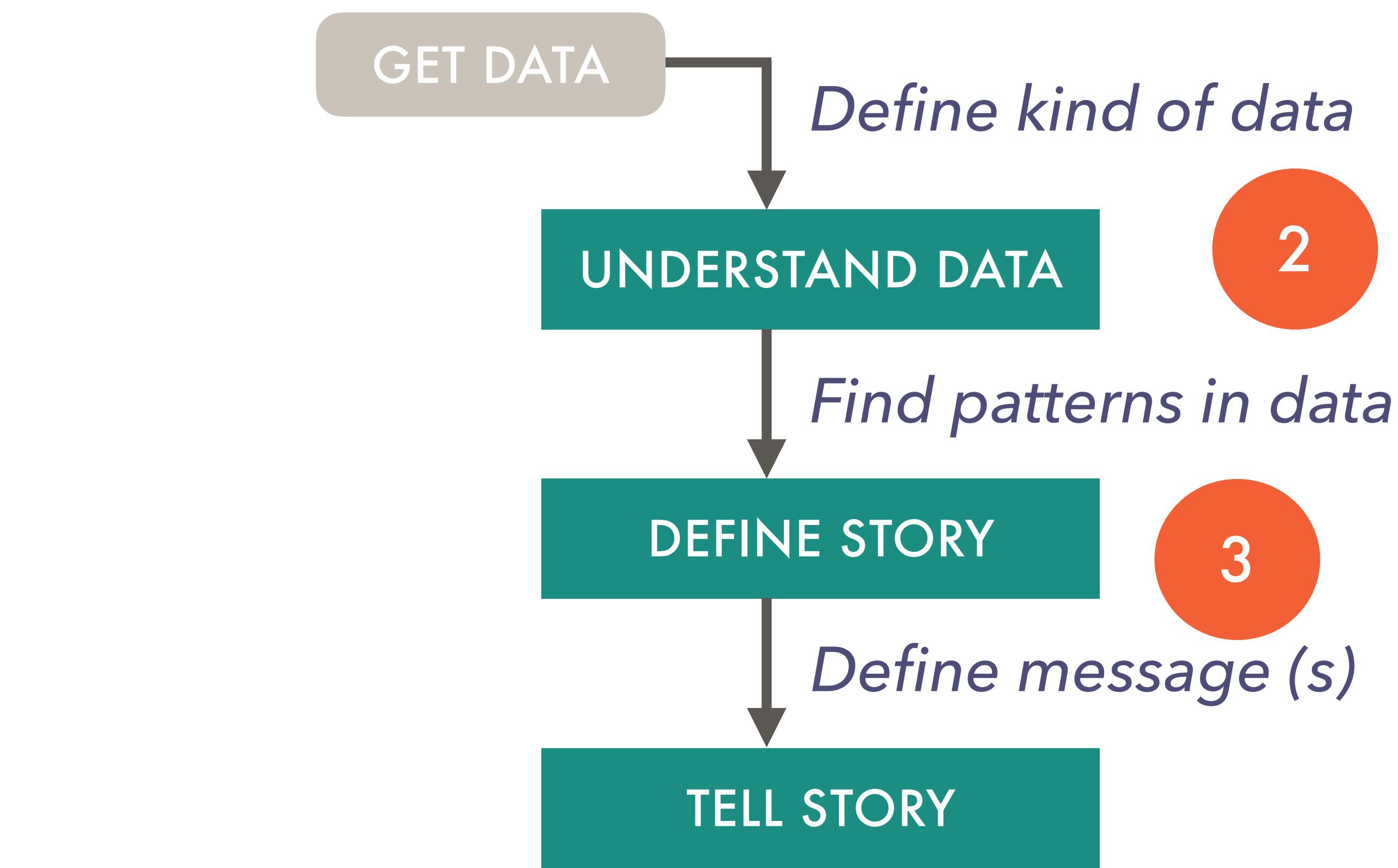


# HOW TO CREATE **GOOD** STORIES WITH DATA



- Data Visualization**
- *Set intention of visualization*
  - *Choose chart type*
  - *Create visualizations following design principles*
- Learn & understand → *design principles*

# HOW TO CREATE GOOD STORIES WITH DATA



- *Set intention of visualization*
  - *Choose chart type*
  - *Create visualizations following*

# Learn & understand → *design principles*

# COURSE CONTENT

1

TELL STORY

- *Set intention of visualization*
- *Create visualizations following design principles*

2

UNDERSTAND DATA

- *Define kind of data*
- *Choose chart type*

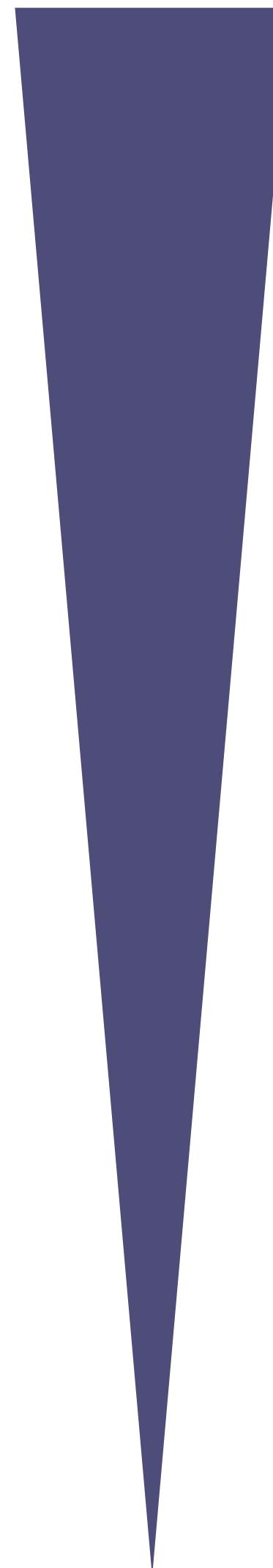
3

DEFINE STORY

*Define message (s)*

General

Specific





## HOW WE SEE



Visual perception for design  
Encoding quantitative information

Theory



Practice



COFFEE

Apply concepts to  
your own work

## HOW WE SHOW



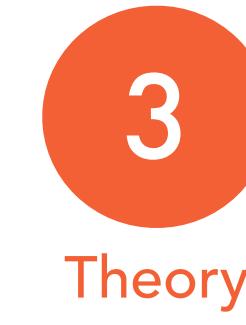
General design principles  
Graph design  
Overview types of graphs

Theory



Types of data  
Details types of graphs

## HOW WE TELL



Theory

LUNCH



Practice

Storytelling principles

COFFEE

Storytelling practice

BEFORE WE START WITH THEORY  
KNOW YOUR AUDIENCE (AND YOUR TRAINERS).

# WHY ARE YOU VISUALIZING YOUR DATA

Set the intention of your visualization

# GOALS OF DATA VISUALIZATION



Attention  
& Beauty

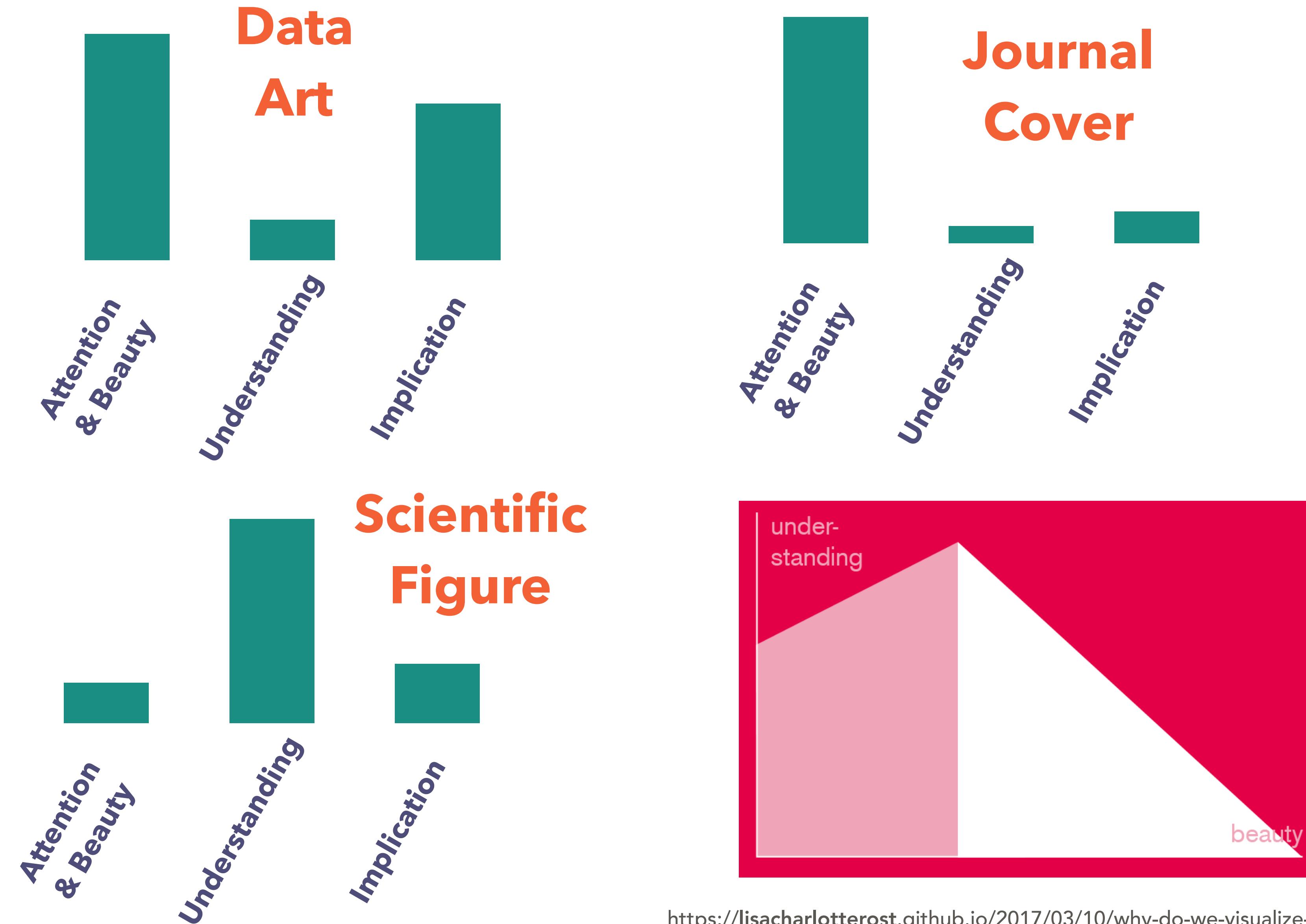


Understanding



Implication

# GOALS OF DATA VISUALIZATION



# GRAPHICAL EXCELLENCE

efficient communication of quantitative ideas

# GRAPHICAL INTEGRITY

telling the truth about the data

# GRAPHICAL EFFICIENCY

draw viewers attention to the substance of the data and not to something else.

— Edward R. Tufte

**INTEGRITY**

an oath of good practices to start with

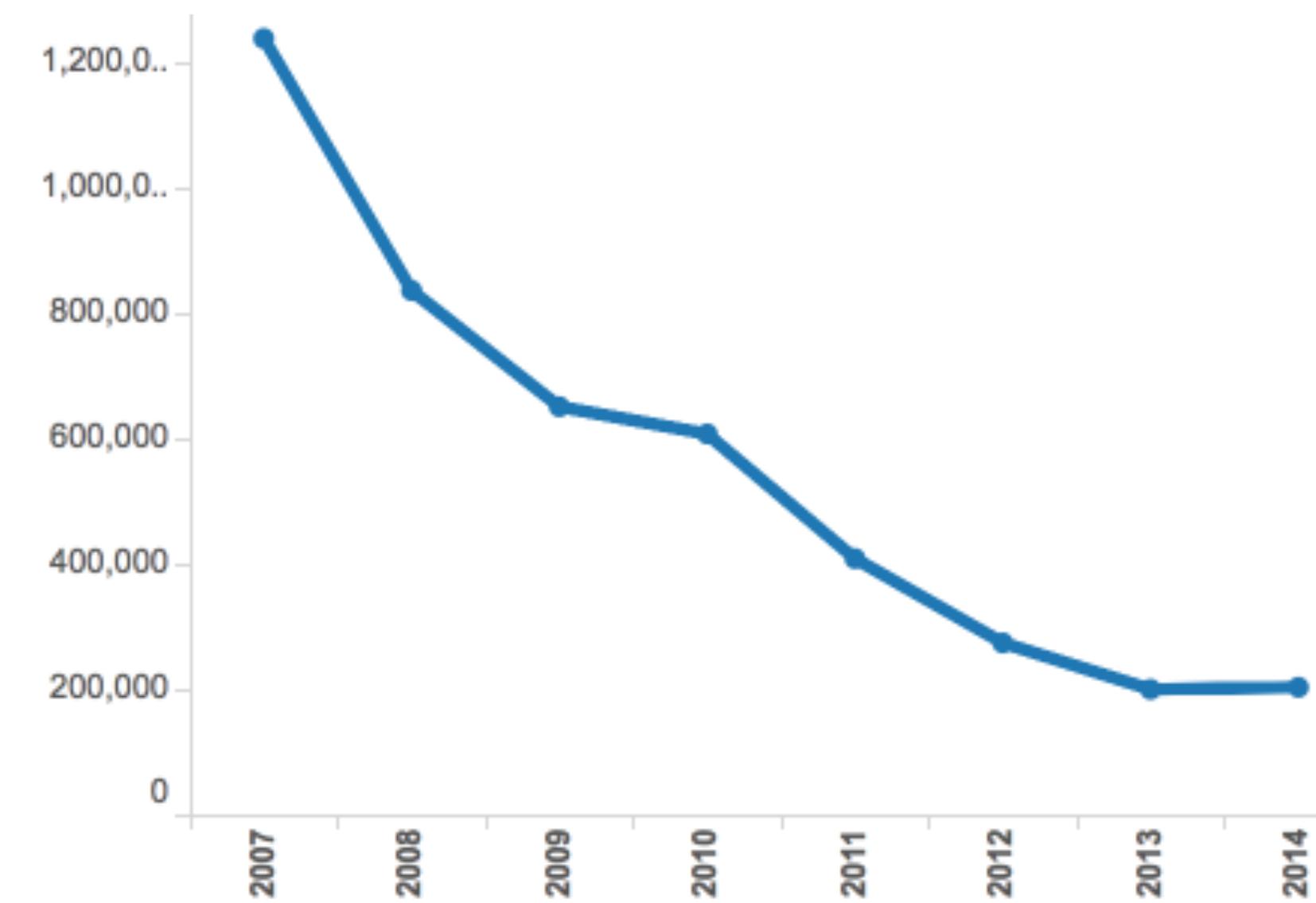
“

*HEREBY I SWEAR TO APPLY  
ALL I LEARN IN THIS COURSE  
FOR **GOOD**, TO TELL **TRUE**  
DATA STORIES.*

”

— Course participants CRAG April 2019

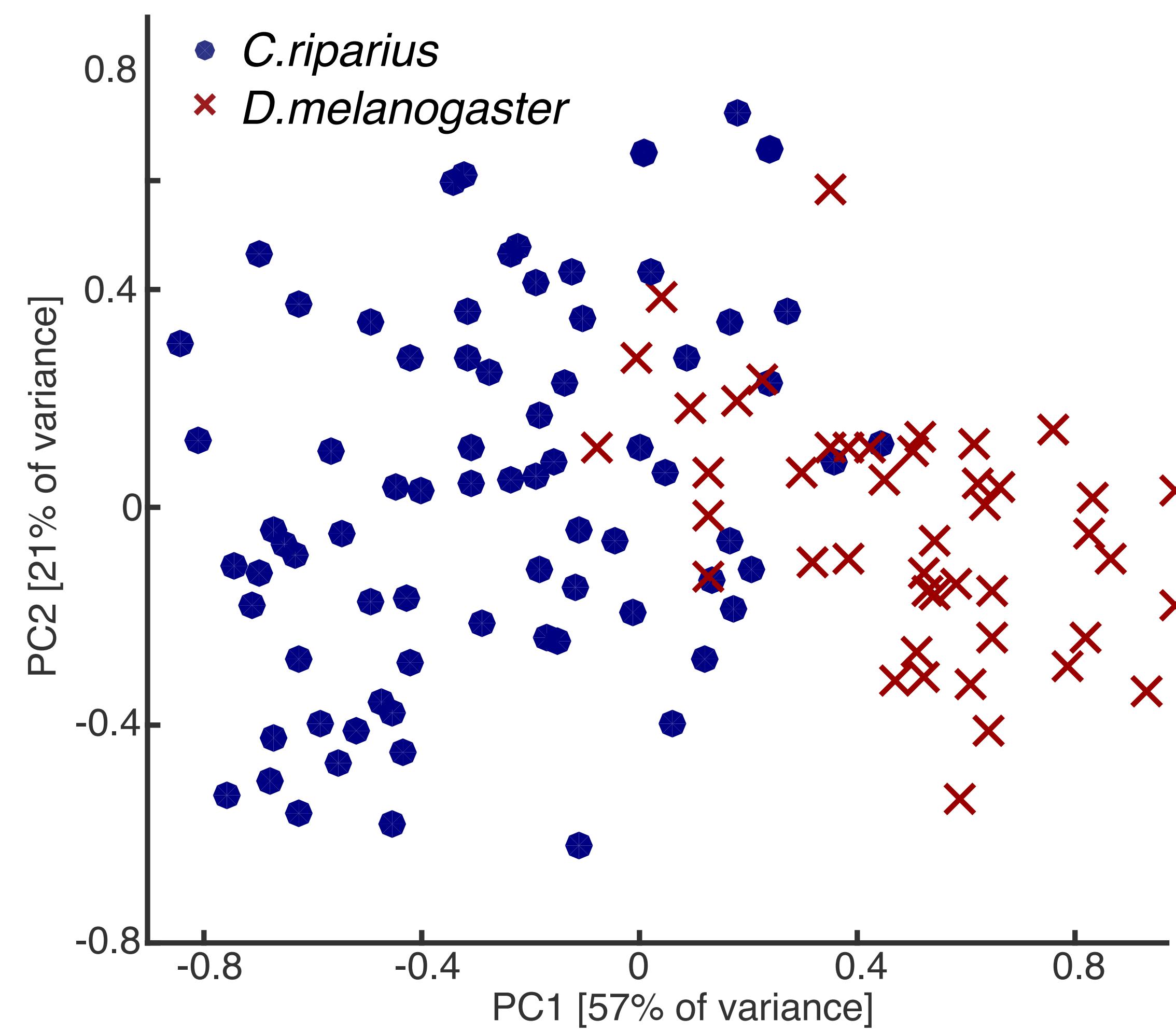
# NOT A TRUE STORY



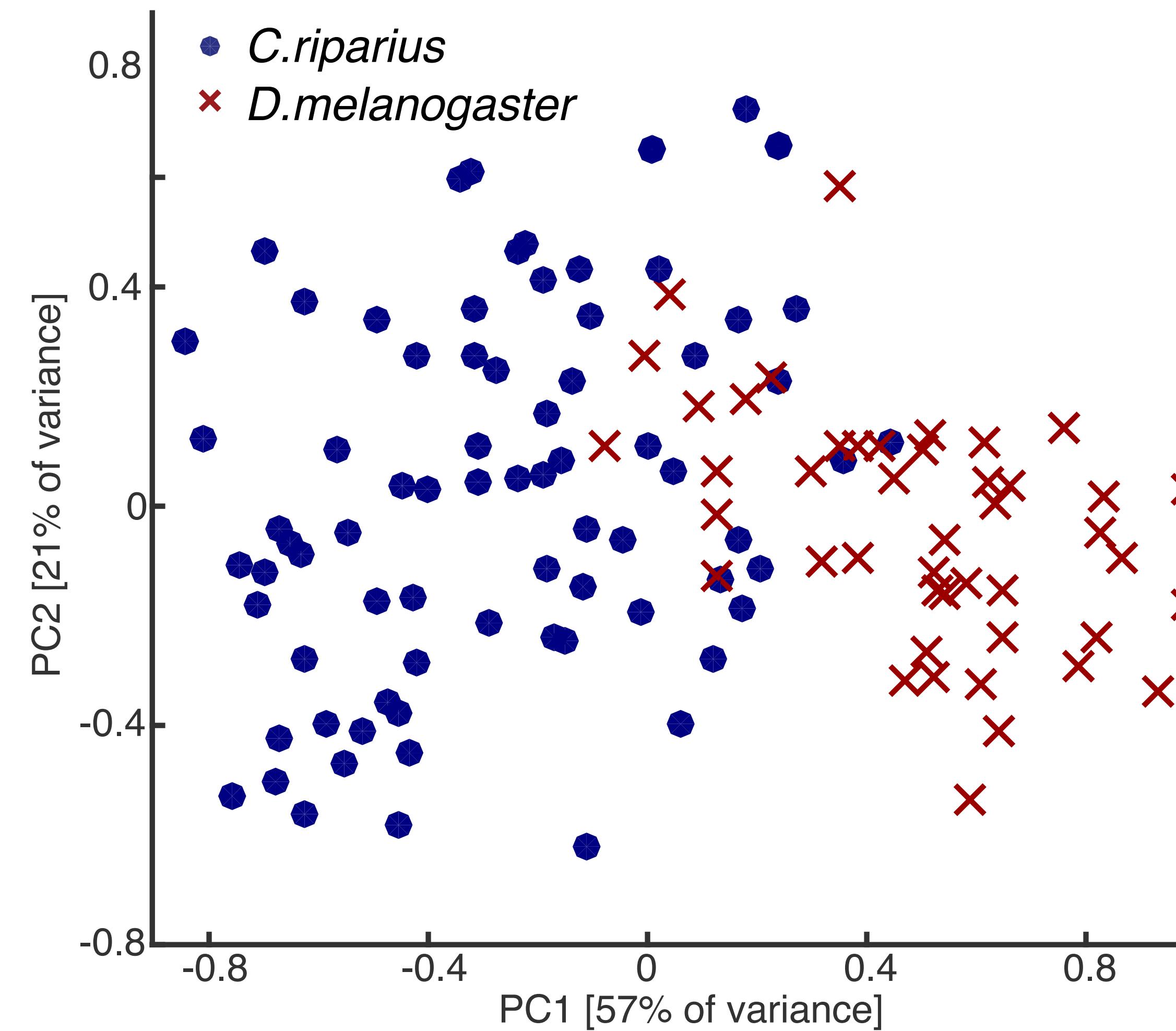
HOW WE SEE

VISUAL PERCEPTION CONCEPTS

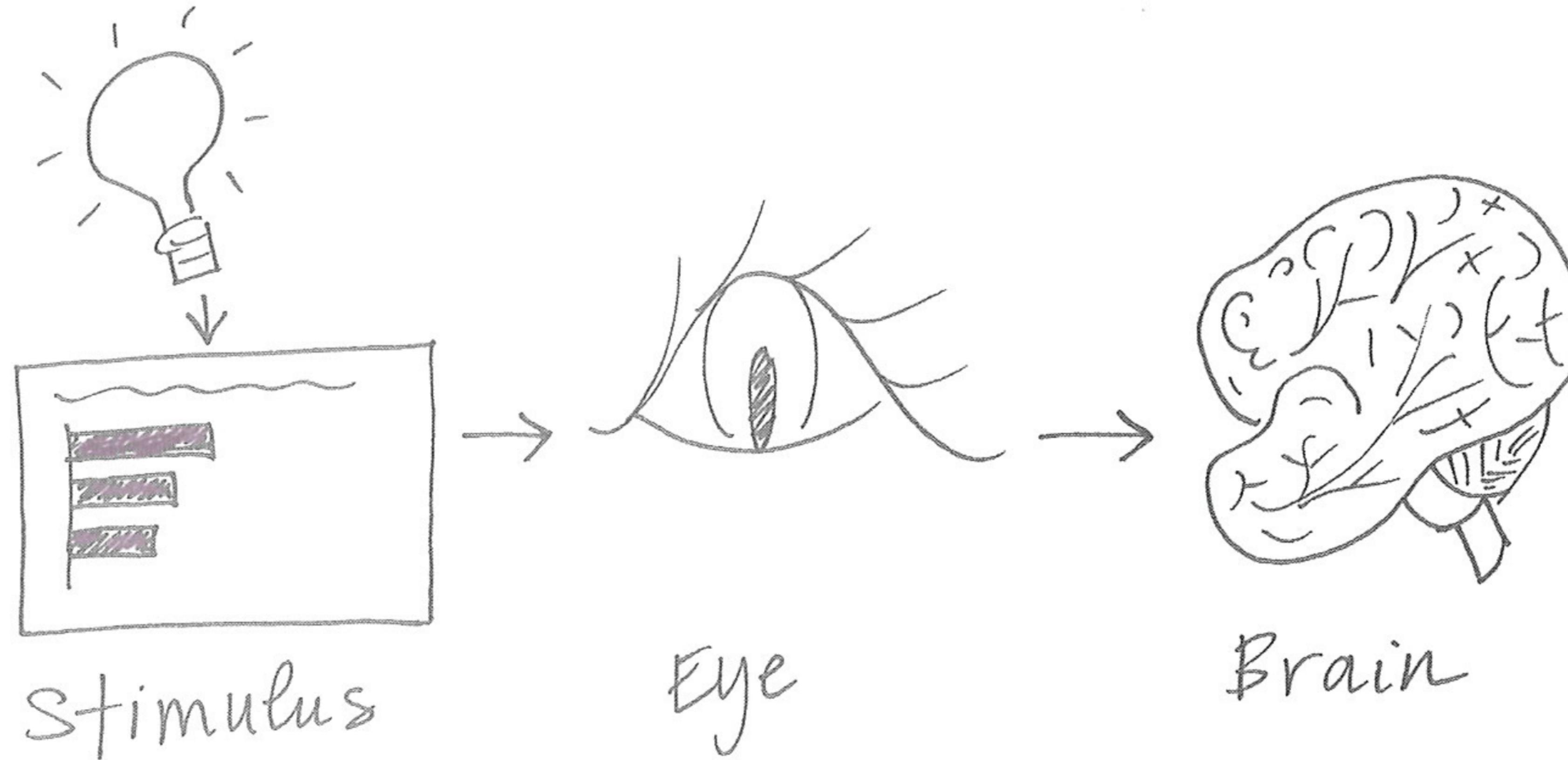
to create more effective graphs.



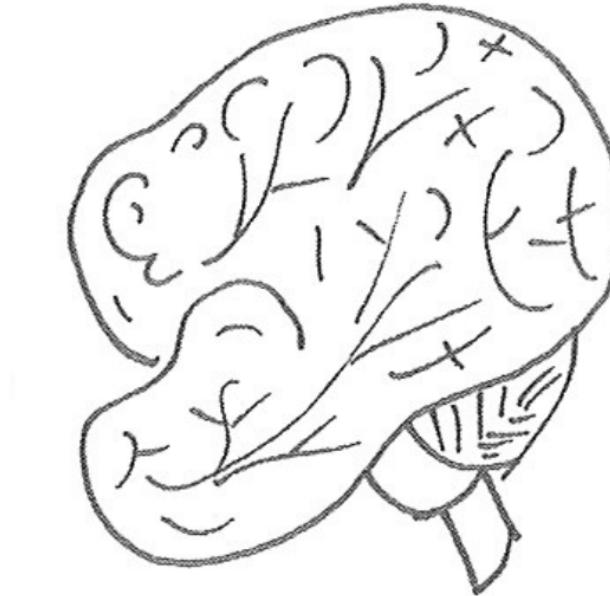
Q2: How Washington made the plot?



# GRASPING 2D INFORMATION



# TYPES OF MEMORY



Iconic memory → Working memory → Long Term memory

**pre-attentive  
processing**

unconscious  
very fast

temporary  
limited storage  
best stored in chunks

stored for later use

**post-attentive  
processing**

conscious  
sequential

**Q: How many 6's are in the plot?**

523689034561345679537421

783562714579014780118793

234789032145672345789124

**Q: How many 6's are in the plot?**

523**6**890345**6**1345**6**79537421

7835**6**2714579014780118793

234789032145**6**72345789124

# ATTRIBUTES TO CREATE CONTRAST

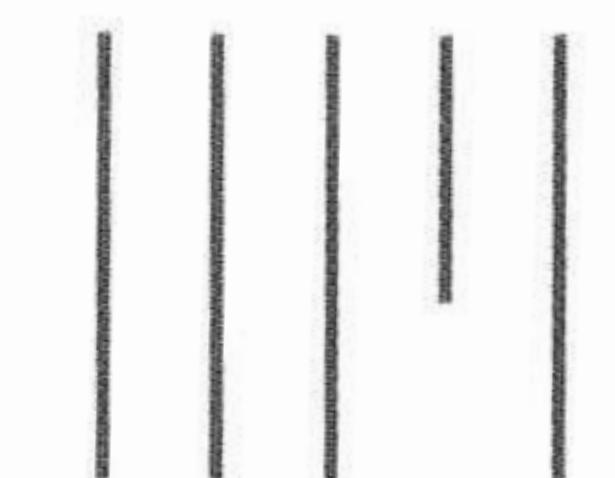
## Form



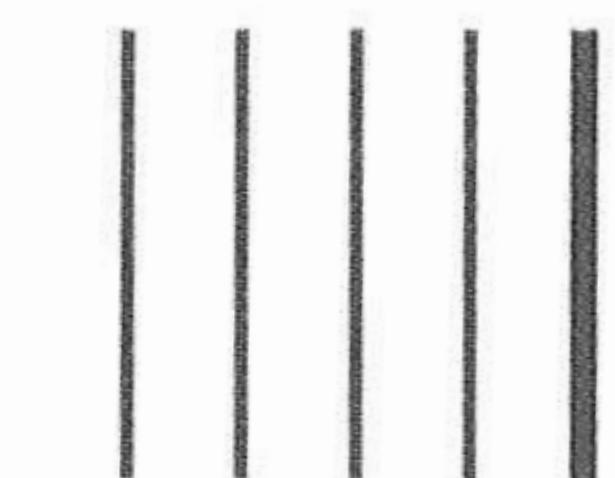
Orientation



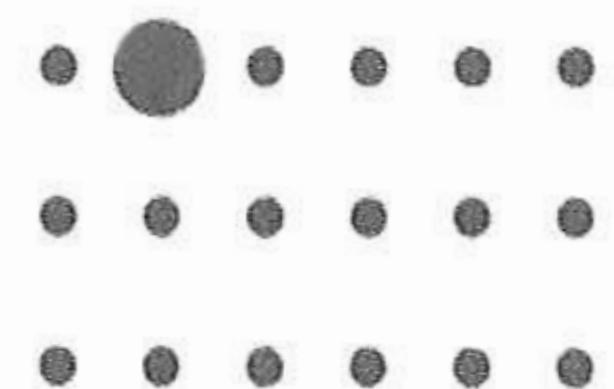
Shape



Line length



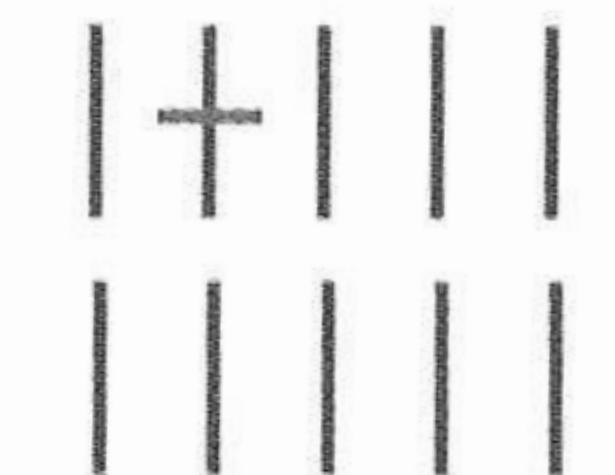
Line width



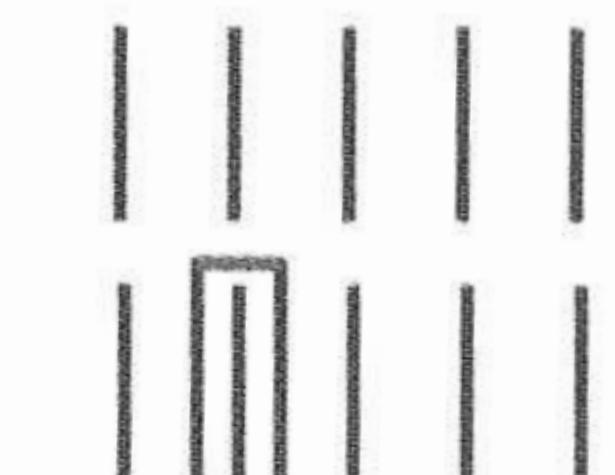
Size



Curvature

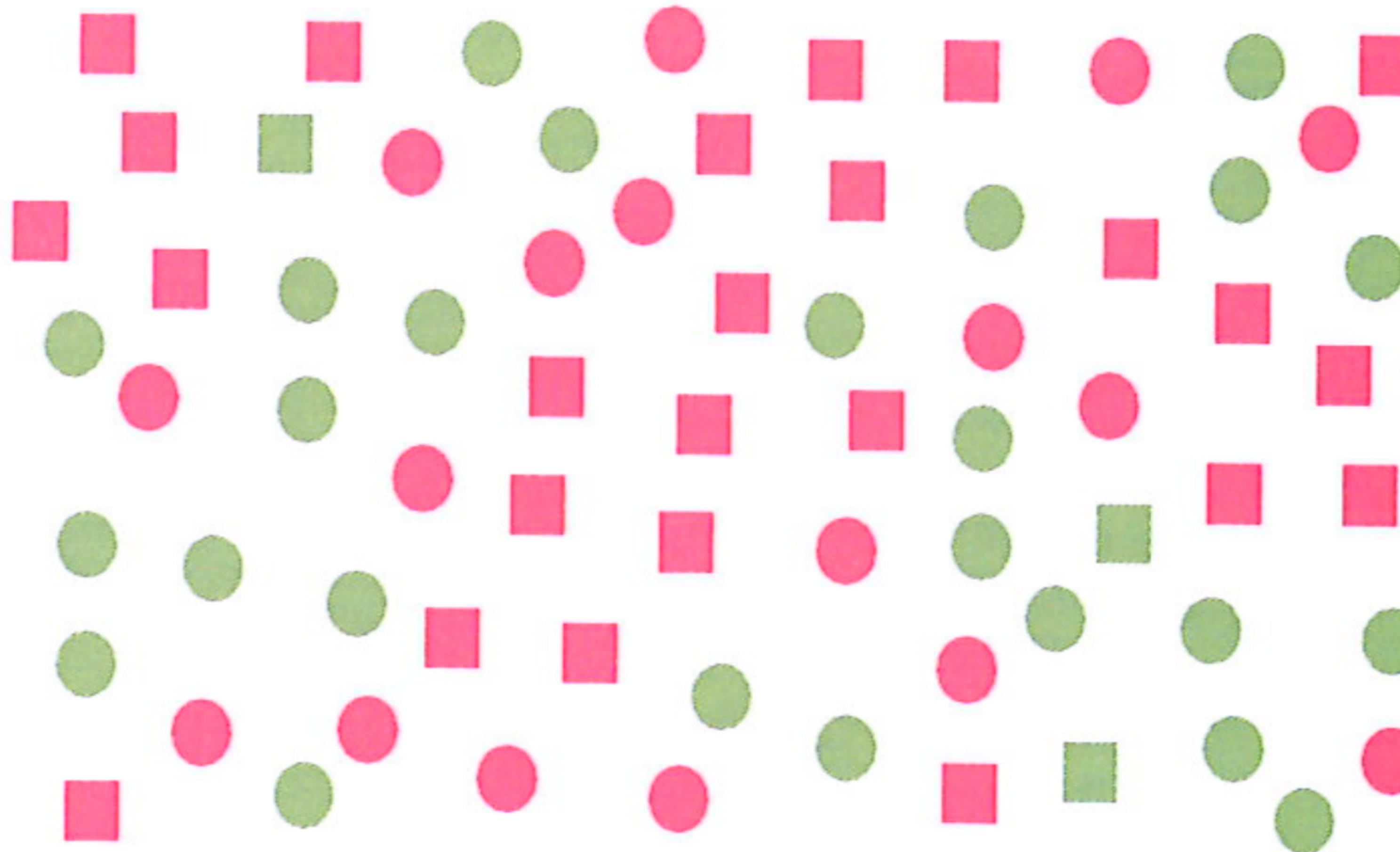


Added marks



Enclosure

Q: How many green squares are in the plot?



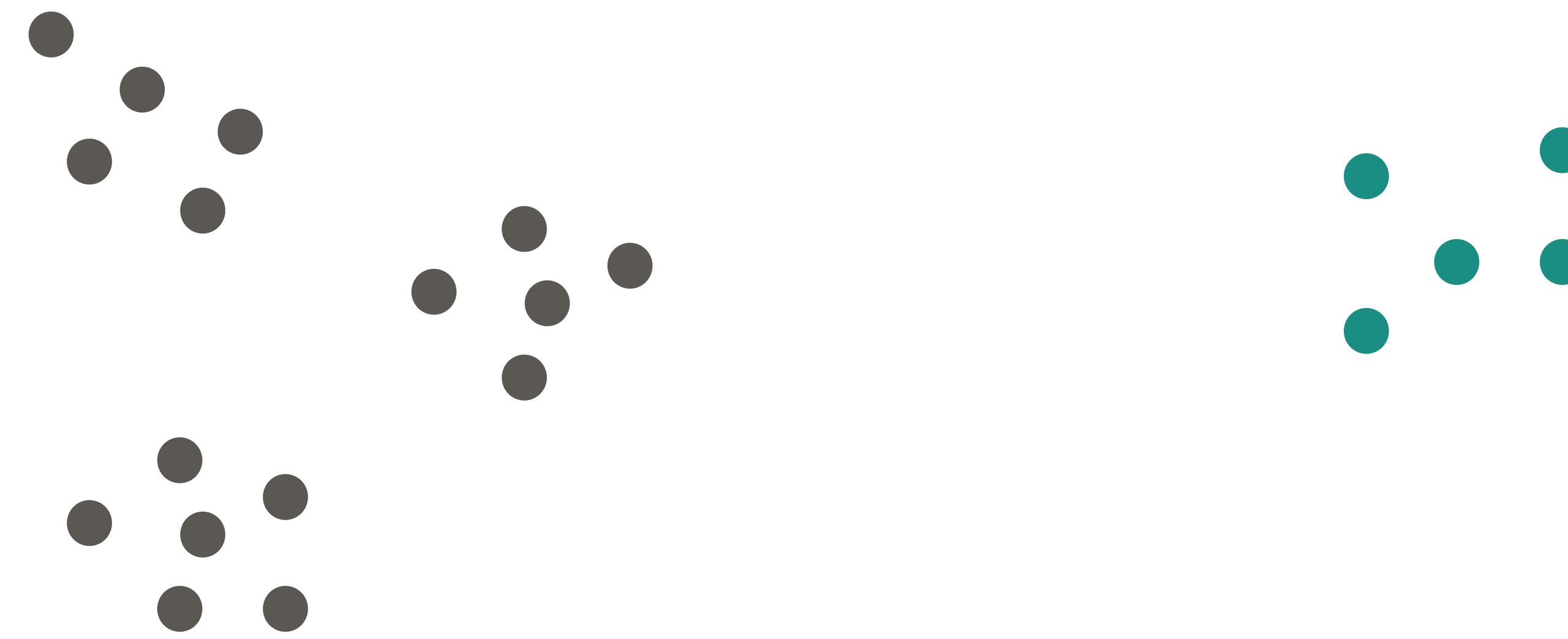
"De lo bueno, poco" [mexican saying]

HOW WE SEE

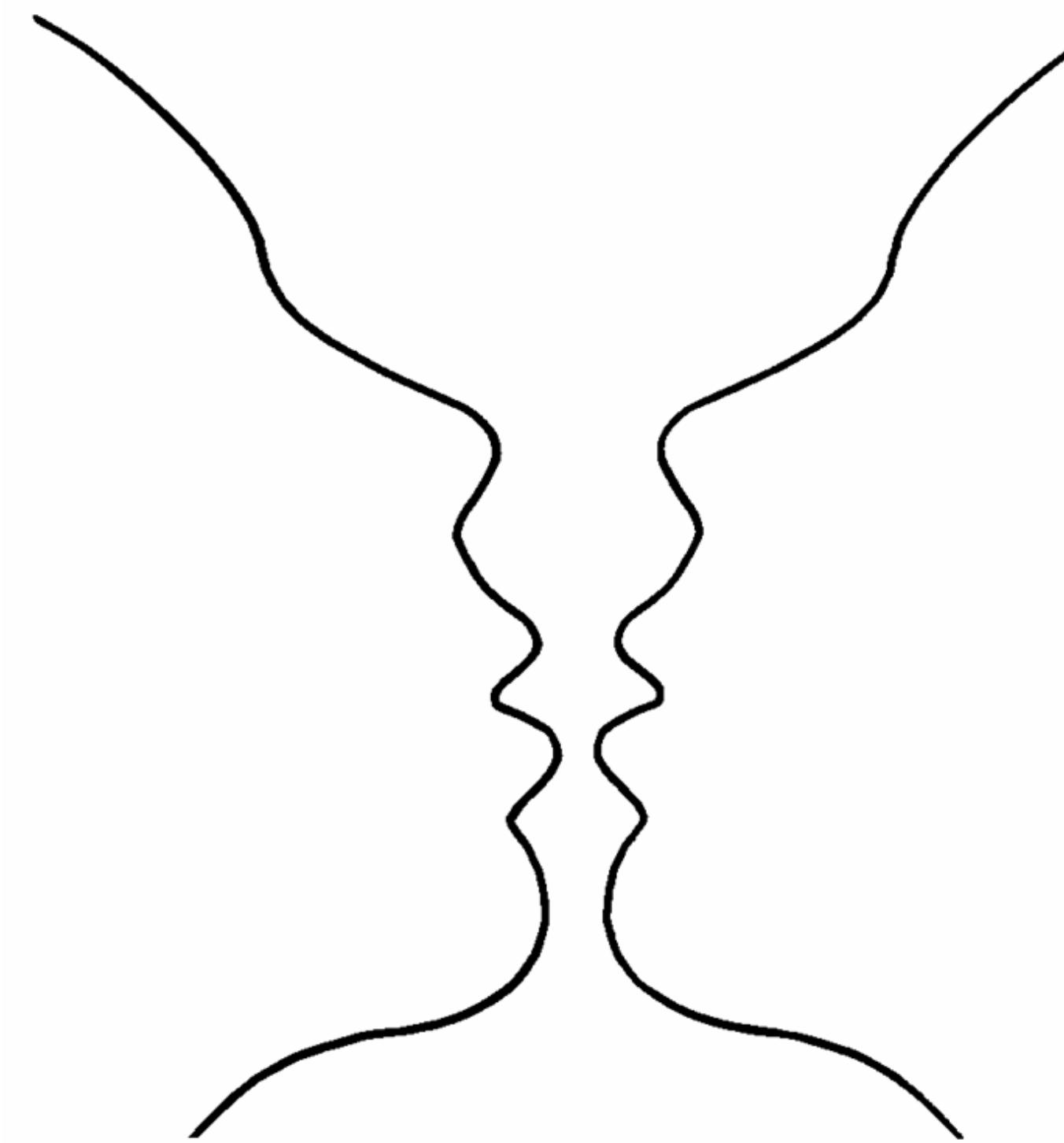
# ORGANIZING VISUAL INFORMATION

the gestalt principles of perception

# 20 DOTS



# OUR BRAIN SEEKS & LOVES PATTERNS



# GESTALT PRINCIPLES: ORDERING THE WORLD

[ger]:= shape, form, structure

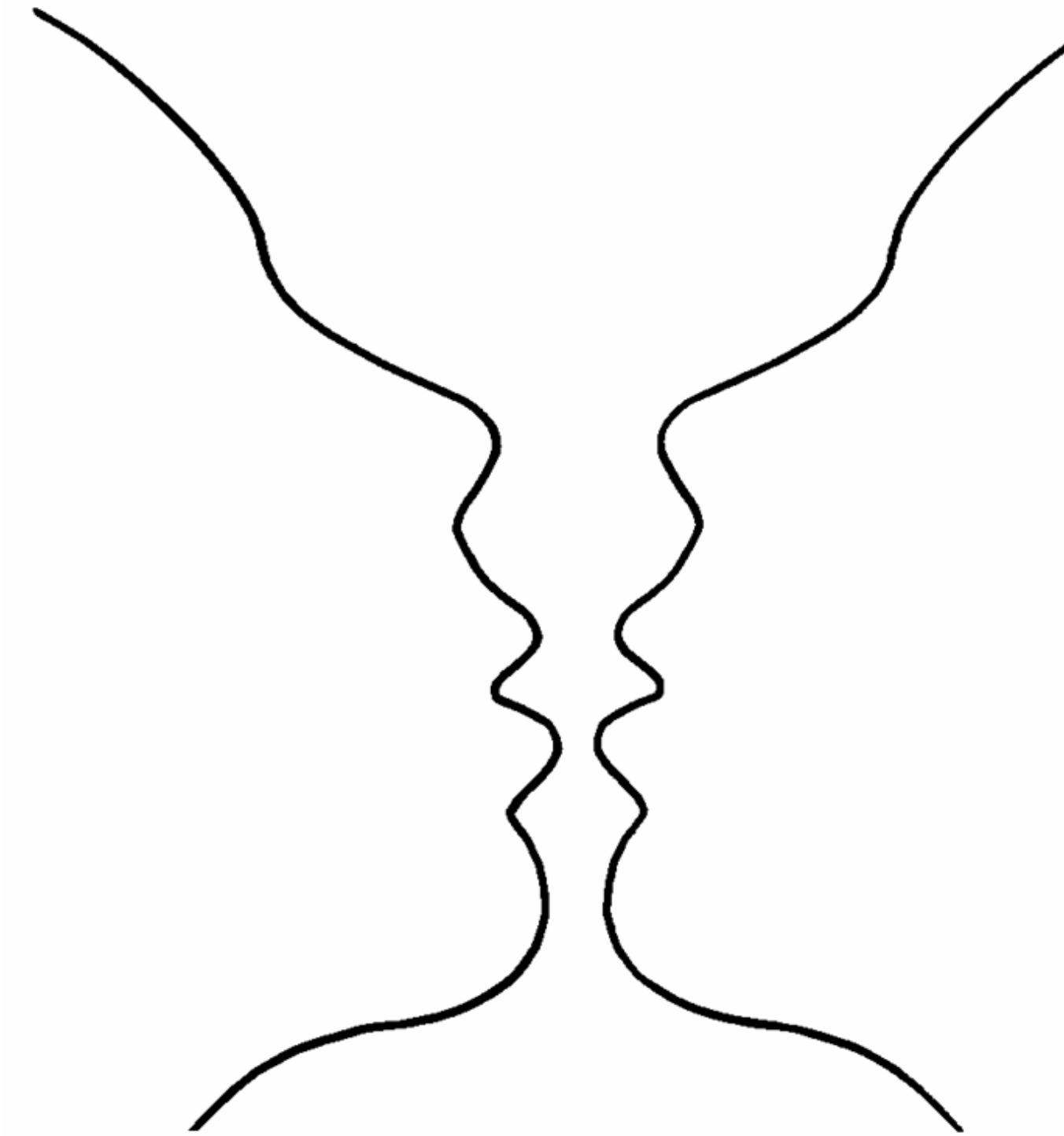


Figure & Ground

# GESTALT PRINCIPLES FOR DATA VIS



Proximity



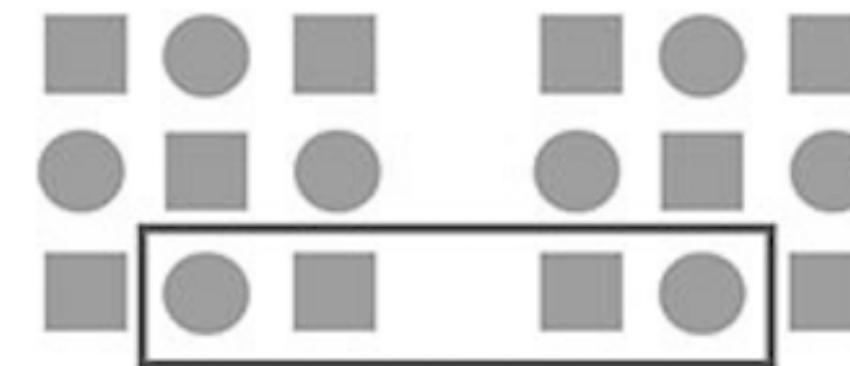
Continuity



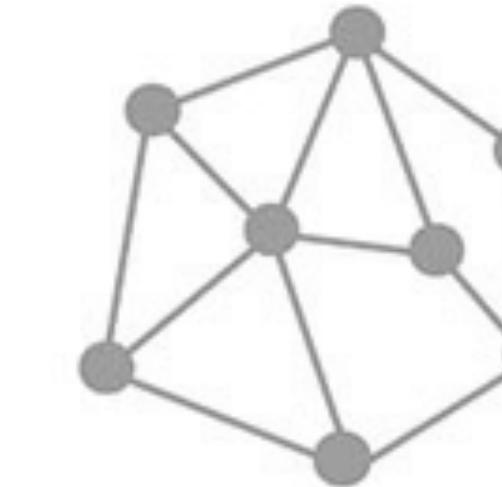
Similarity



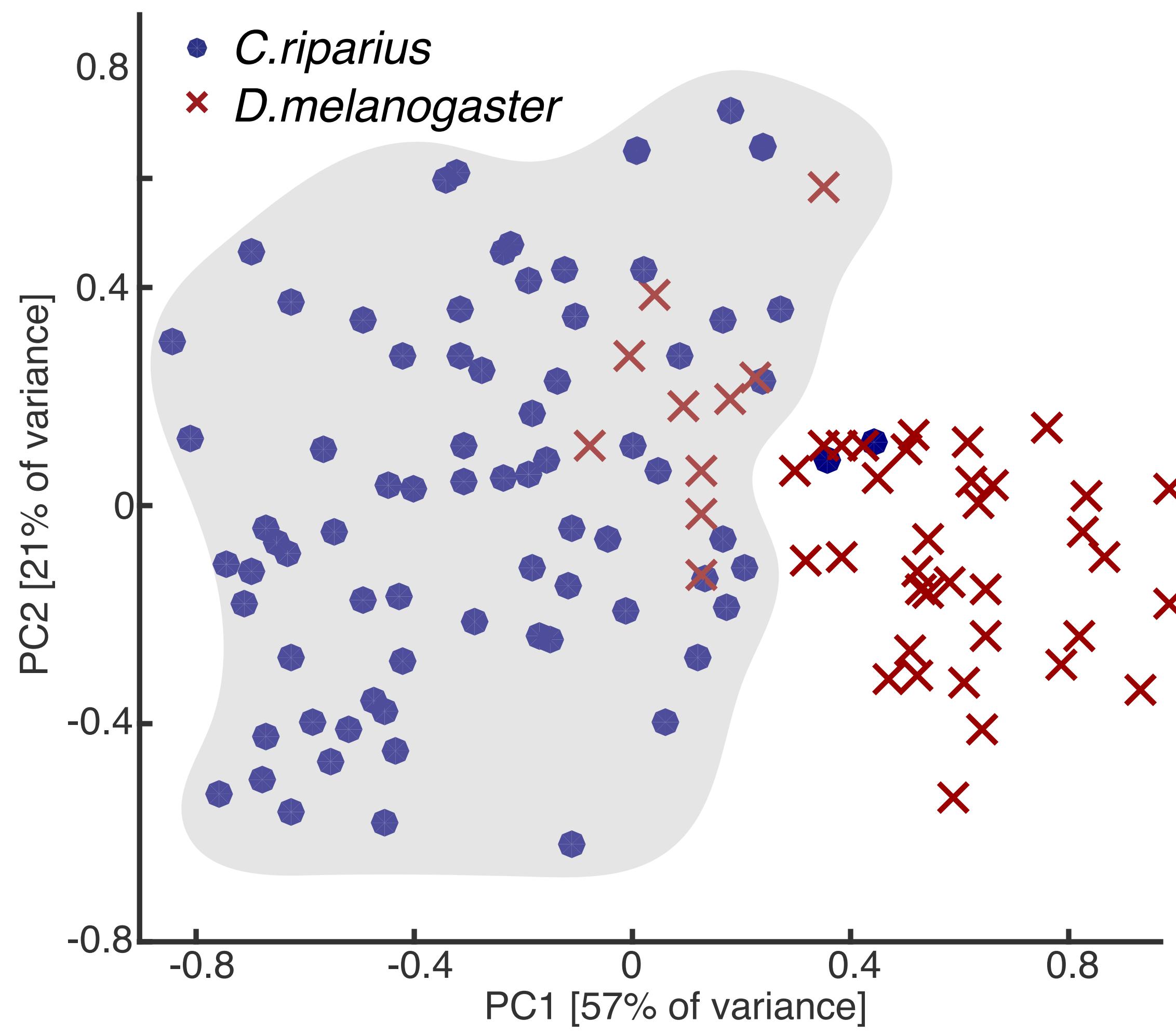
Closure

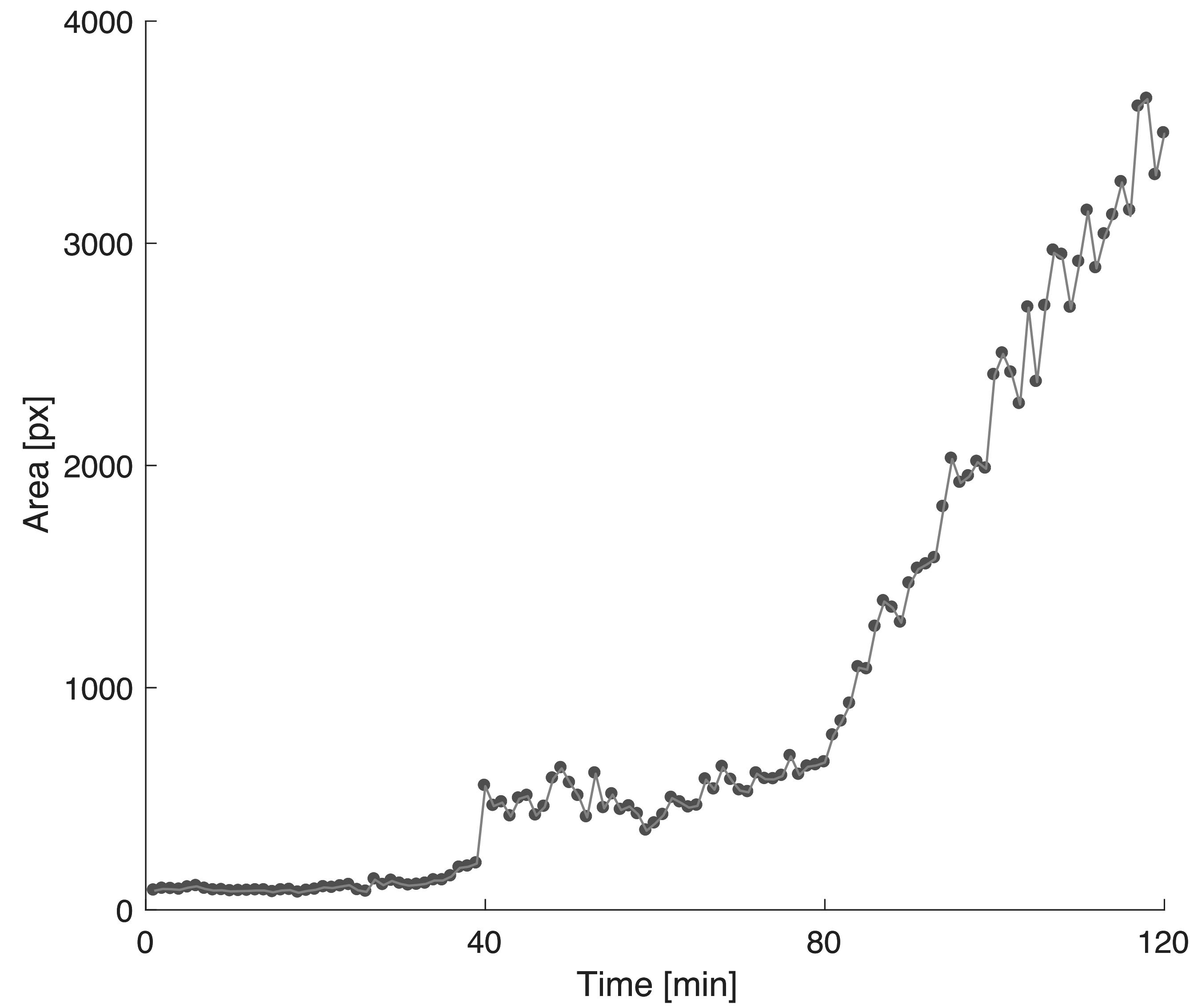


Enclosure



Connectedness





# CHUNKS TO REMEMBER SO FAR

Pre-attentive attributes create **contrast** & draw attention



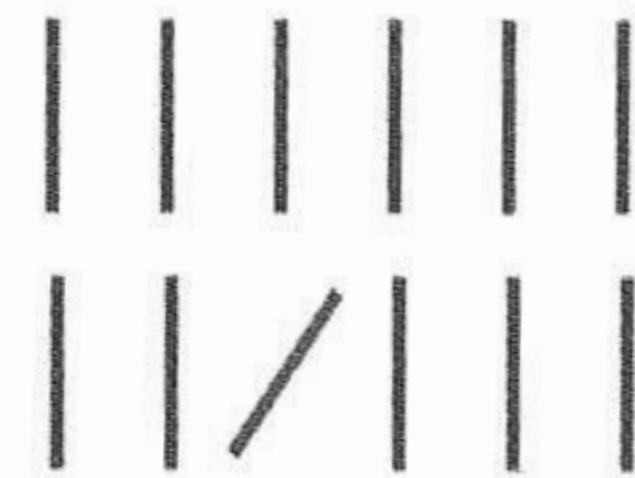
Gestalt principles help us  
group information & structure content



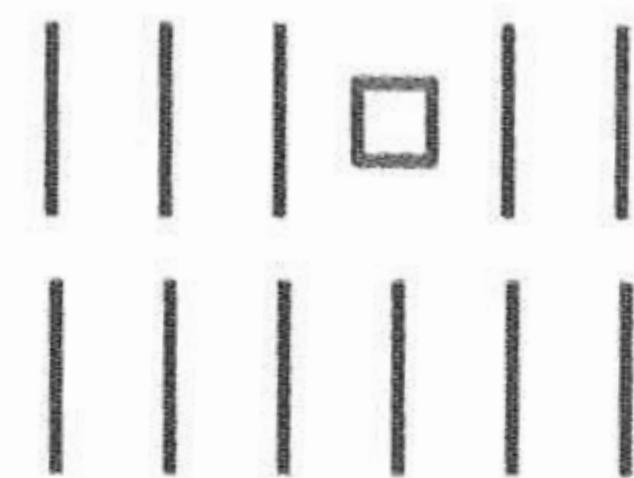
# HOW WE SEE

ENCODING INFORMATION  
into visual attributes

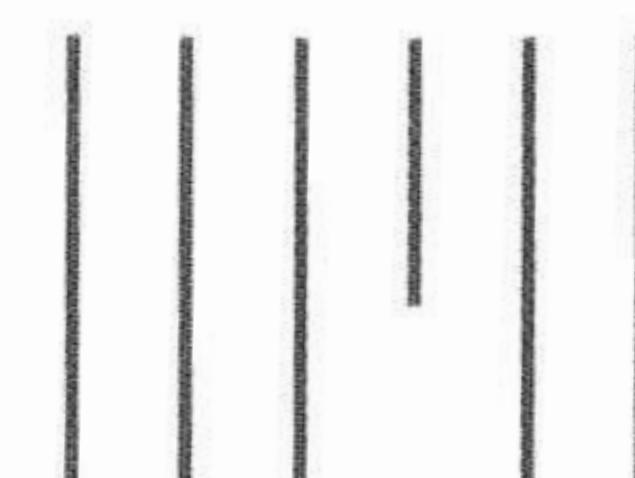
# ATTRIBUTES TO ENCODE INFORMATION



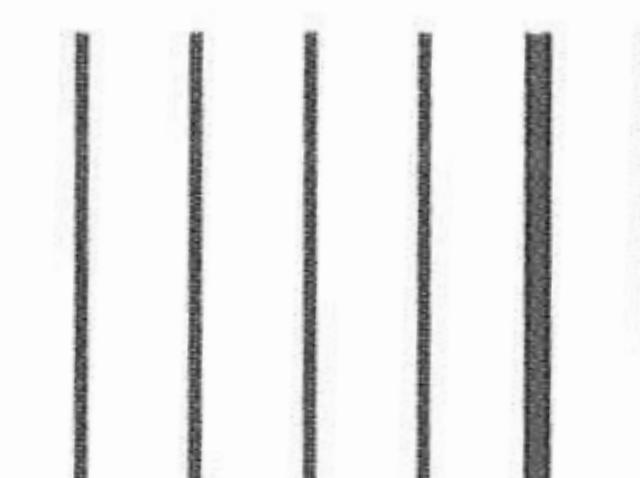
Orientation



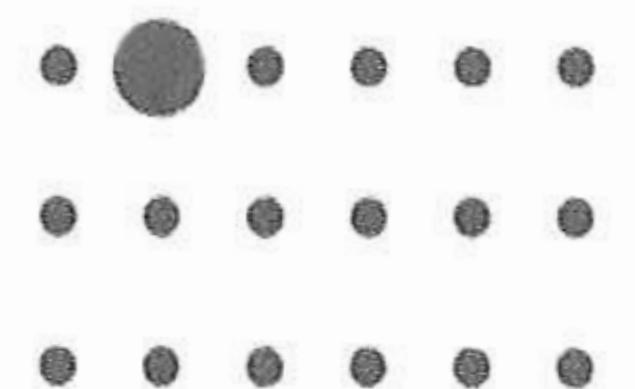
Shape



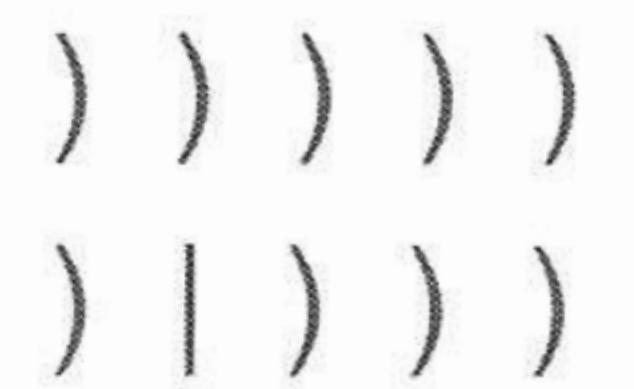
Line length



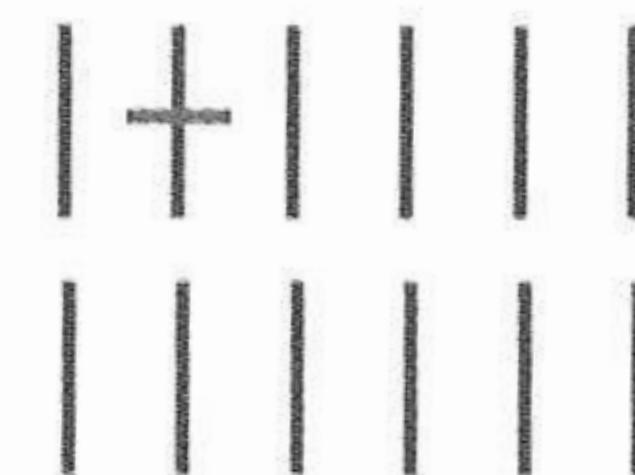
Line width



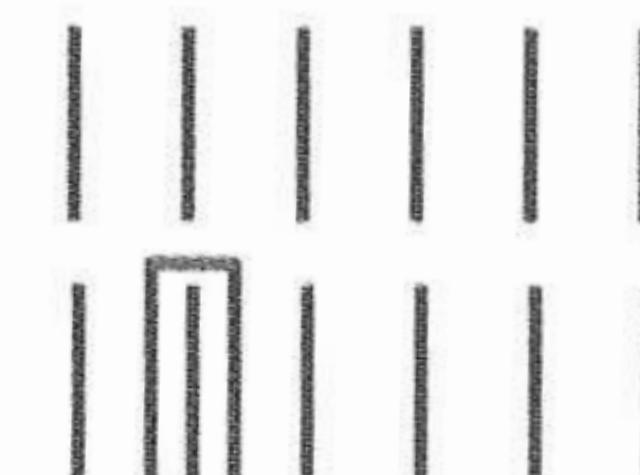
Size



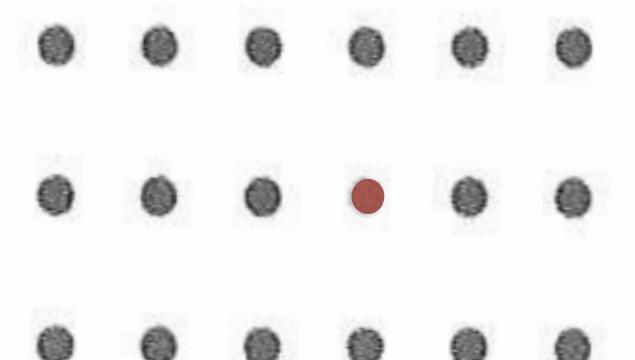
Curvature



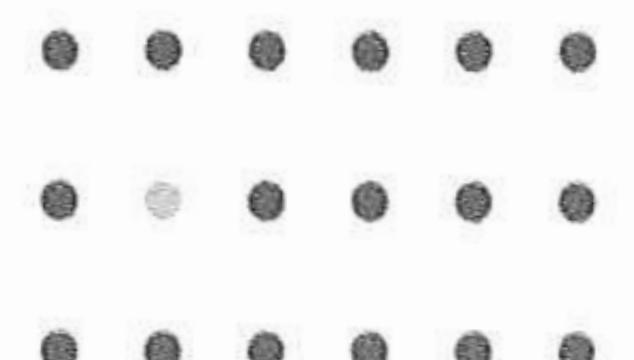
Added marks



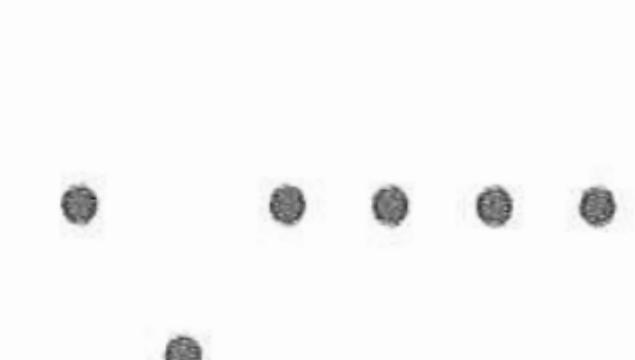
Enclosure



Hue



Intensity

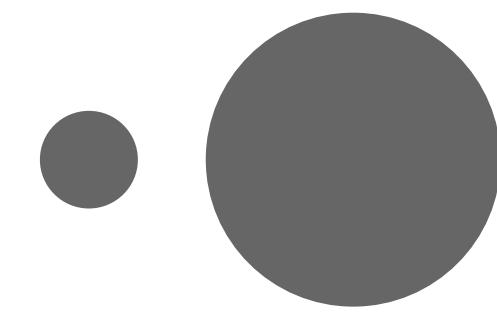


Spatial position

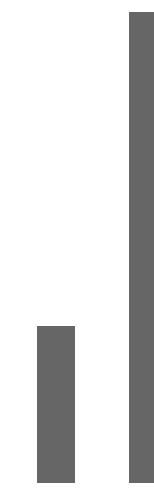


Motion

Q: If left = 1, then right is...?



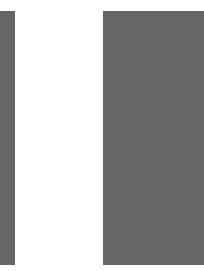
Size



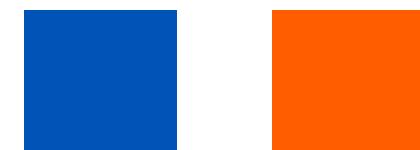
Length



Shape



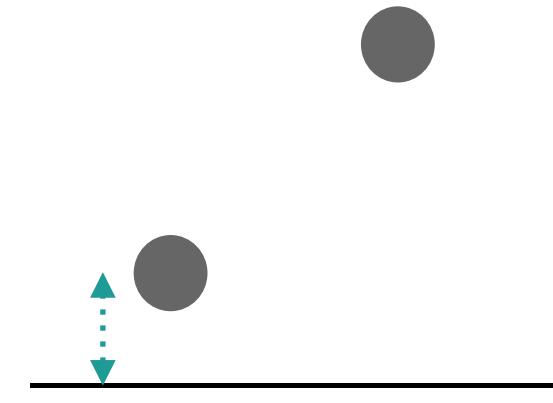
Width



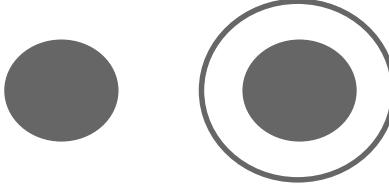
Color (hue)



Color (intensity)



2D position



Enclosure

HOW WE SEE

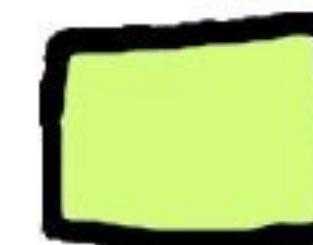
HOW WE SHOW

COLOR

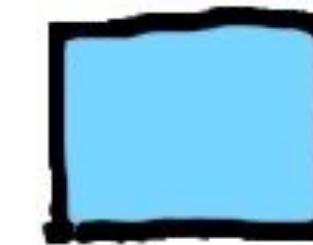


# UNIVERSAL COLOUR KEY FOR SCIENTIFIC GRAPHS

ERRANTSCIENCE.COM



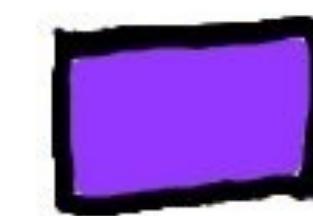
DATA I LIKE



DATA ON FREEZING EXPERIMENTS



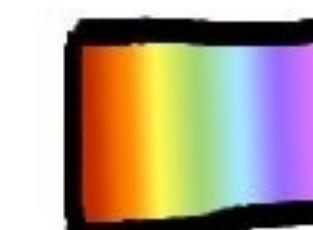
EVIL DATA THAT DISAGREES WITH ME



THIS IS DATA I'M UNSURE ABOUT BUT  
WANT TO MAKE LOOK PRETTY



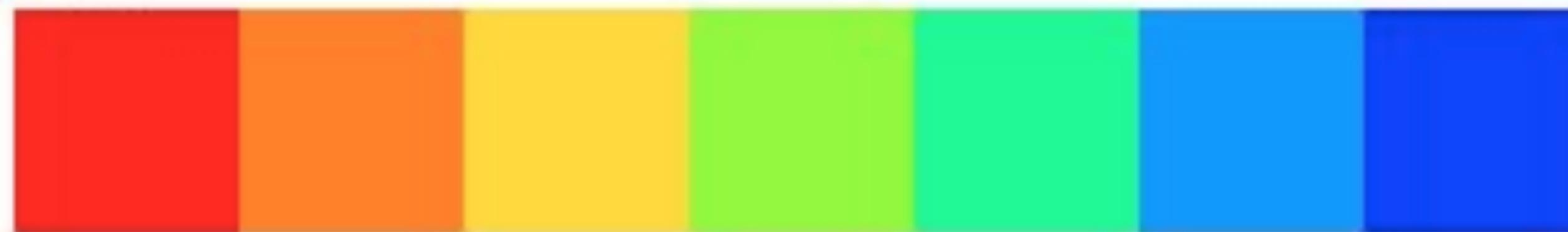
DATA I WANT TO MAKE UNREADABLE  
ON A WHITE BACKGROUND



UNICORN RELATED DATA

# THE ELEMENTS OF COLOR

## Hue



## Saturation



## Brightness



“  
*The use of color should  
always be an intentional  
decision.*

—Nicole Nussbauer

”

# FUNCTIONS OF USING COLOR

Color as categorical encoding



Color as quantitative encoding



(Color as a mean to set the mood of a visualization)



category 1

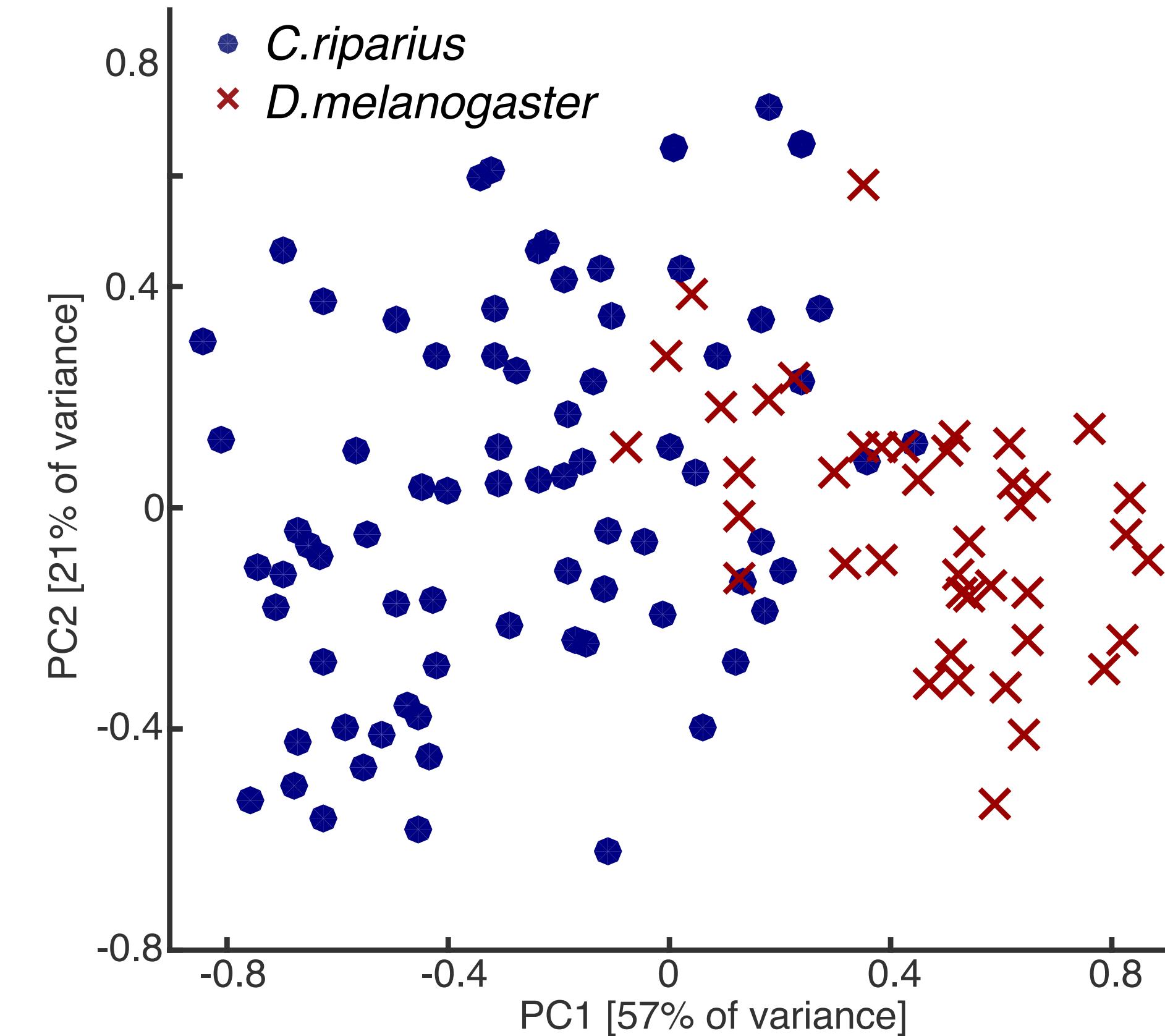
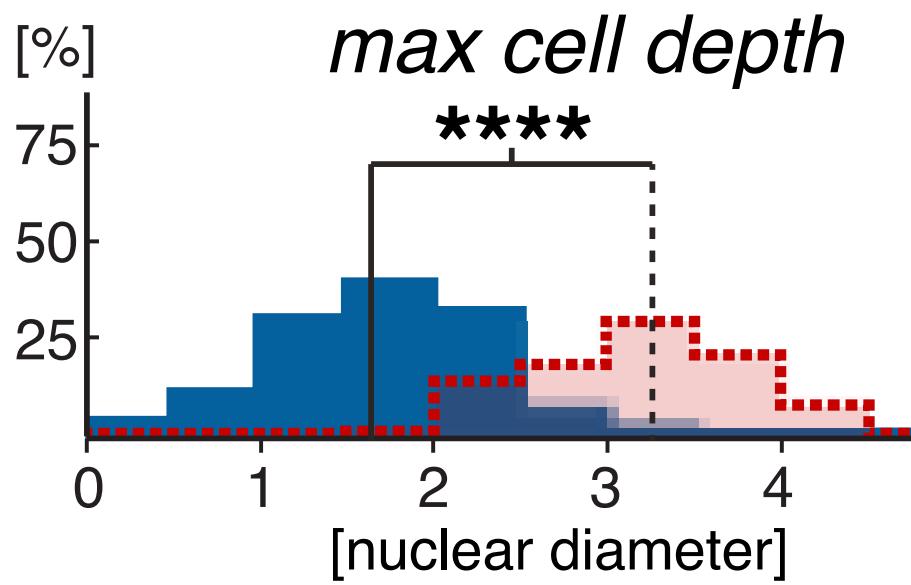
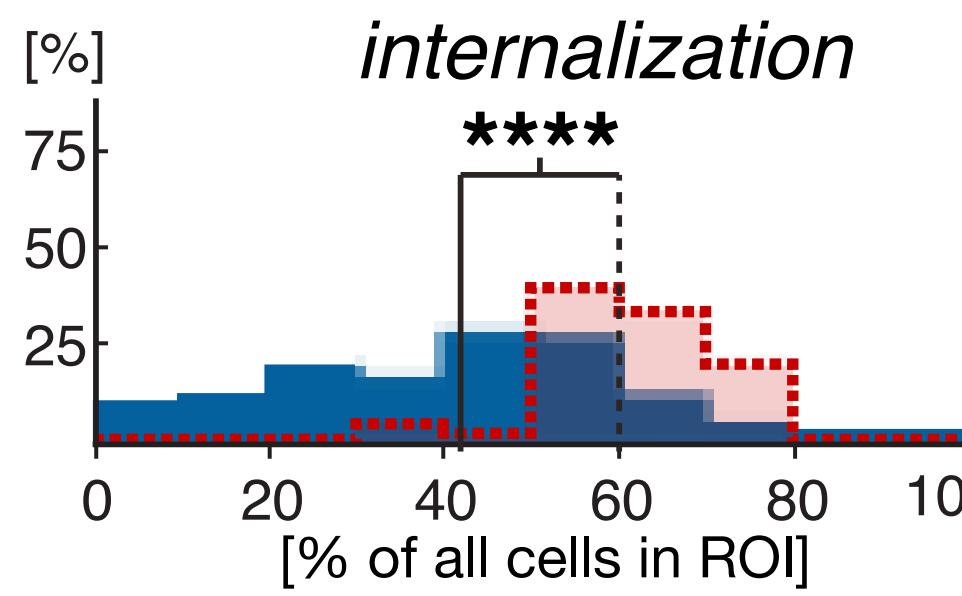
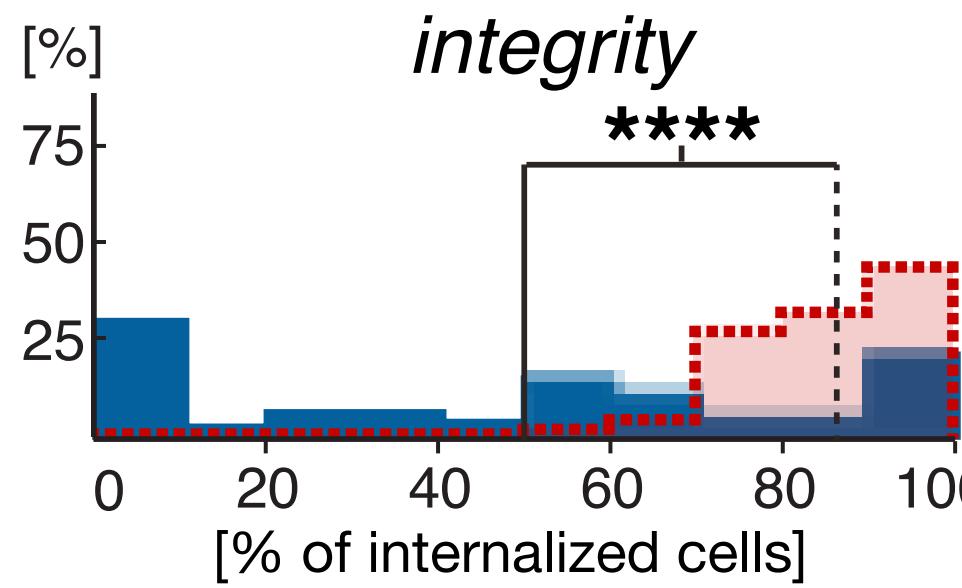


category 2

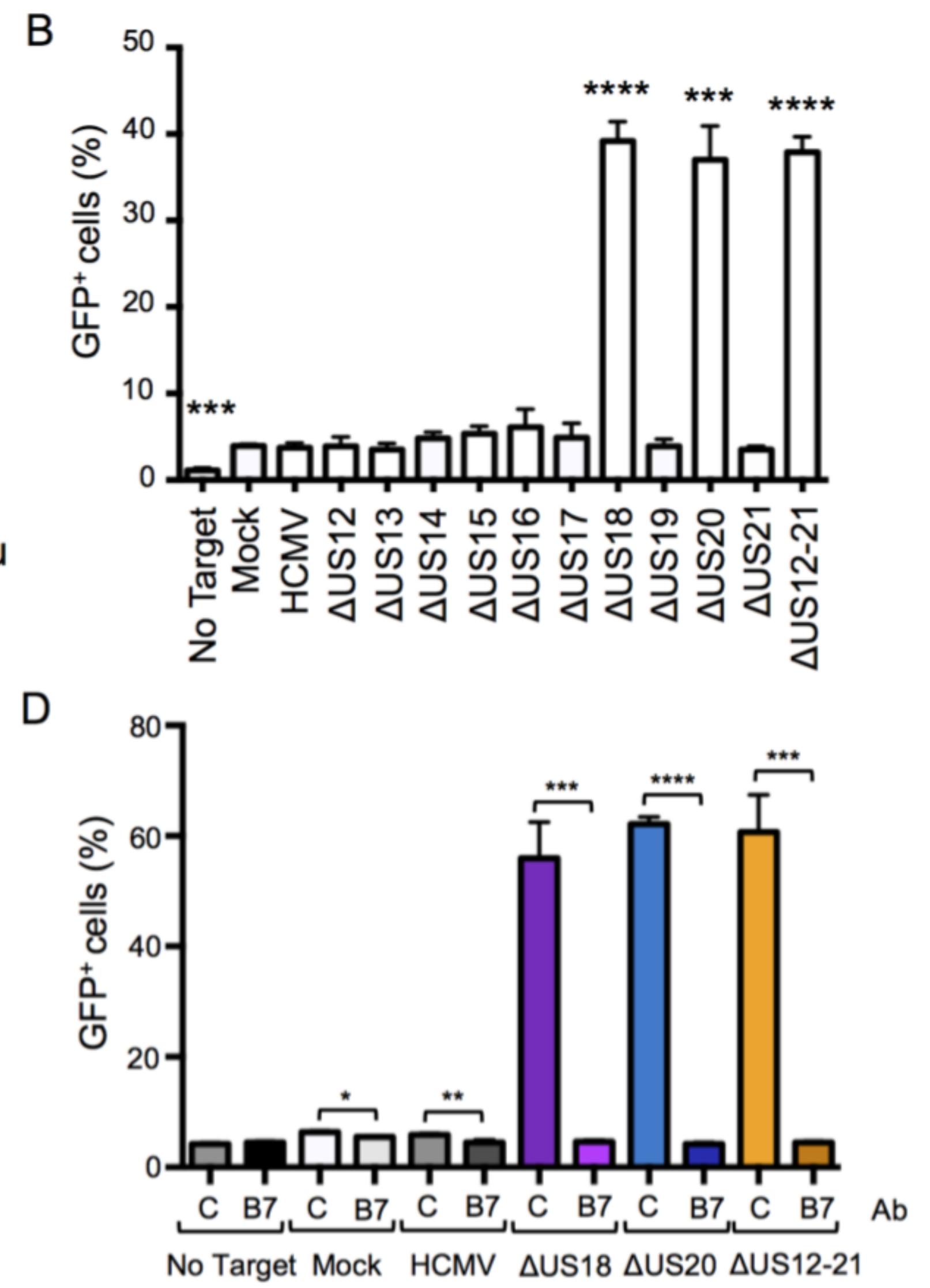
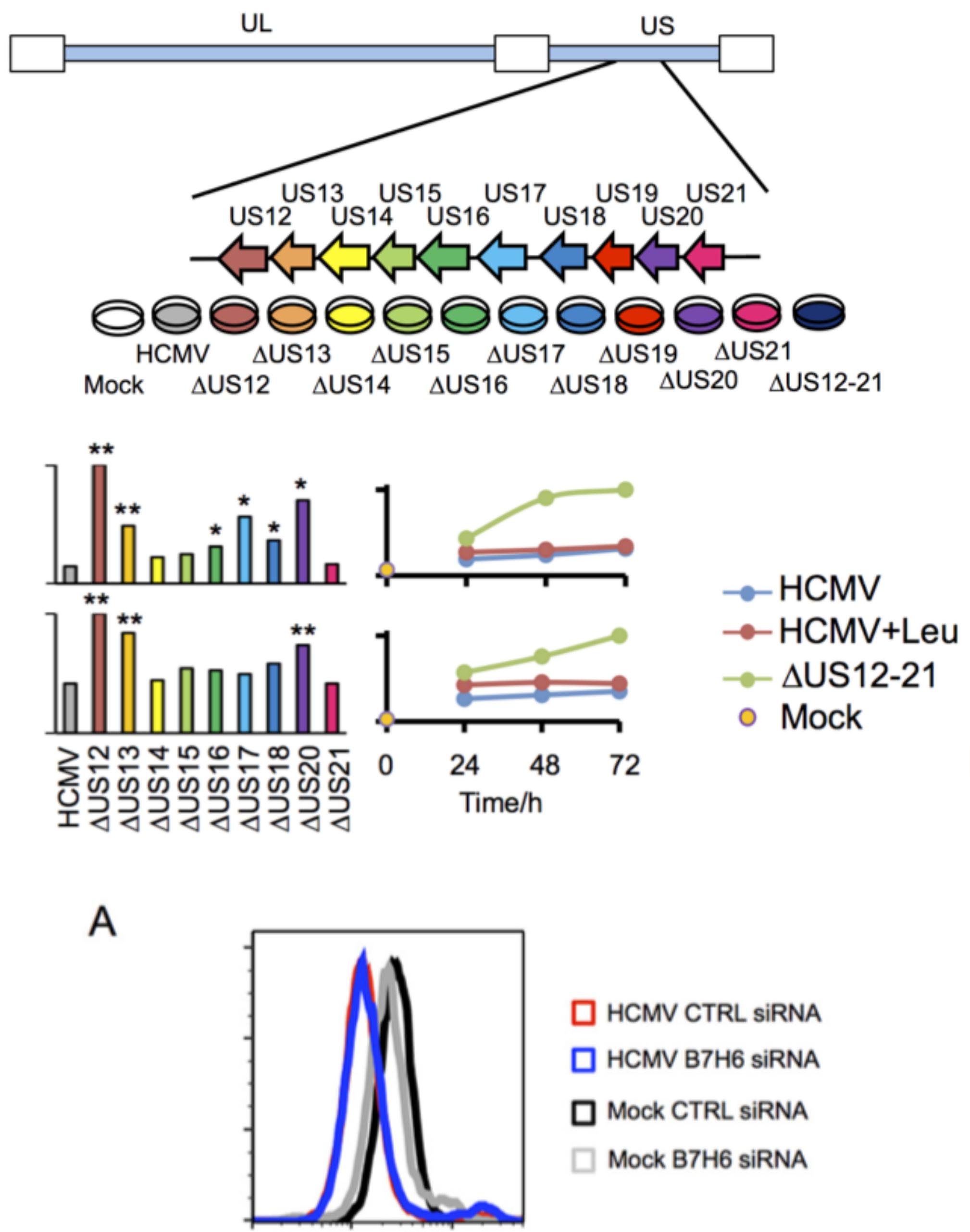


category 2

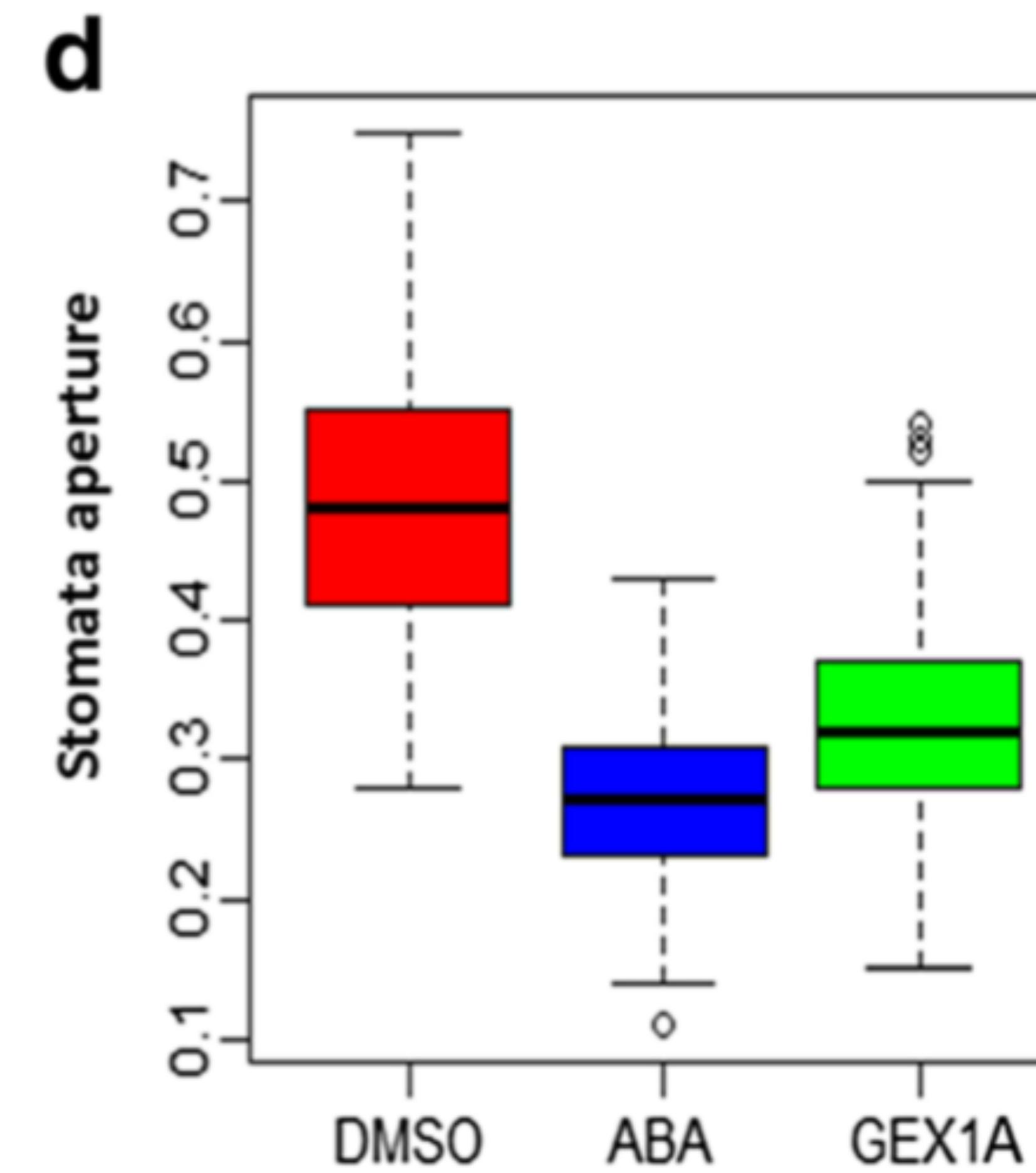
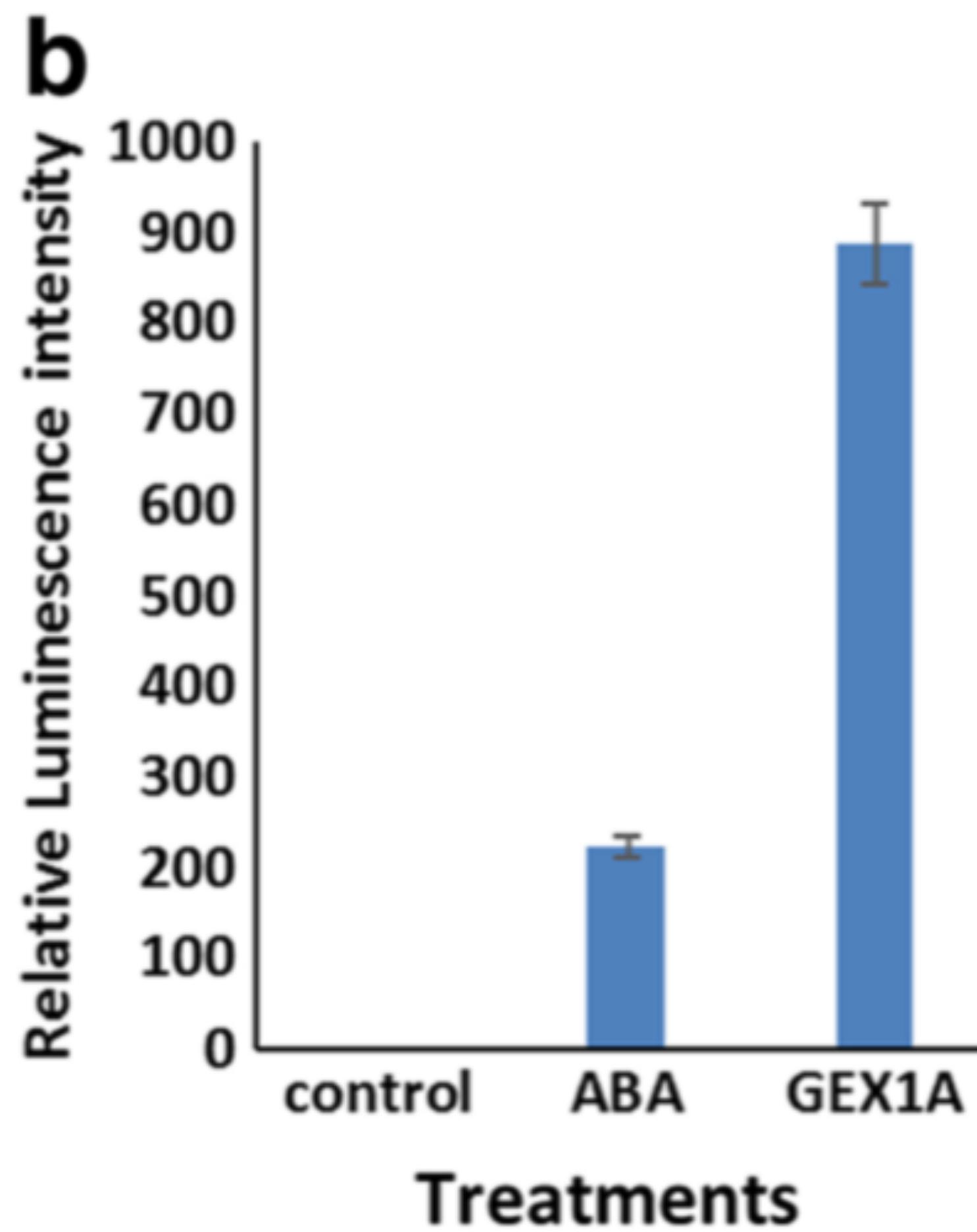
# COLOR TO MARK CATEGORICAL DATA



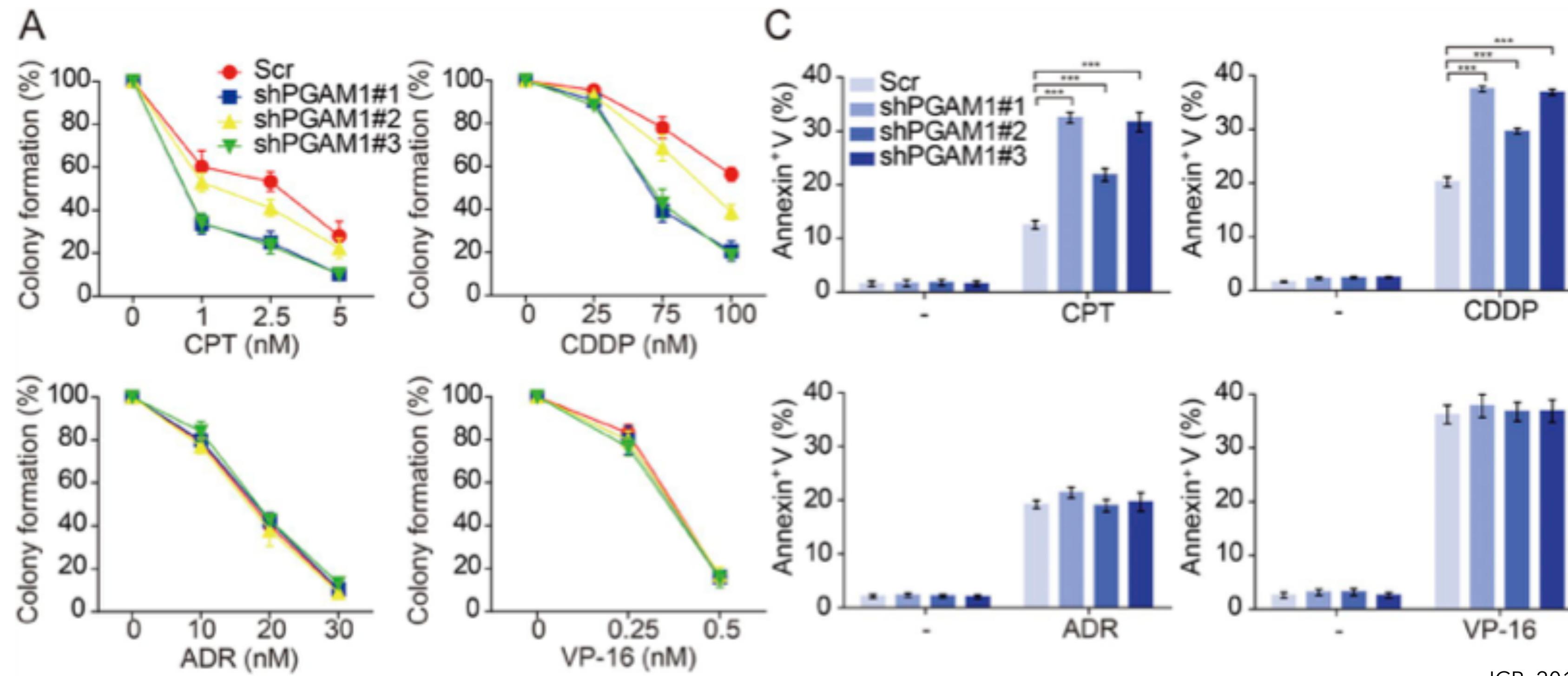
# DON'T O



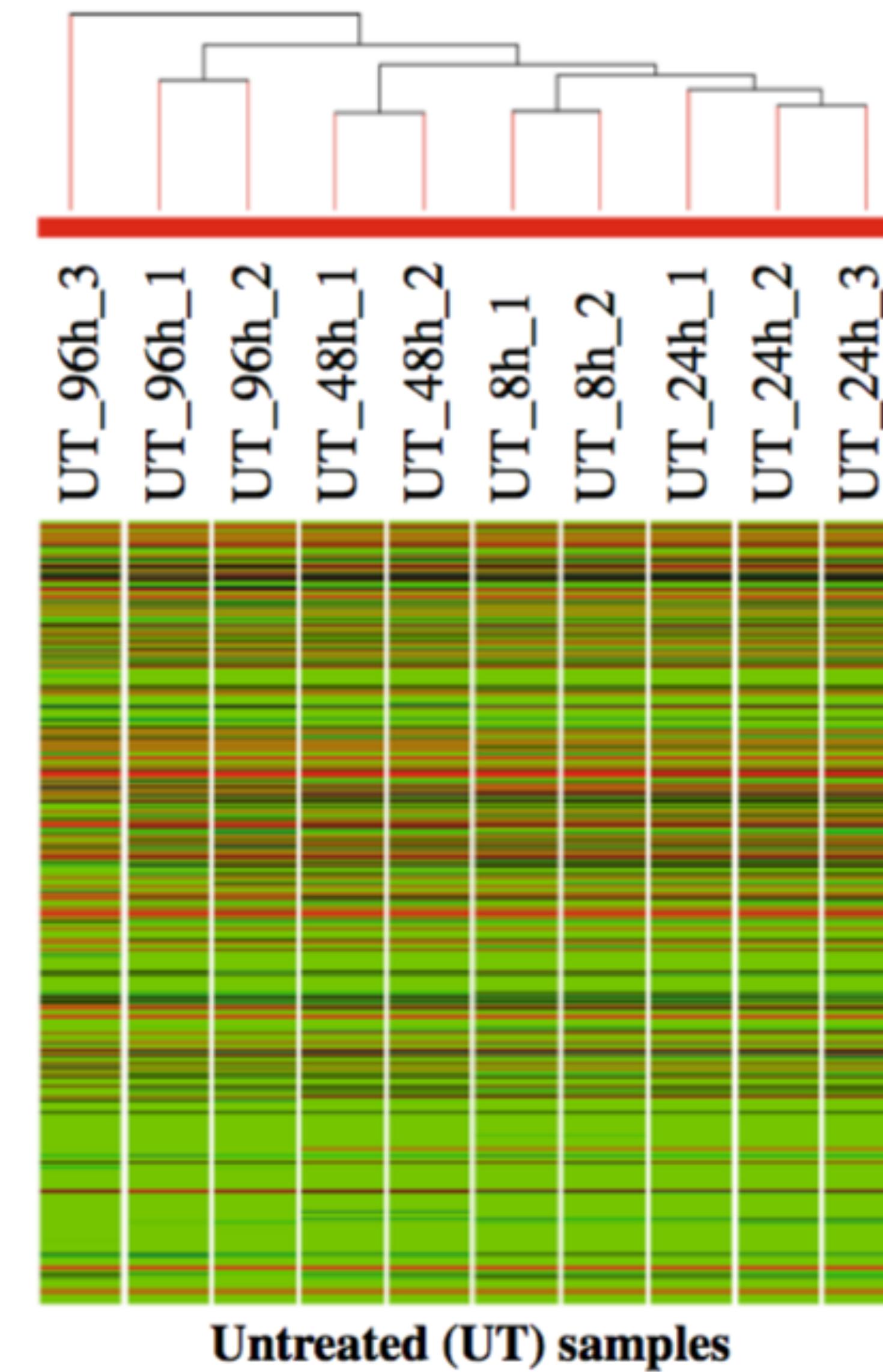
BE CONSISTENT



# BE CONSISTENT



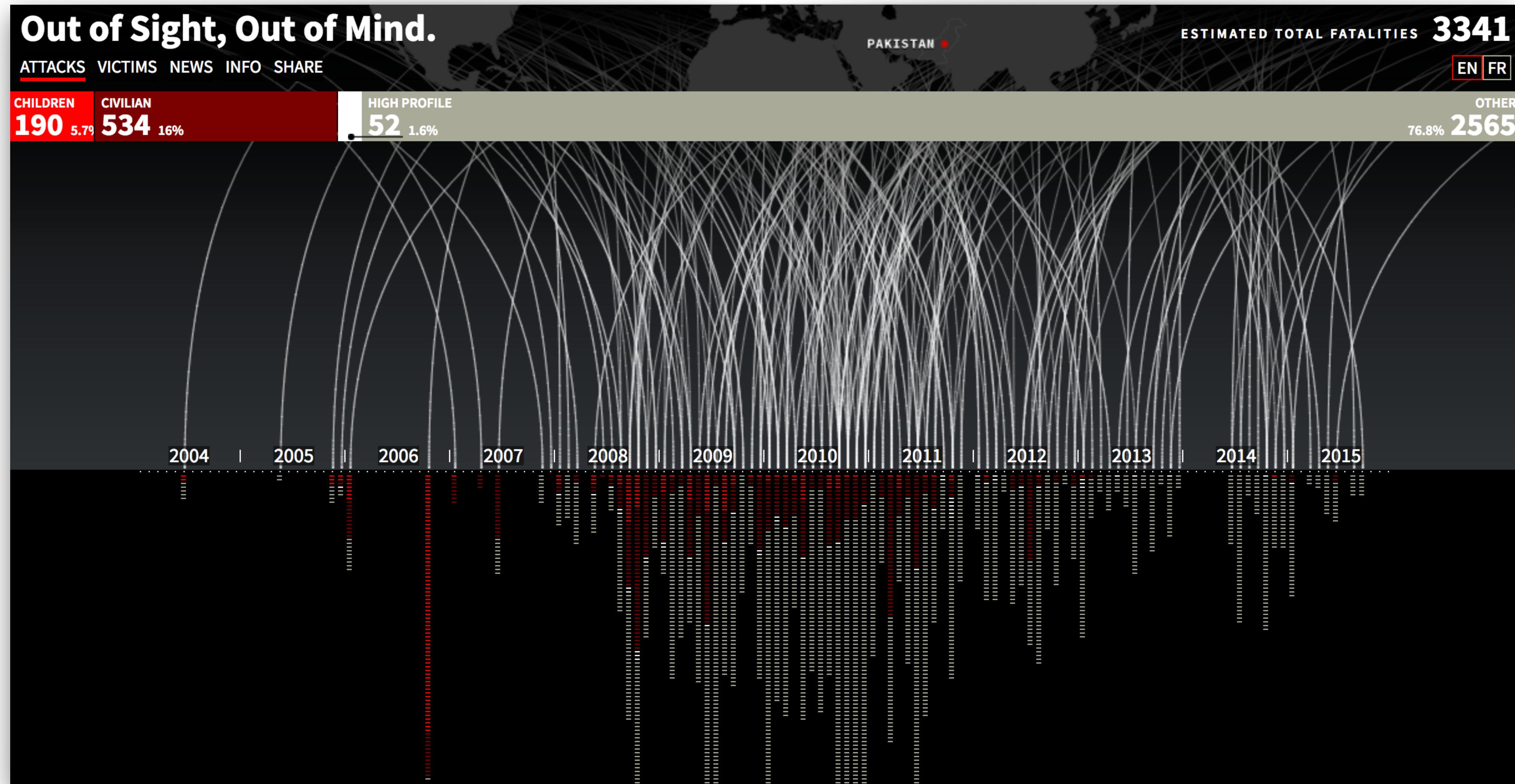
# KEEP MINORITIES IN MIND



# COLOR SETS A MOOD



# COLOR SETS A MOOD

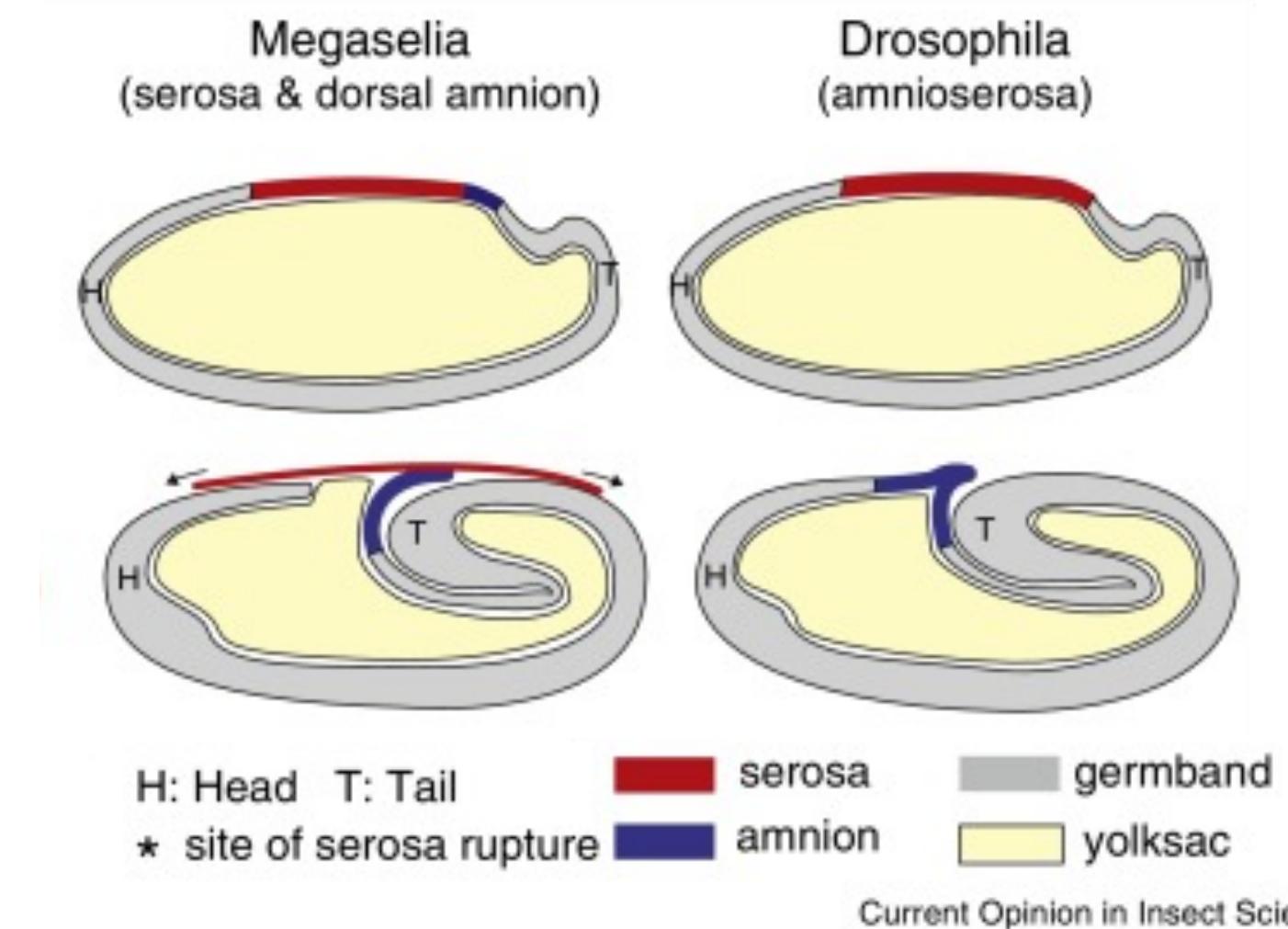


# COLOR SETS A MOOD

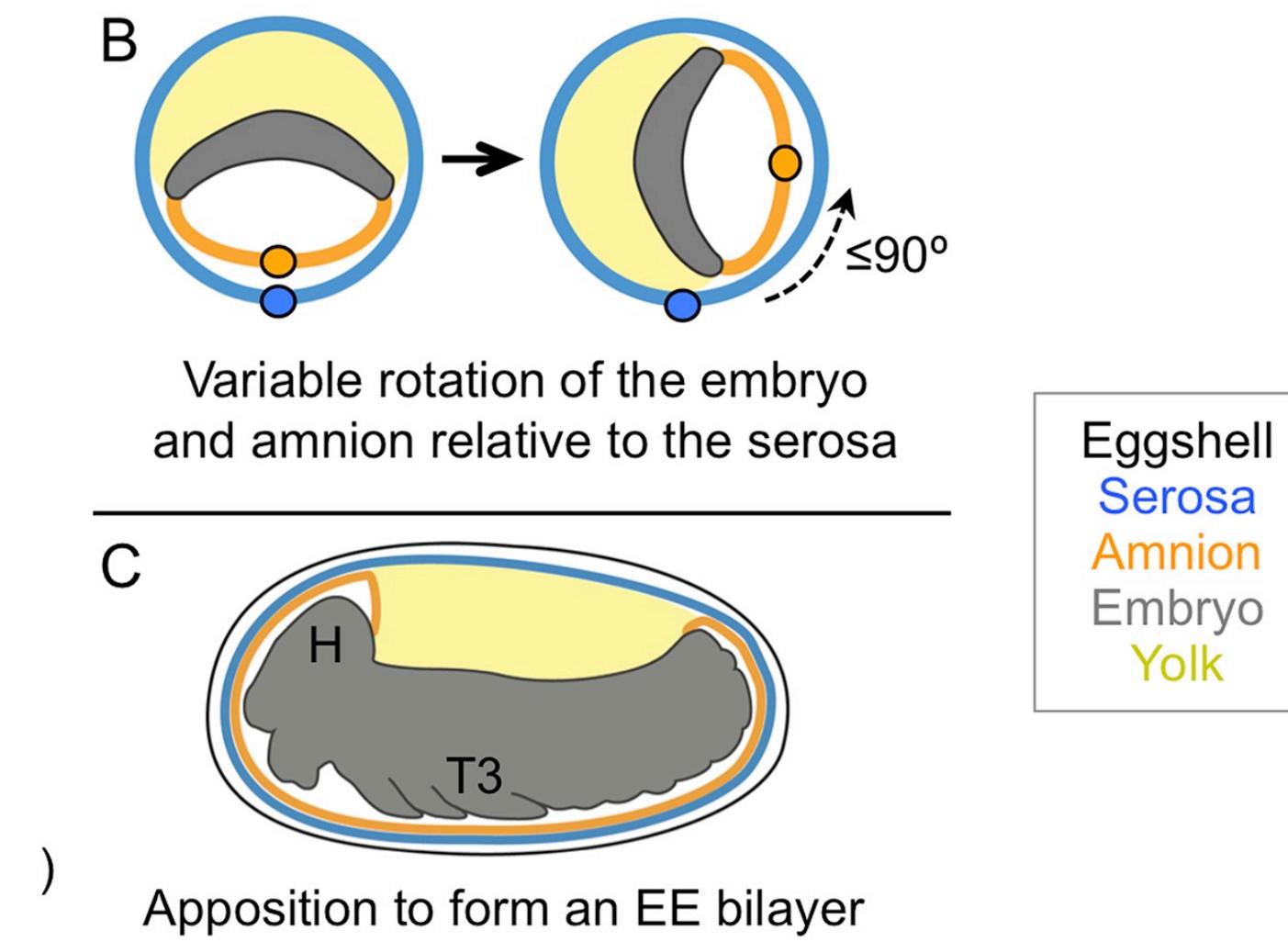
PURPLE	BLUE	GREEN	YELLOW	ORANGE	RED	WHITE	BLACK
<b>Association:</b> Wisdom, wealth, royalty, power, luxury, magic	<b>Association:</b> Depth, stability, wisdom, trust, confidence	<b>Association:</b> Growth, health, harmony, safety nature.	<b>Association:</b> Energy, happy, warming, attention	<b>Association:</b> Enthusiasm, heat, success creativity	<b>Association:</b> Passion, energy, strength, love, power, determination	<b>Association:</b> Purity, light, clean, sterile, innocent, spacious	<b>Association:</b> Power, mystery, elegance, evil, mourning, death
<b>Mood:</b> Powerful, calming, strength	<b>Mood:</b> Calming	<b>Mood:</b> Calm, refreshed	<b>Mood:</b> Aggravation, joy	<b>Mood:</b> Warmth, excitement	<b>Mood:</b> Intensity, angry, excitement	<b>Mood:</b> Cold, unfriendly	<b>Mood:</b> Confident, calm, stable, mysterious

# COLOR CAN HAVE EVEN MORE MEANING

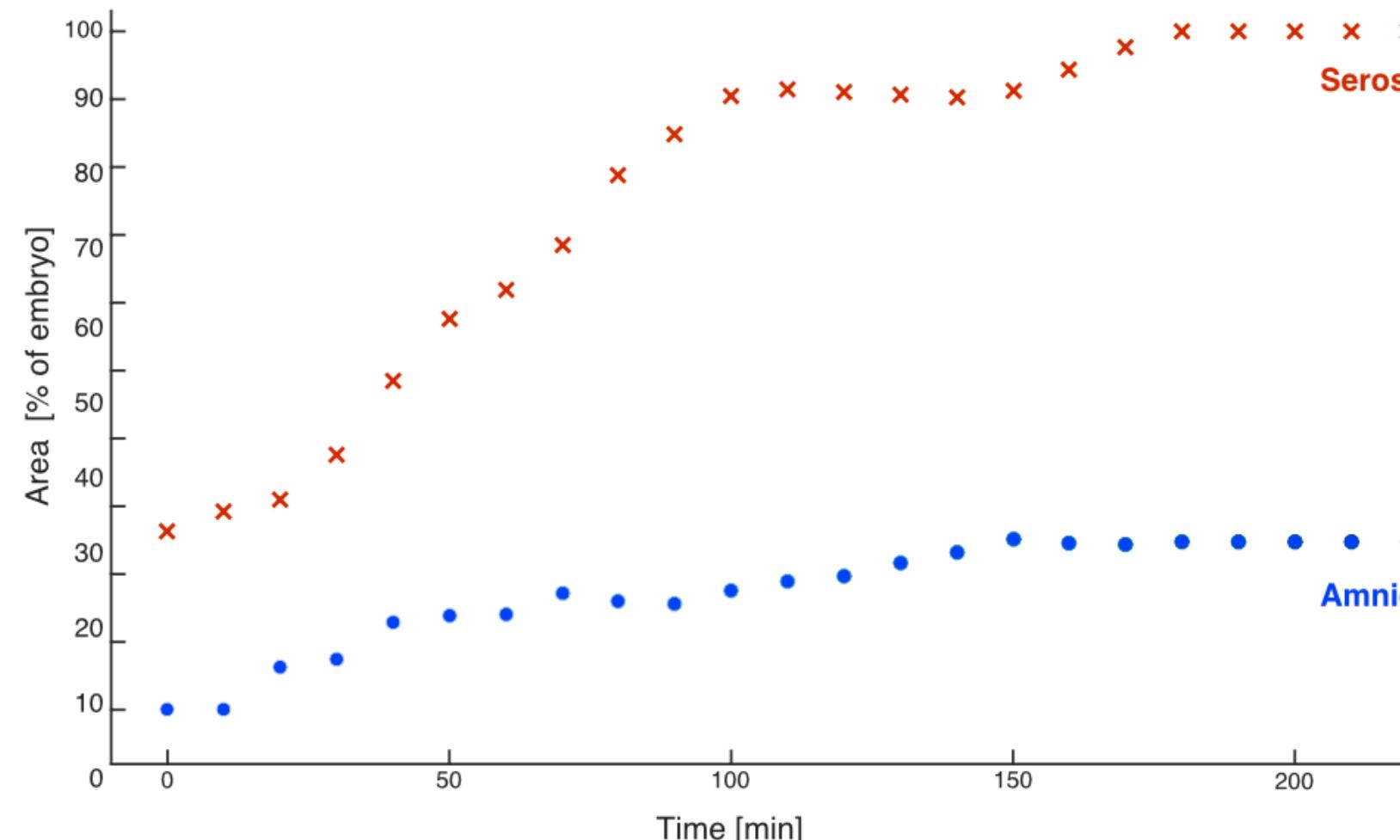
## old lab figure



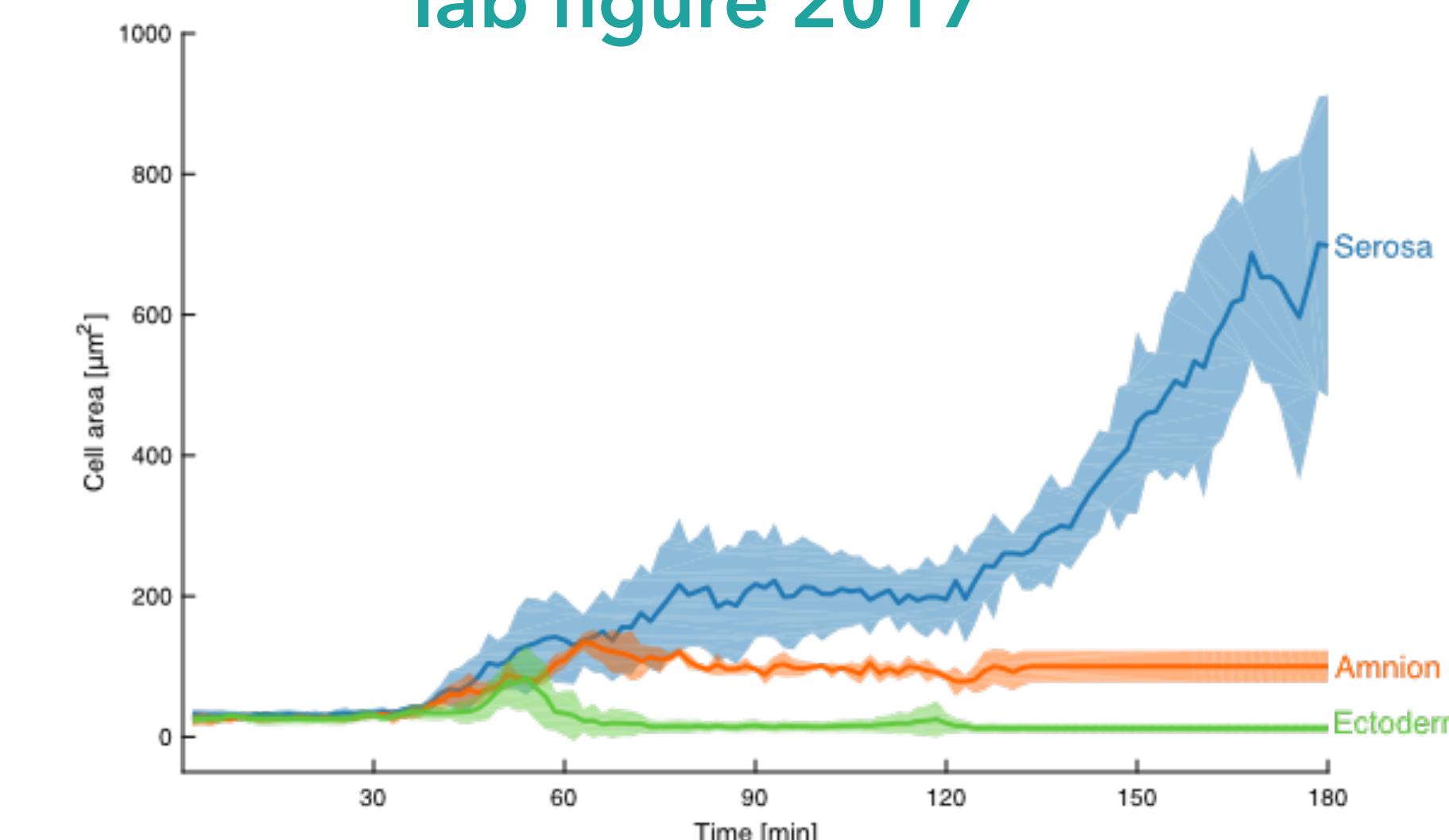
## competition lab fig



## lab figure 2015



## lab figure 2017



# GUIDELINES FOR QUALITATIVE COLOR

**do**



**don't**



**distinctive colours**



**similar intensity**



**mind the color blind**



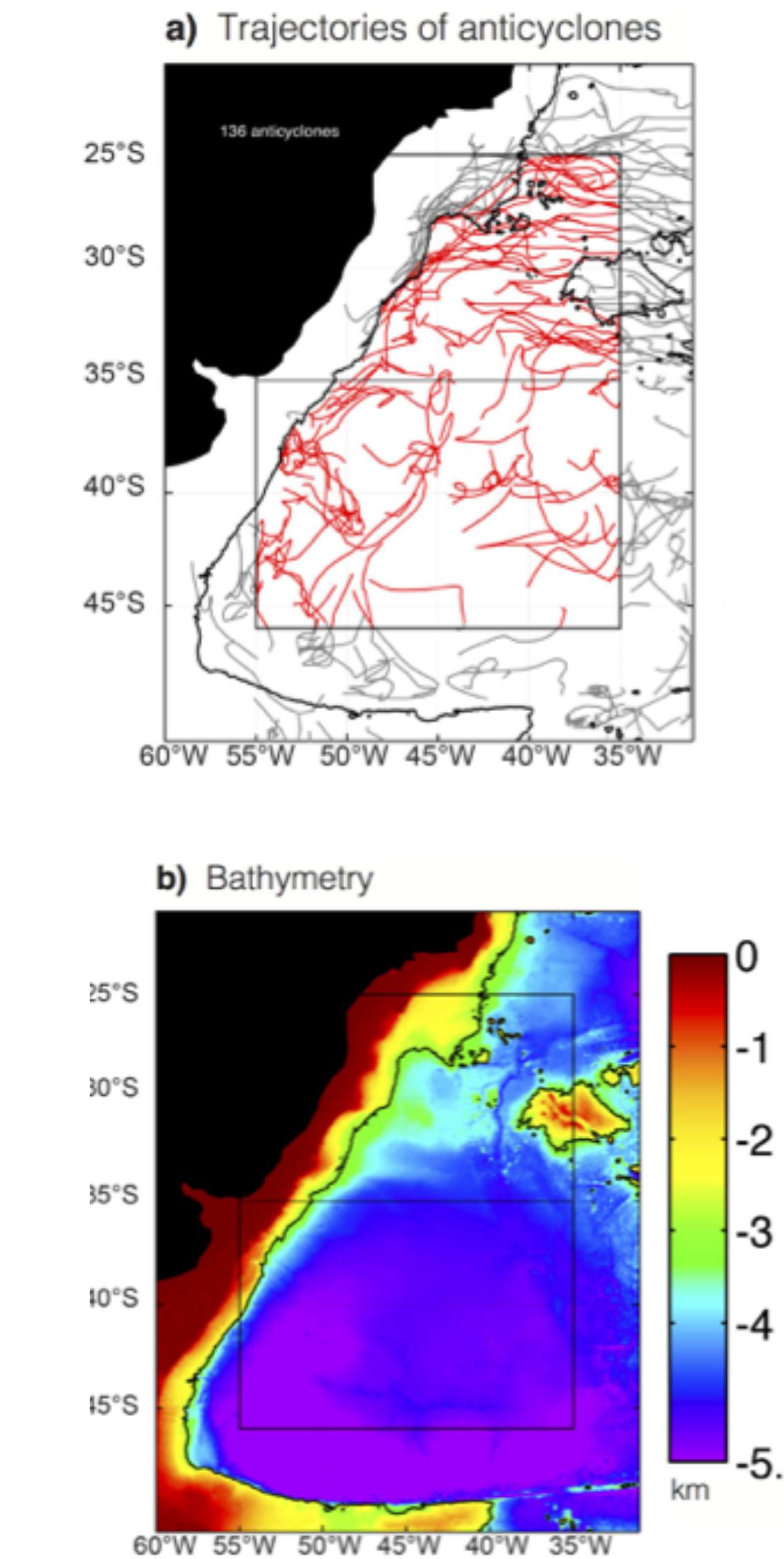
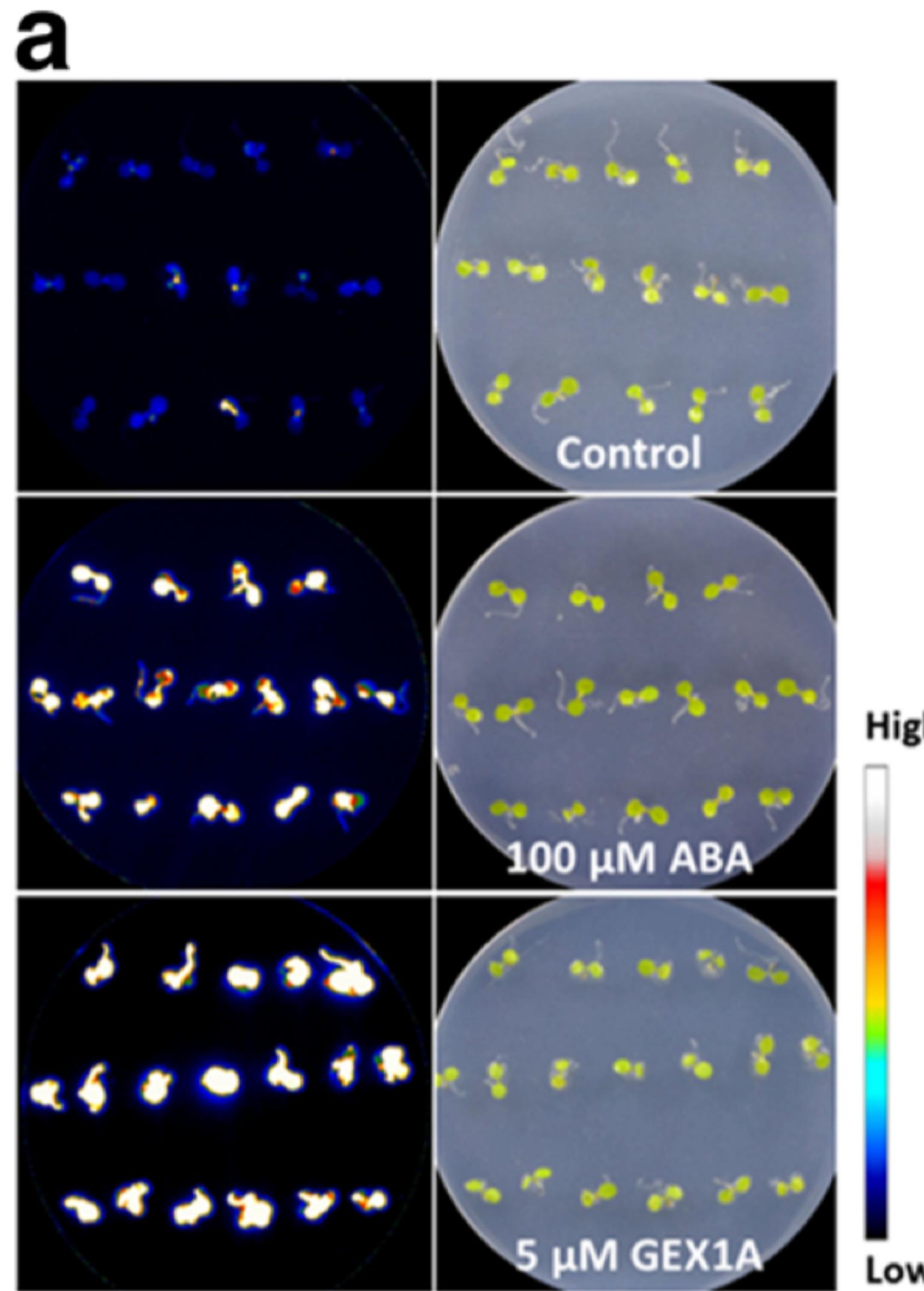
**consider tone**



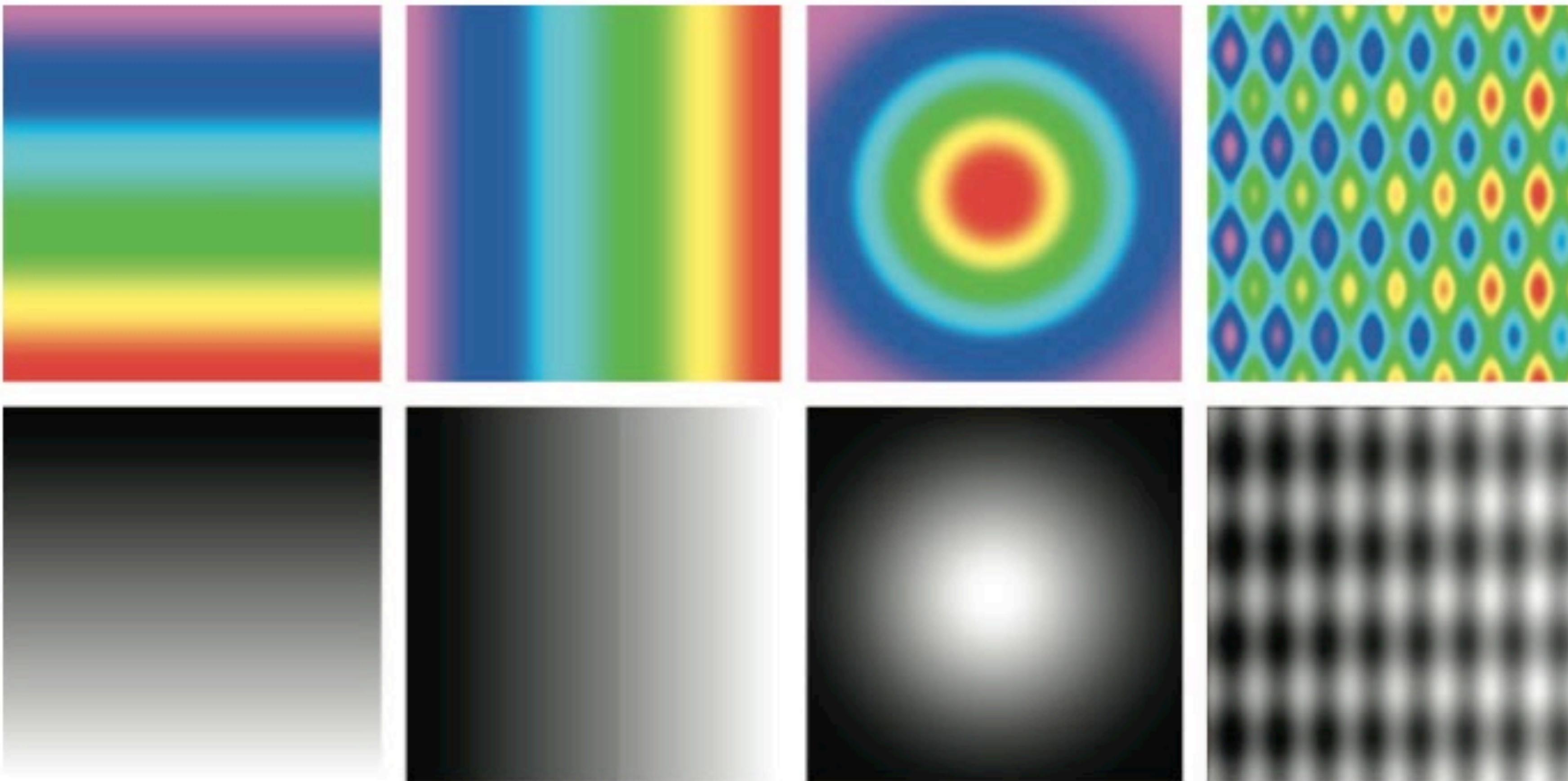
# COLOR AS QUANTITATIVE ENCODING



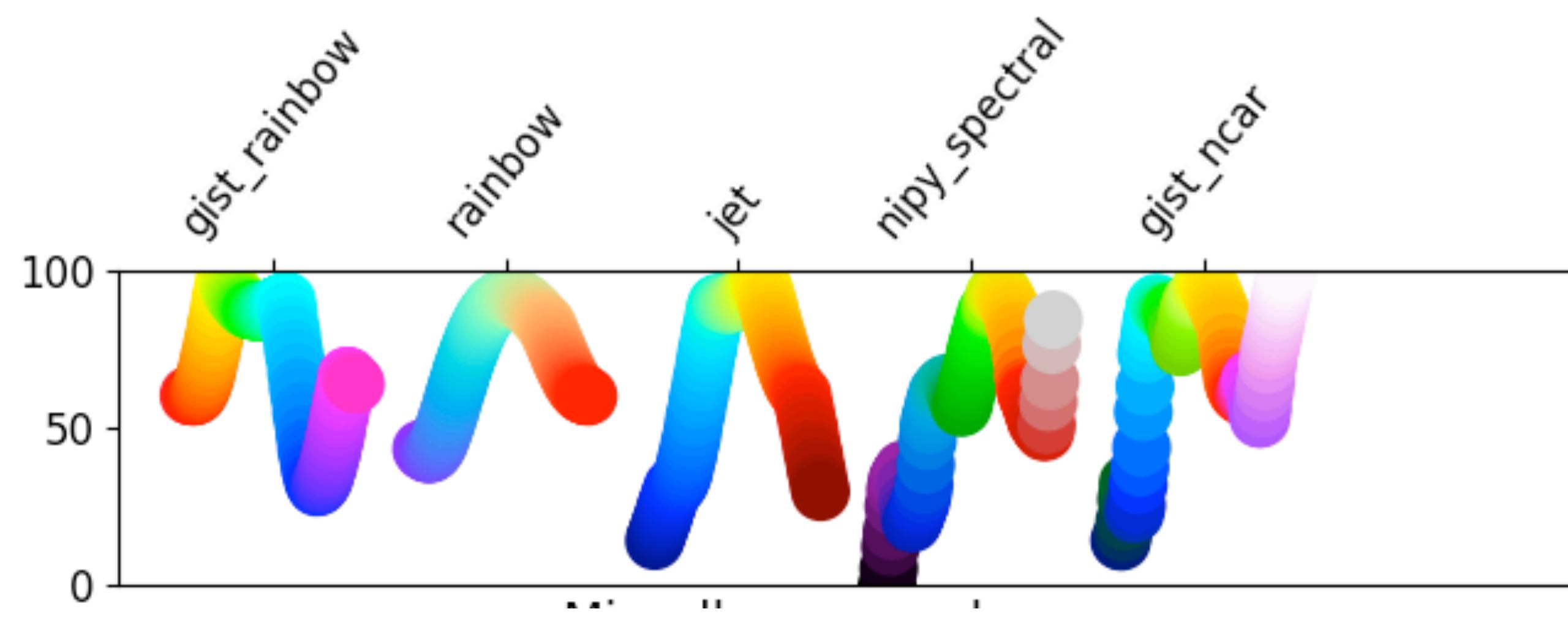
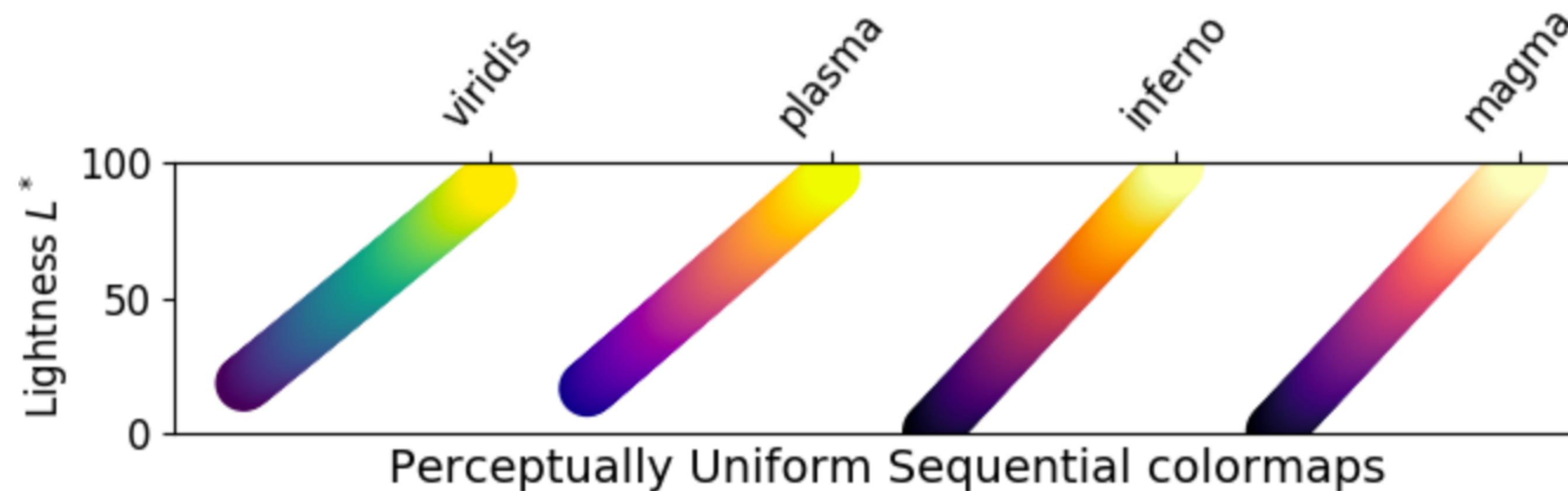
# COLOR AS QUANTITATIVE ENCODING



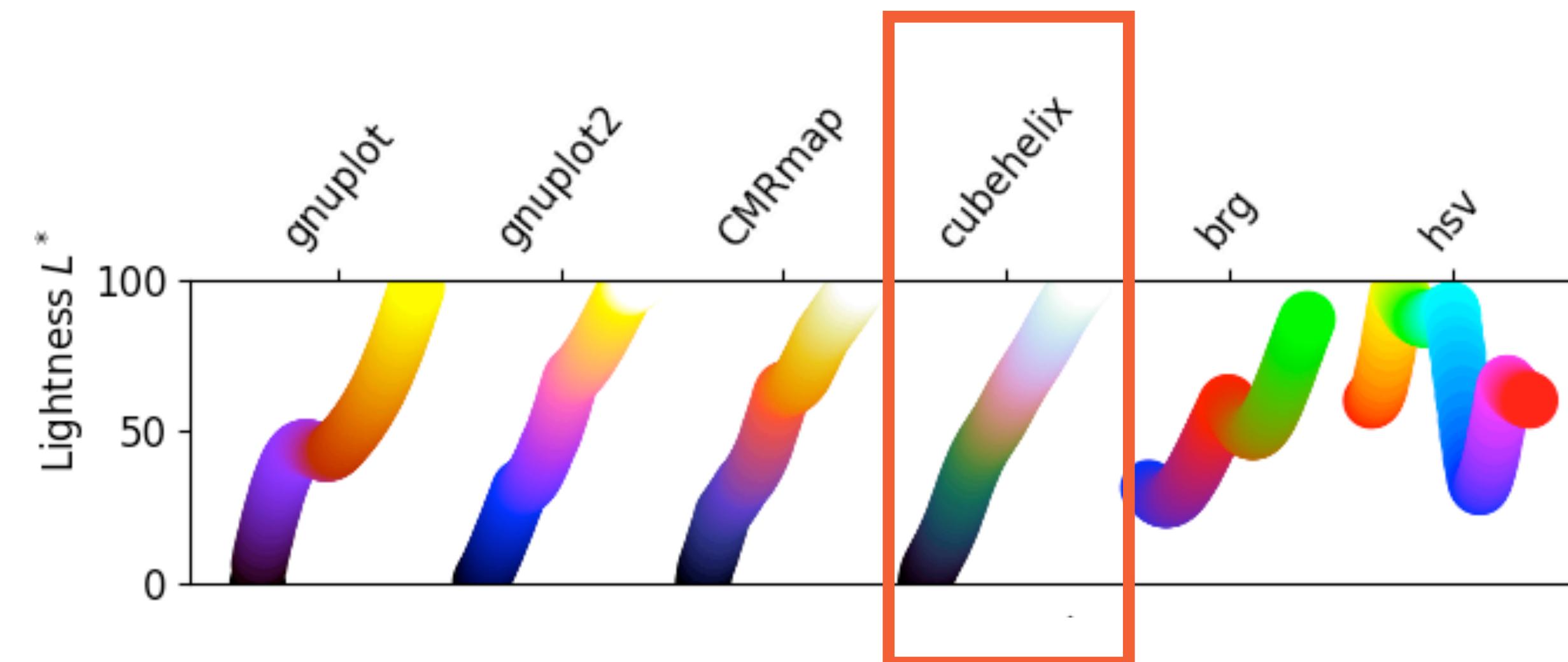
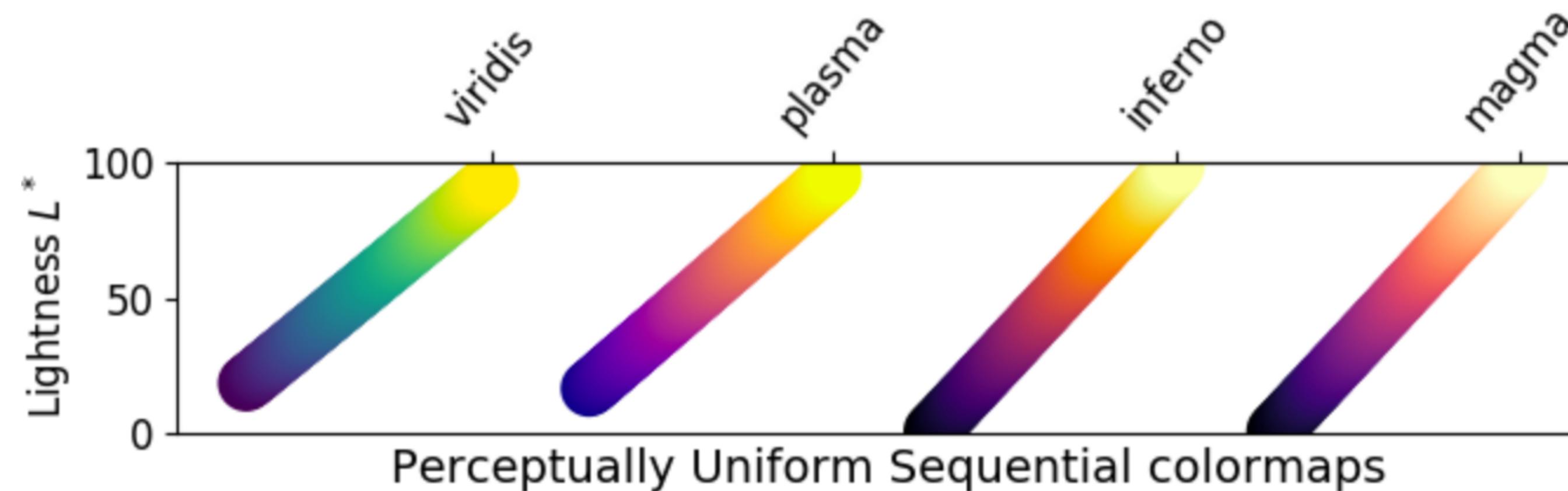
# THE PROBLEM WITH RAINBOWS



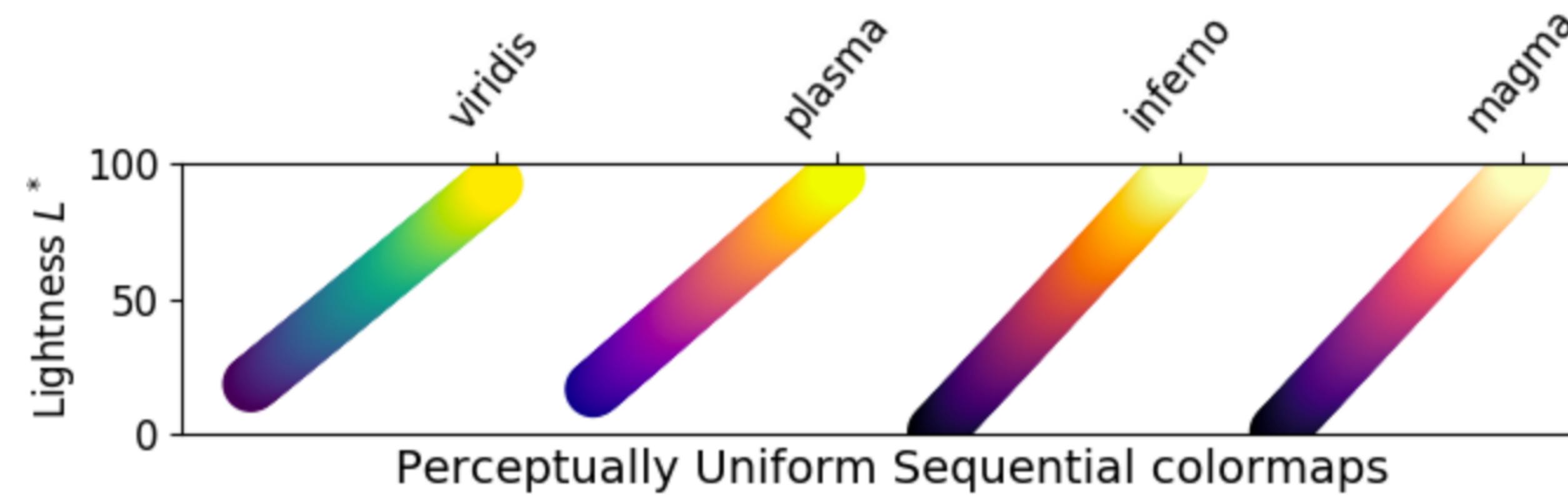
# LINEARITY IN COLOR PALETTES



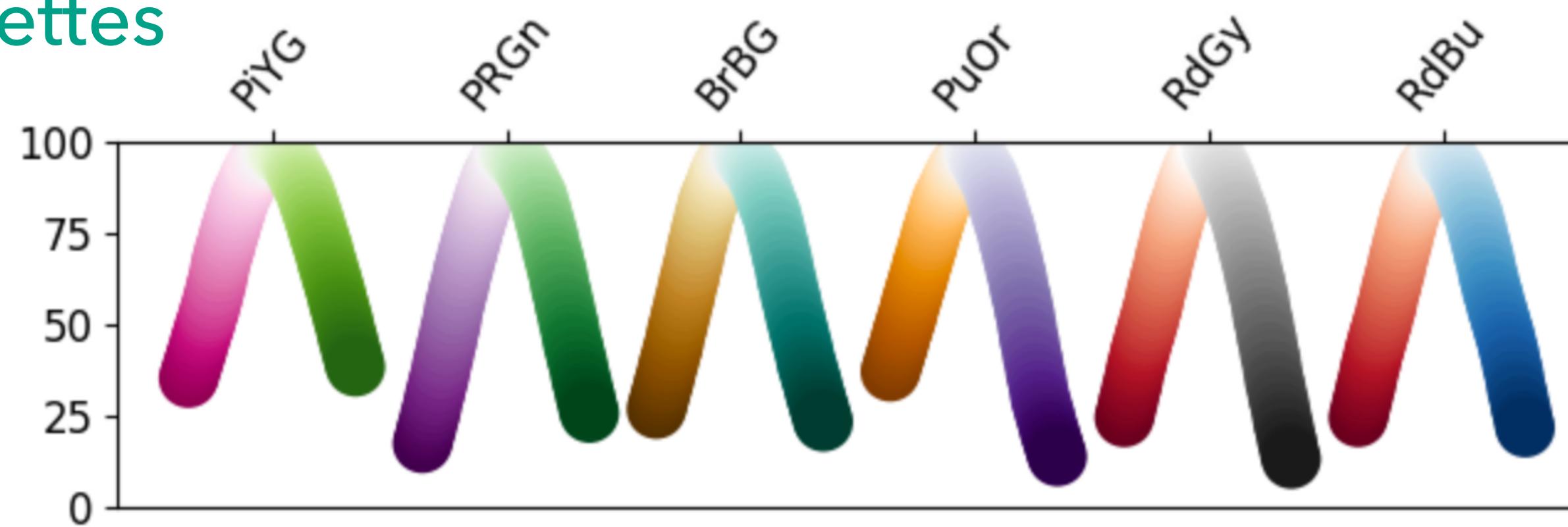
# LINEARITY IN COLOR PALETTES



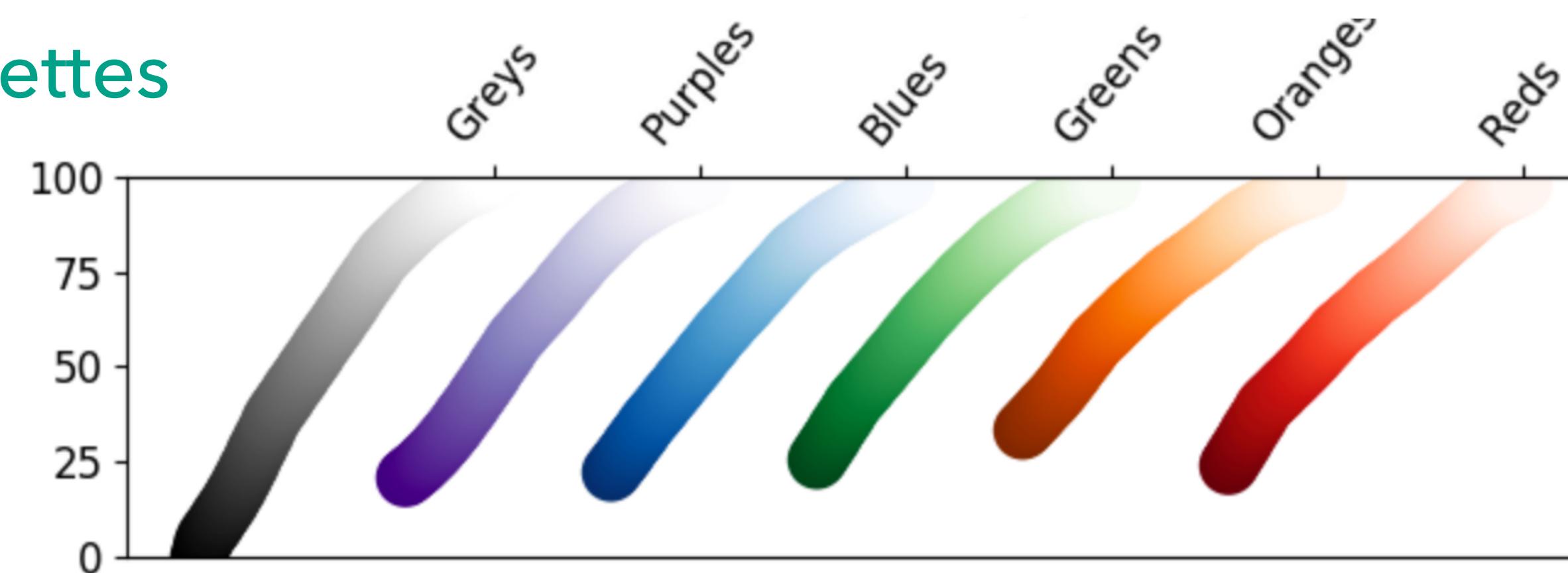
# LINEARITY IN COLOR PALETTES



diverging palettes

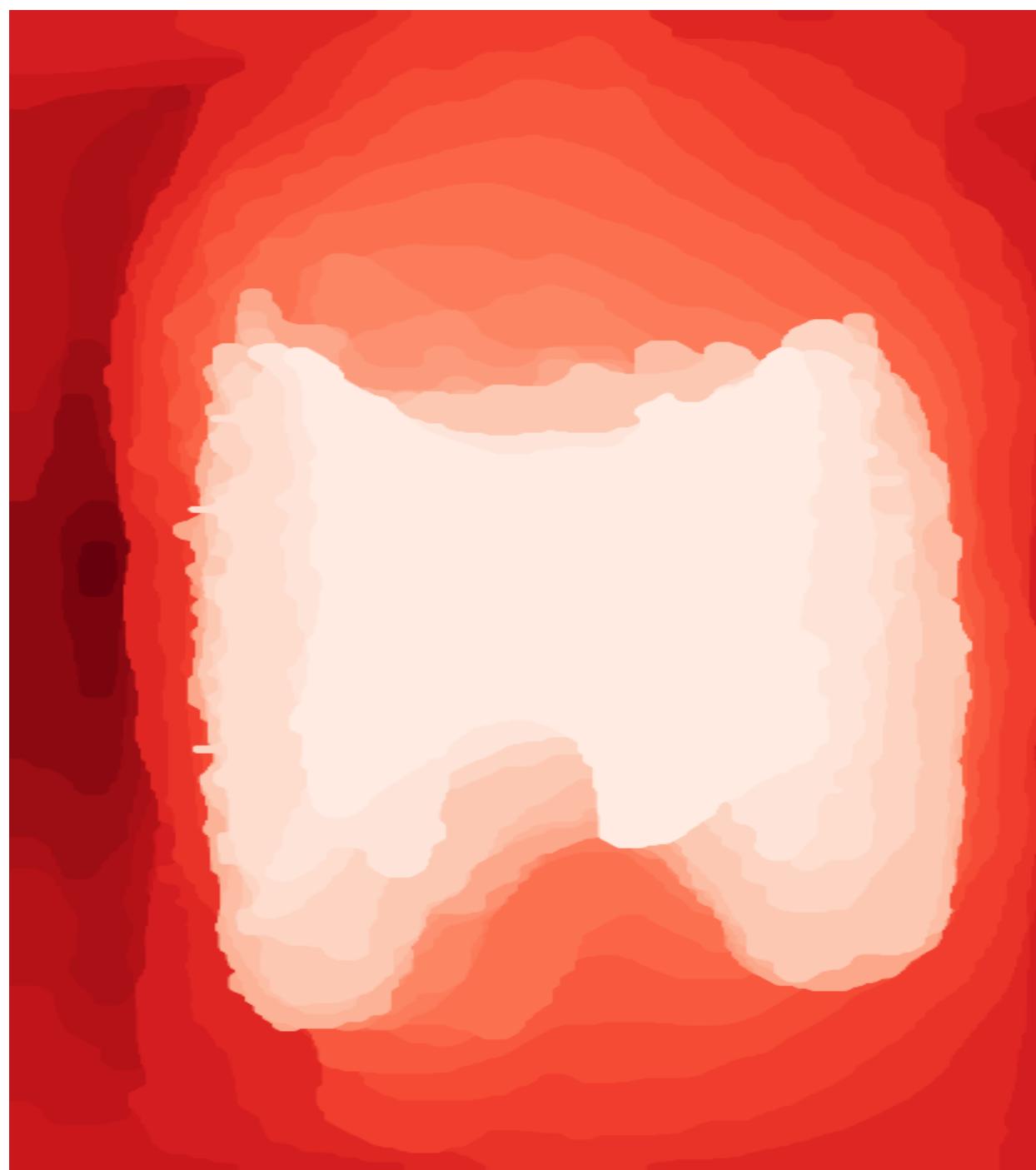


sequential palettes

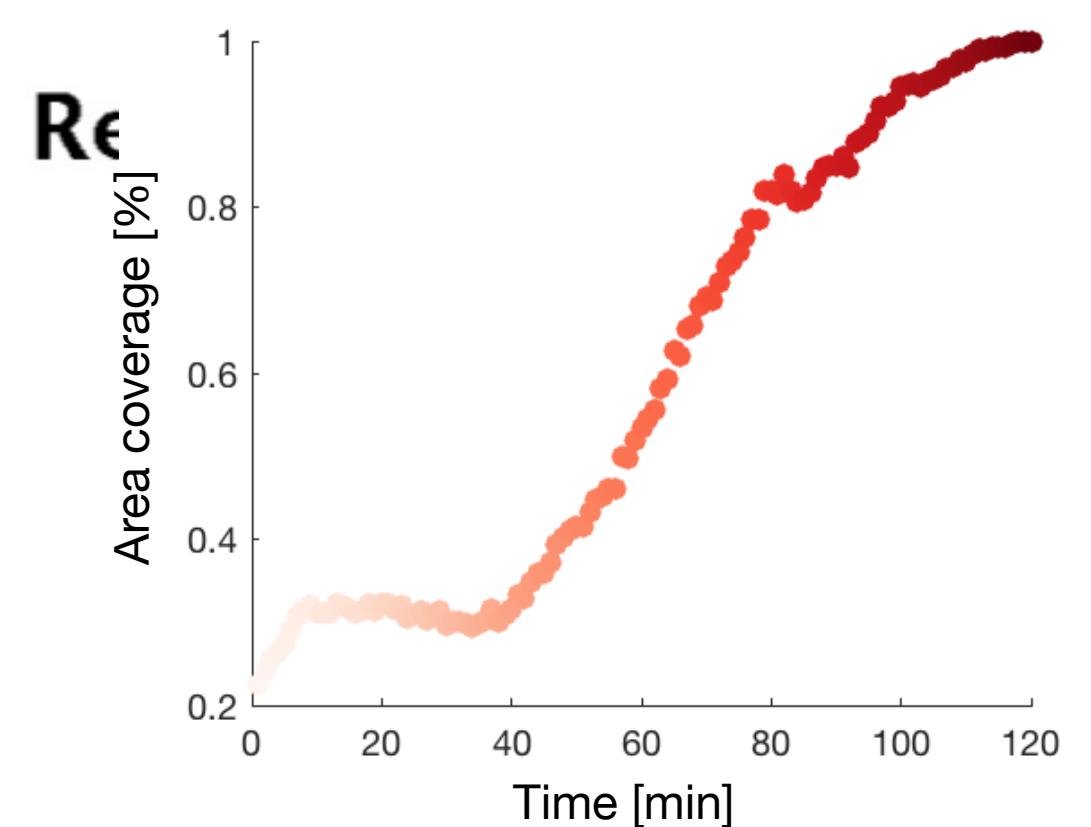
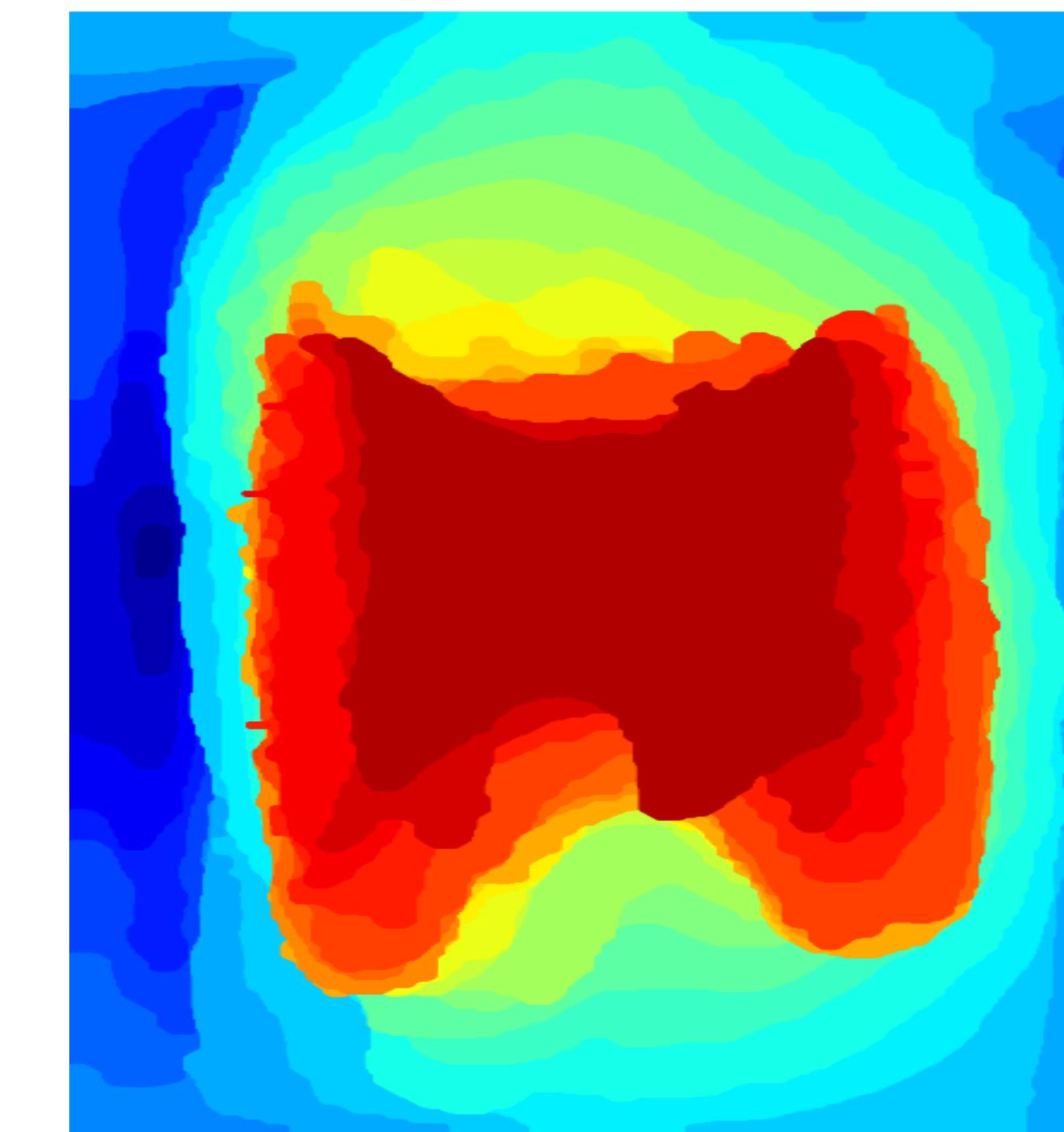


# SEQUENTIAL PALETTES FOR SEQUENTIAL DATA

sequential data

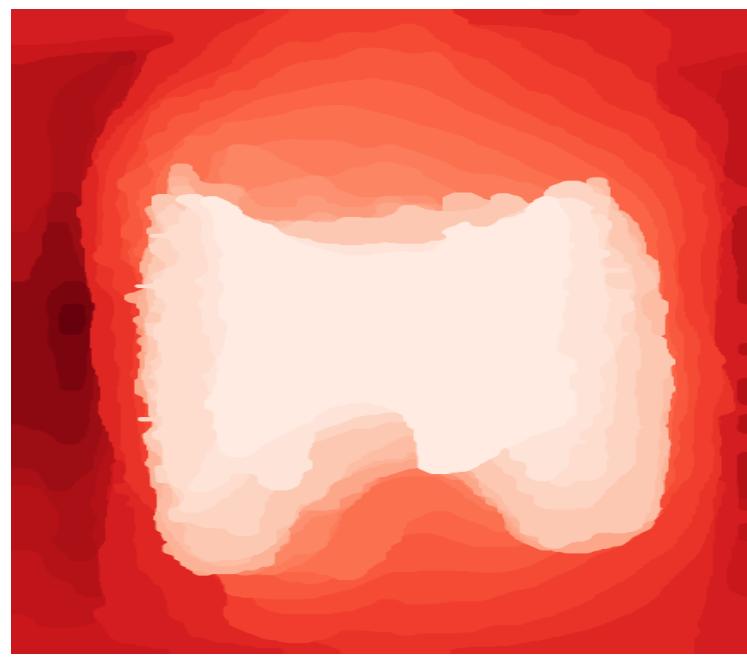


diverging



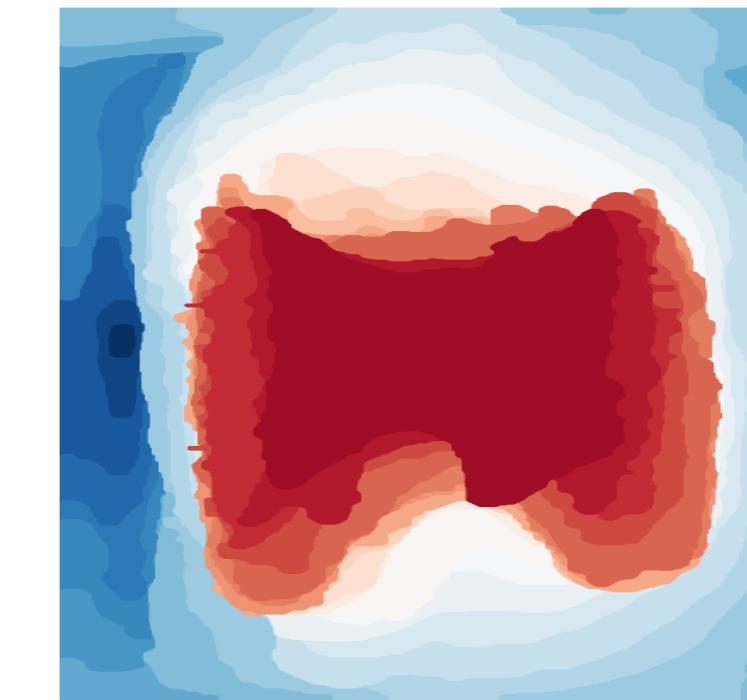
# GUIDELINES FOR QUANTITATIVE COLOR

**do**

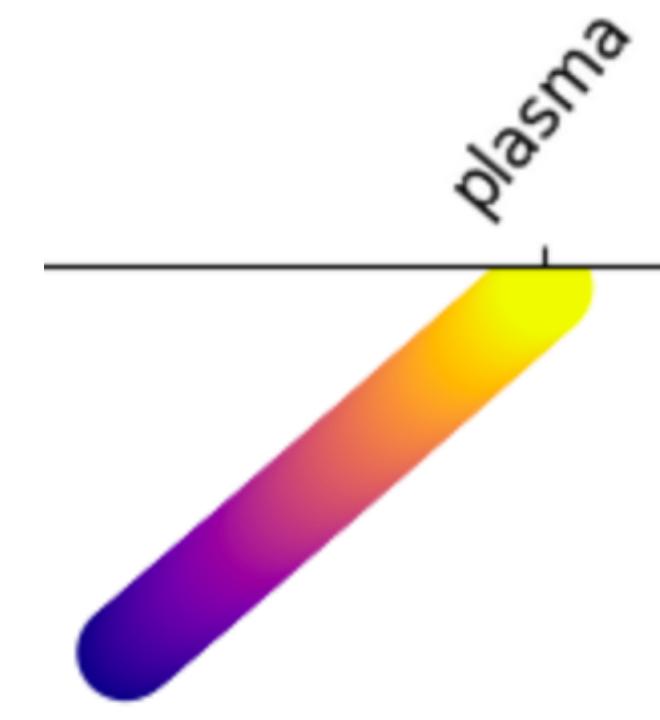


sequential palettes  
for sequential data

**don't**



**do**



consider perception  
of linearity and avoid  
rainbows

**don't**



Fig. 2

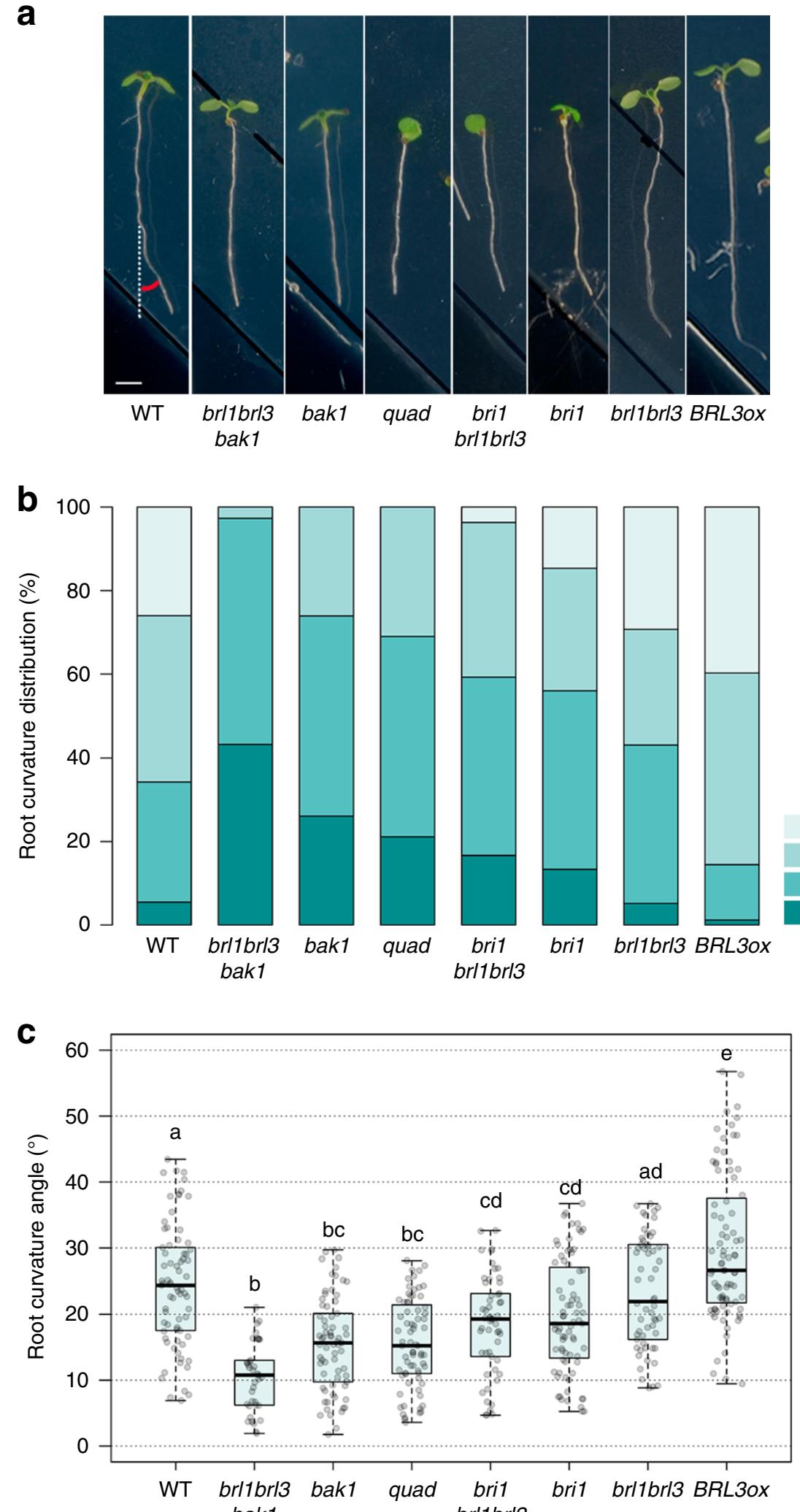


Fig. 3

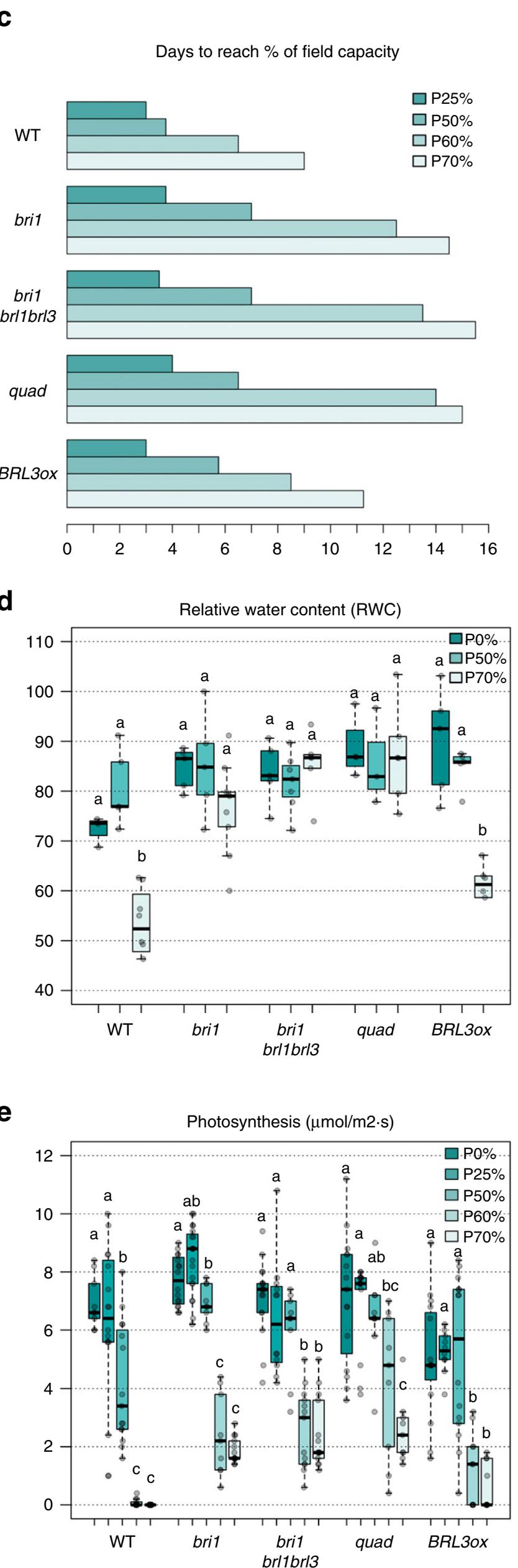
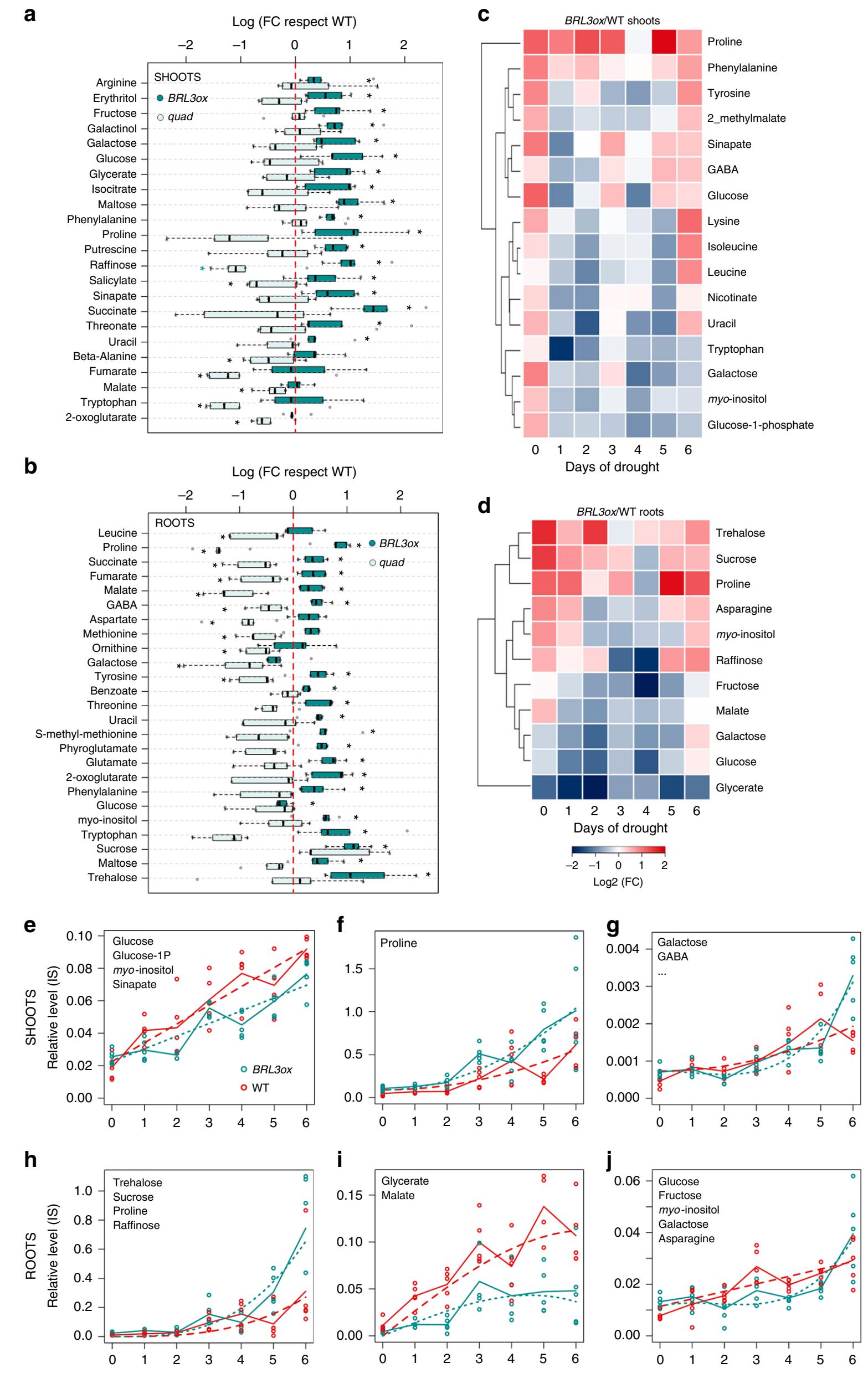
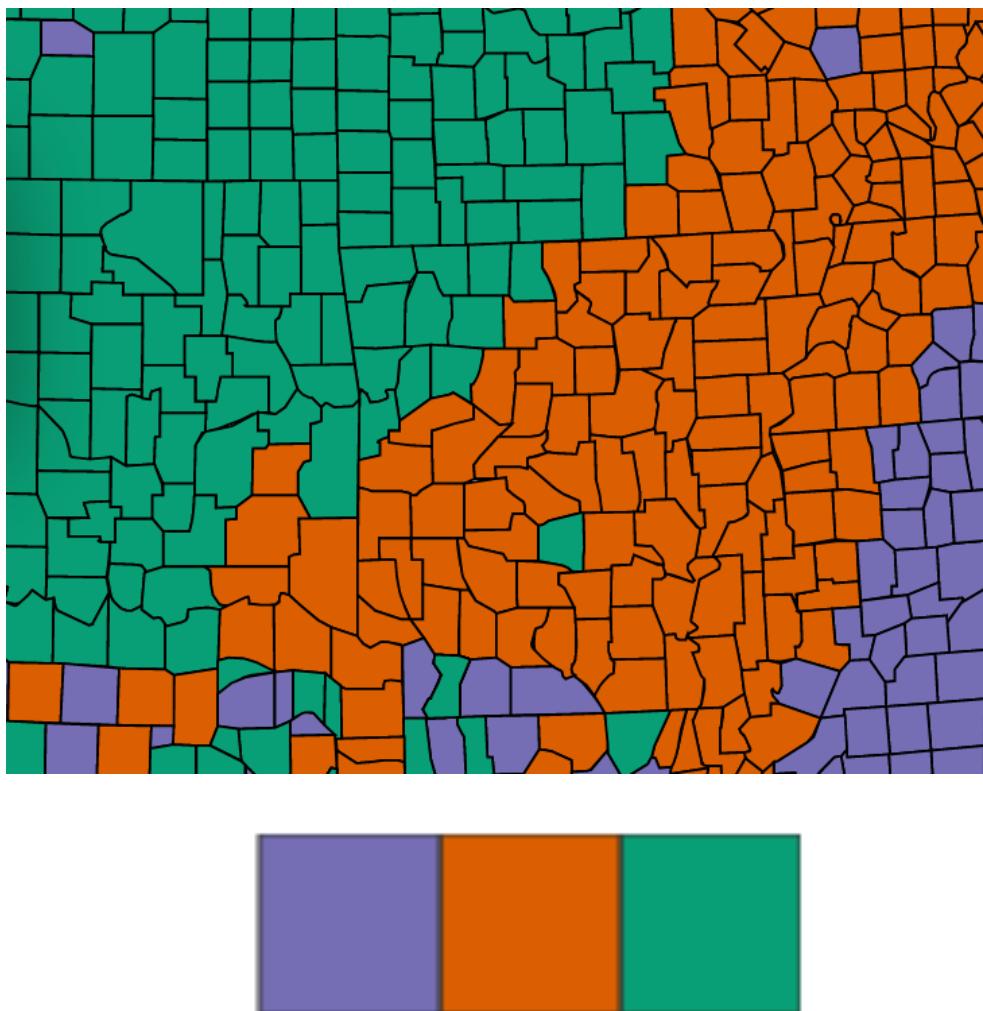


Fig. 4



# TOOLS TO CHOOSE COLOURS



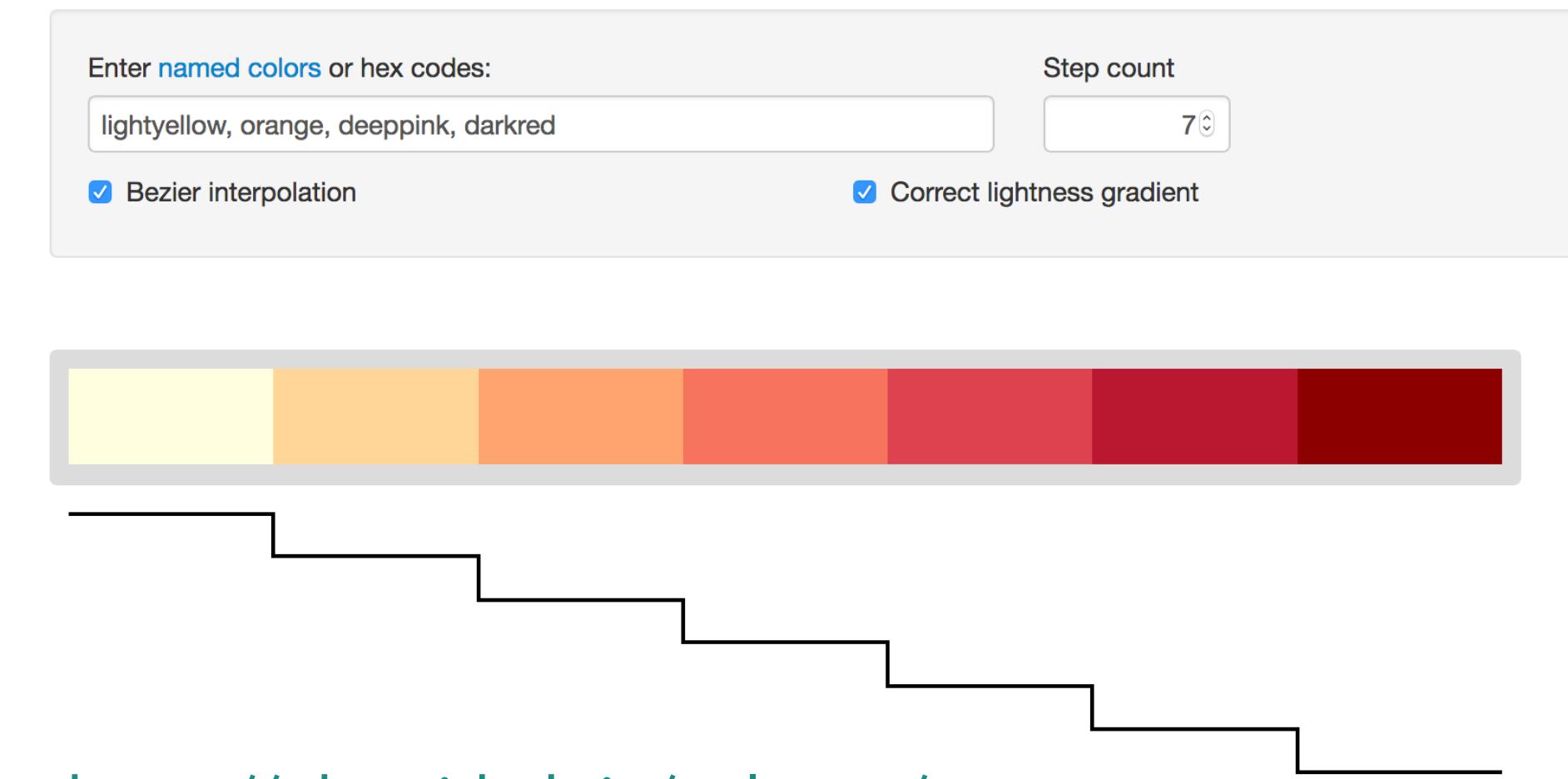
*Color Brewer*

<http://colorbrewer2.org/>



## Chroma.js Color Scale Helper

This [chroma.js](#)-powered tool is here to help us [mastering multi-hued, multi-stops color scales](#).



<https://gka.github.io/palettes/>

## VIZ PALETTE

### PICK

Use Chroma.js

Add Replace

Use Colorgrical

Use ColorBrewer

### EDIT

- 1 #ffd700
- 2 #ffb14e
- 3 #fa8775
- 4 #ea5f94
- 5 #cd34b5

Add

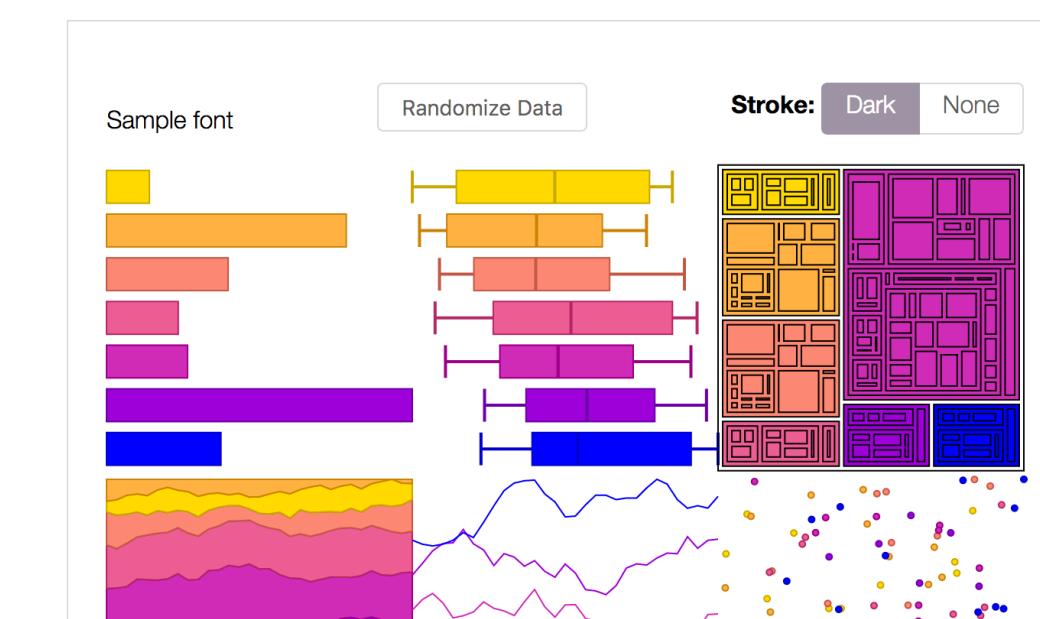
Remove

## COLORS IN ACTION

Color Population:

No Color Deficiency - 92% Deutanomaly - 2.7% Protanomaly - 0.66%

Protanopia - 0.59% Deutanopia - 0.56%



<http://projects.susielu.com/viz-palette>

# COPY FROM THE EXPERTS



*“Copy nature”*

— Edward R. Tufte



*Wes Anderson palettes*



**Color** Lisa

A B C D E F G H I J K L M

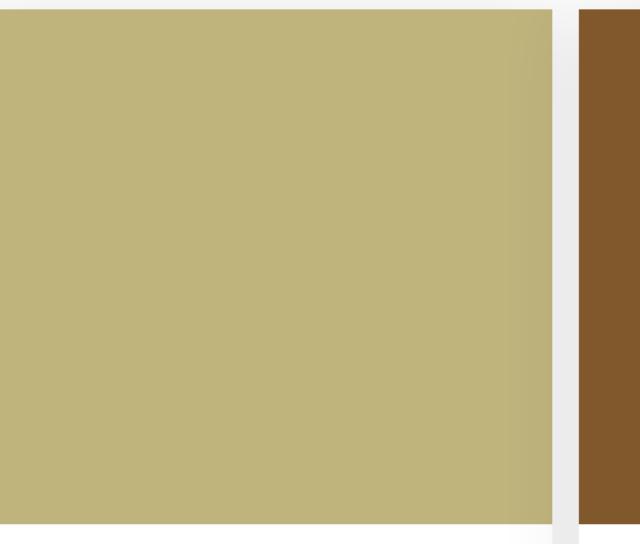
👁 **THE PERSISTENCE OF MEMORY** BY SALVADOR DALÍ



HEX #40798C



HEX #BCA455

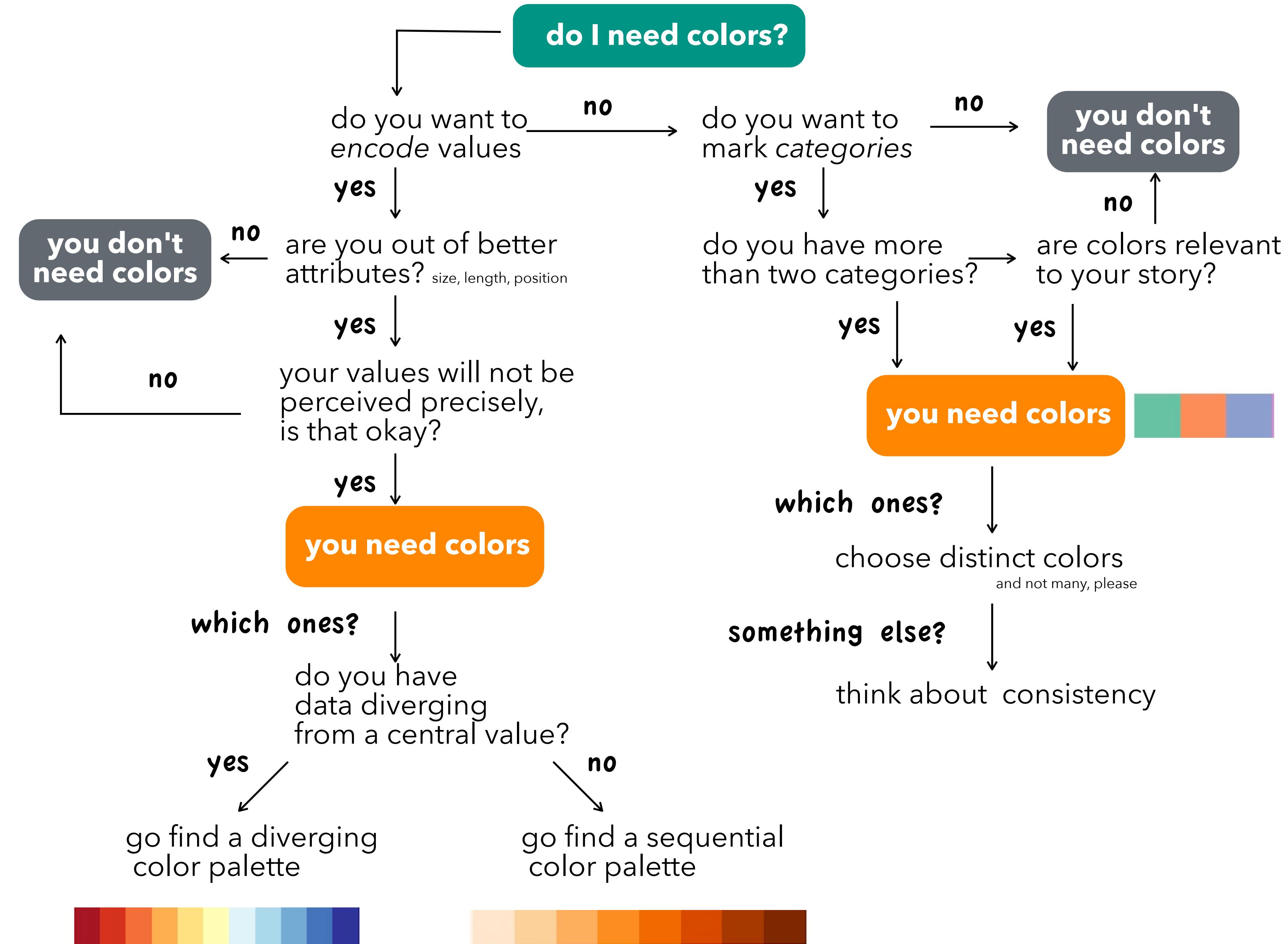


HEX #BFB37F

👁 **MONA LISA** BY LEONARDO DA VINCI



<http://colorlisa.com/>





“

*DESIGN IS A REQUIREMENT,  
NOT A COSMETIC ADDITION*

— Bang Wong

”

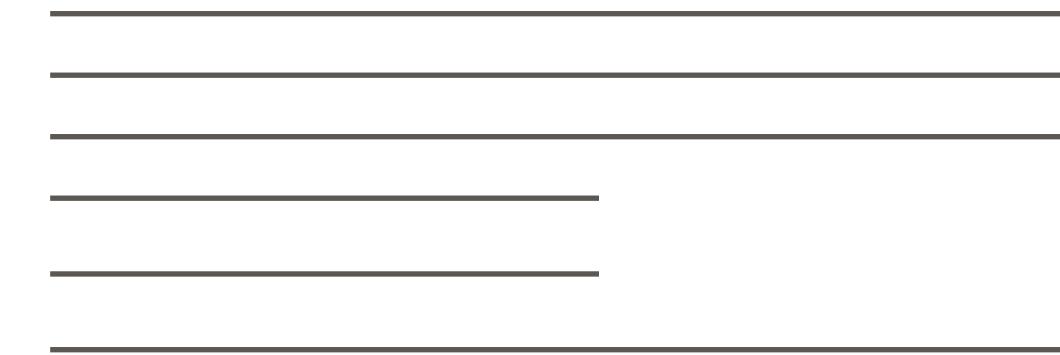
# GENERAL DESIGN PRINCIPLES

for graphical communication

# THE TWO PRINCIPLES OF 2D DESIGN

## Organize

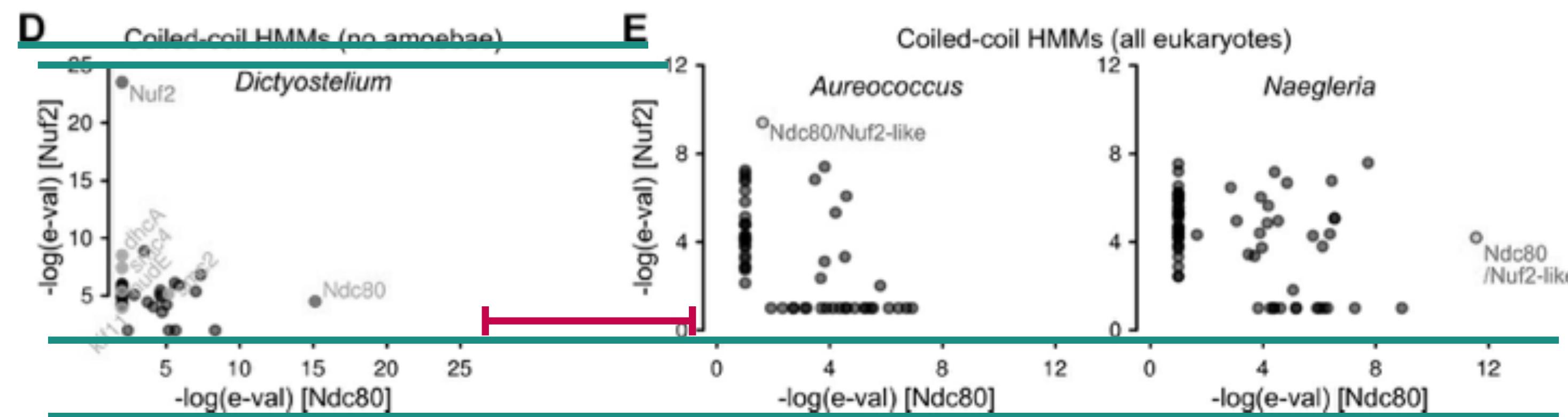
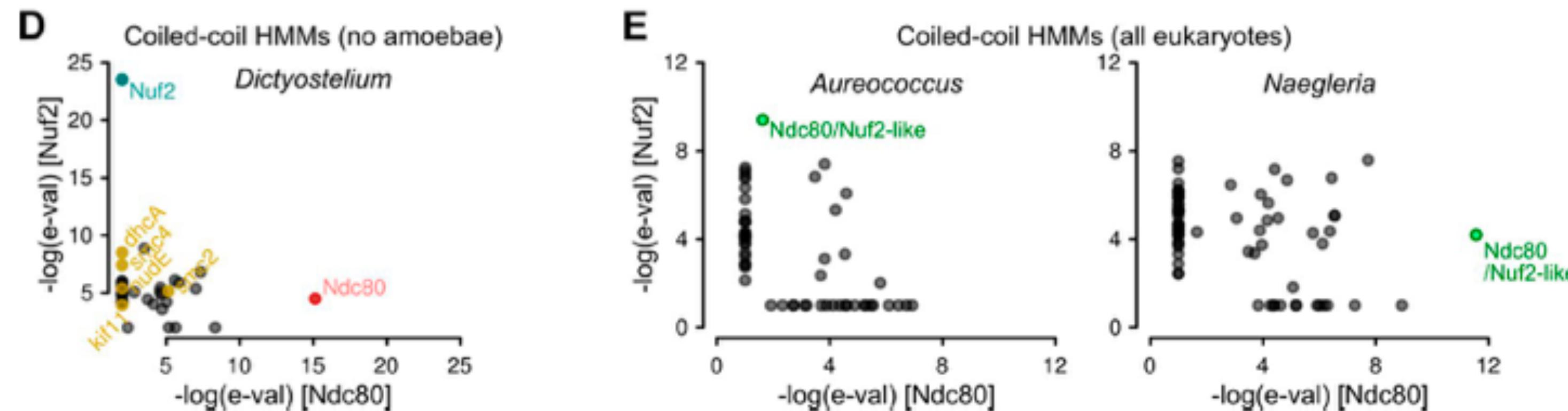
White Space  
Alignment



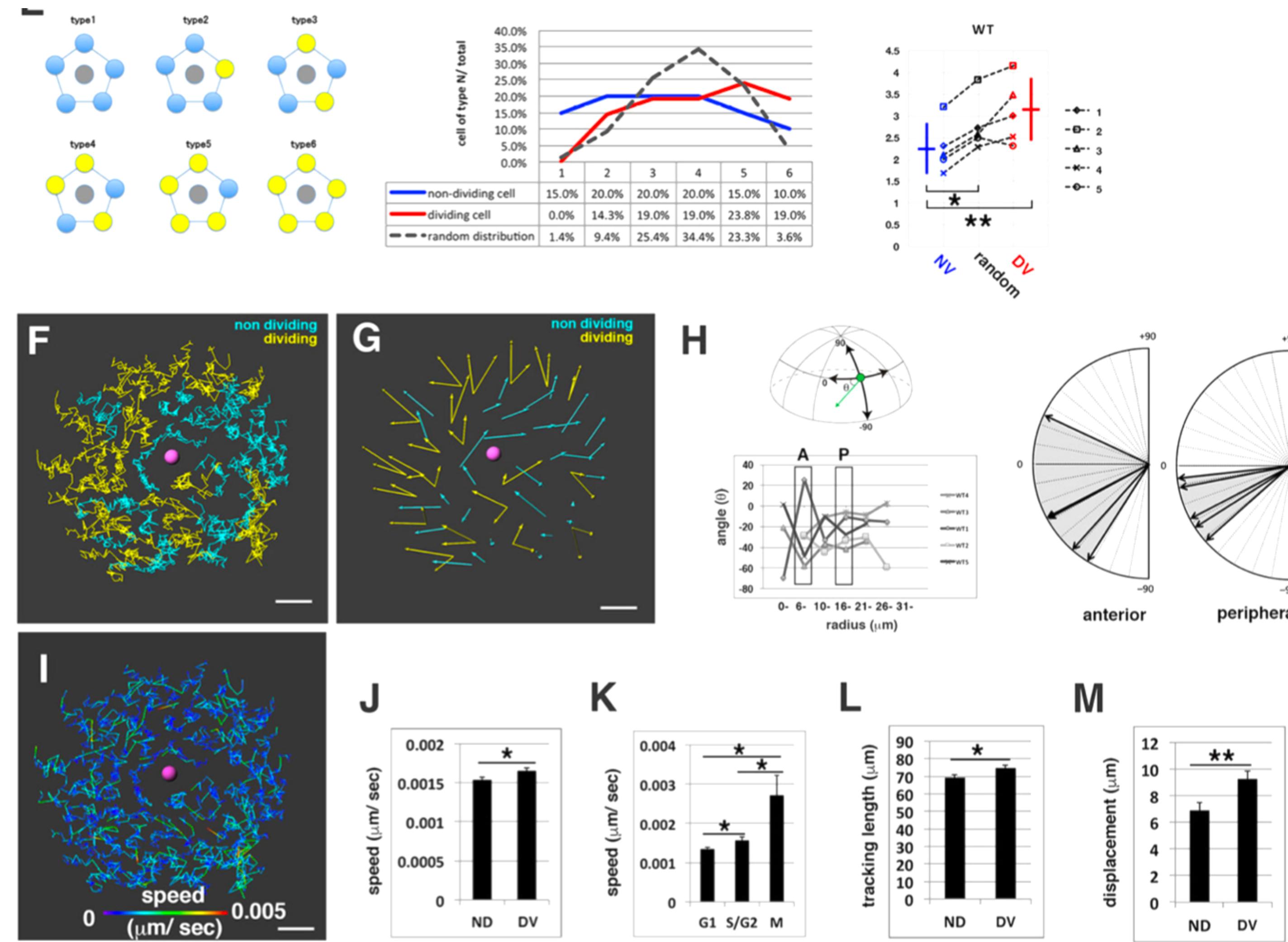
## Highlight



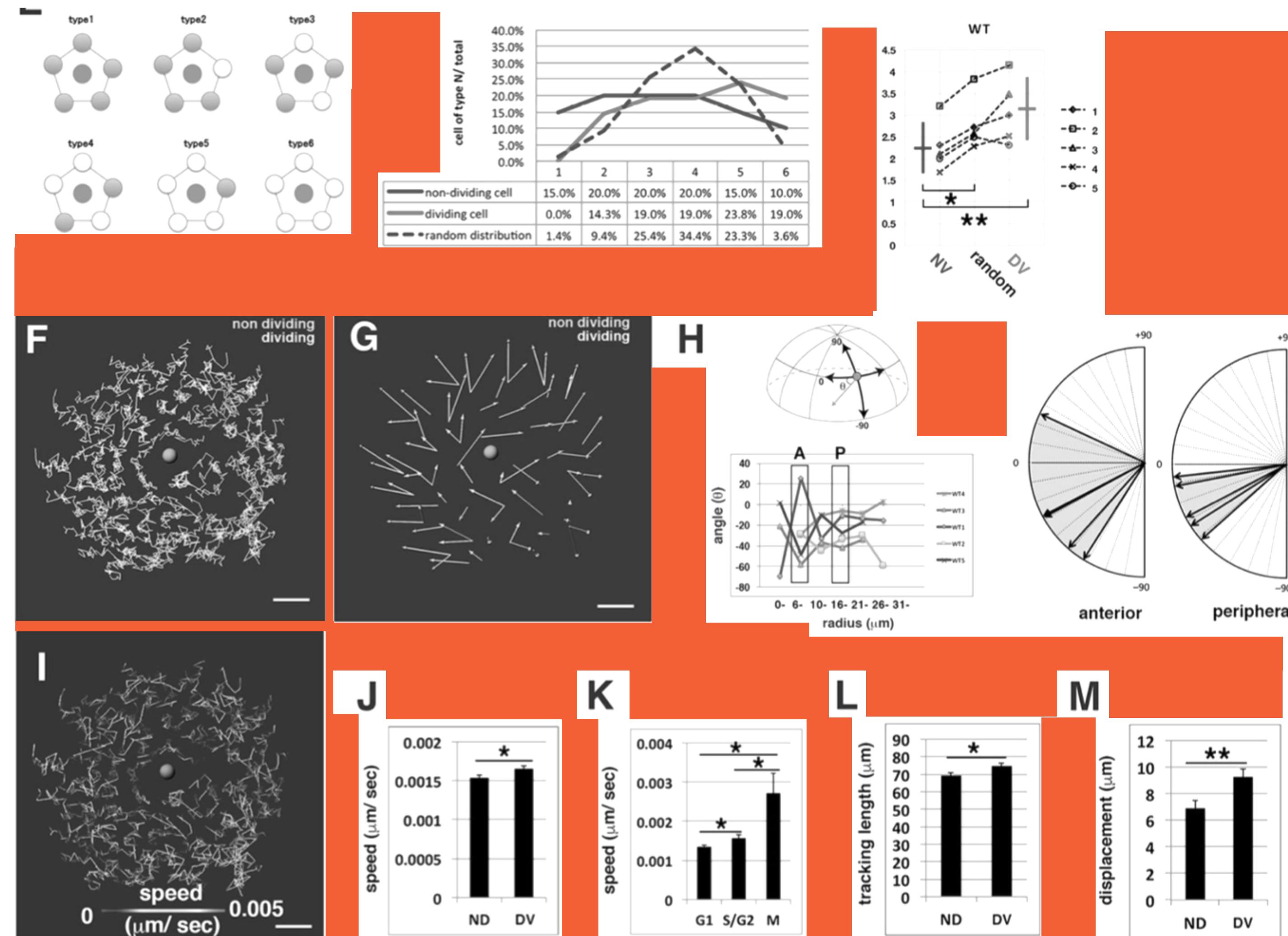
# ORGANIZE: ALIGNMENT



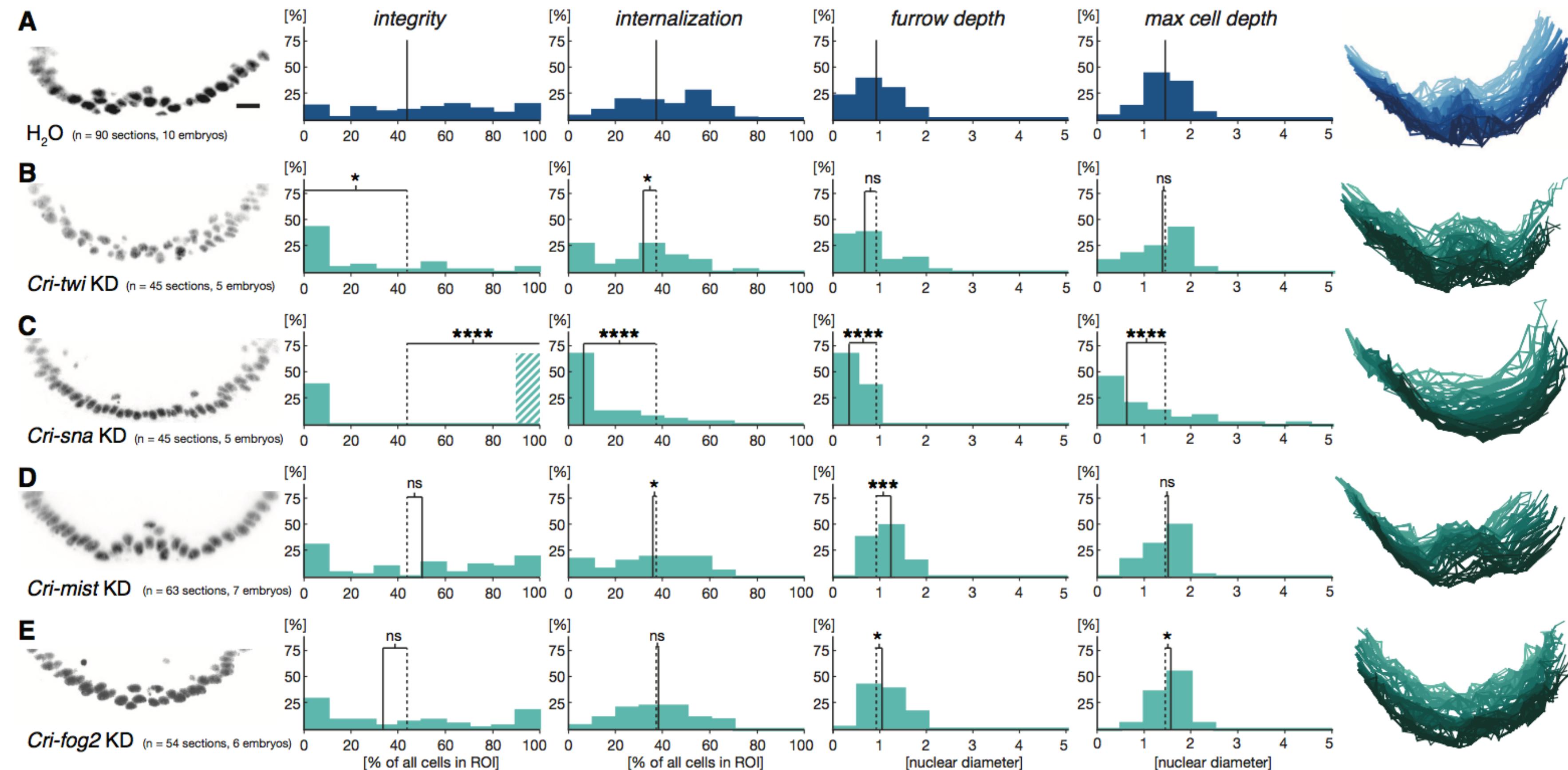
# ORGANIZE: WHITE SPACE



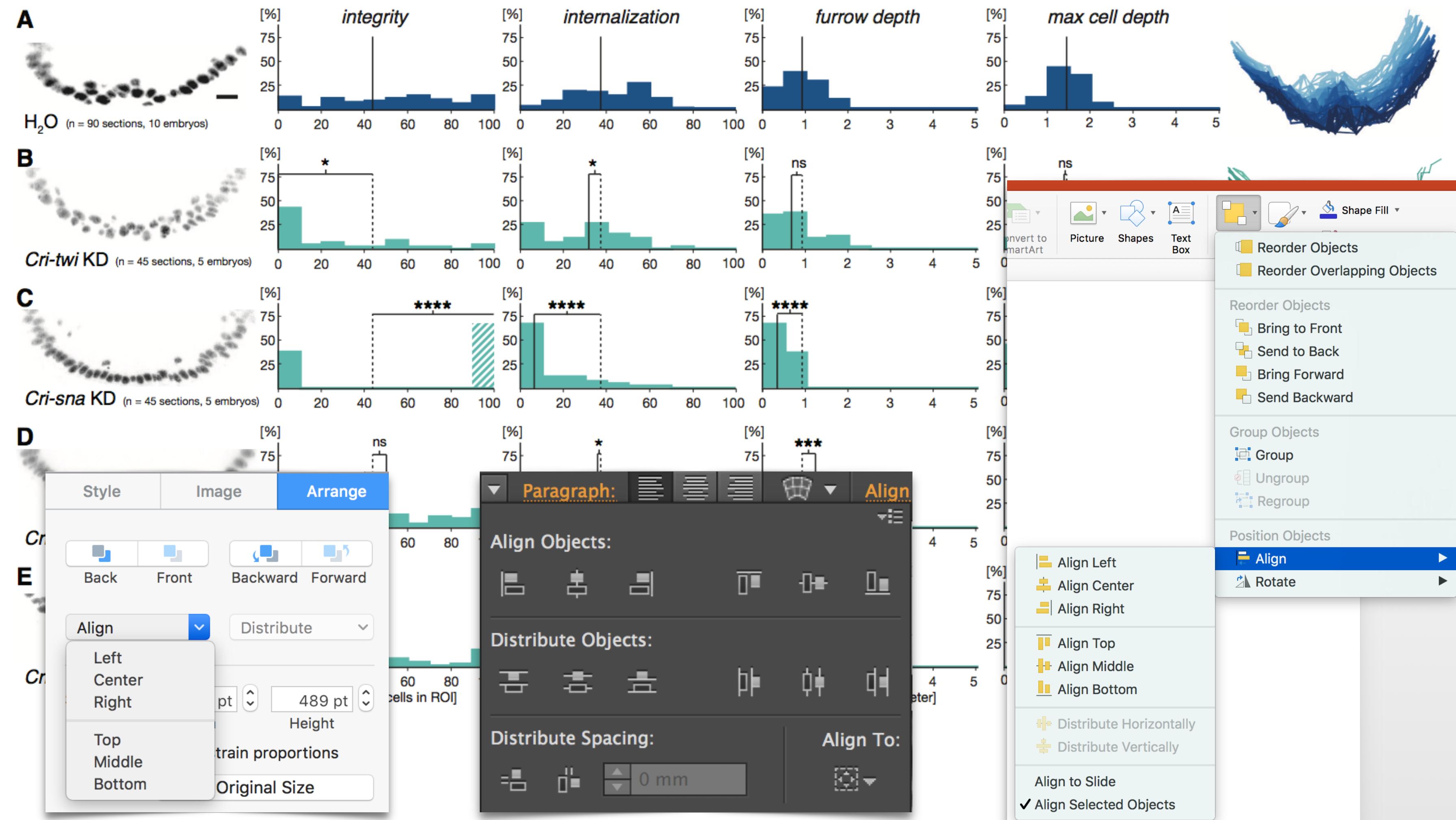
# ORGANIZE: WHITE SPACE



# ORGANIZE: ALIGNMENT & WHITESPACE



# ORGANIZE: ALIGNMENT & WHITESPACE

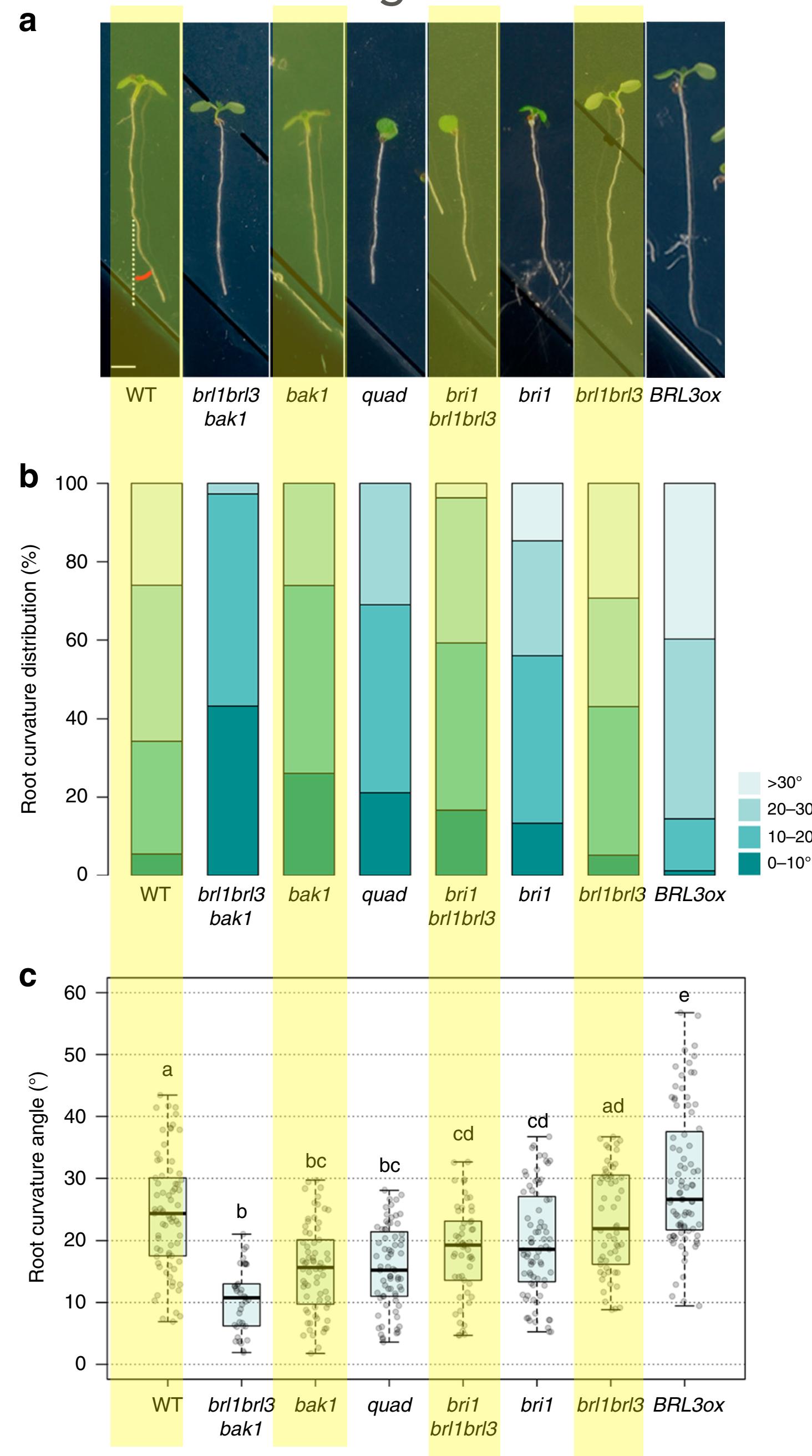


Keynote

Illustrator

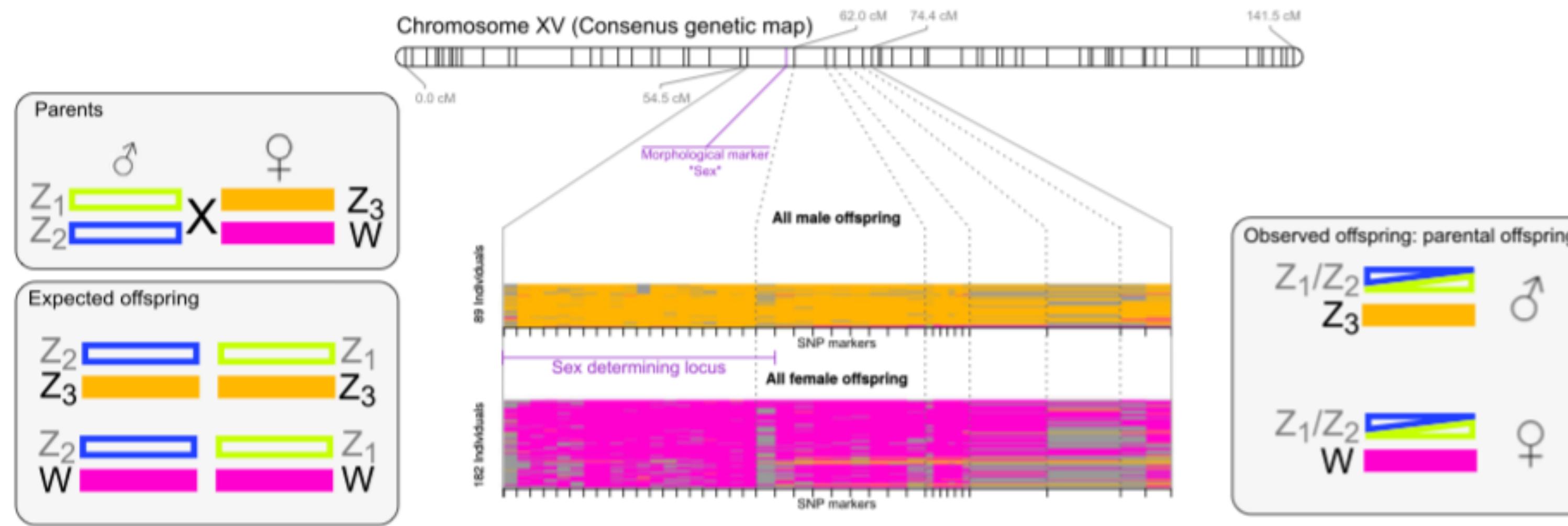
PowerPoint

Fig. 2

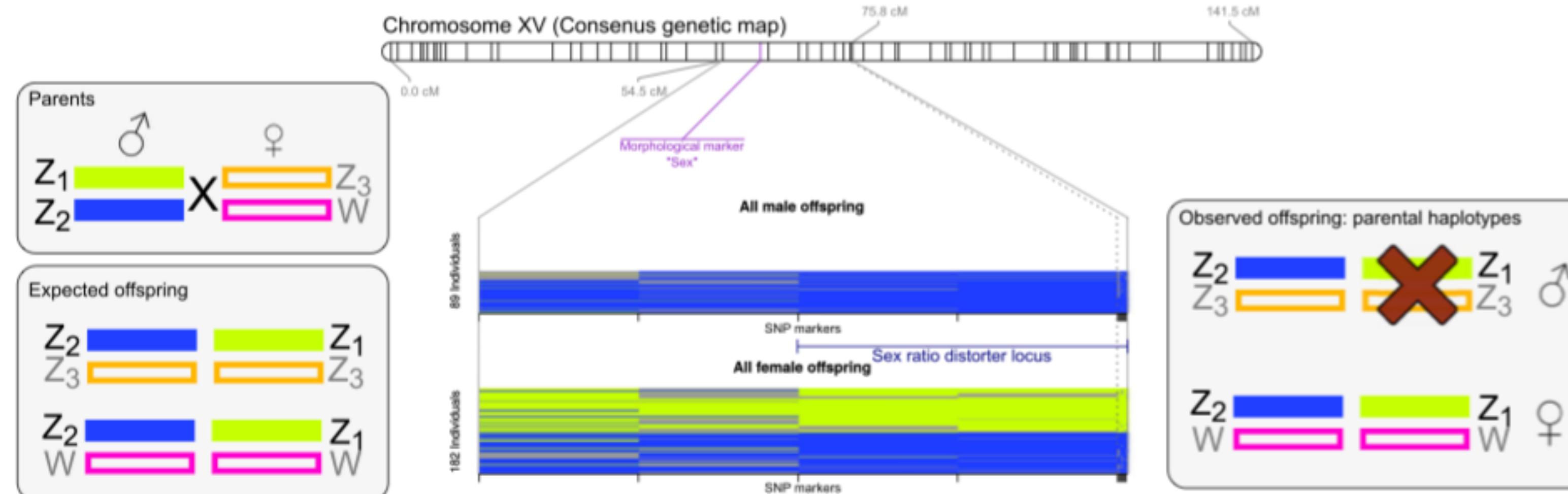


# HIGHLIGHT

## A Segregation of maternal haplotypes



## B Segregation of paternal haplotypes



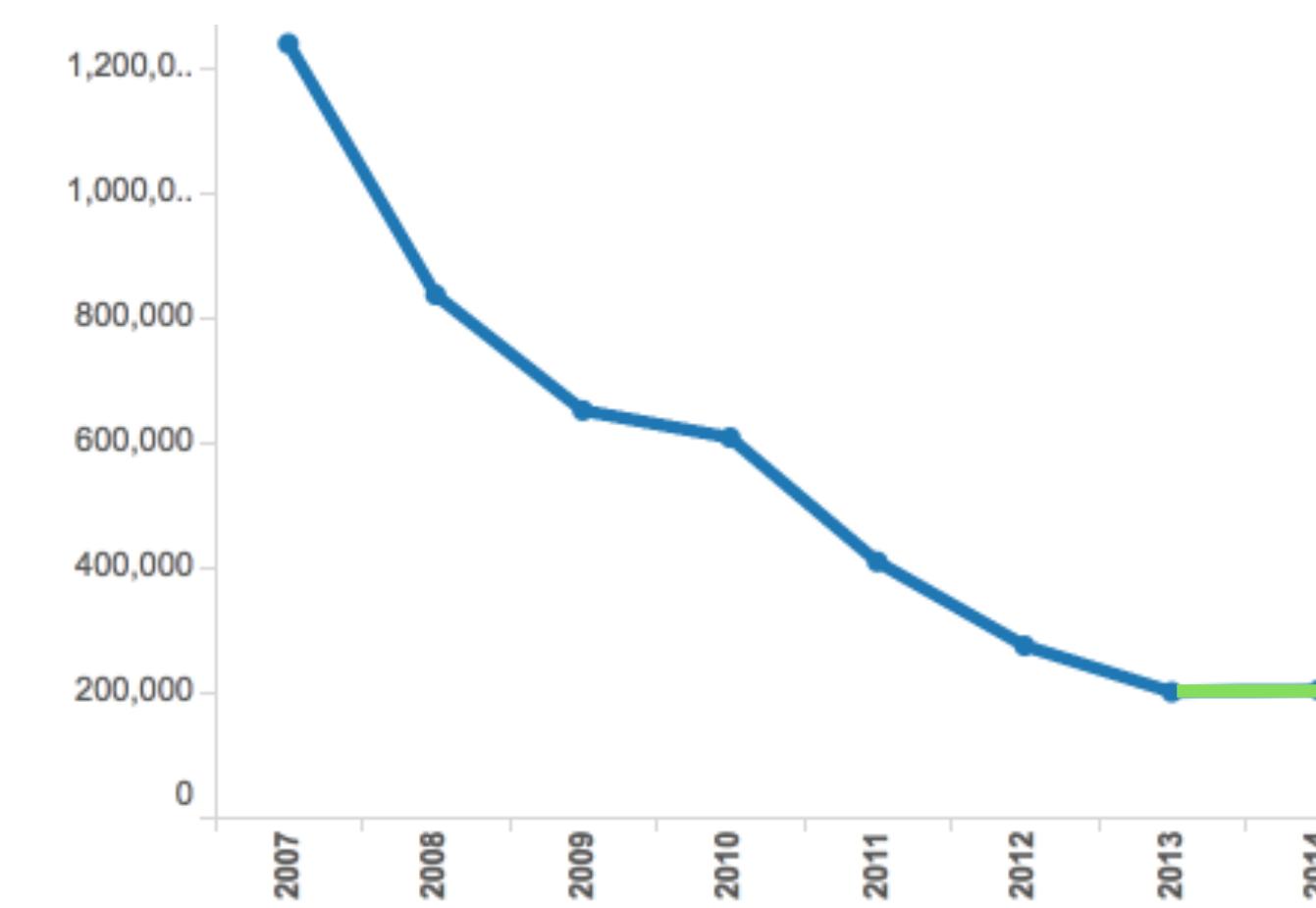
# SPECIFIC GRAPHIC DESIGN FOR GRAPH DESIGN

A matter of integrity

# RULES OF GOOD GRAPH DESIGN

1. Maintain **visual correspondance to quantity**
2. **Avoid Chart Junk**
3. **Annotate correctly**
4. **Avoid 3d**

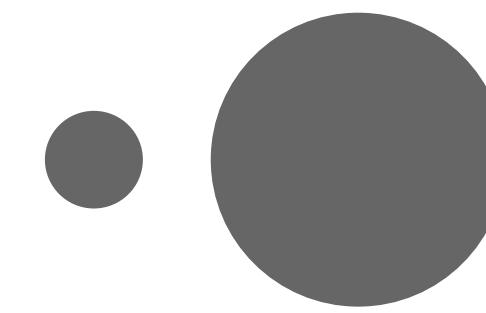
# BAD GRAPH DESIGN



# MAINTAIN VISUAL CORRESPONDANCE TO QUANTITY

Use effective attributes

Q: If left = 1, then right is...?



Size

Radius: 3 ; Area: 9



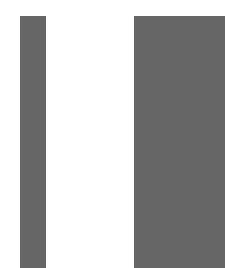
Length

3



Shape

Na



Width

3



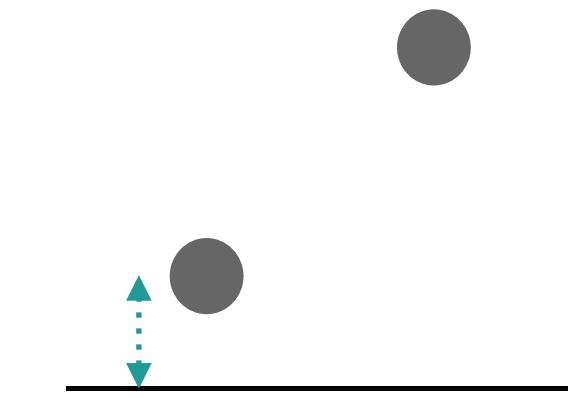
Color (hue)

Na



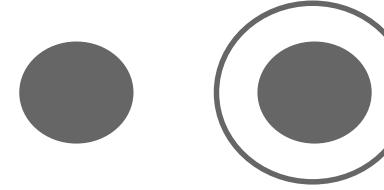
Color (intensity)

0.5



2D position

3



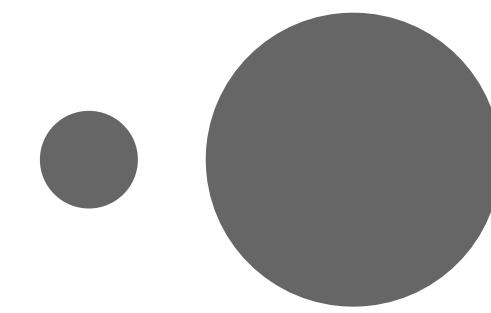
Enclosure

Na

# MAINTAIN VISUAL CORRESPONDANCE TO QUANTITY

Use effective attributes

Q: If left = 1, then right is...?



Size

Radius: 3 ; Area: 9

1/26



Color (hue)

Na

-



Length

3

25/26



Color (intensity)

0.5

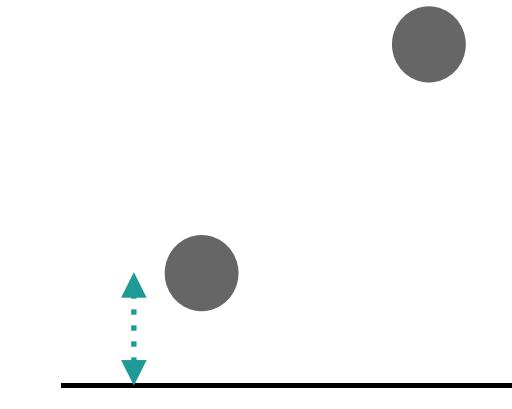
10/26



Shape

Na

-



2D position

3

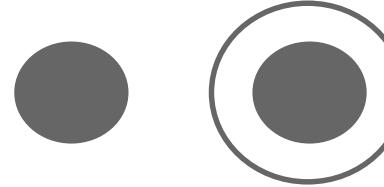
24/26



Width

3

7/26



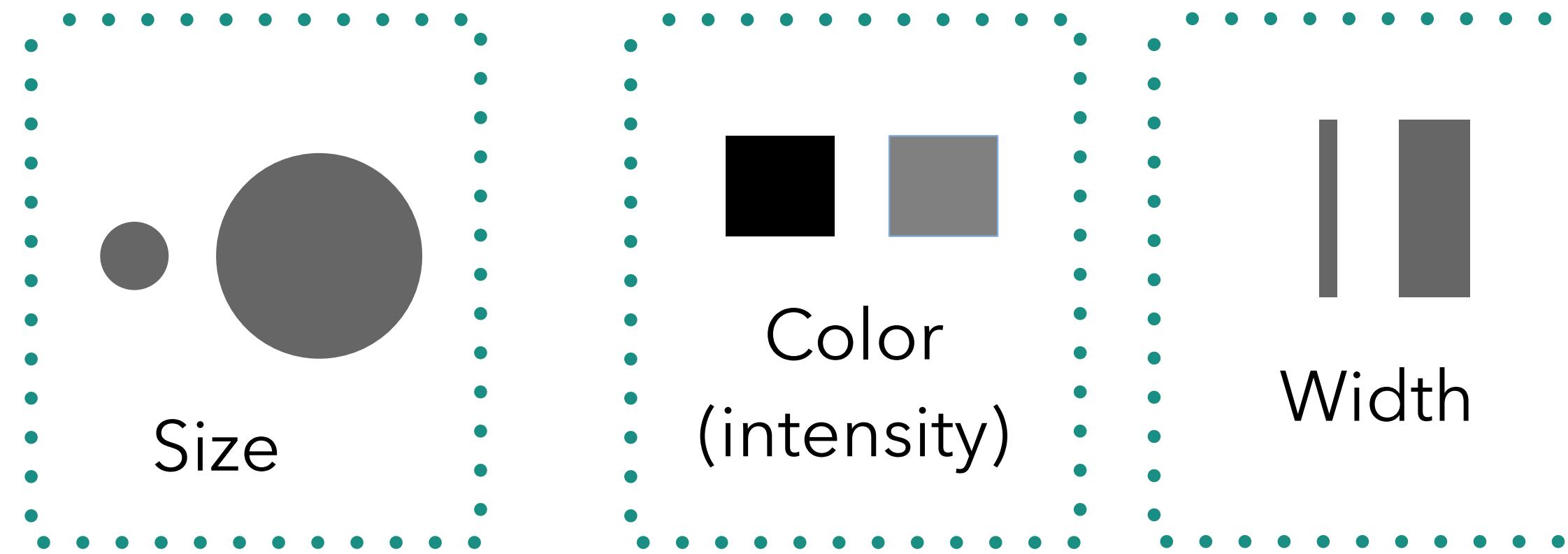
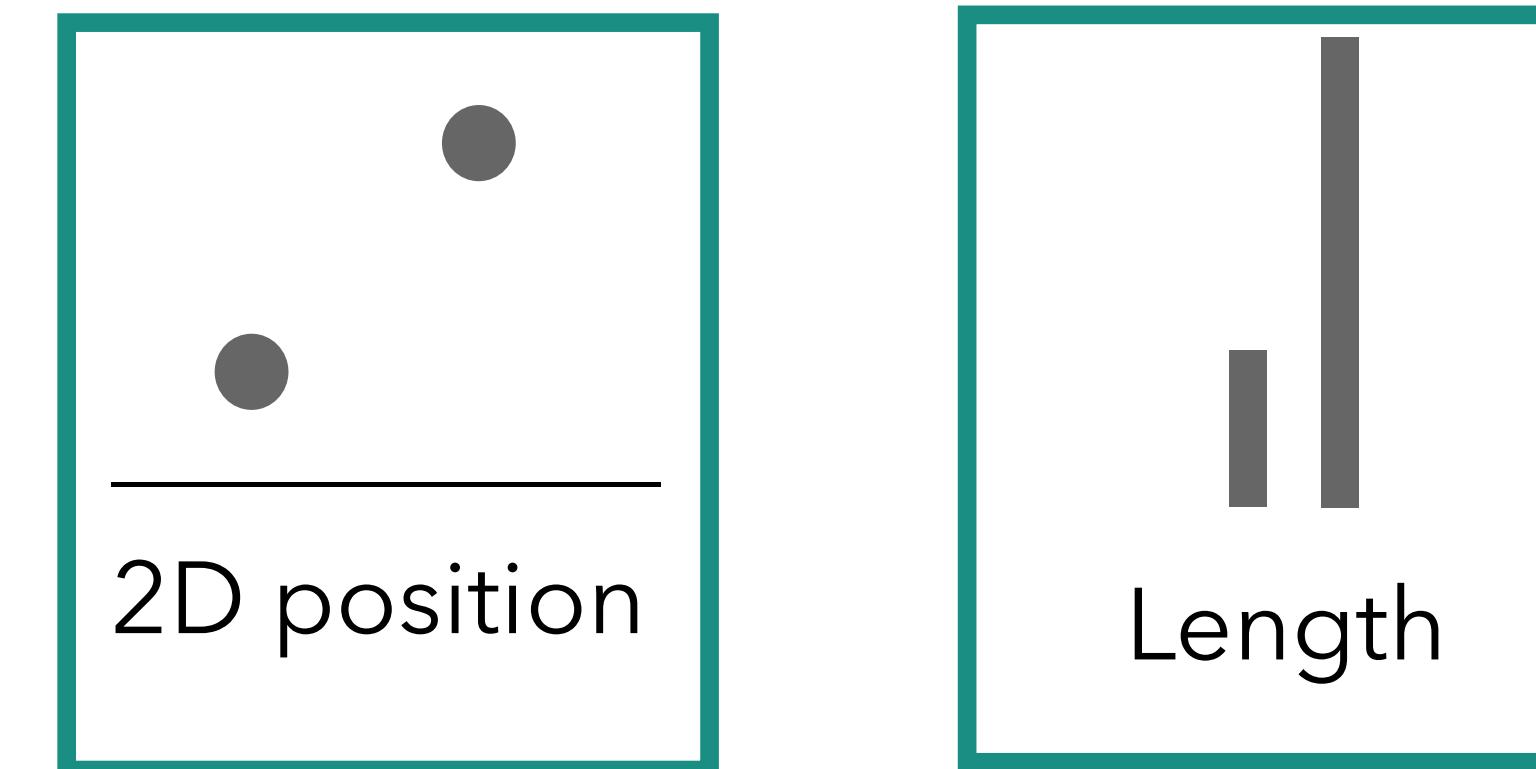
Enclosure

Na

-

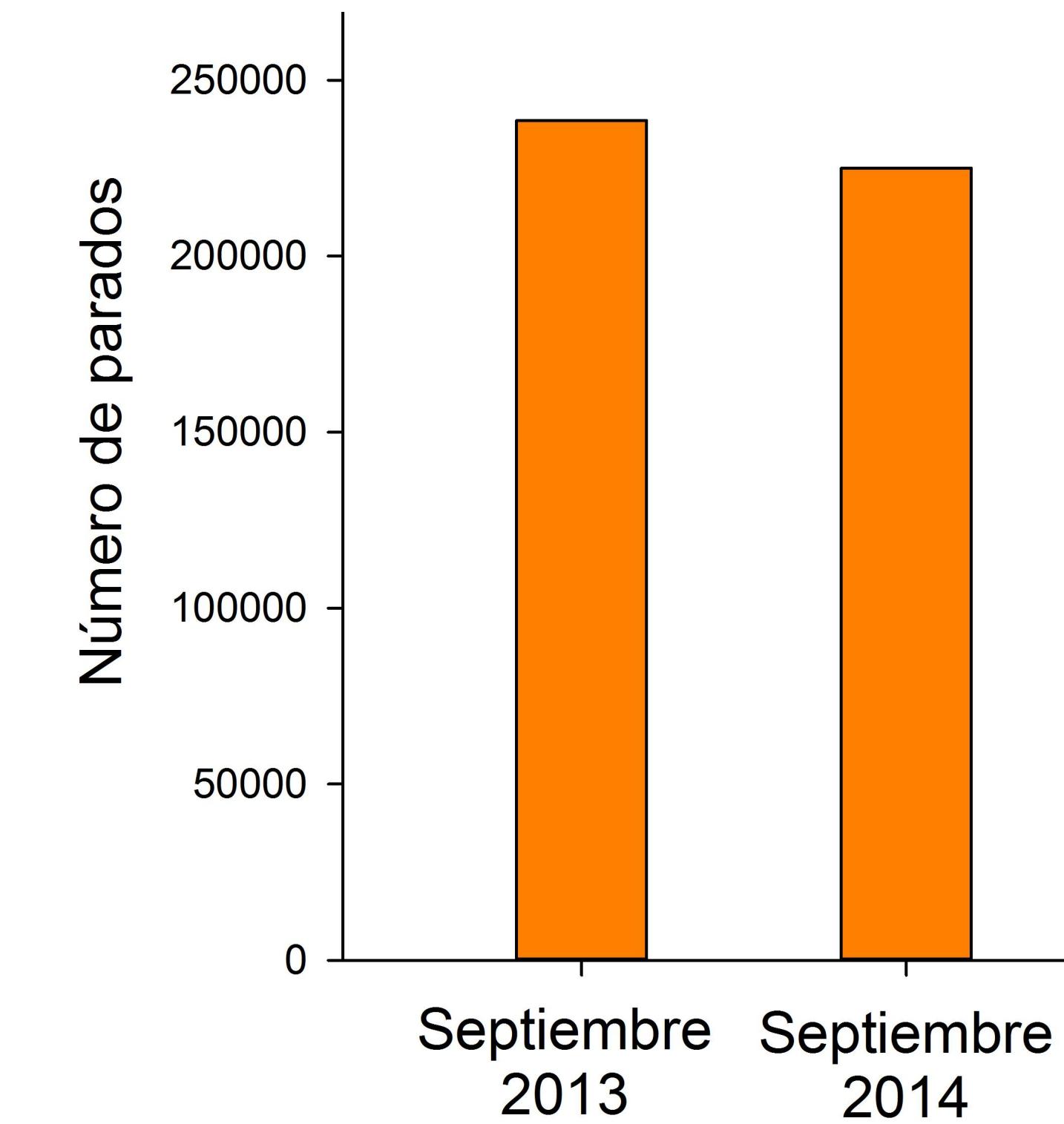
# MAINTAIN VISUAL CORRESPONDANCE TO QUANTITY

Use effective attributes

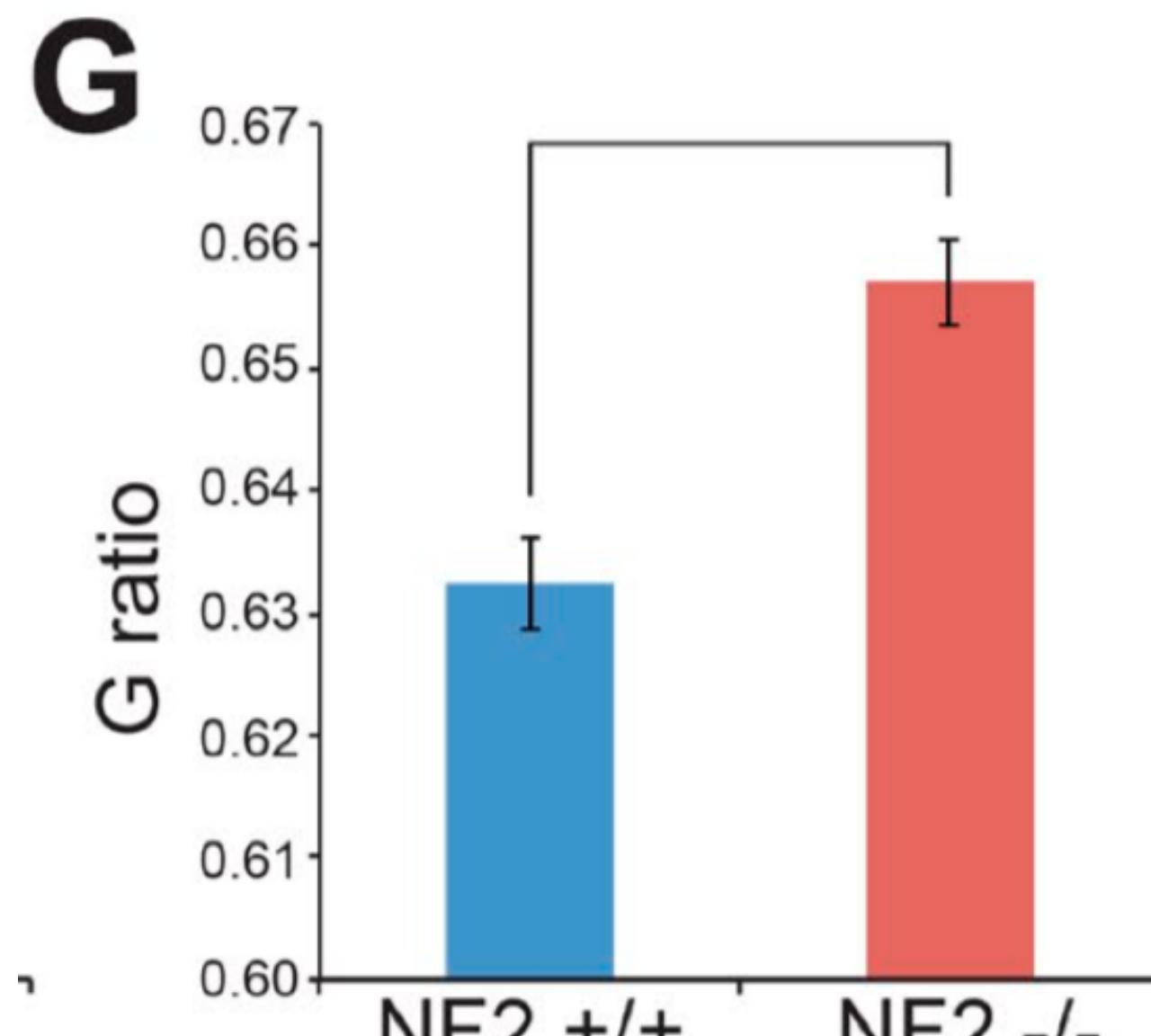


# MAINTAIN VISUAL CORRESPONDANCE TO QUANTITY

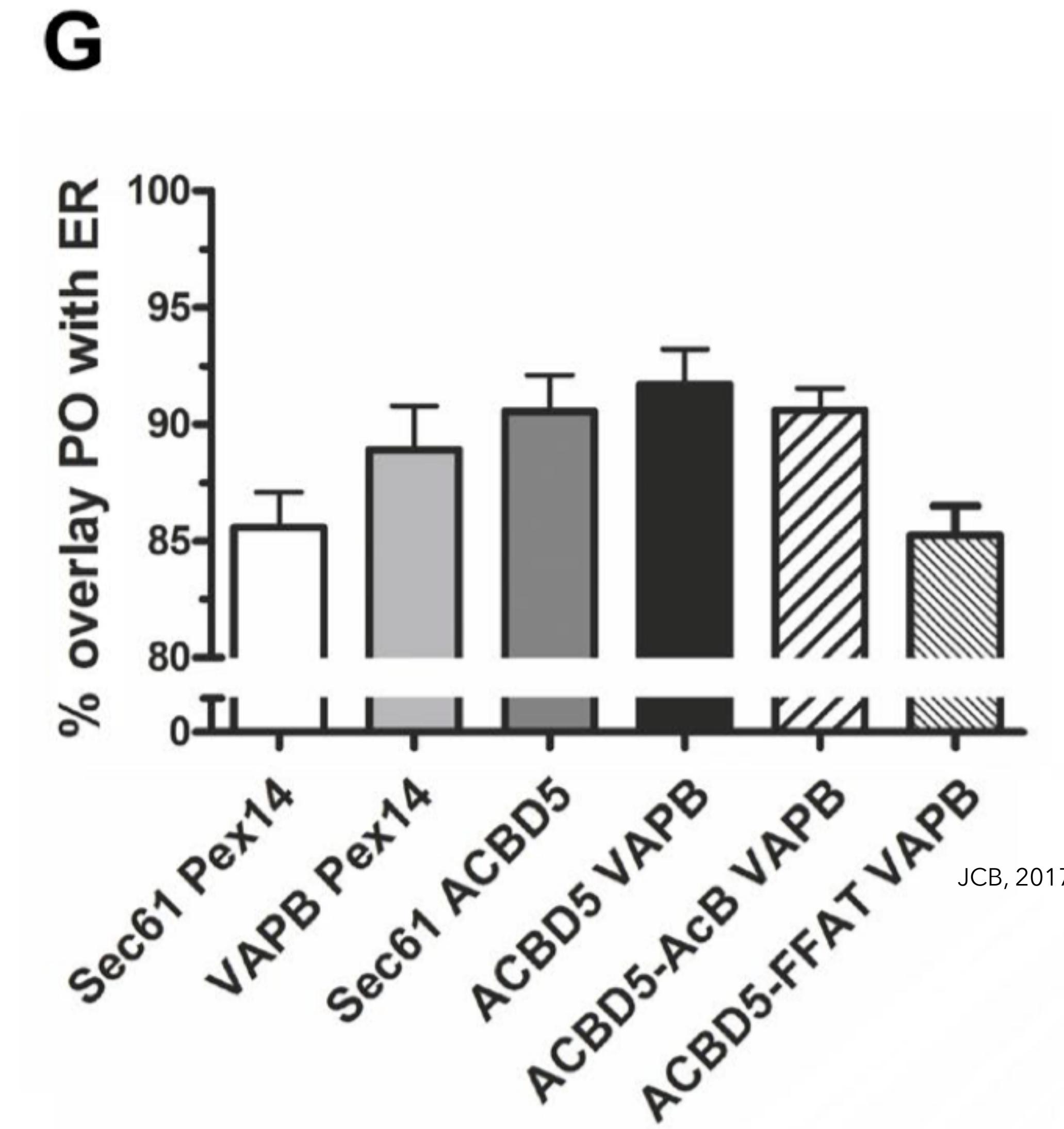
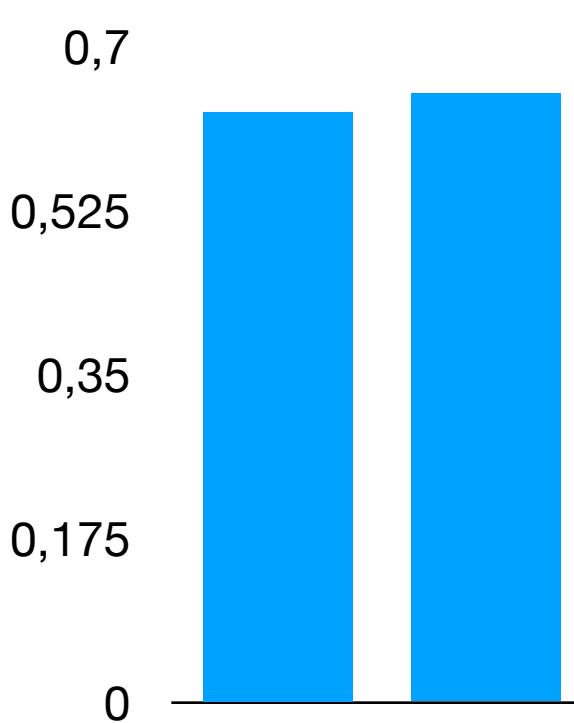
Beware of axis manipulation



# USING NON-0 BASELINE FOR BARS

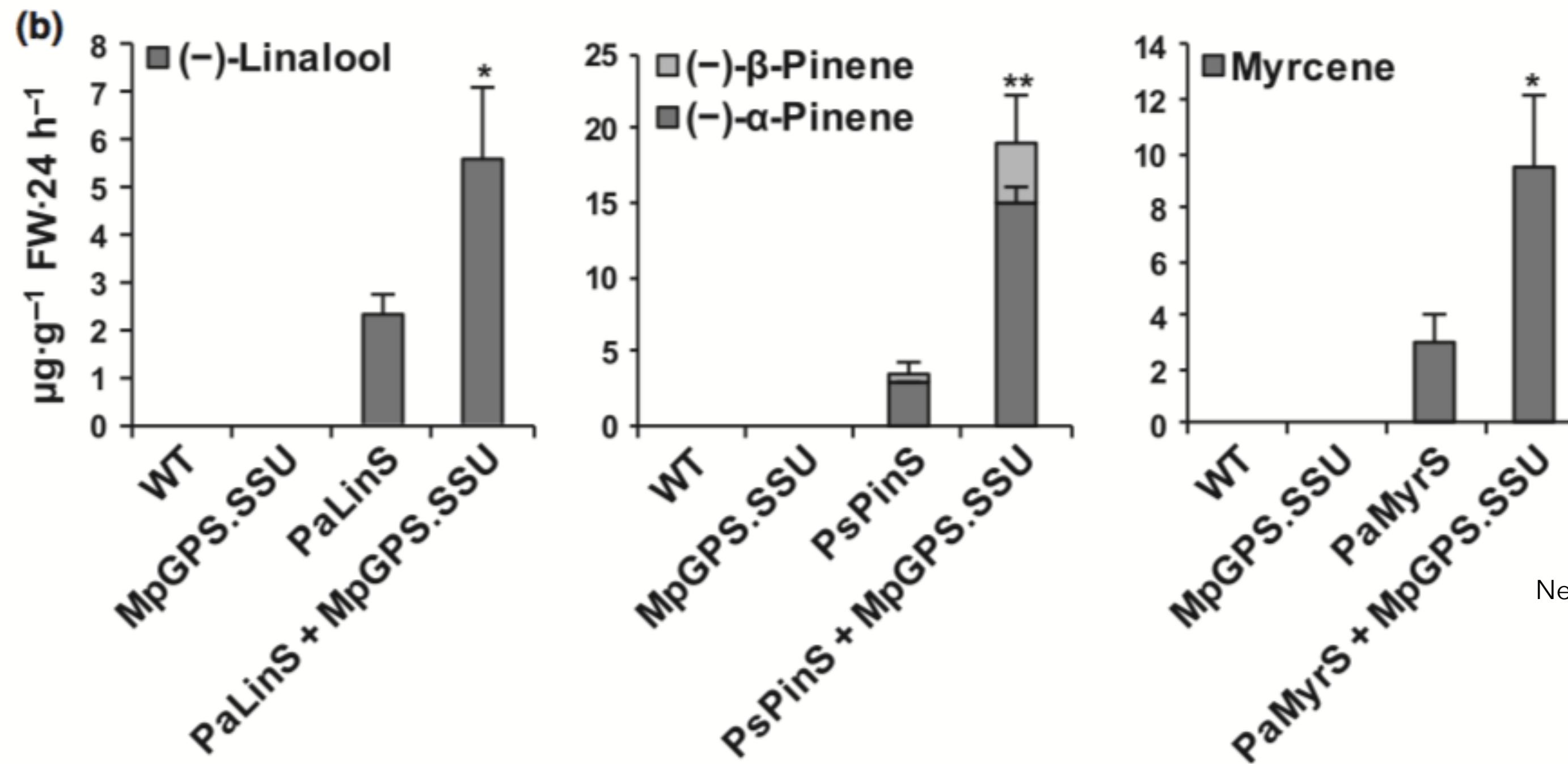


JCB, 2017

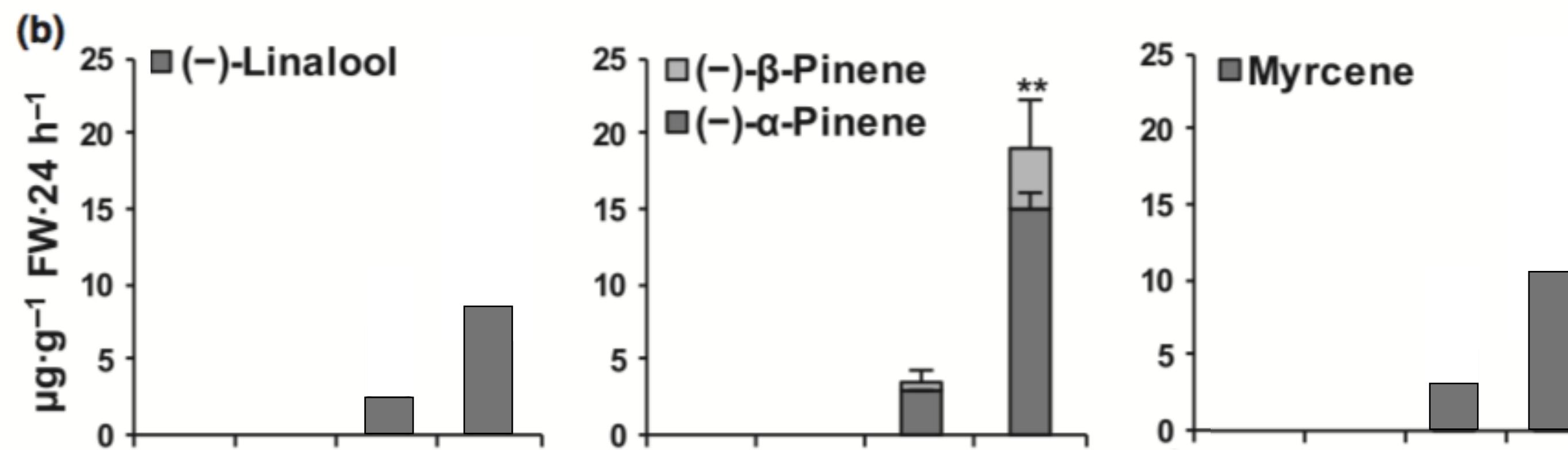


JCB, 2017

# "OPTIMIZING" AXIS TO MAXIMUM



NewPhytolog, 2017



# CHART JUNK

focus attention on the essential

# NO CHART JUNK

maximize

$$\text{Data-ink ratio} = \frac{\text{Data-ink}}{\text{Total ink used in graphic}}$$

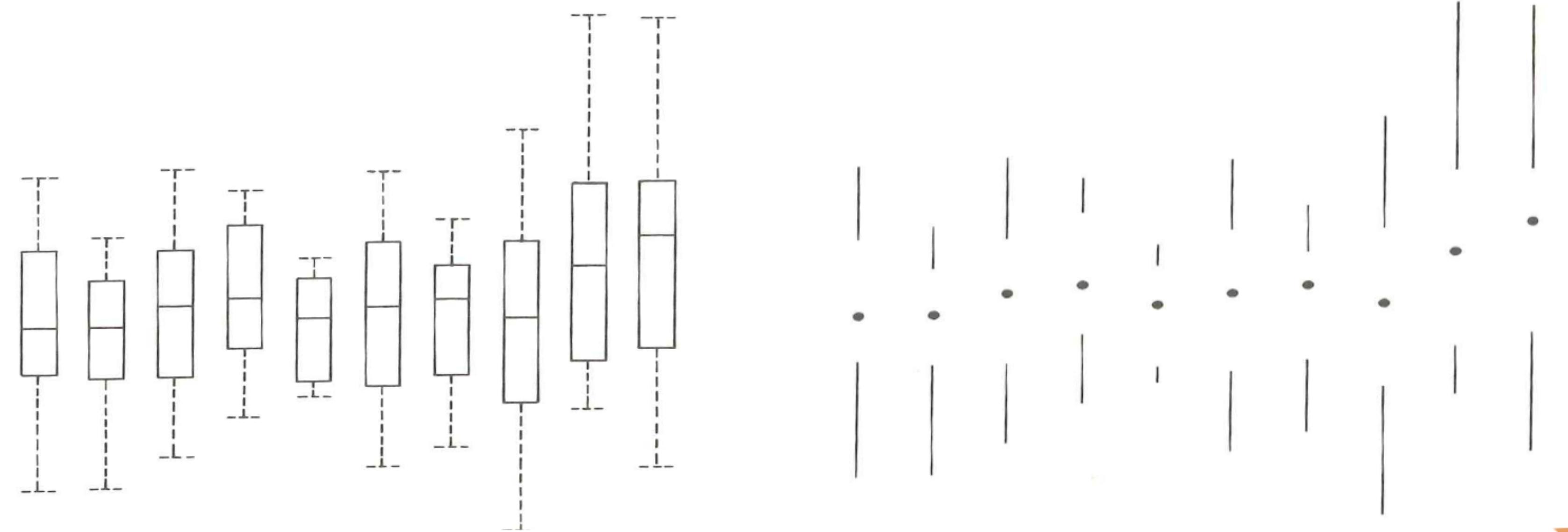
by

— Edward R. Tufte

1. Enhancing the data ink

2. Reducing the non-data ink

*“Would the data suffer any loss of meaning  
or impact if this was eliminated?”*

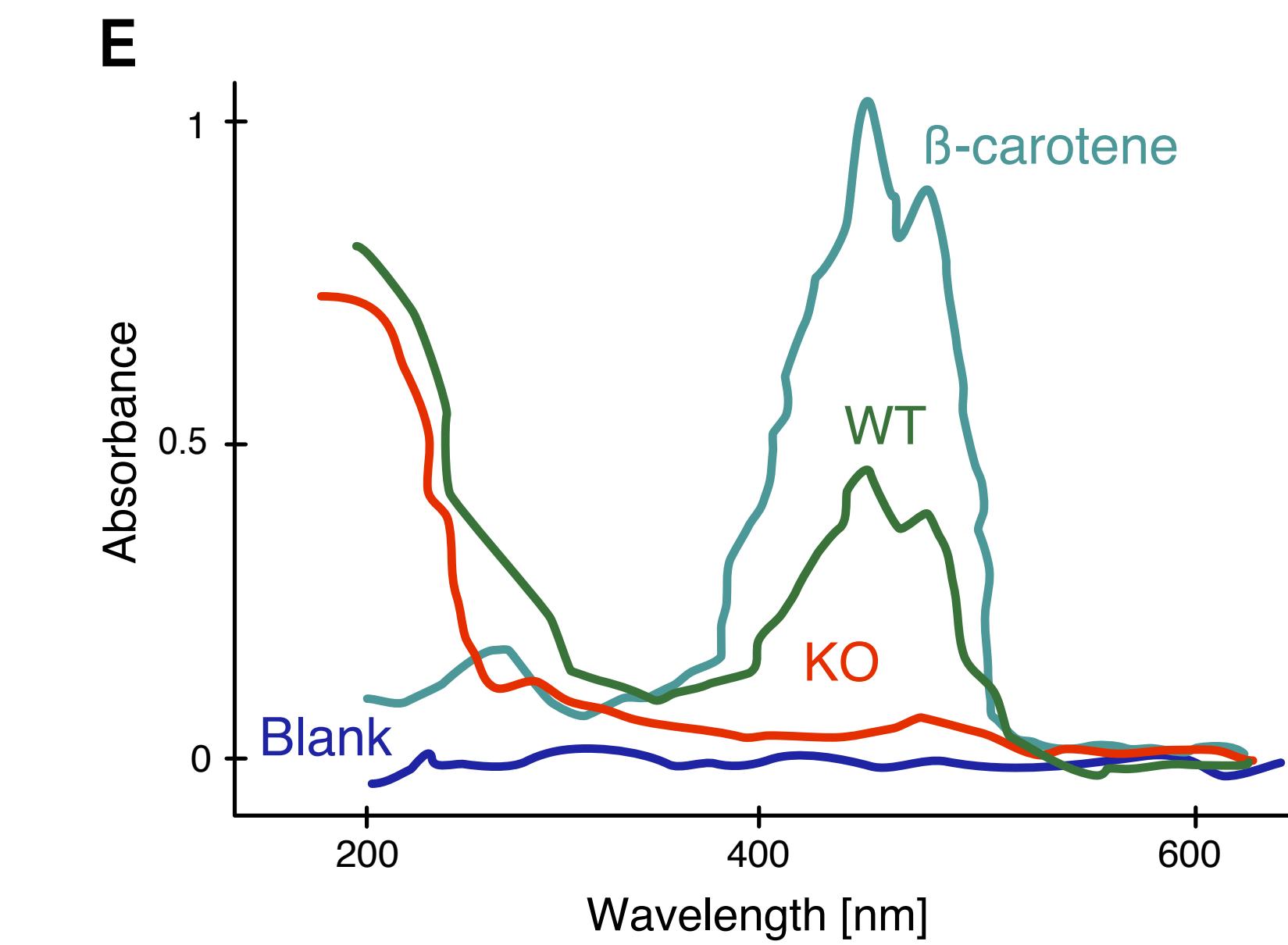
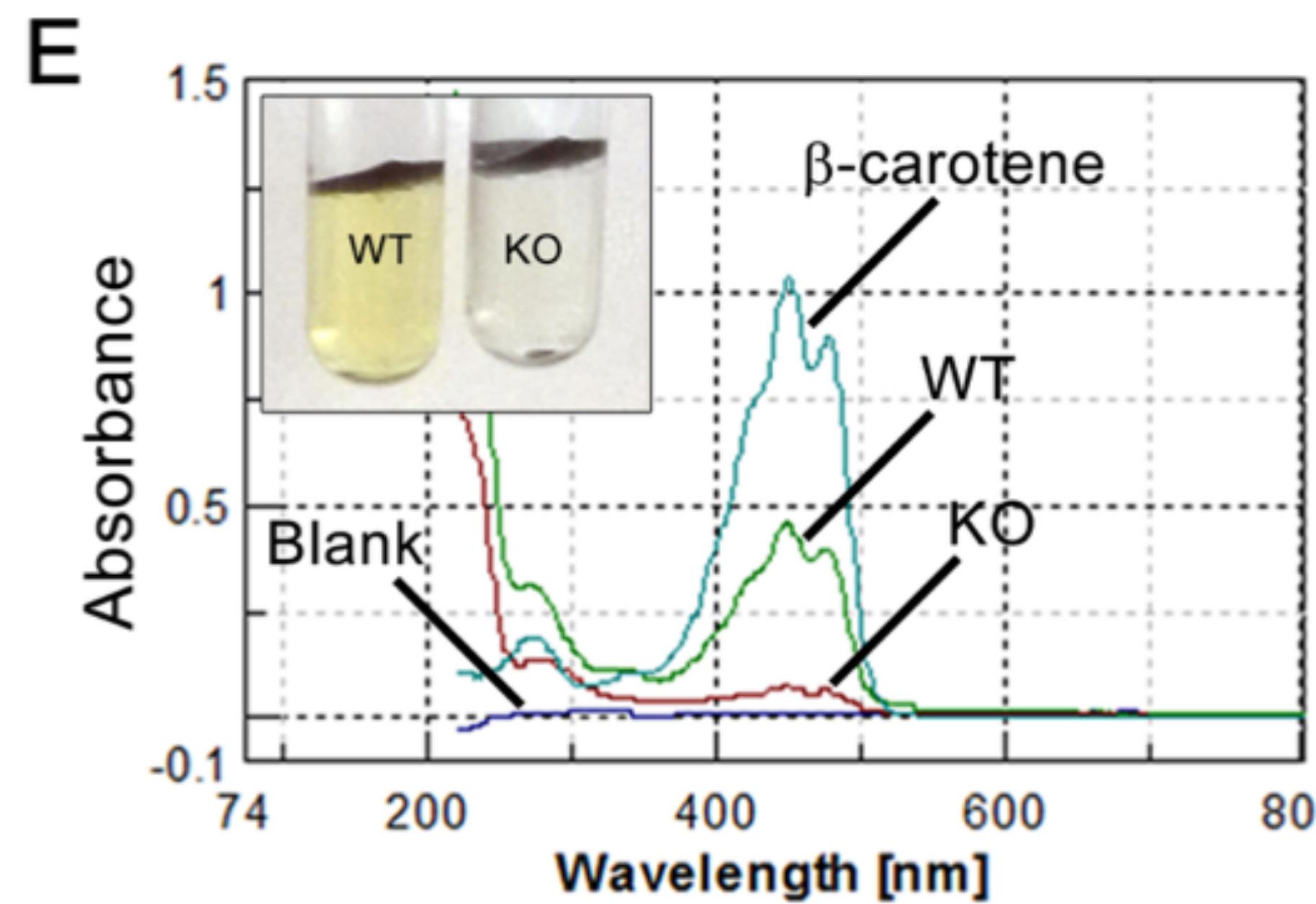


*Edward R. Tufte minimal Box Plots*

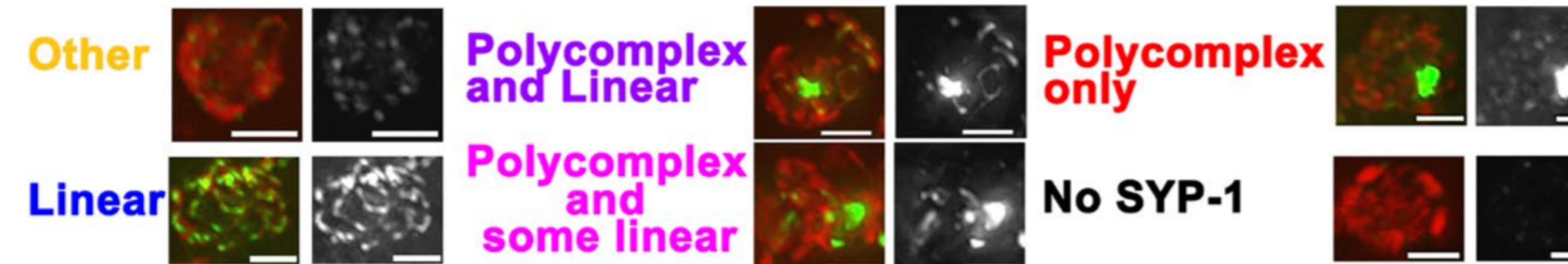
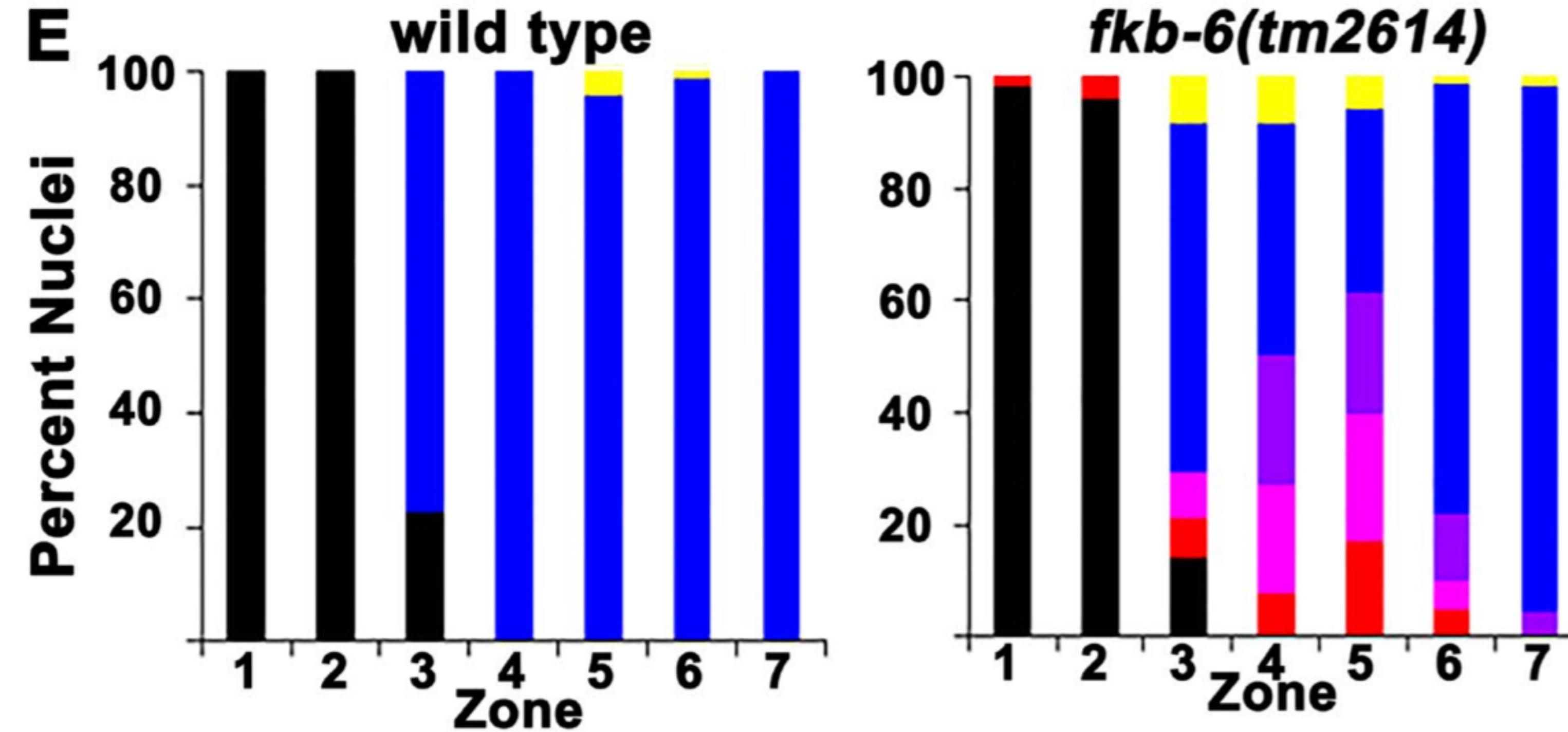
*“Chart junk is any element of a chart that does not contribute to clarifying the intended message.”*

*Robert Kosara, 2014*

# GETTING RID OF CHART JUNK

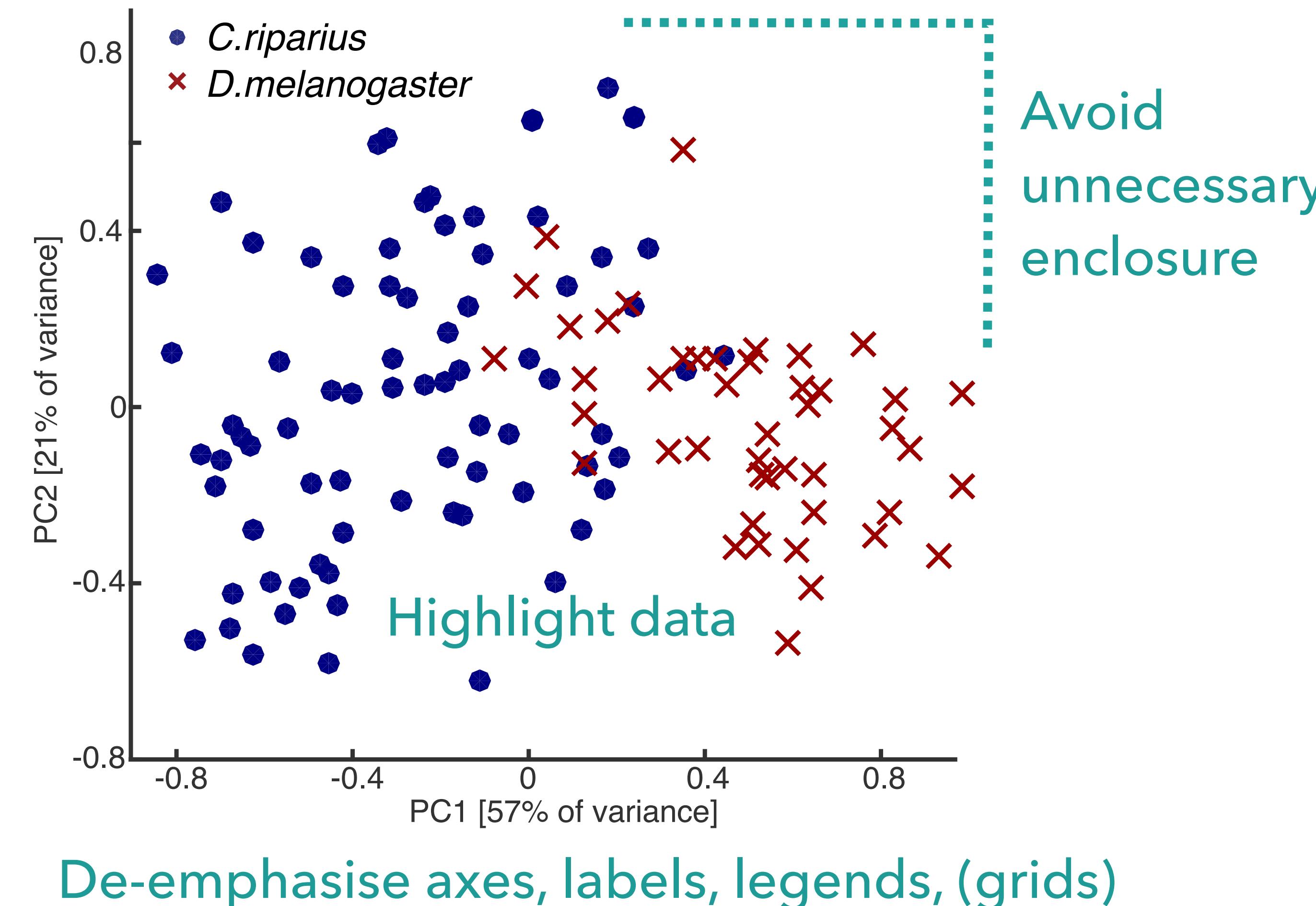


# CHART JUNK CAN ALSO BE TEXT



# GUIDELINES TO AVOID CHART JUNK

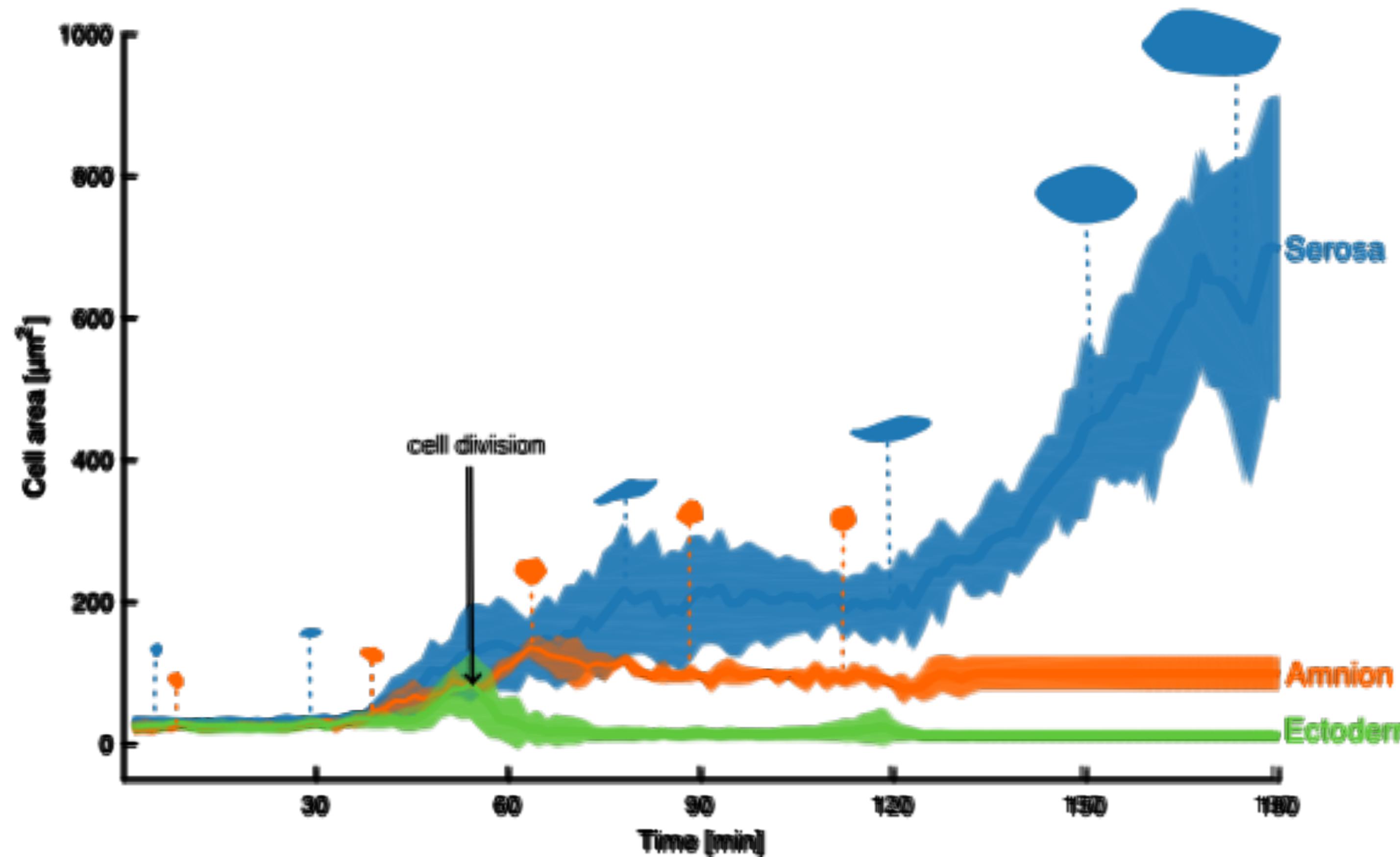
*"Would the data suffer any loss of meaning or impact if this was eliminated?"*



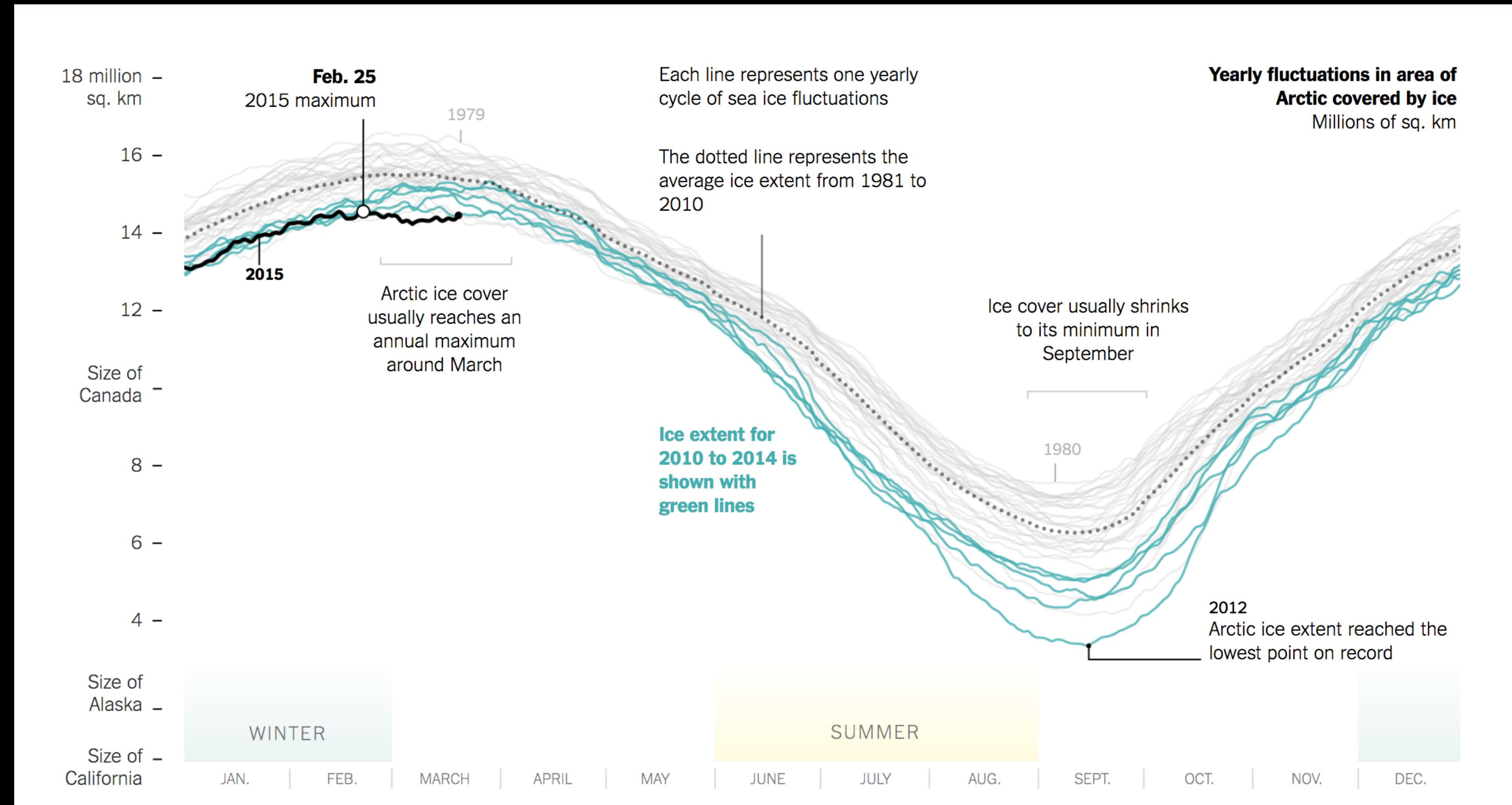
# ANNOTATION

extra layer of information that provides context

# HELP YOUR READERS UNDERSTAND YOUR GRAPH

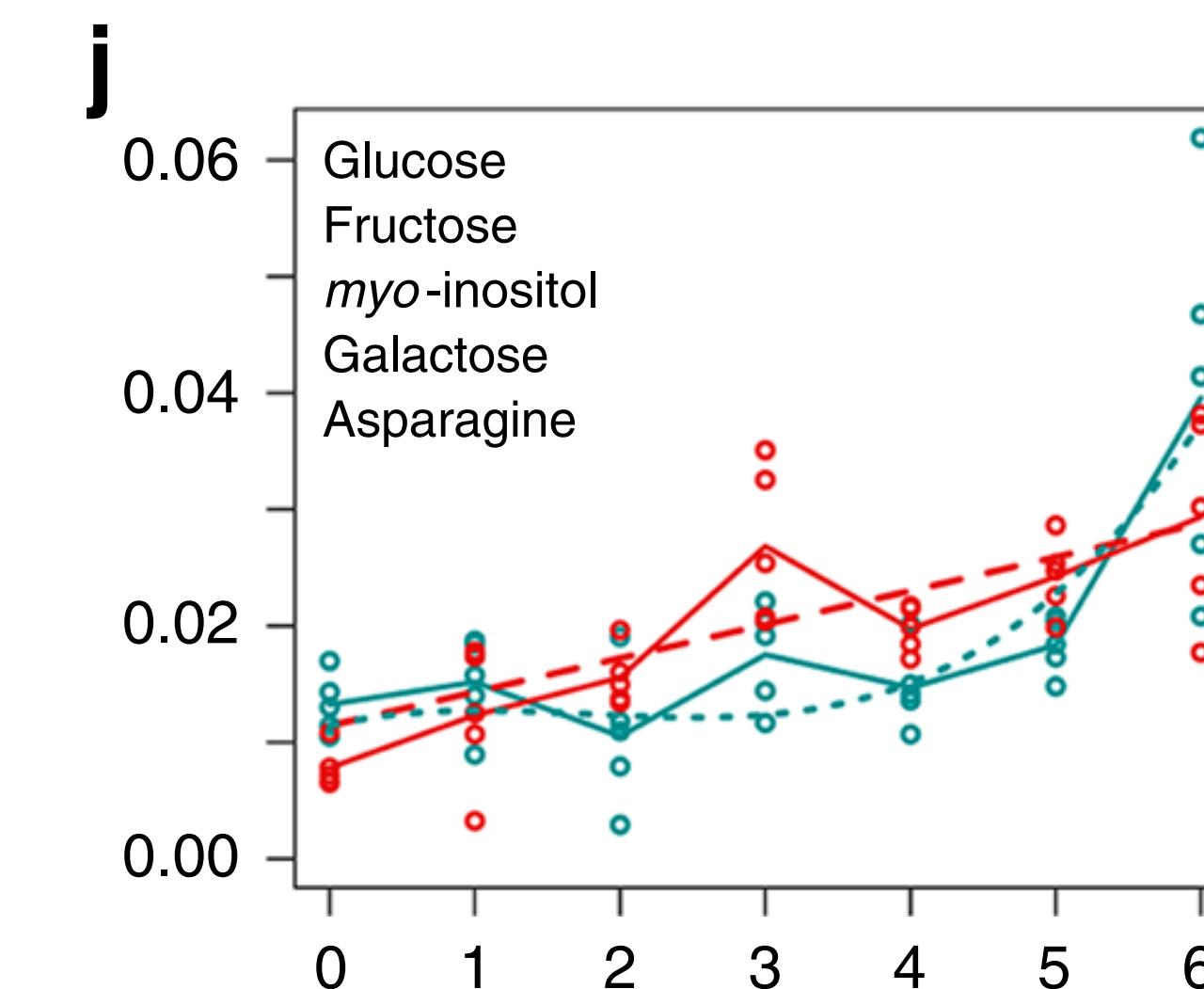
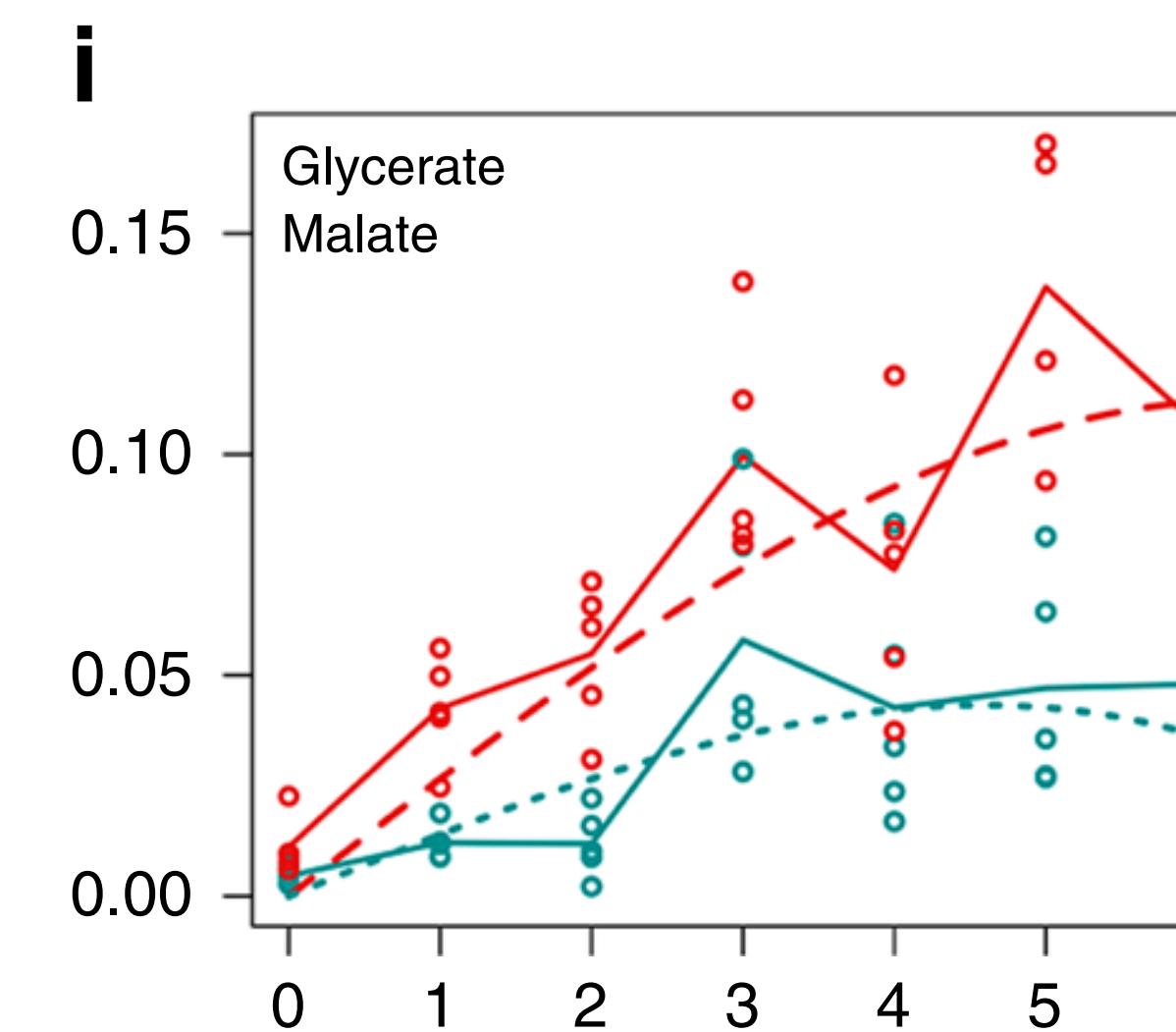
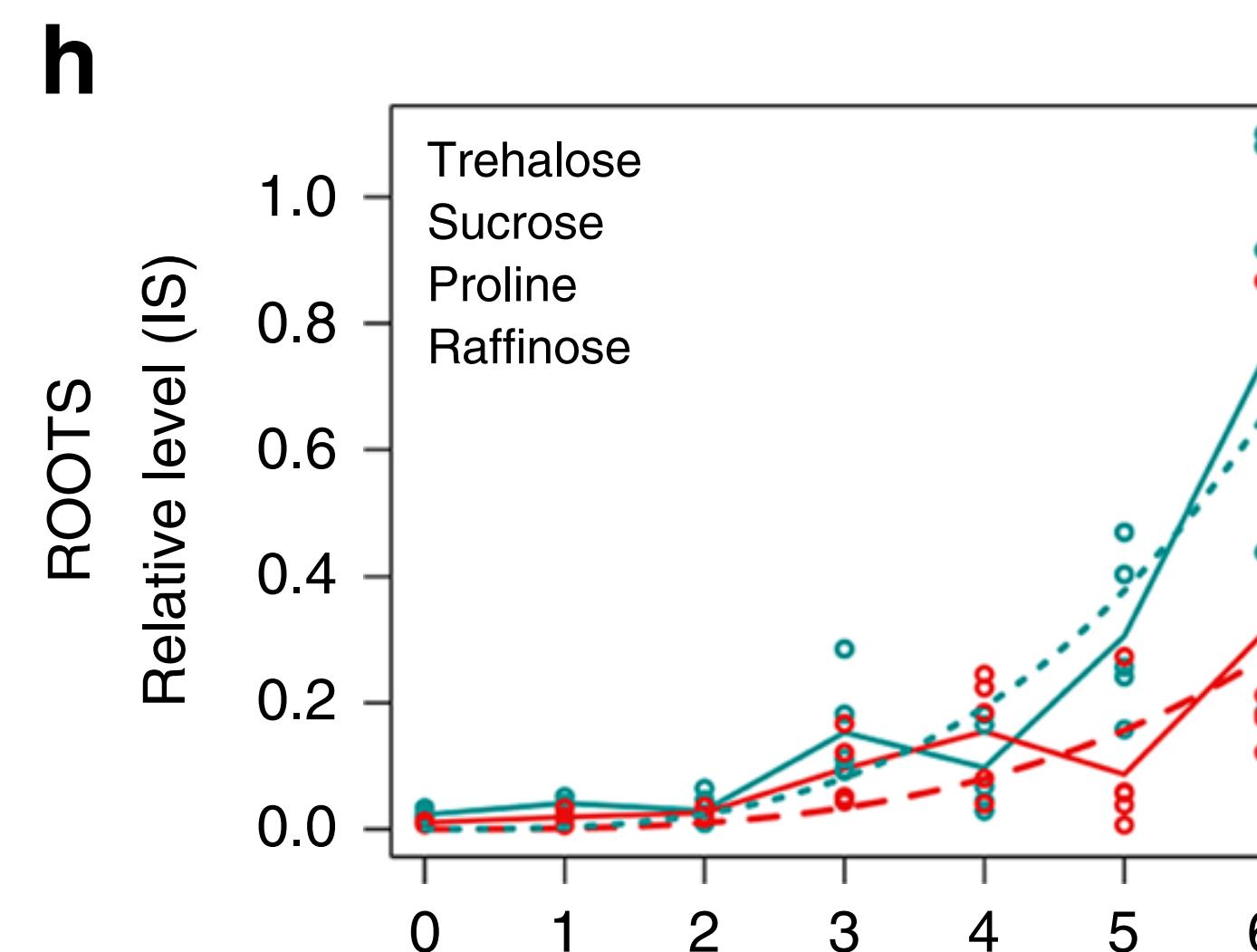
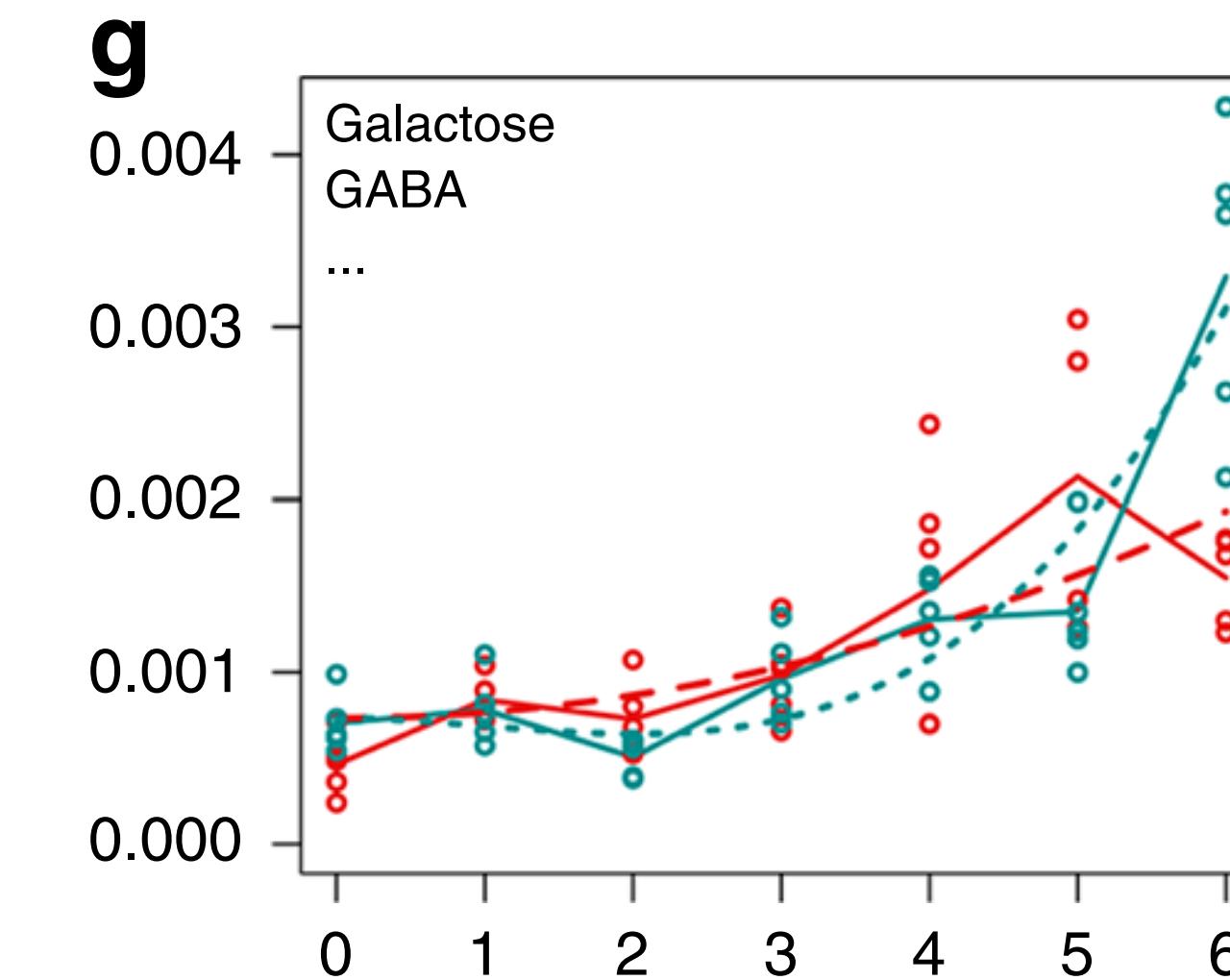
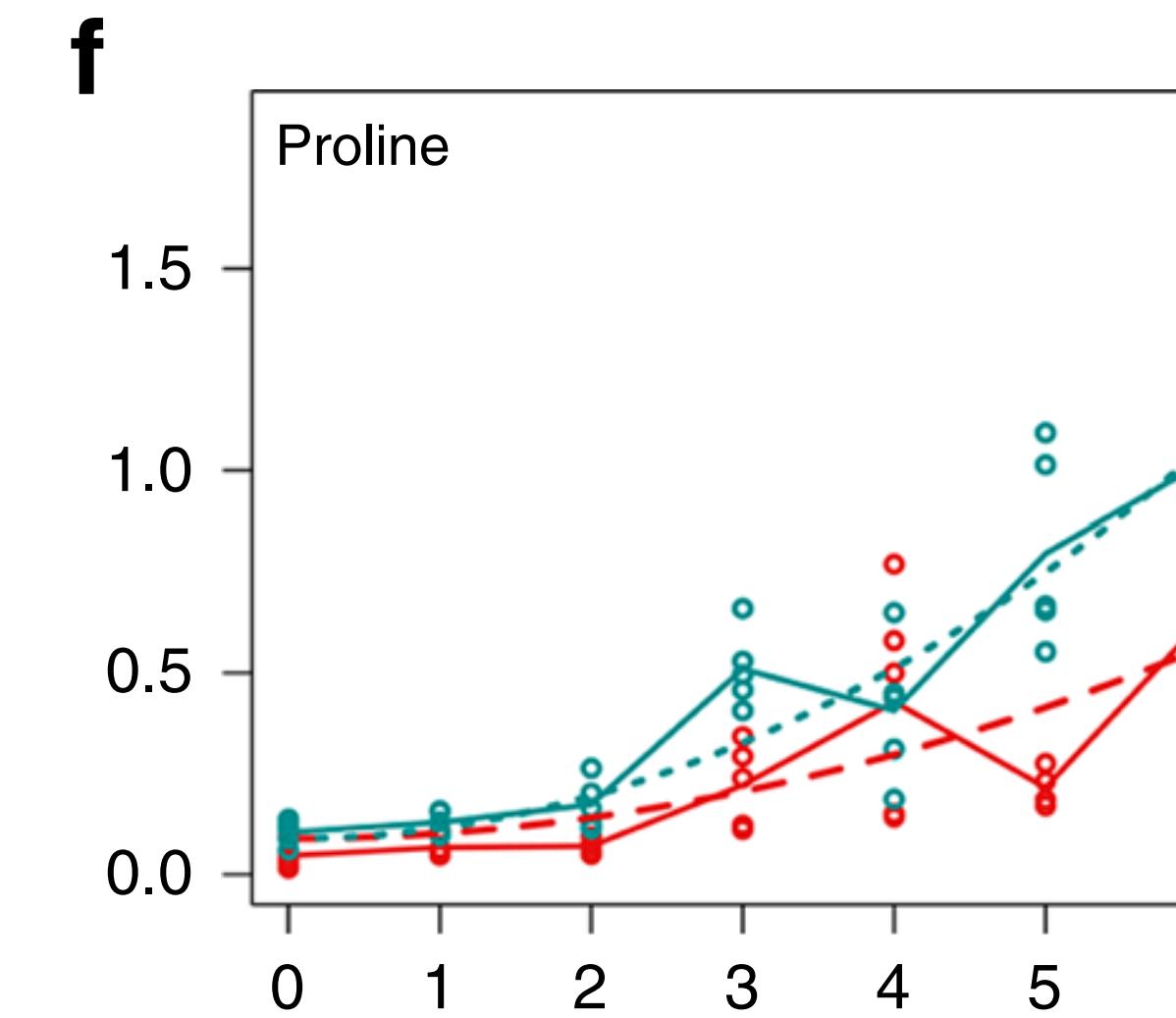
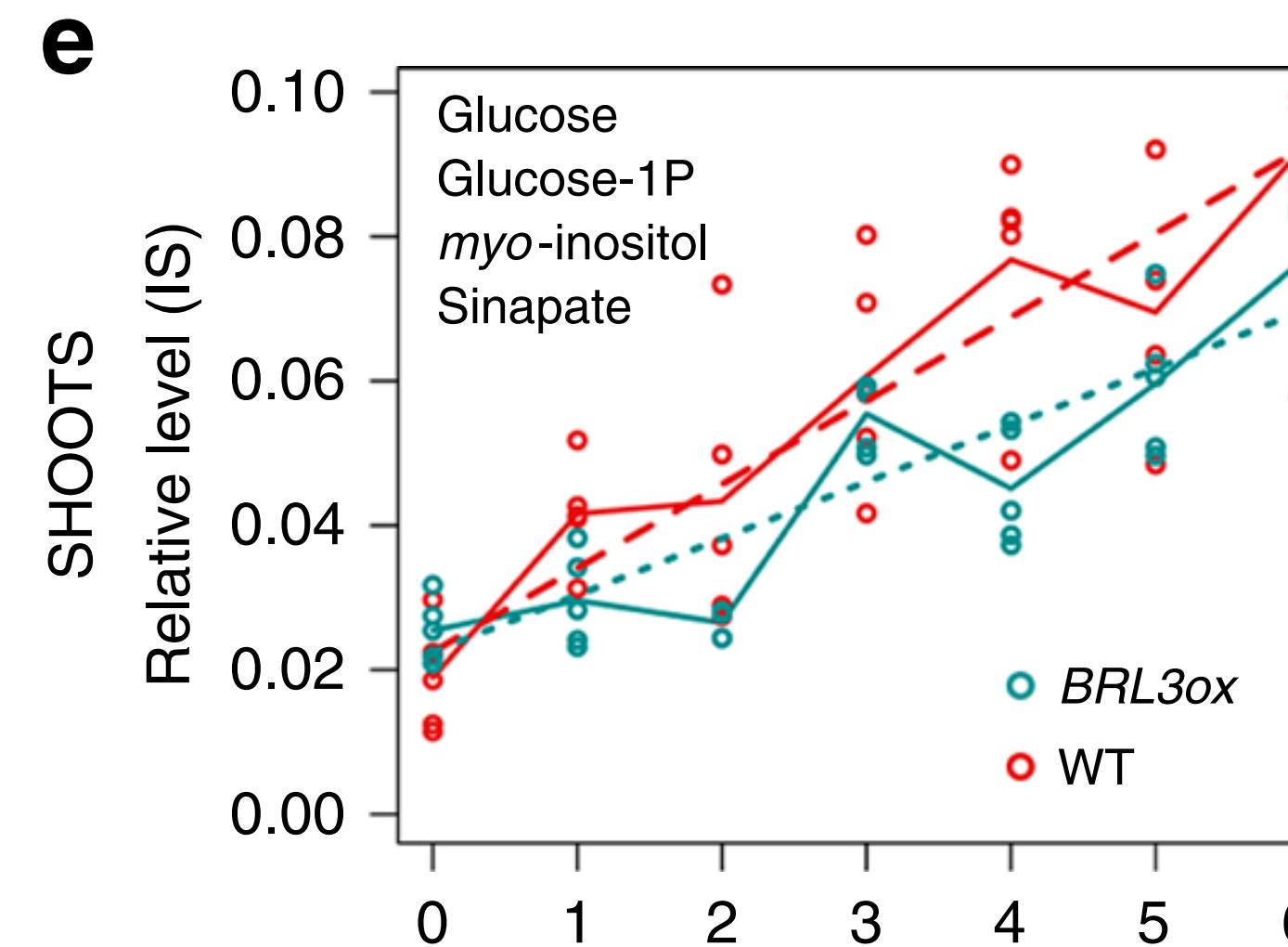


**Fig X: Cell area change in time for the different cell types analysed.** Blue = Serosa, Orange = Amnion, Green = Ectoderm. Until 60 min after GE extension cell types are indistinguishable in size. Afterwards the ectoderm cells start dividing reducing their cell area ....

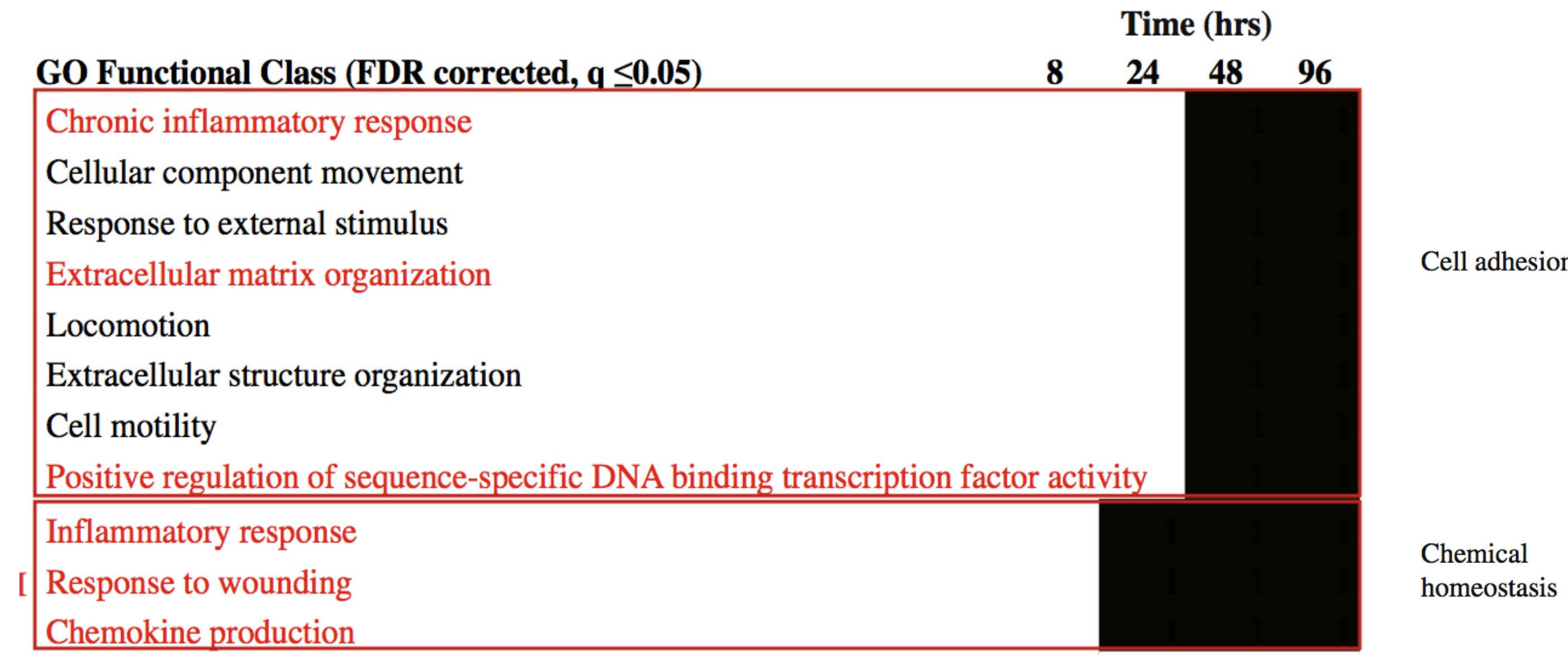


DEREK WATKINS, Arctic Ice Reaches a Low Winter Maximum, New York Times, 2015

Fig. 4



# A NOTE ABOUT FONTS



**(B)**

**Group IV**

Time (hrs)

GeneSymbol	8	24	48	96
AMELX	-1.5	-1.5	-0.9	-1.6
AMIGO1	0.0	-1.2	-1.9	-2.2
AZGP1	-0.4	-1.0	-1.6	-1.3
CCL5	-0.1	-1.2	-1.6	-1.6
CD22	-0.1	-1.7	-1.6	-2.5
CLDN1	-0.6	-0.9	-1.1	-2.1
CNTN1	0.2	-0.6	0.0	-1.0
EPHA1	-0.2	-1.0	-1.5	-2.7
LEF1	-0.3	-2.0	-1.4	-1.9
MFGE8	-0.3	-0.8	-2.2	-1.5
NEDD9	0.0	-1.0	-0.9	-2.0
NTM	0.3	-2.2	-0.4	-1.8
ATP2B2	-0.6	-0.9	-2.3	-1.9
CCL5	-0.1	-1.2	-1.6	-1.6
F2R	-0.1	-1.7	-3.9	-2.8
HK1	-0.2	-0.8	-2.3	-1.3
KCNK3	0.0	-1.6	-2.7	-2.5
MFI2	-0.4	-0.9	-1.4	-0.7

BMCgenomics, 2017

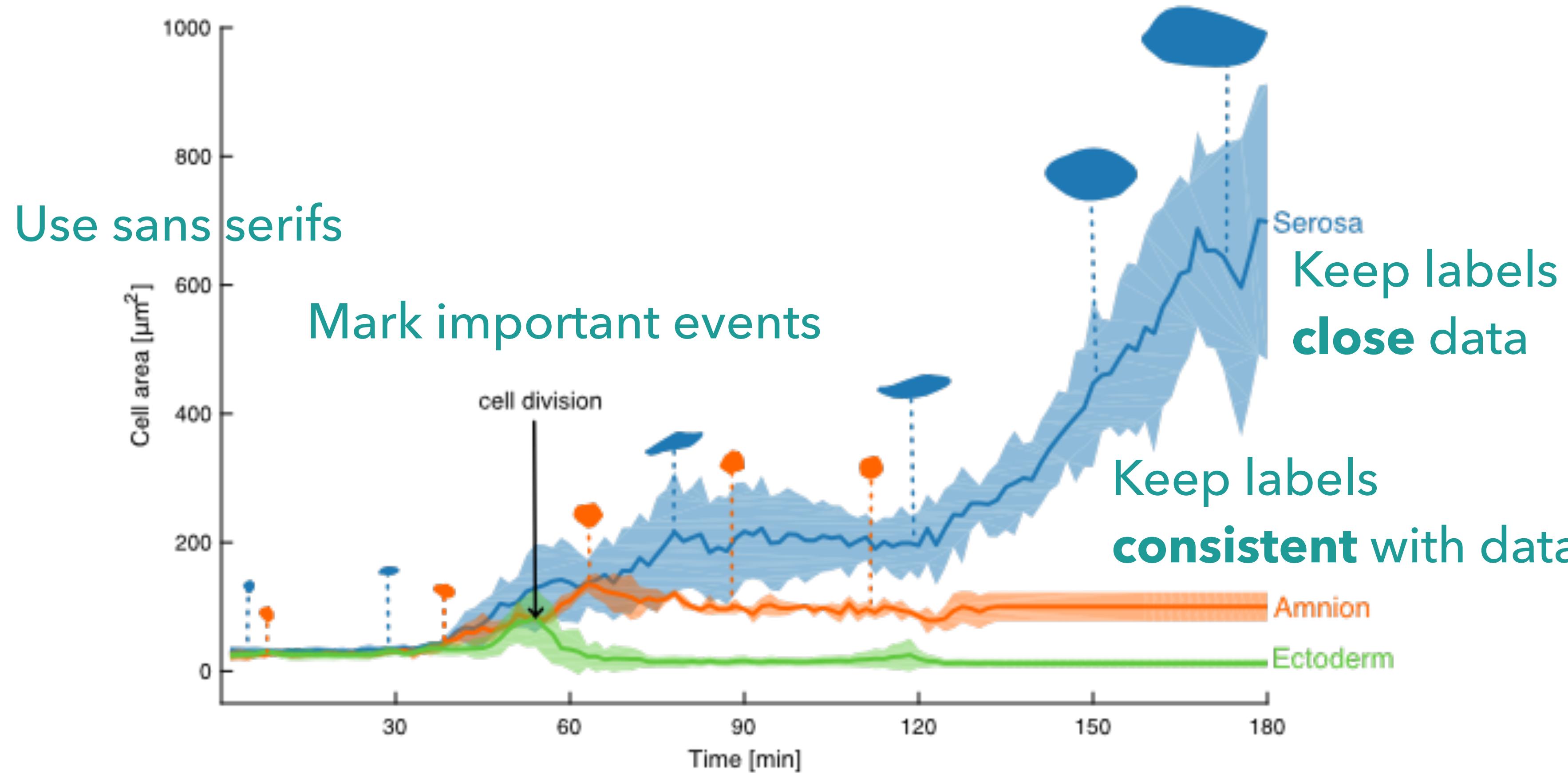
Serif

Sans Serif

Always use **sans-serif** fonts for figure elements!

# SOME RULES ABOUT ANNOTATION

Consider adding a **title** e.g. for poster presentations

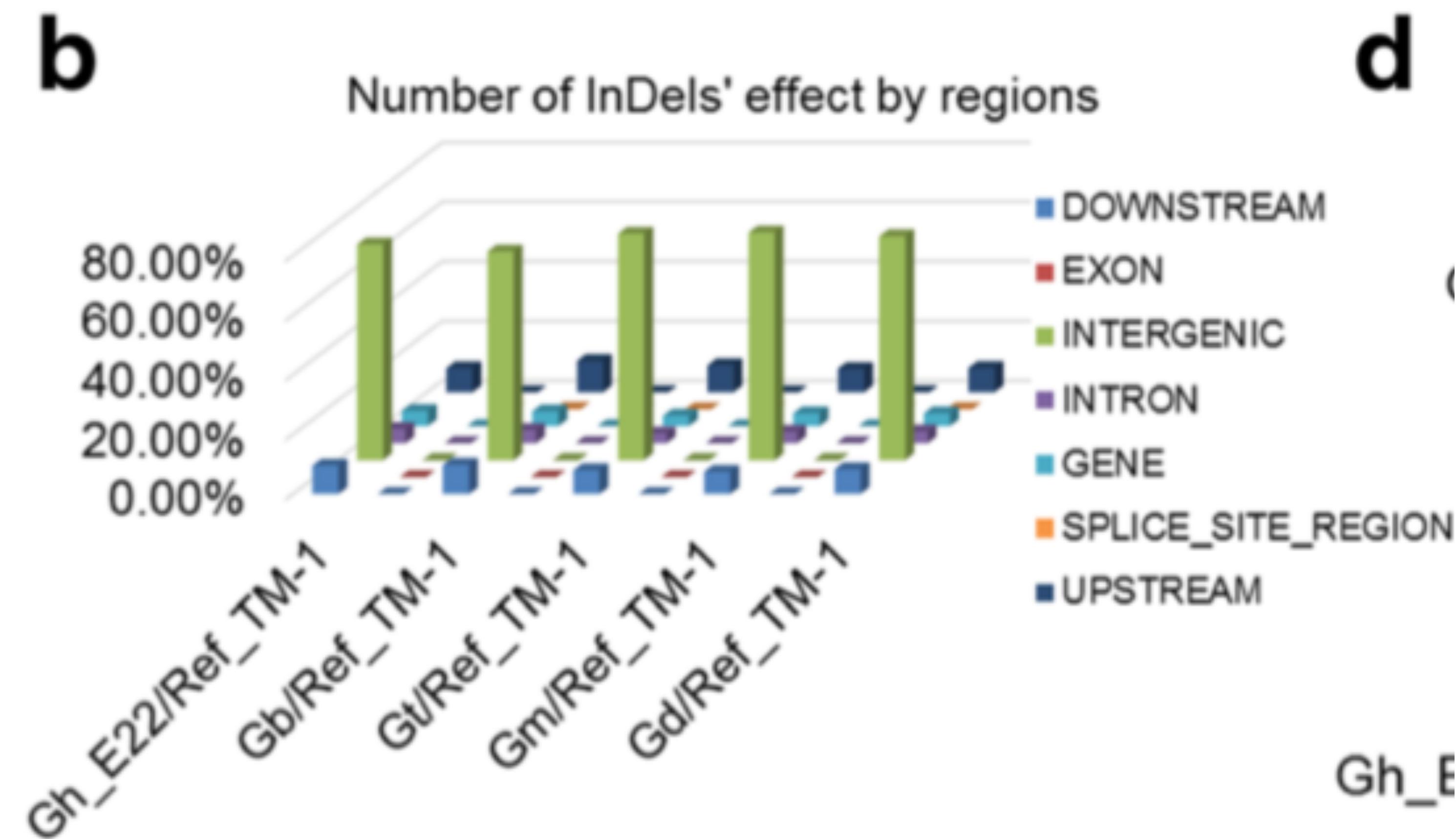


Keep in mind what is essential: remember chart junk!

# THE CASE OF 3D PLOTS

And why you should avoid them

# AVOID 3D



# 3D Pie - Prezi Template \$5.00



Description

Video Preview

## Description

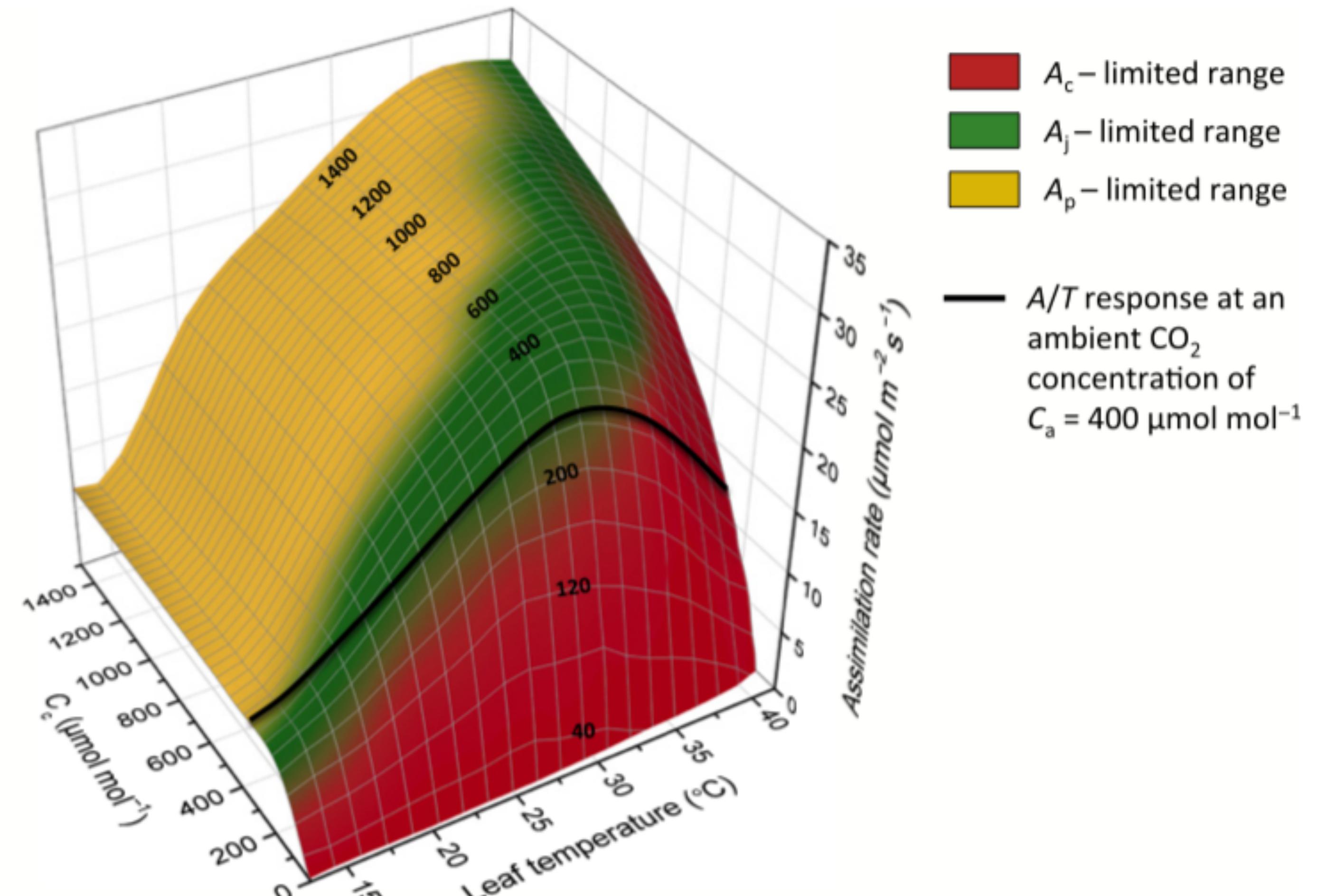
Prezi Template with a **colorful 3D pie chart design** and 4 equal quarters.

Add to cart

Present your business or company information on a world map background.

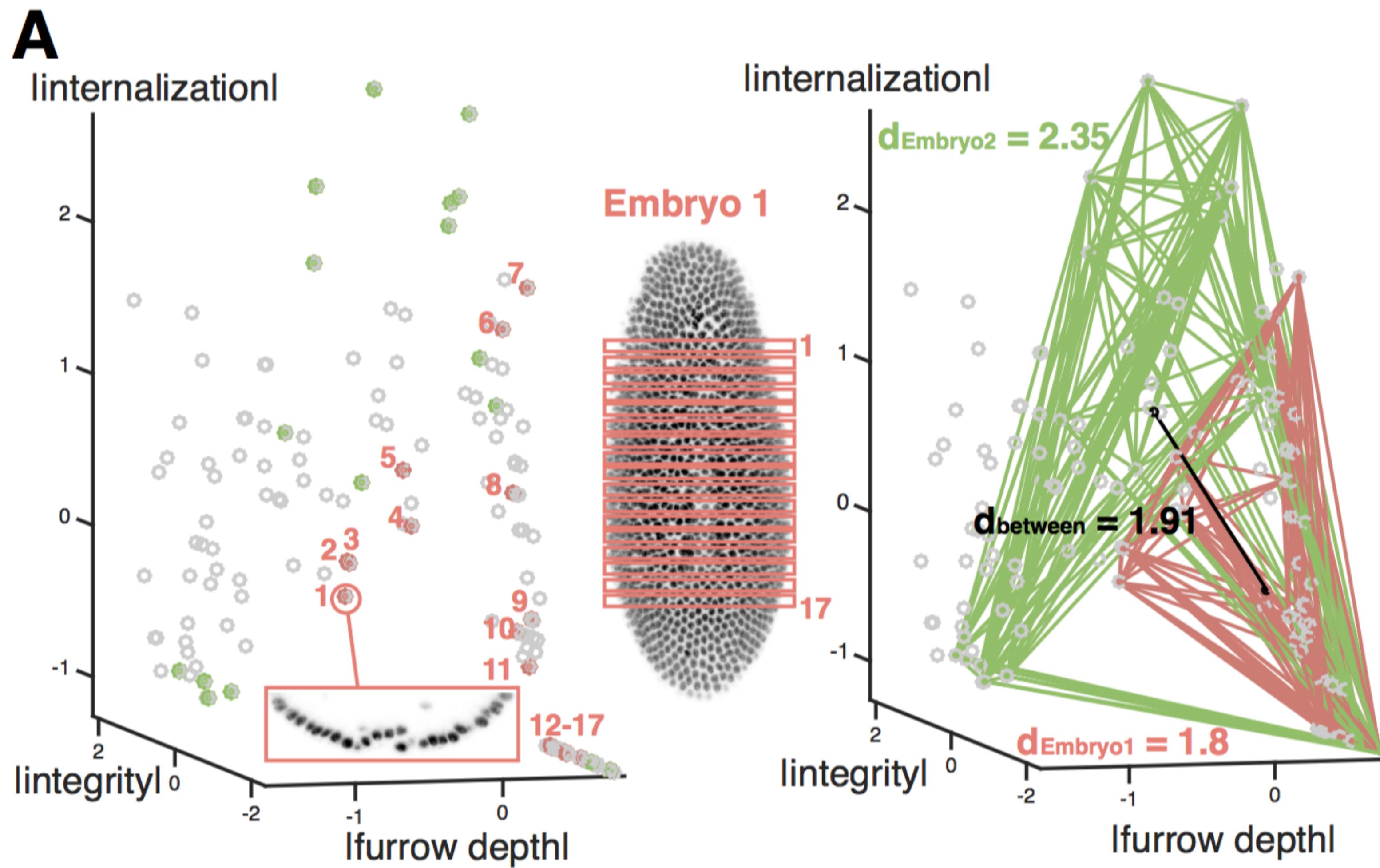
Create a creative infographic presentation with symbolic icons.

# WHAT ABOUT 3D DATA?



PlantCell, 2017

# IF YOU CAN'T AVOID 3D, BE EXTRA CAREFUL



# FLOW CHART: DO I NEED 3D

do I need 3D?

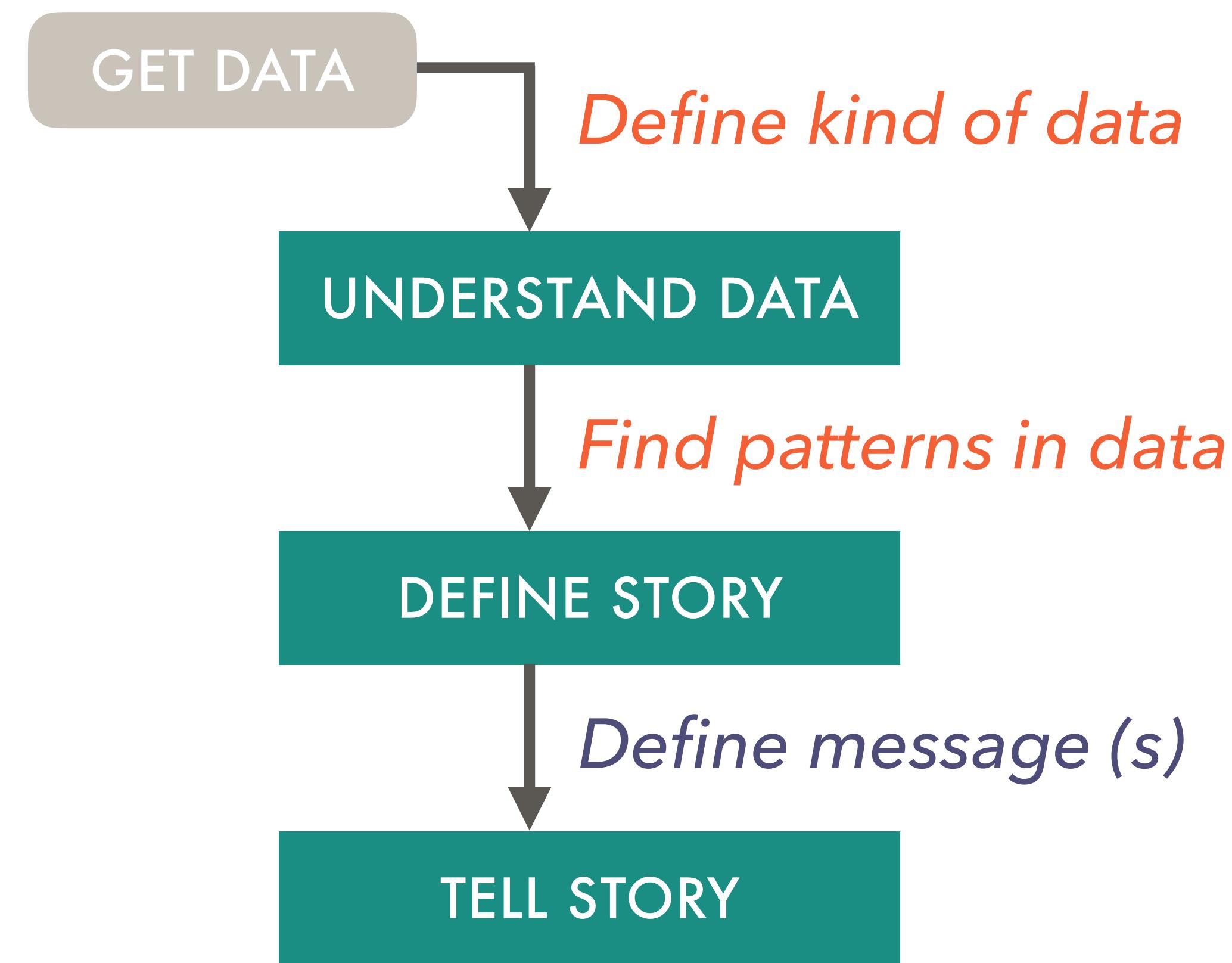


you don't need 3d

# CHOOSING THE RIGHT CHART

overview

# CHOOSING THE RIGHT CHART



- *Set intention of visualization*
- *Choose chart type*
- *Create following design principles*

# TYPES OF DATA

## NUMERICAL (QUANTITATIVE)

10  
200  
34.3  
56  
87  
42  
14  
16

## CATEGORICAL

M

F

cell type 1

cell type 2

# TYPES OF DATA

## NUMERICAL (QUANTITATIVE)

10

200

34.3

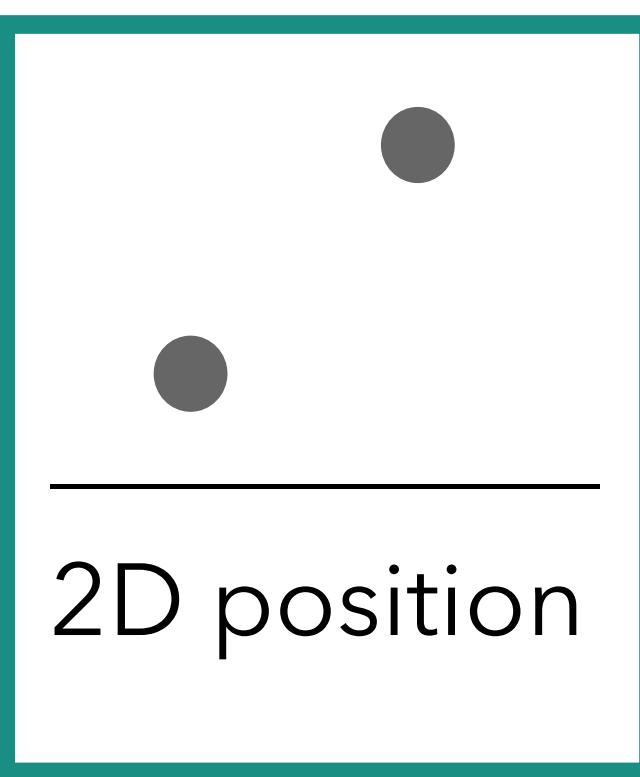
56

87

42

14

16



Length

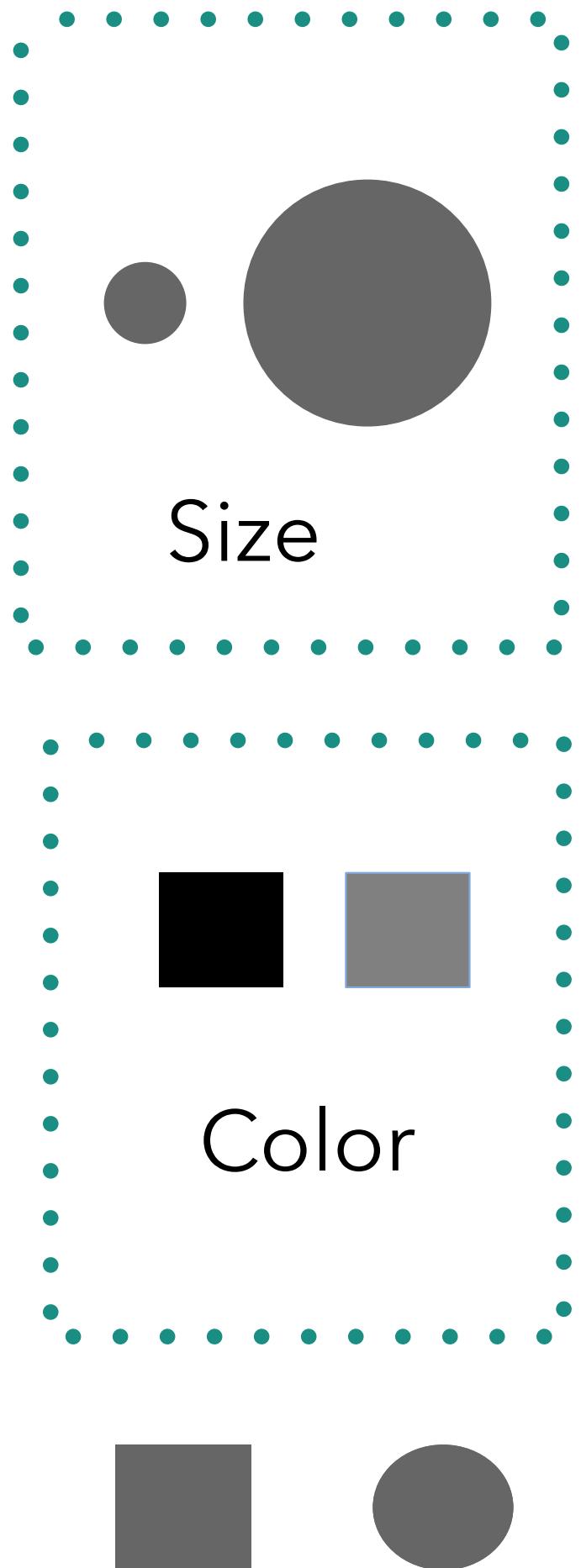
## CATEGORICAL

M

F

cell type 1

cell type 2



# TYPES OF DATA (RELATIONSHIPS)

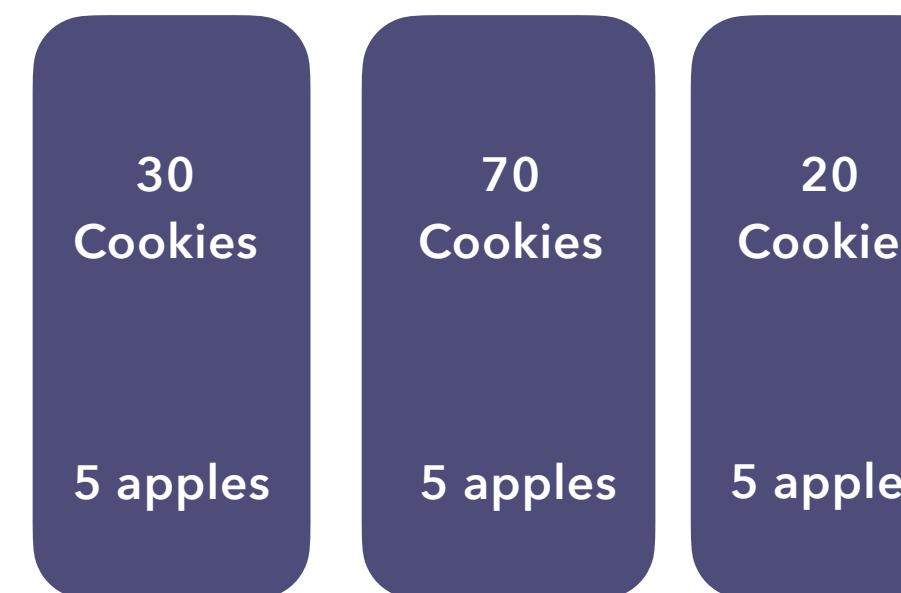
## MAGNITUDE

	Cookies	Apples
#	120	30

## PART TO WHOLE

	Cookies	Apples
% of snacks	60	15

## SPATIAL



snacks Tray 1

Tray 2

Tray 3

## CHANGE IN TIME

Days	Cookies	Apples
1	120	30
2	71	28
3	32	25
4	0	12
5	0	0

## CORRELATION

Days	Cookies	Apples
1	120	30
2	71	28
3	32	25
4	0	12
5	0	0

# TYPES OF DATA (RELATIONSHIPS)

## DISTRIBUTION

	Course 1	Course 2	Course 3
# Cookies	120	180	100

## STATISTICS TO SUMMARIZE

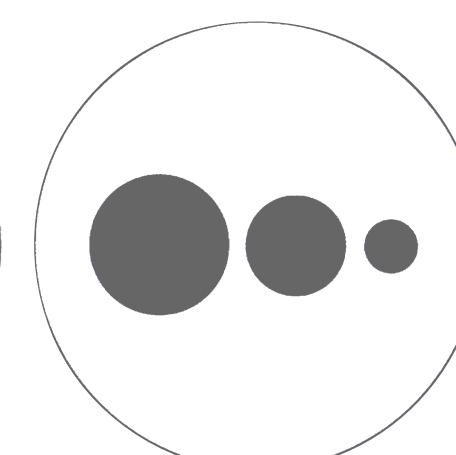
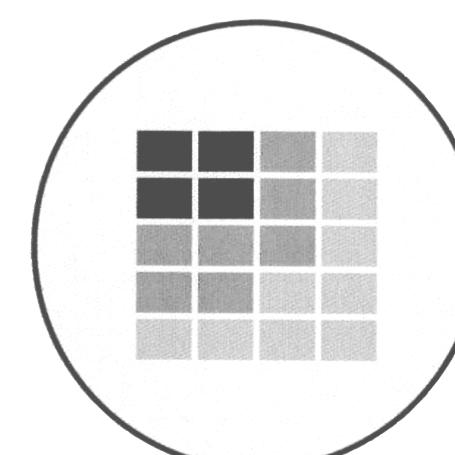
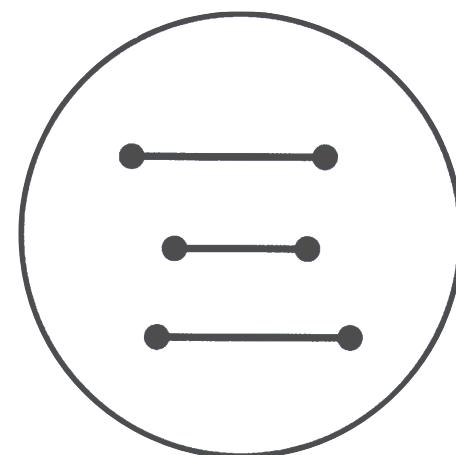
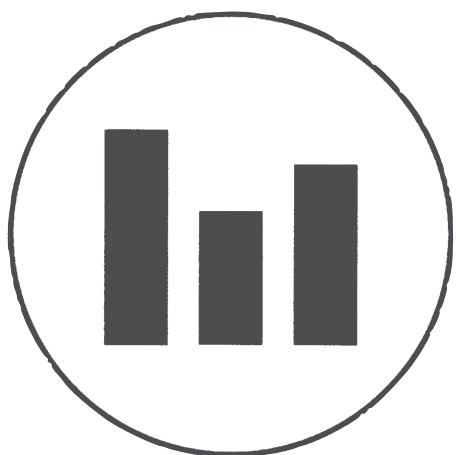
Mean

Median

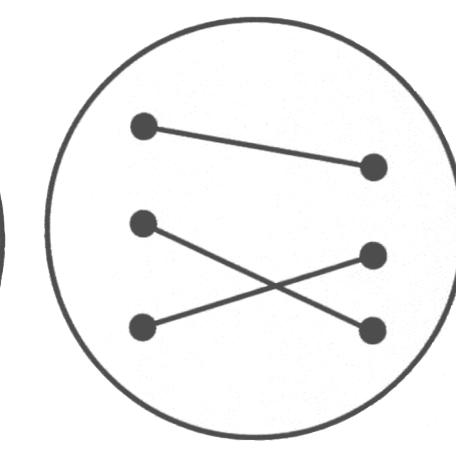
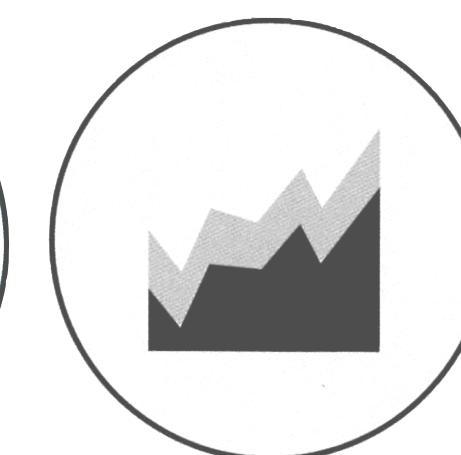
Standard deviation

..etc..

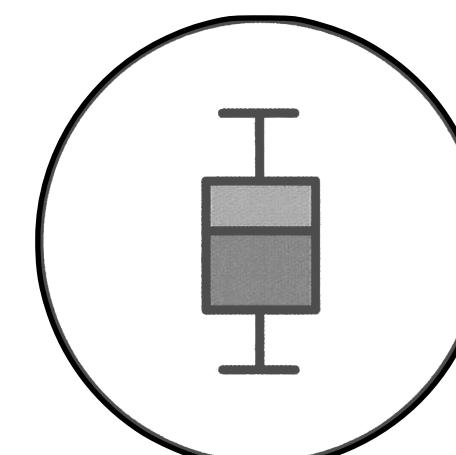
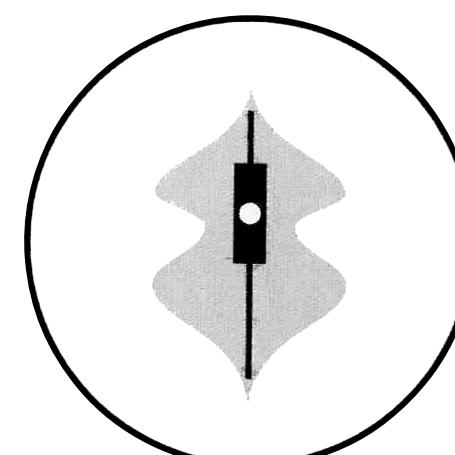
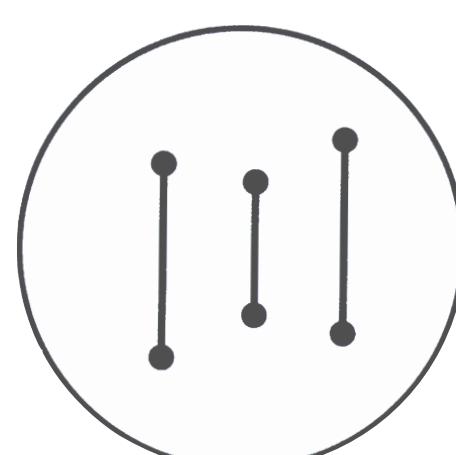
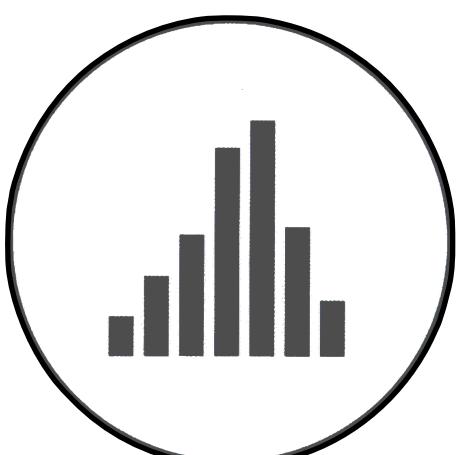
## MAGNITUDE



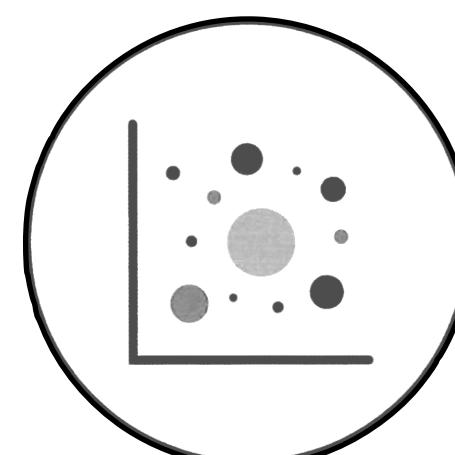
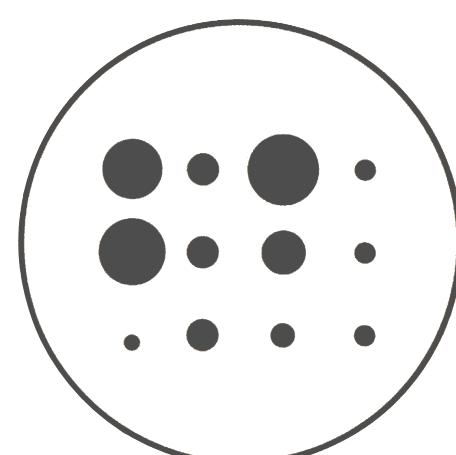
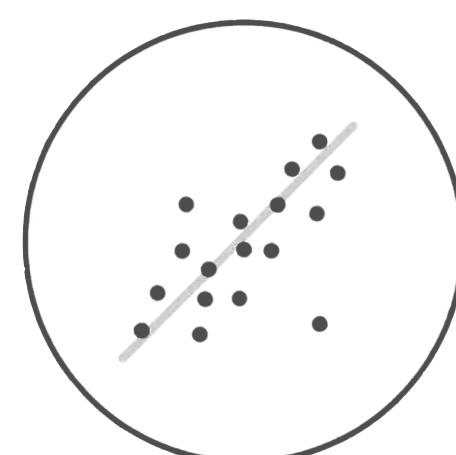
## CHANGE IN TIME



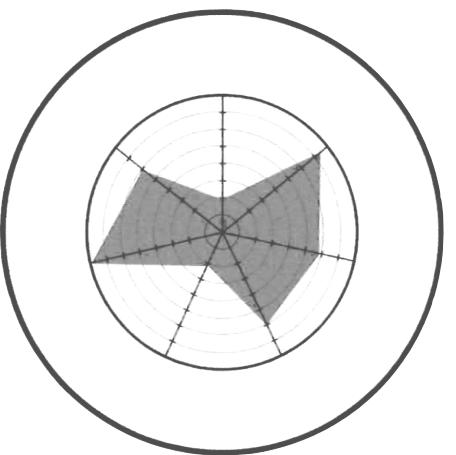
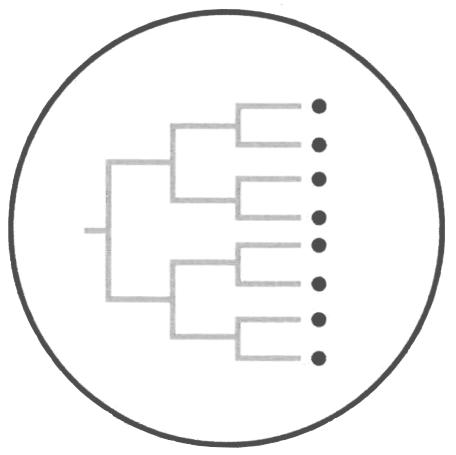
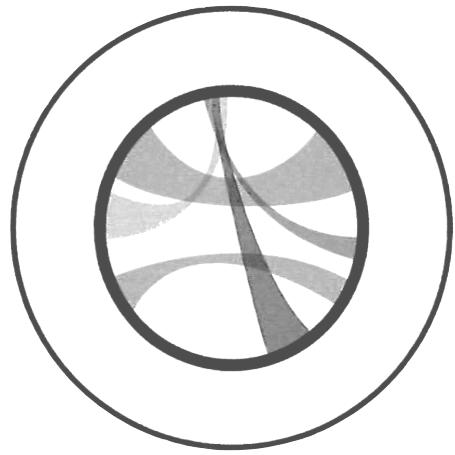
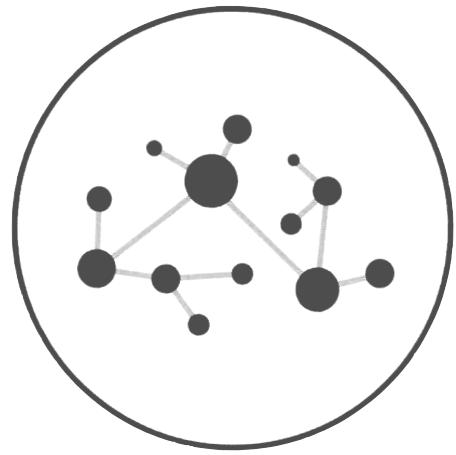
## DISTRIBUTION



## CORRELATION



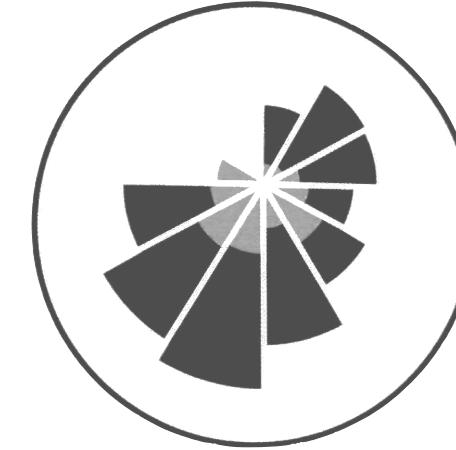
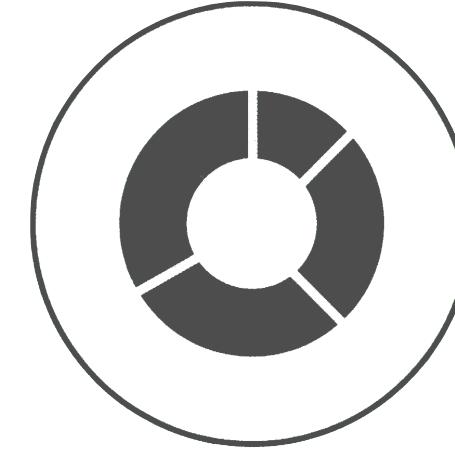
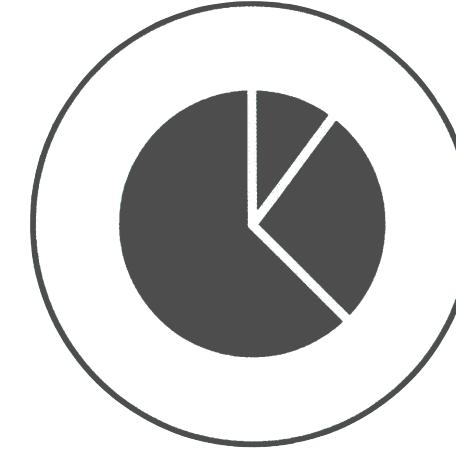
## RELATIONSHIP & FLOW



## SPATIAL



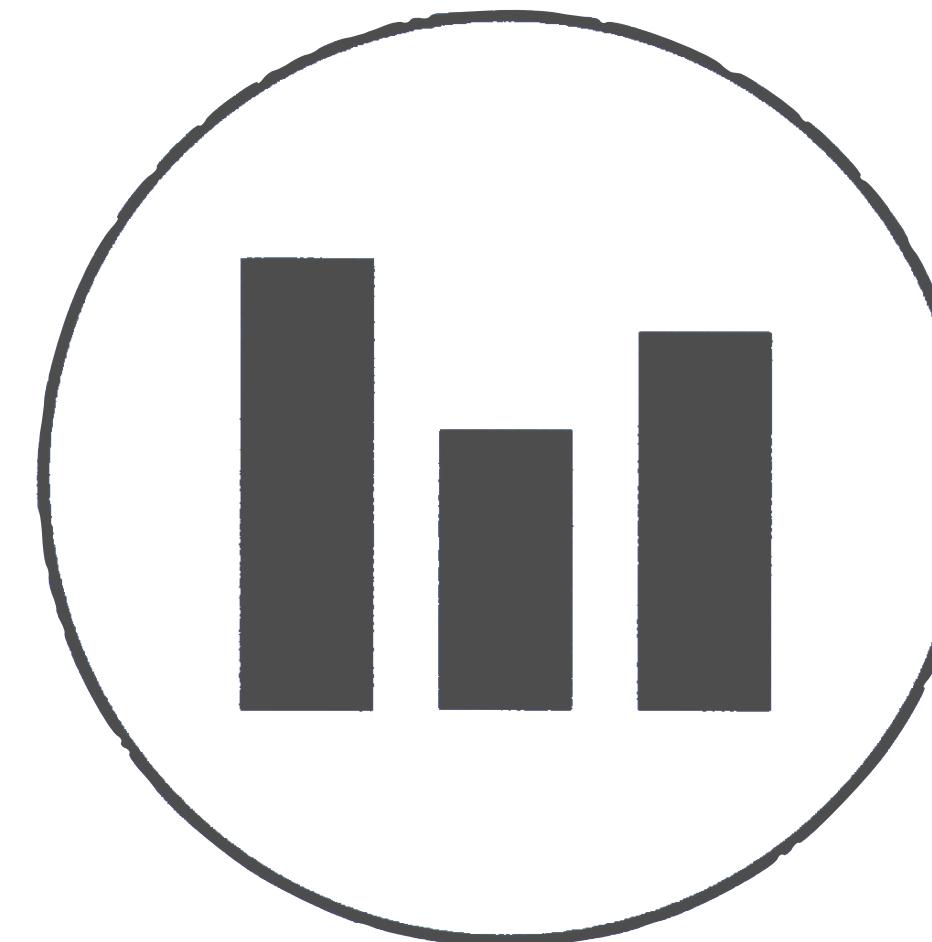
## PART TO WHOLE



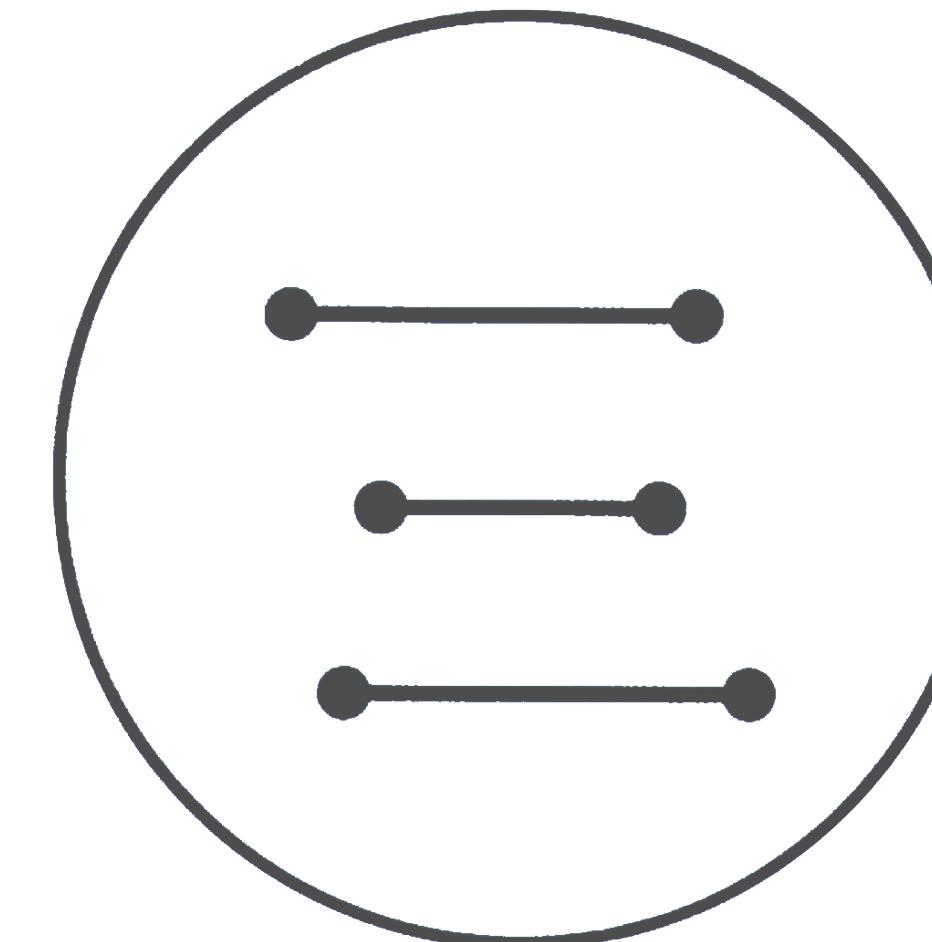
# MAGNITUDE & RANK

Compare single values across categories

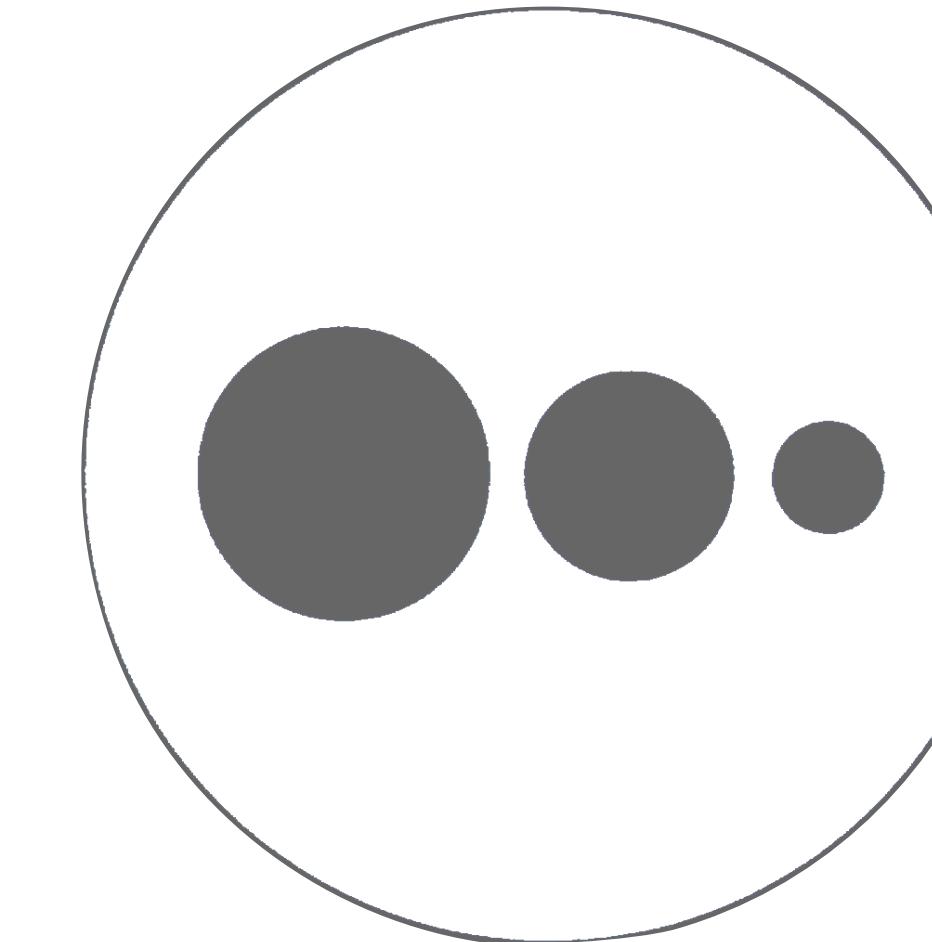
Bar  
Chart



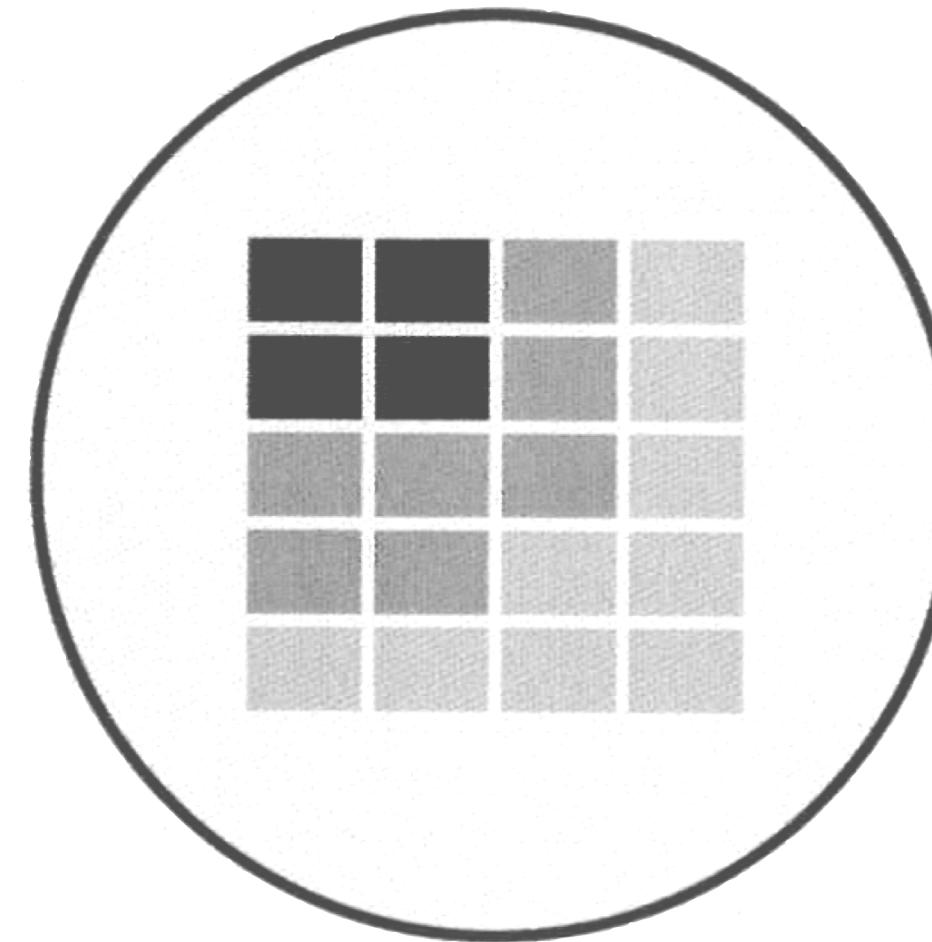
Dot  
Plot



Bubble  
(Area)



Heatmap



# MAGNITUDE & RANK

Compare single values across categories

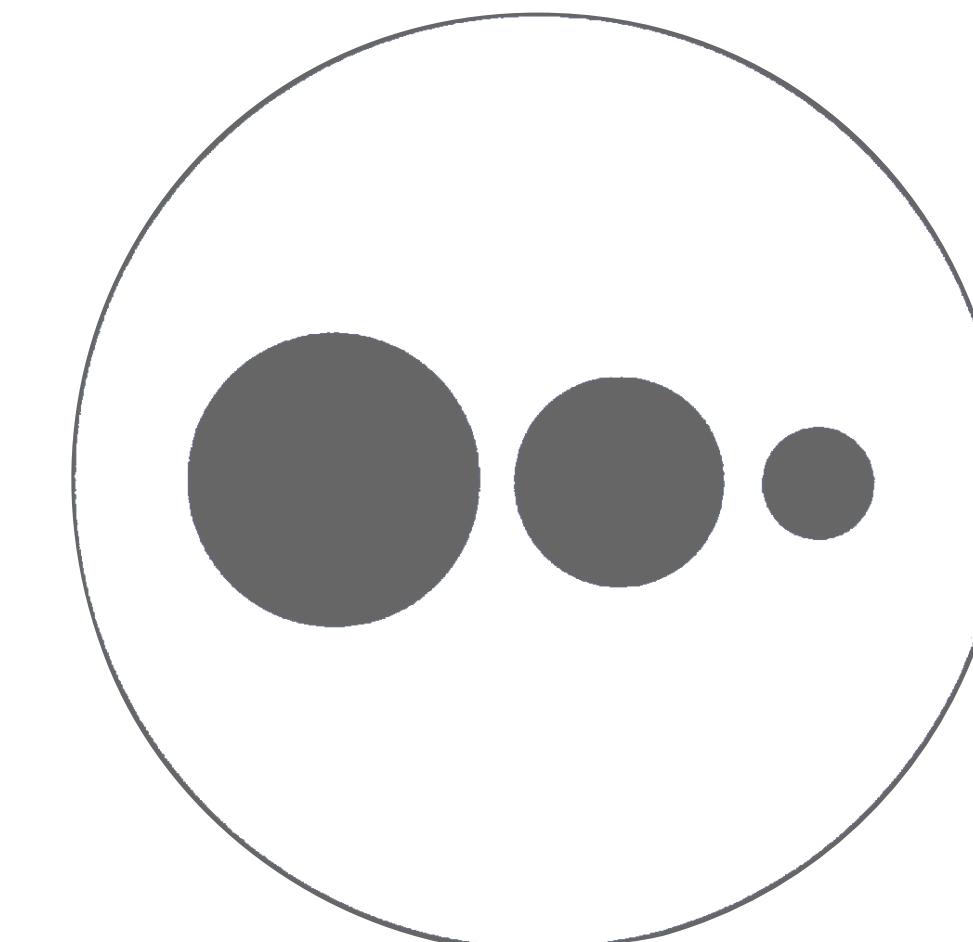
Bar  
Chart



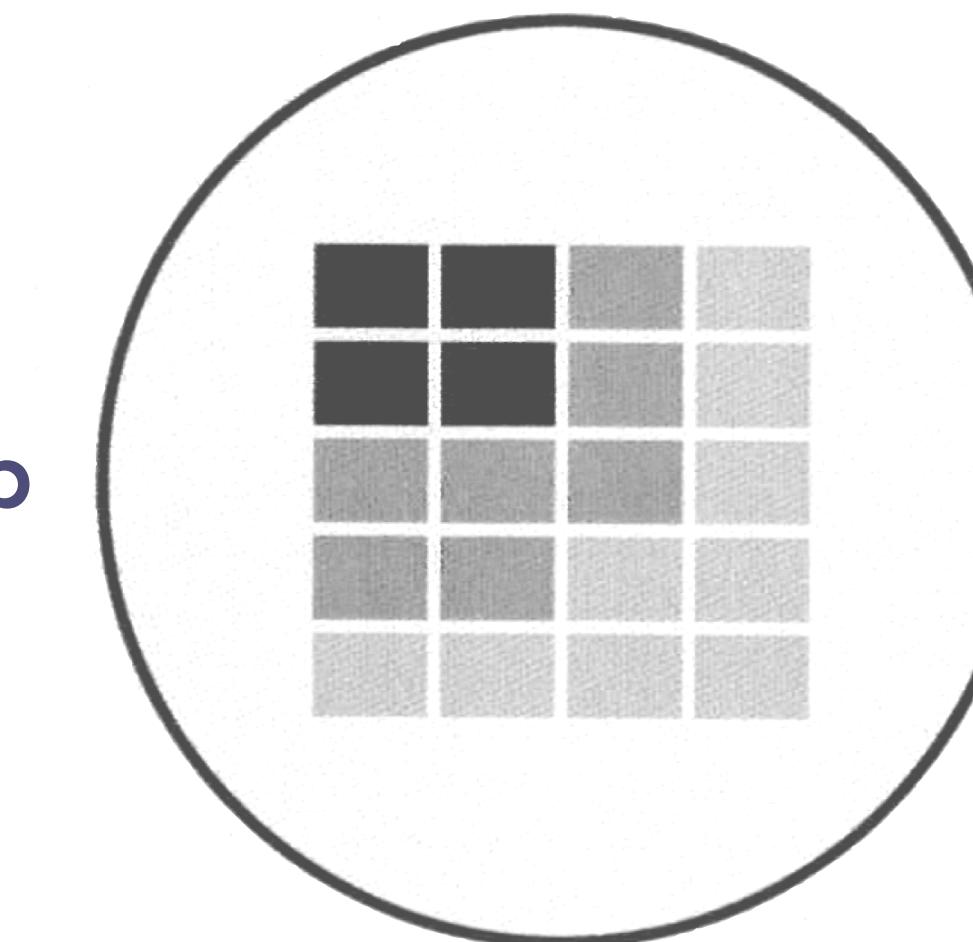
Dot  
Plot



Bubble  
(Area)



Heatmap



Best for:

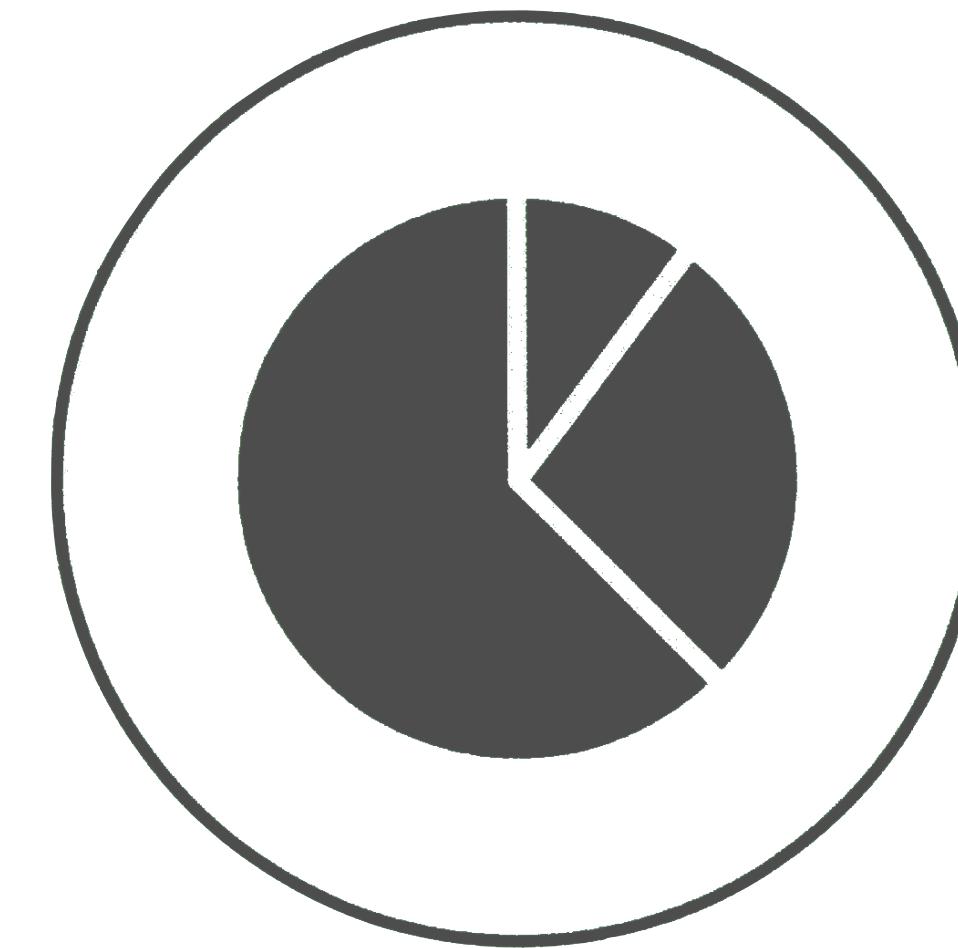
exploratory

explanatory

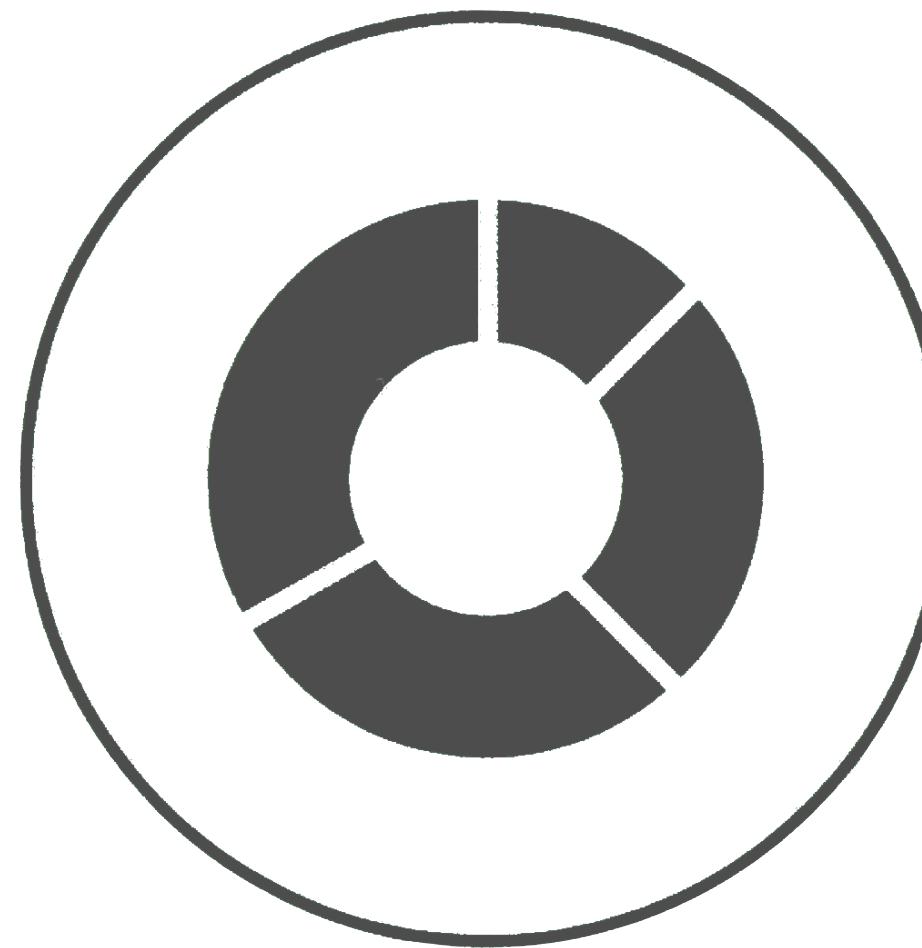
# PART TO WHOLE

Compares the proportion of categories to a quantity

**Pie chart**



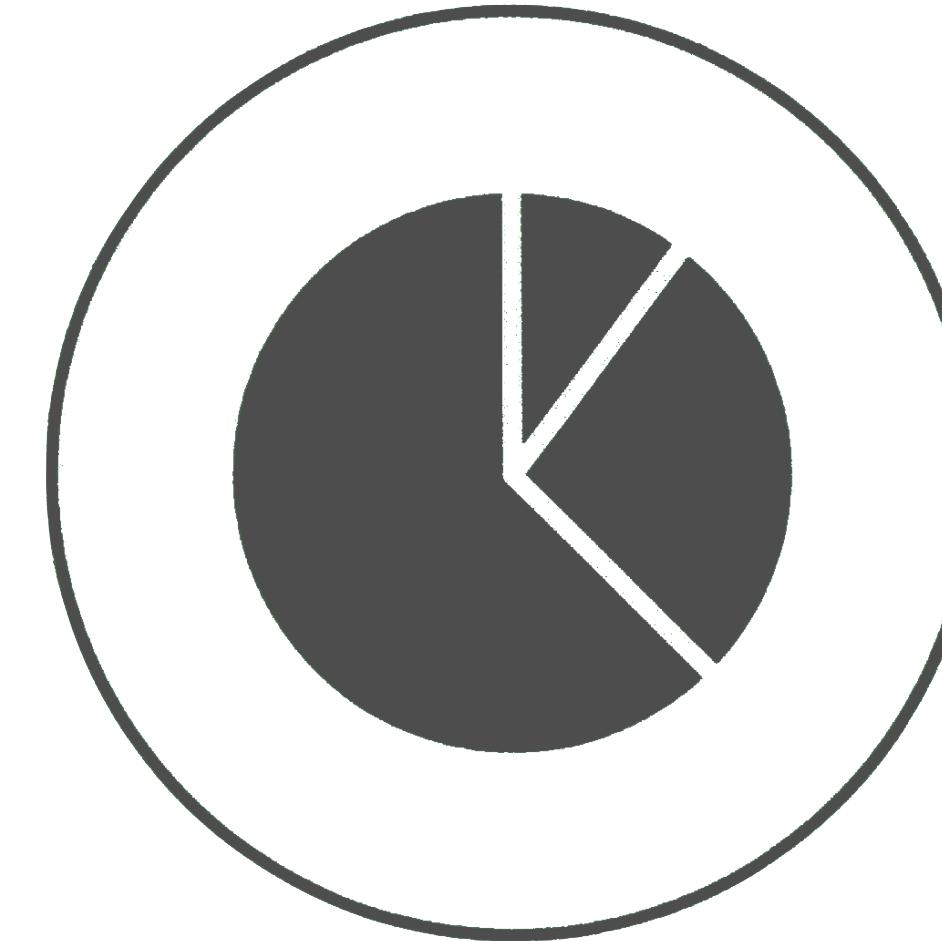
**Donut chart**



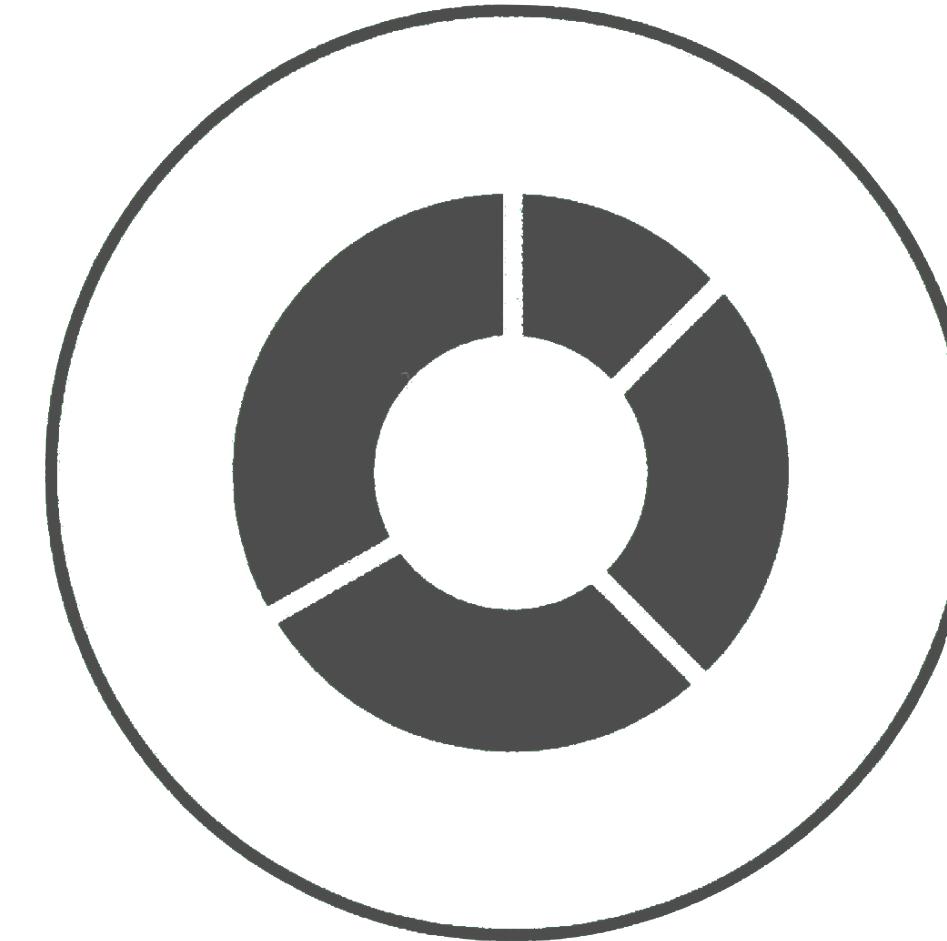
# PART TO WHOLE

Compares the proportion of categories to a quantity

**Pie chart**



**Donut chart**



**Bar plot**



*Best for:*



*exploratory*



*explanatory*

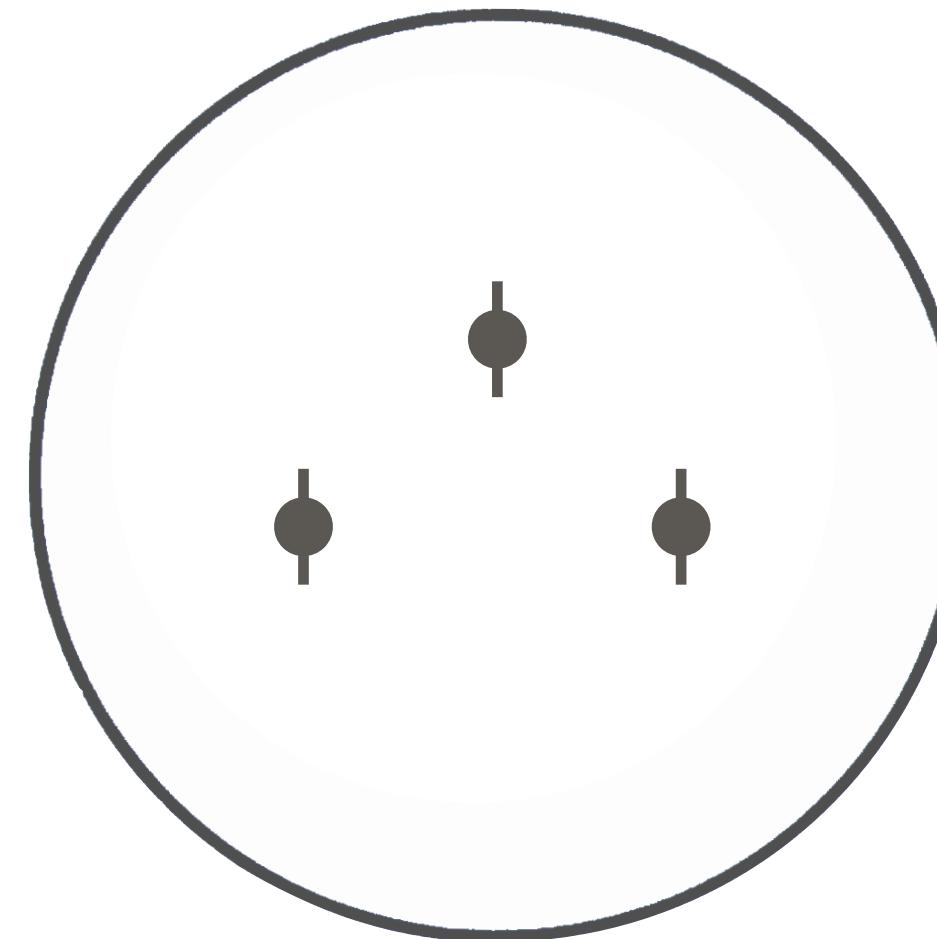
# DISTRIBUTION

Compare distribution of values (with stats) across categories

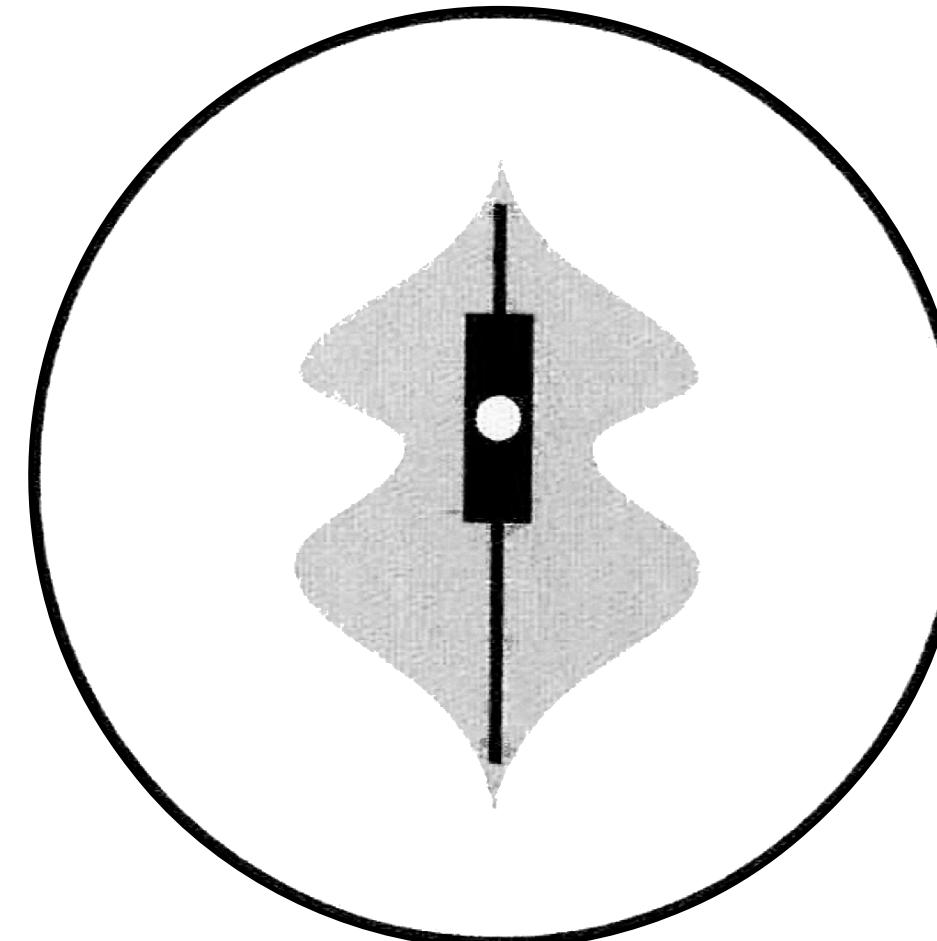
**Histogram**



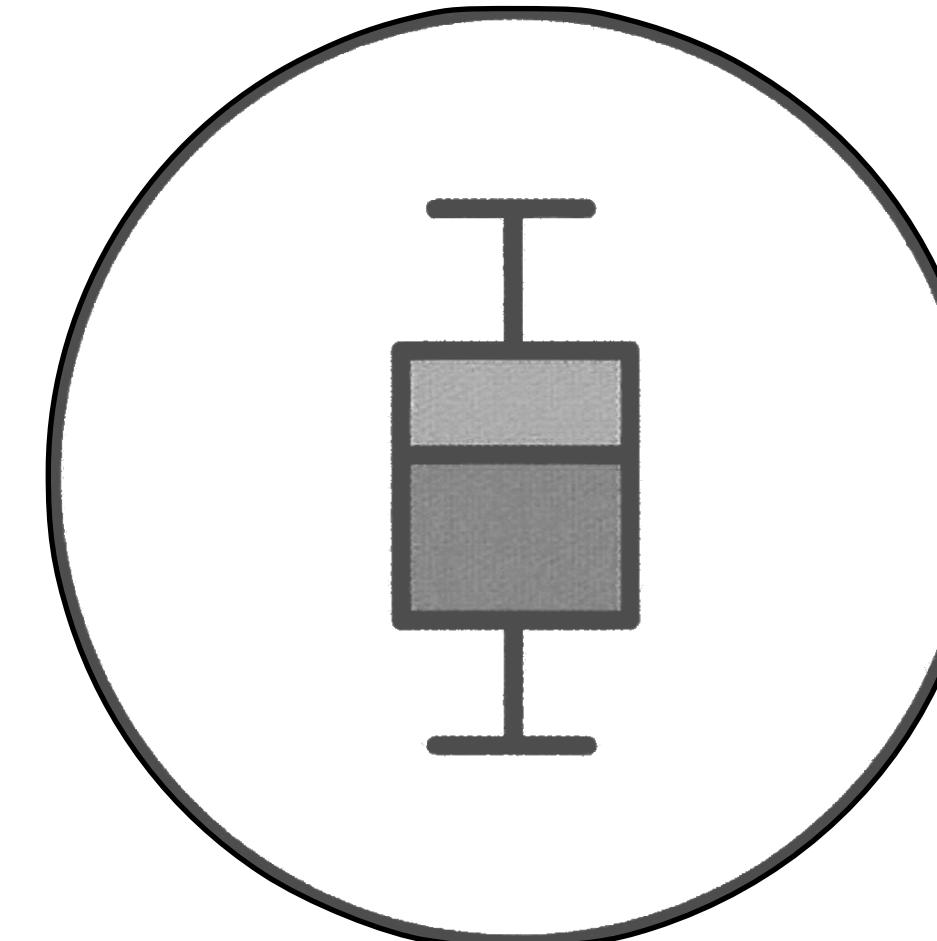
**Dot plot**



**Violin plot**

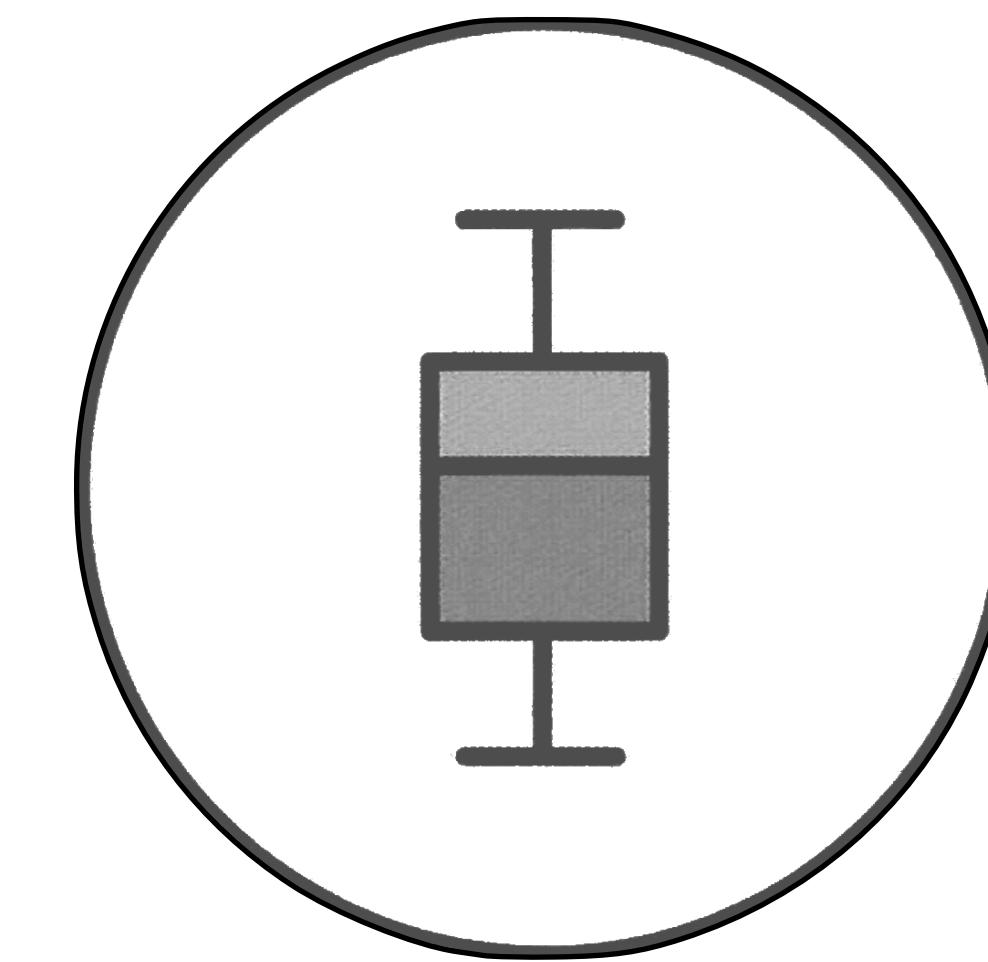
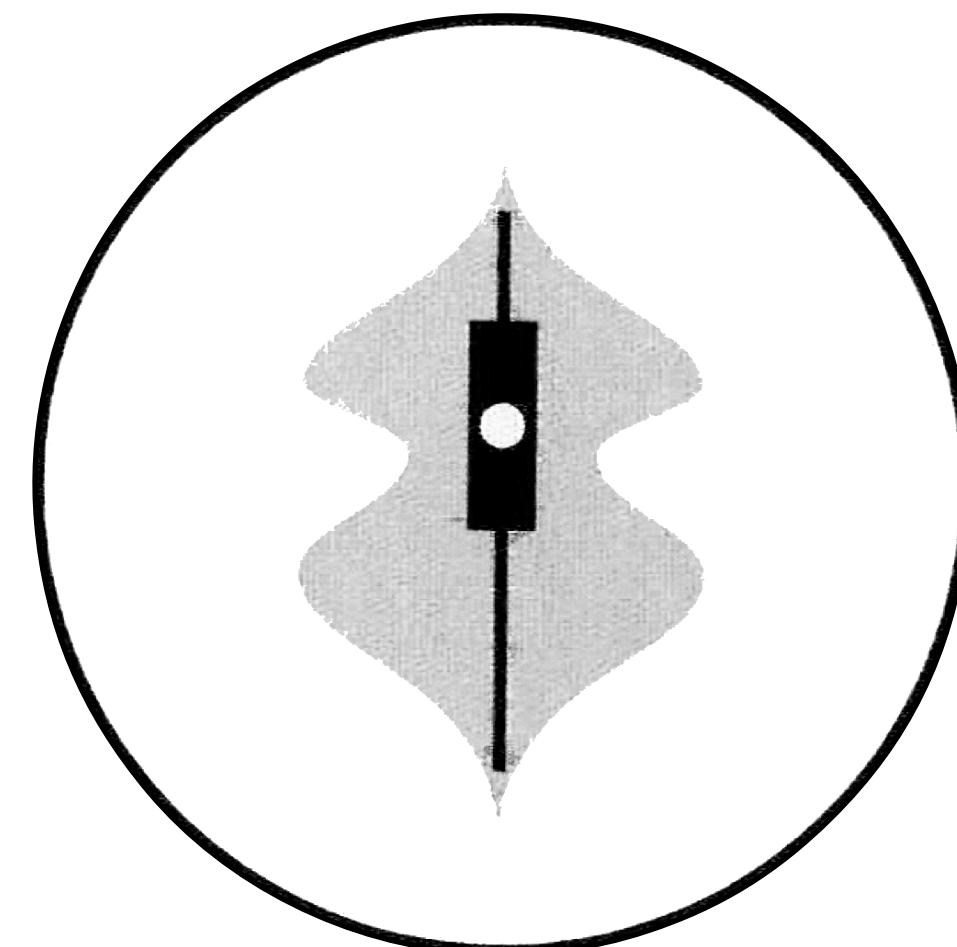
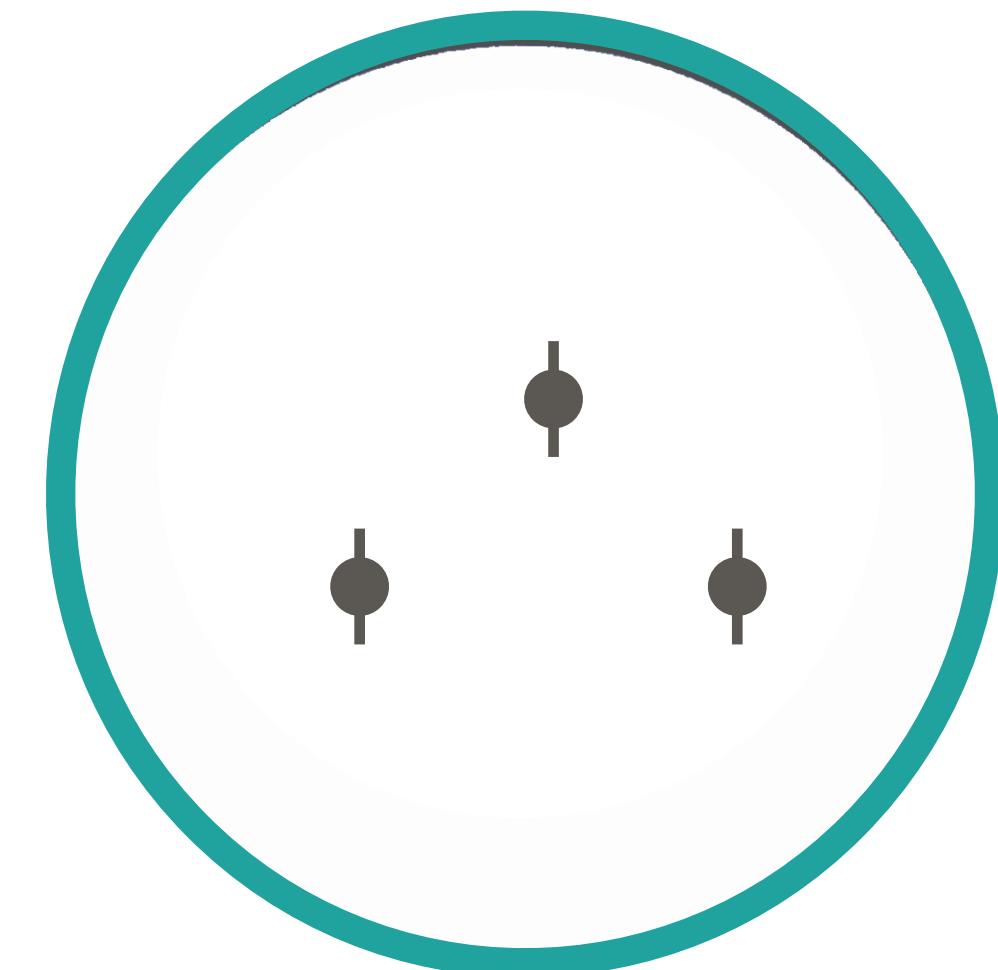


**Box plot**



# DISTRIBUTION

Compare distribution of values (with stats) across categories



Best for:

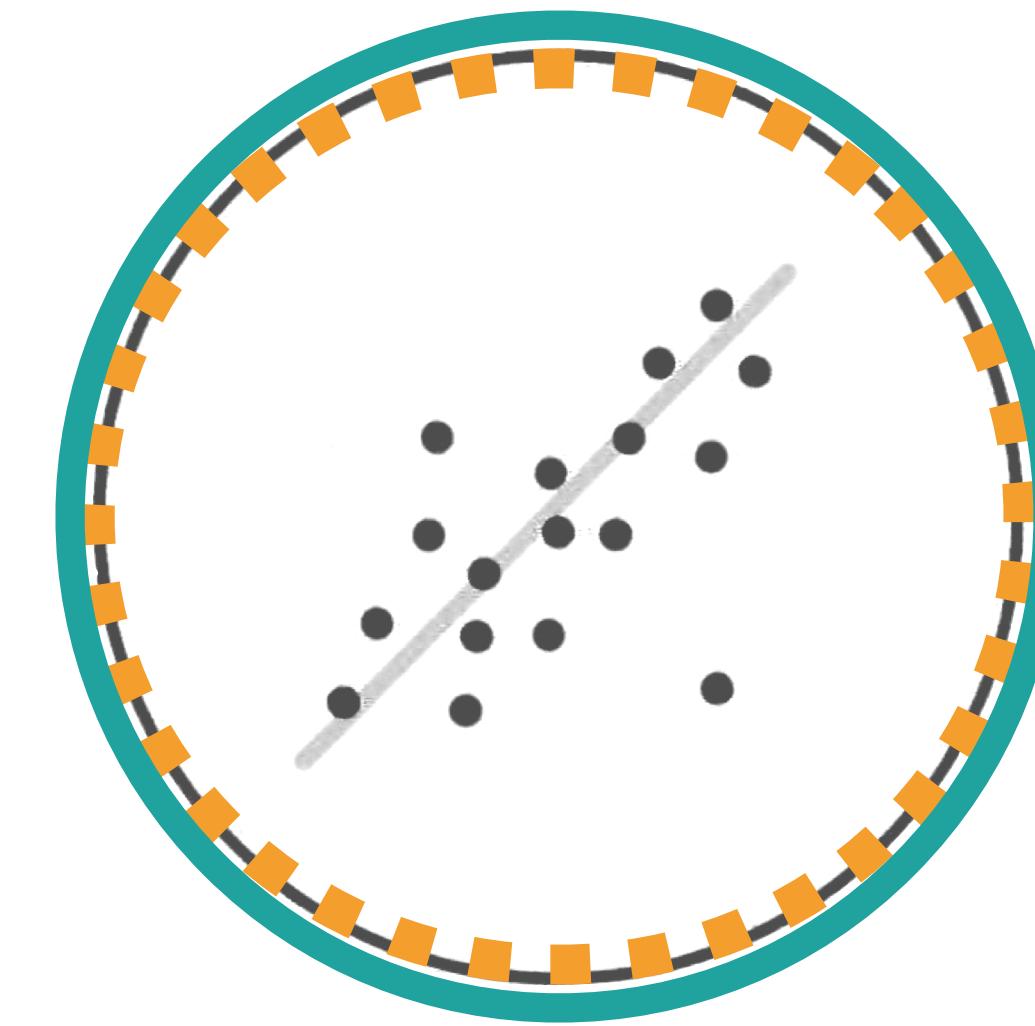
exploratory

explanatory

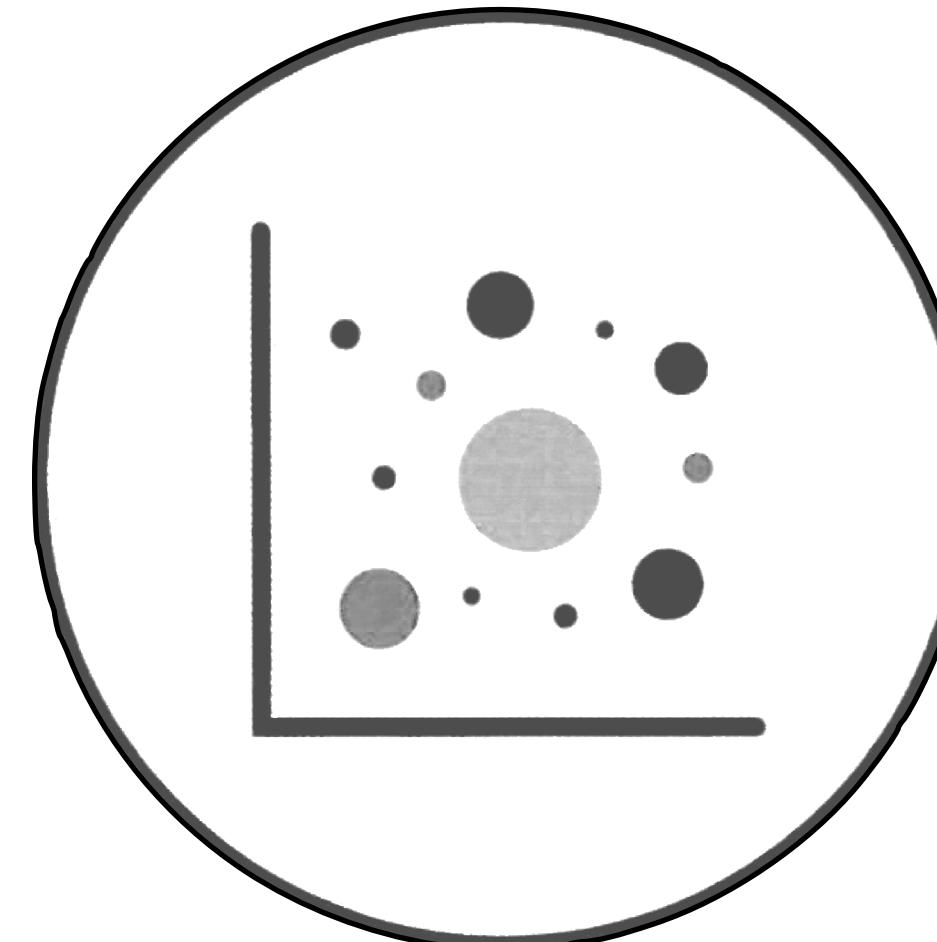
# CORRELATION

Compare paired sets of quantitative values

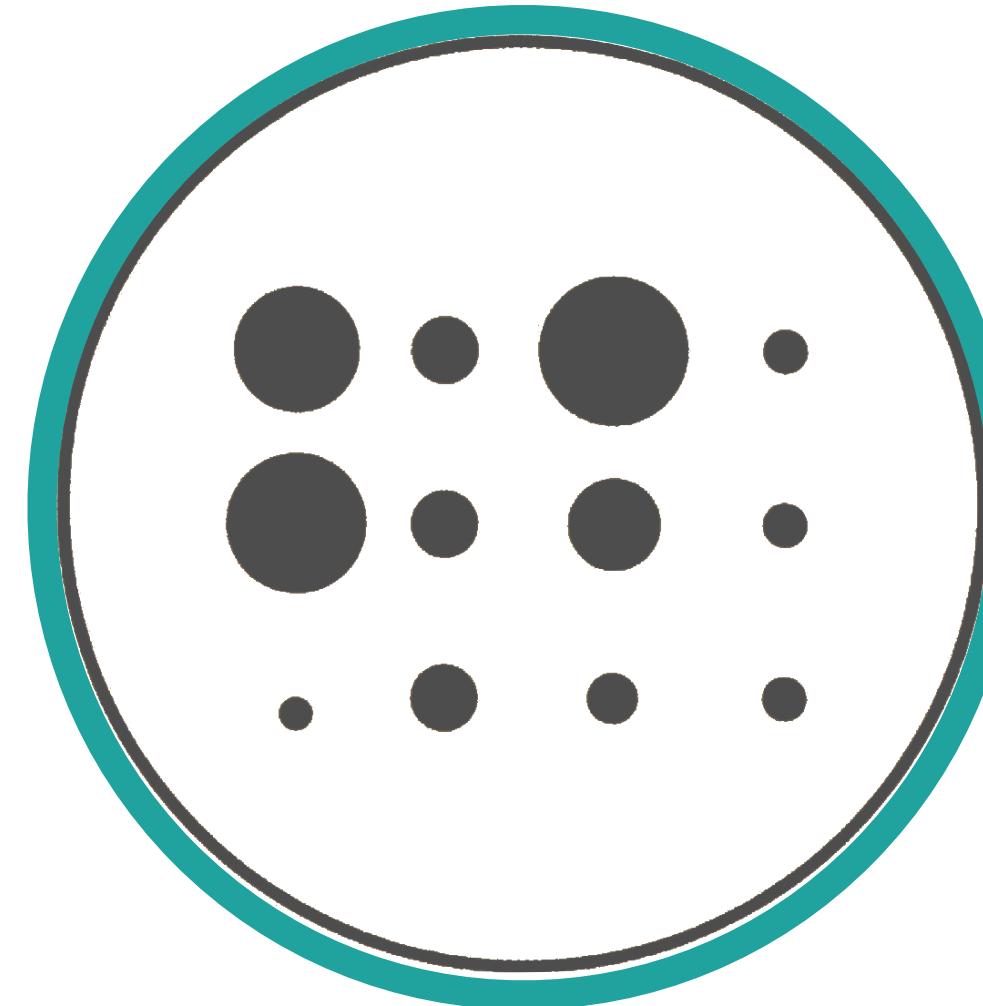
Scatter plot



Bubble plot



Correlation  
Matrix



Best for:

exploratory

explanatory

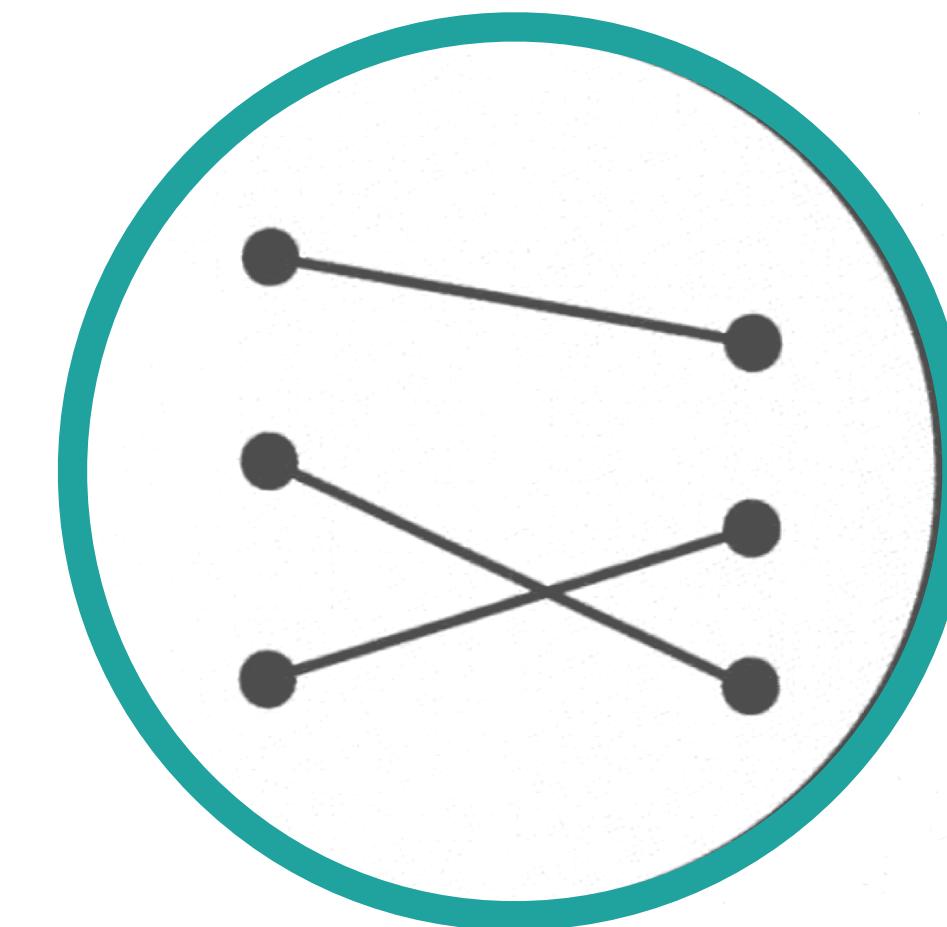
# CHANGE OVER TIME

Compare pairs a set of quantitative ordered in time

Line



Slope



Area



Best for:



exploratory

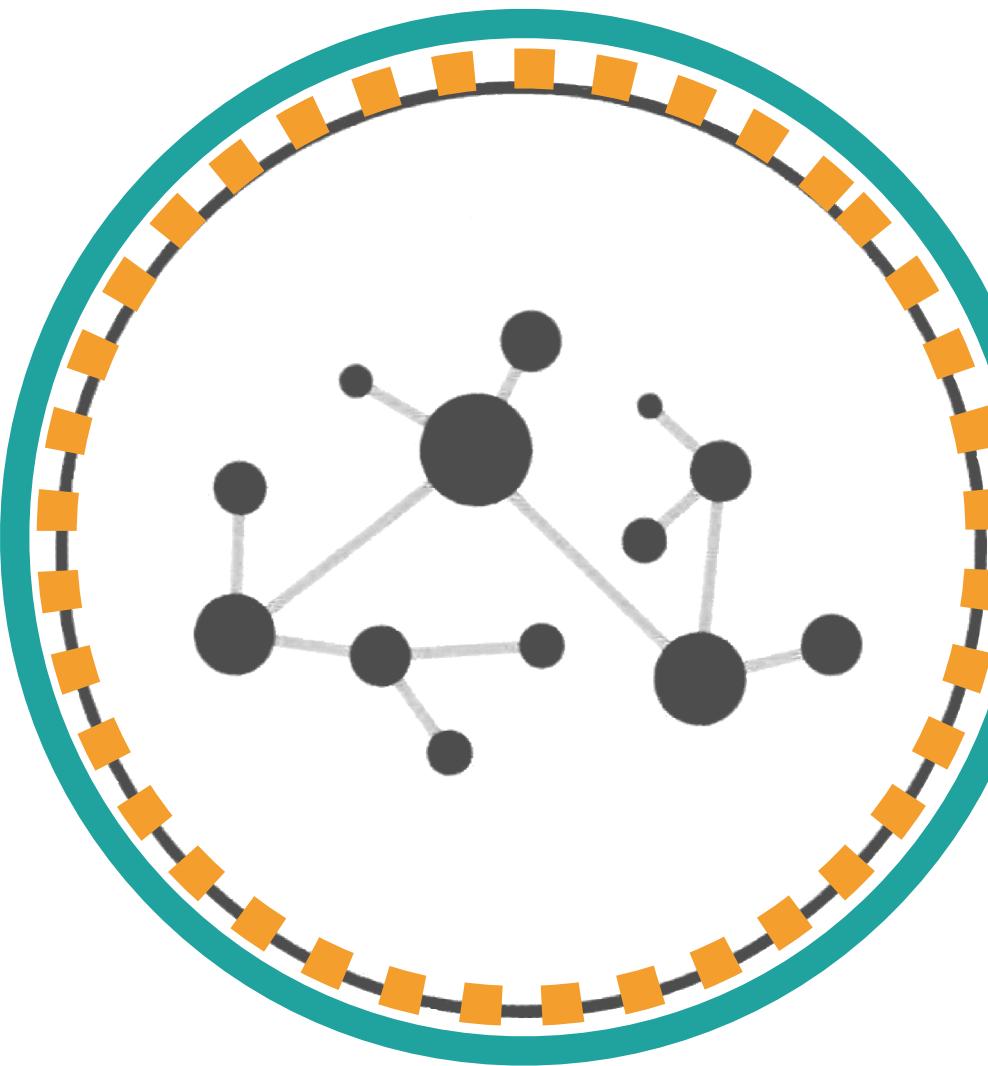


explanatory

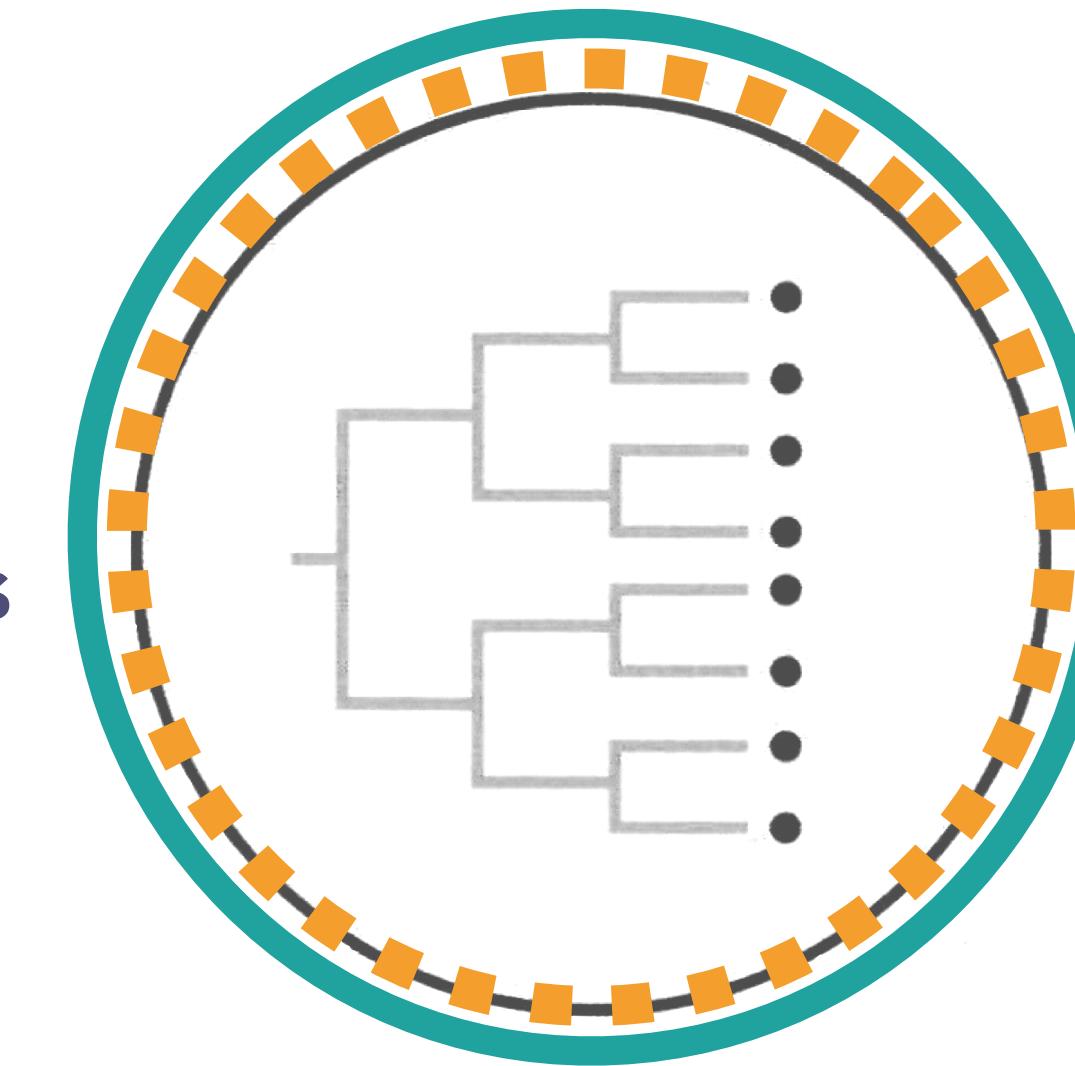
# RELATIONSHIP AND FLOW

Visualise quantitative relationships between elements set

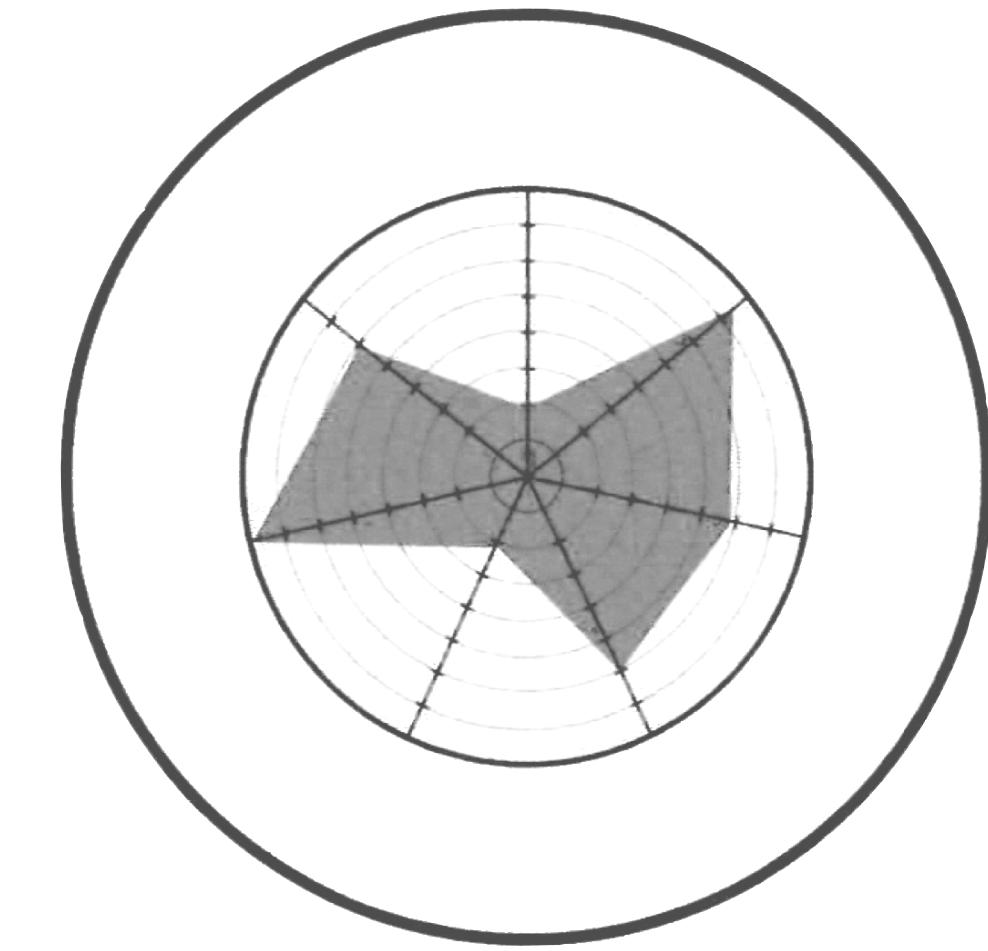
Networks



Trees



Radar



Chords



Best for:

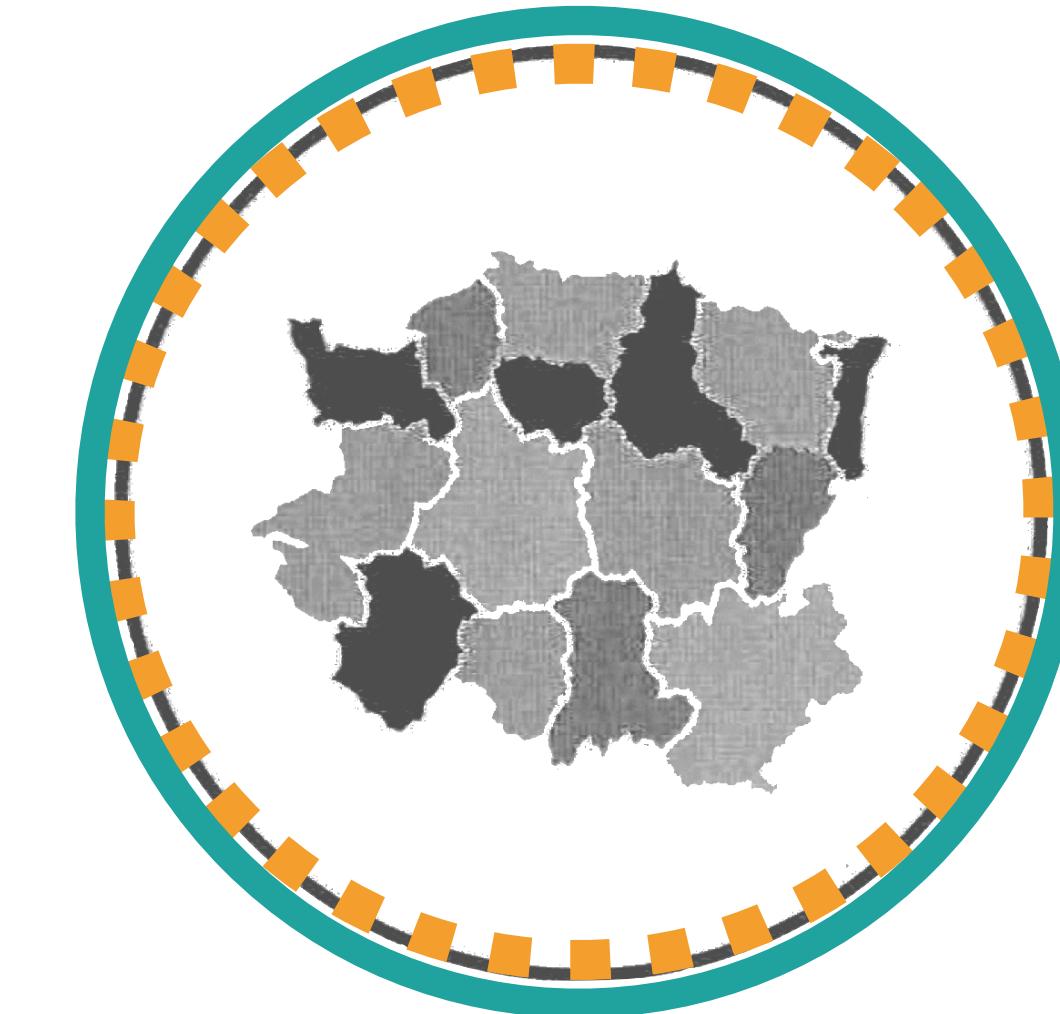
exploratory

explanatory

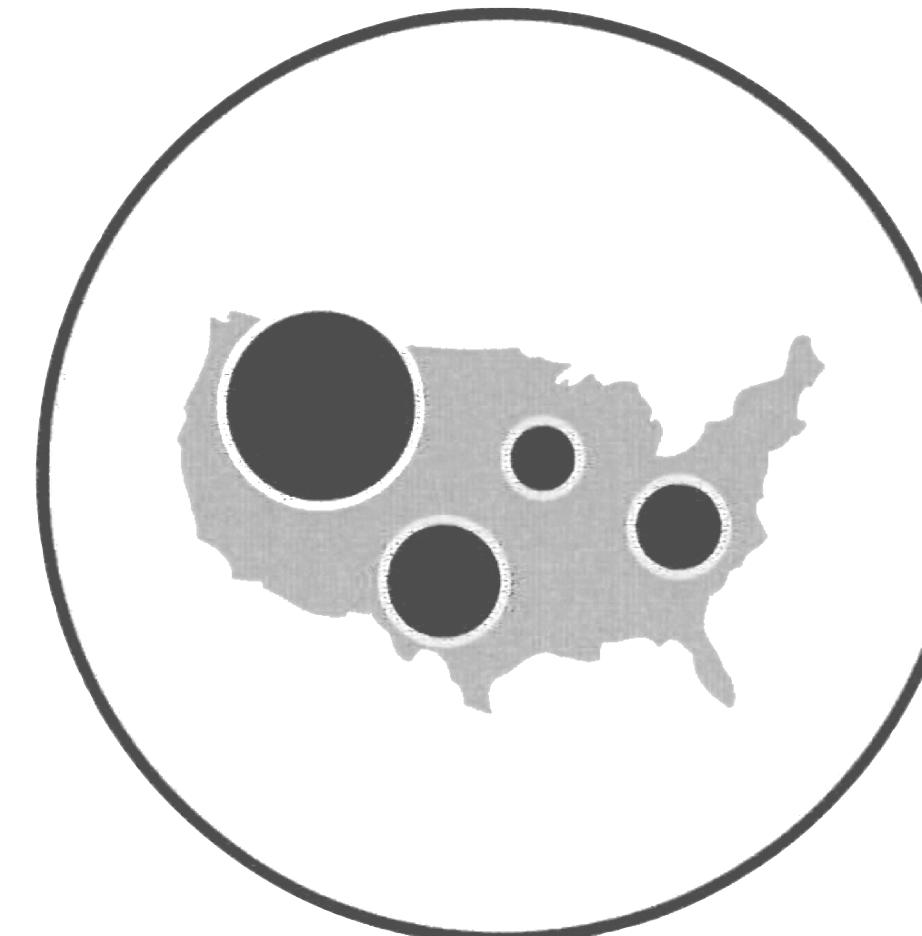
# SPATIAL

Visualize values in relation to a specific location

Choropleth



Bubble map



Connection map



Best for:



exploratory



explanatory

# USEFUL RESOURCE FOR TYPES OF CHARTS

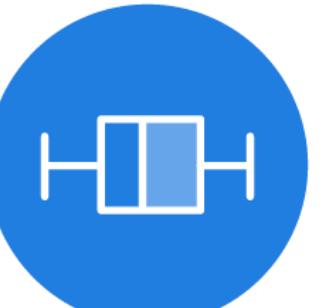
<http://www.datavizcatalogue.com/index.html>

The Data Visualisation Catalogue

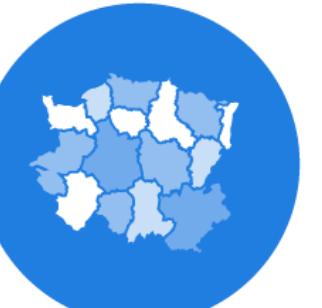
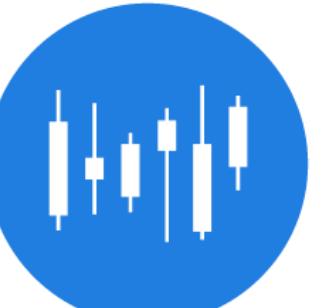
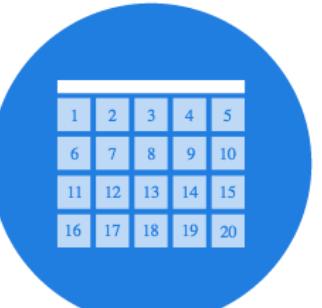
About • Suggest • Shop • Resources

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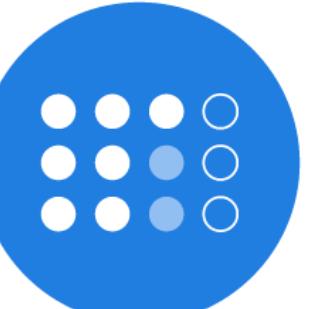
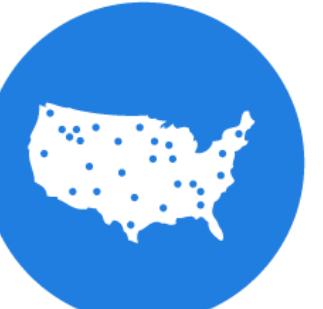
Search by Function      View by List



Arc Diagram      Area Graph      Bar Chart      Box & Whisker Plot      Brainstorm      Bubble Chart



Bubble Map      Bullet Graph      Calendar      Candlestick Chart      Chord Diagram      Choropleth Map



Circle Packing      Connection Map      Density Plot      Donut Chart      Dot Map      Dot Matrix Chart

Description

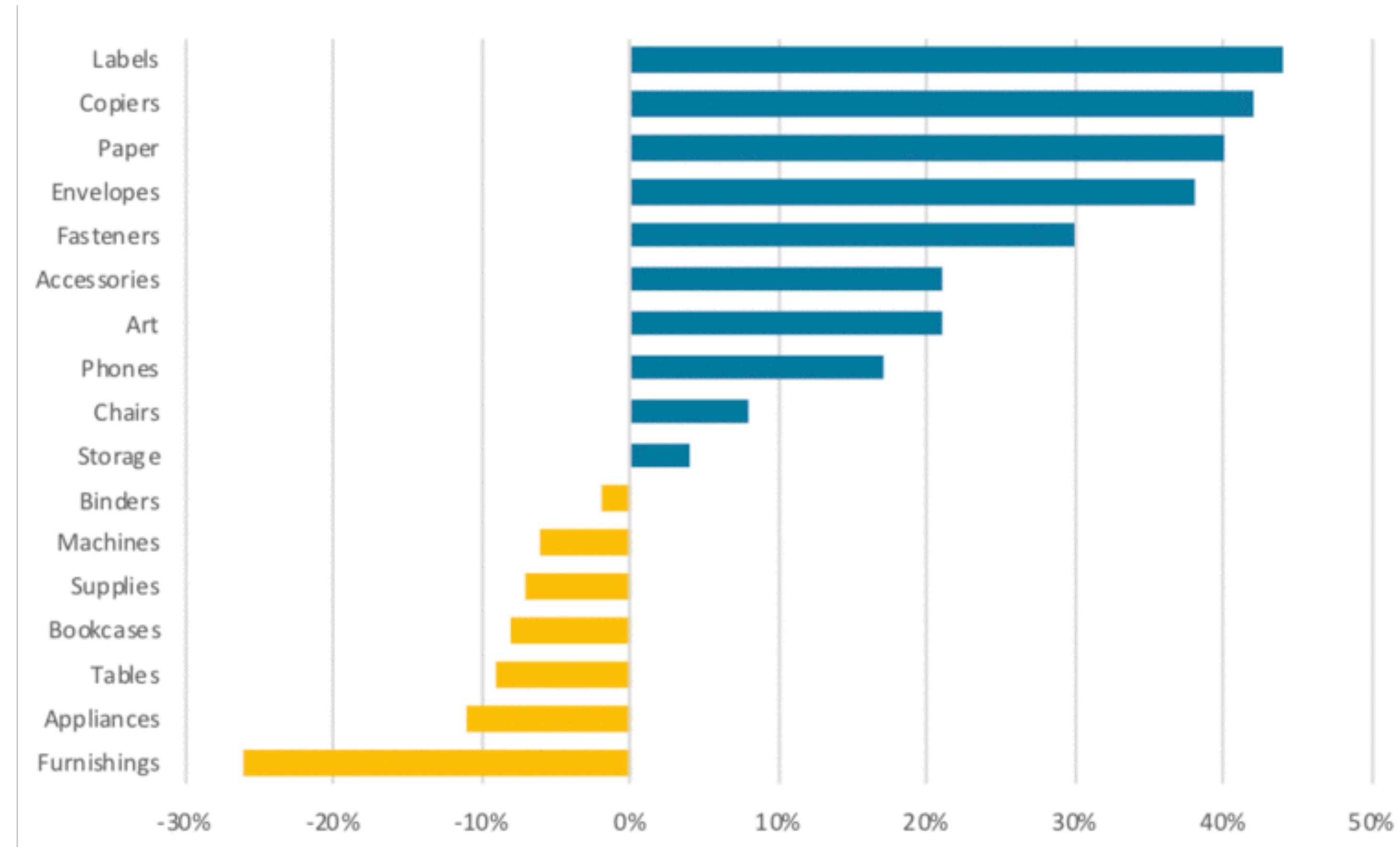
Function

Examples

Tools to generate

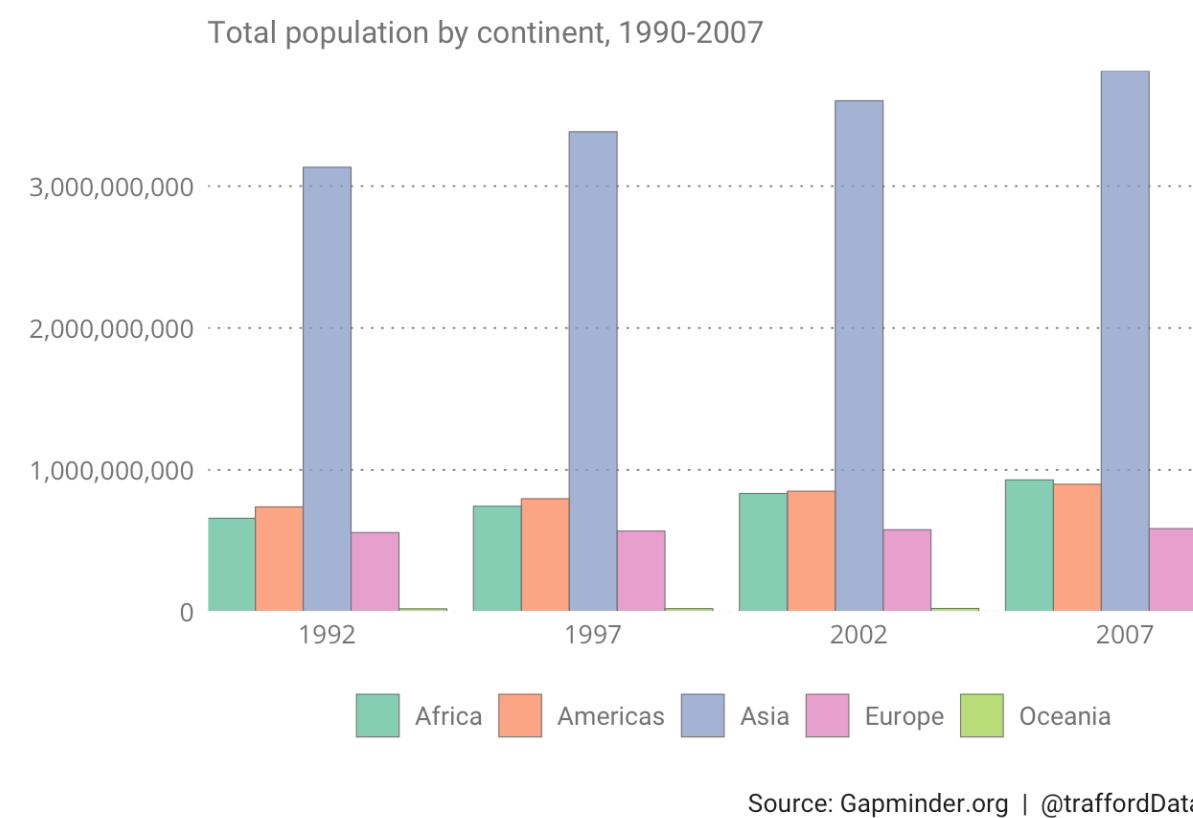
# TOOL RESOURCES

# THE VISUAL VOCABULARY IN EXCEL

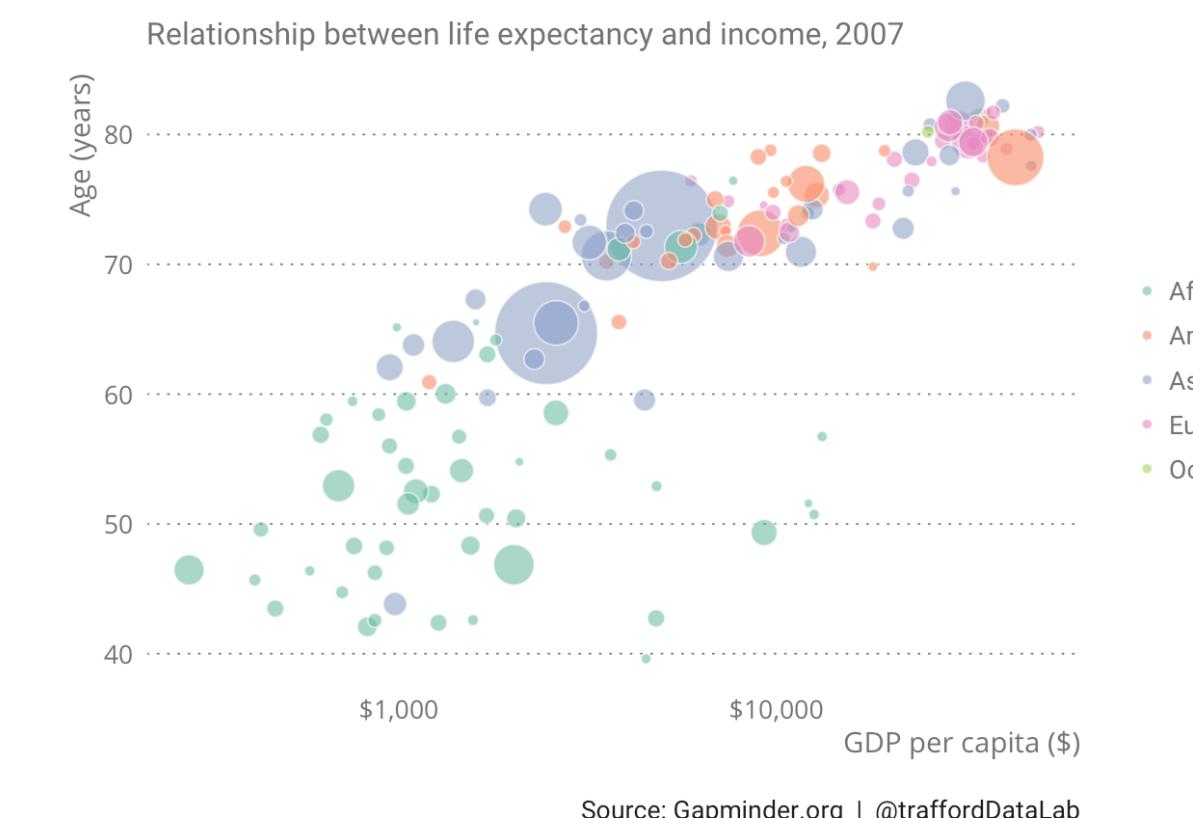


# THE VISUAL VOCABULARY IN GG PLOT2

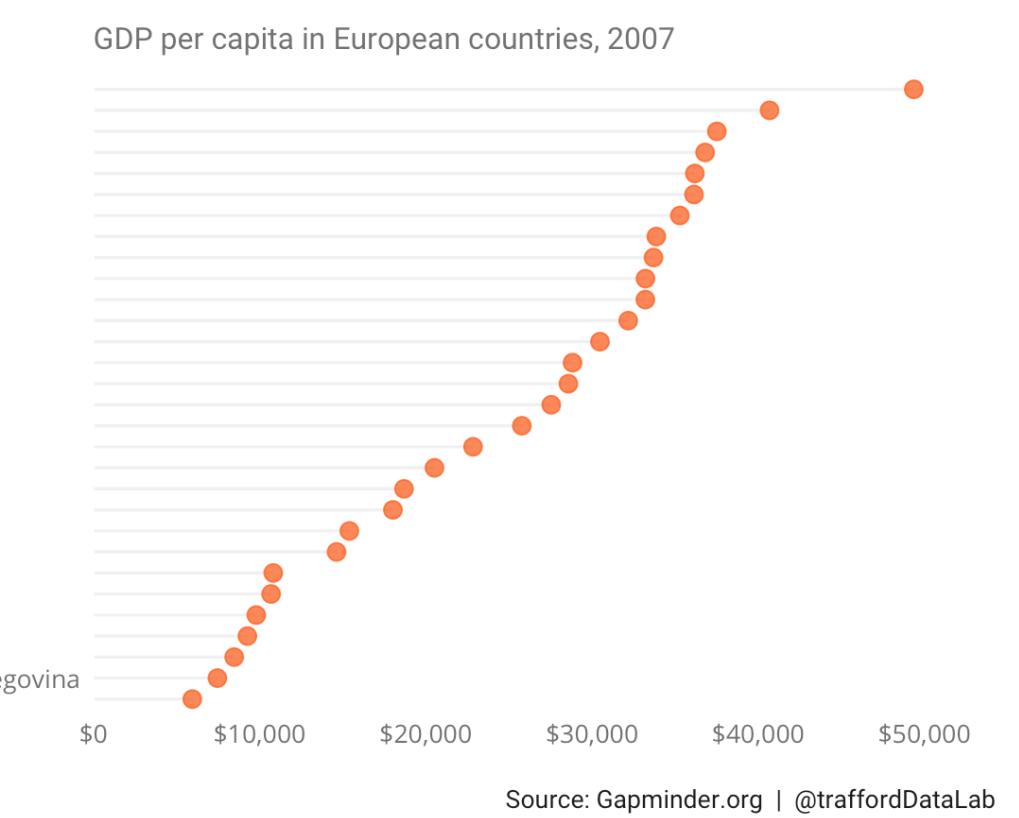
Grouped bar chart



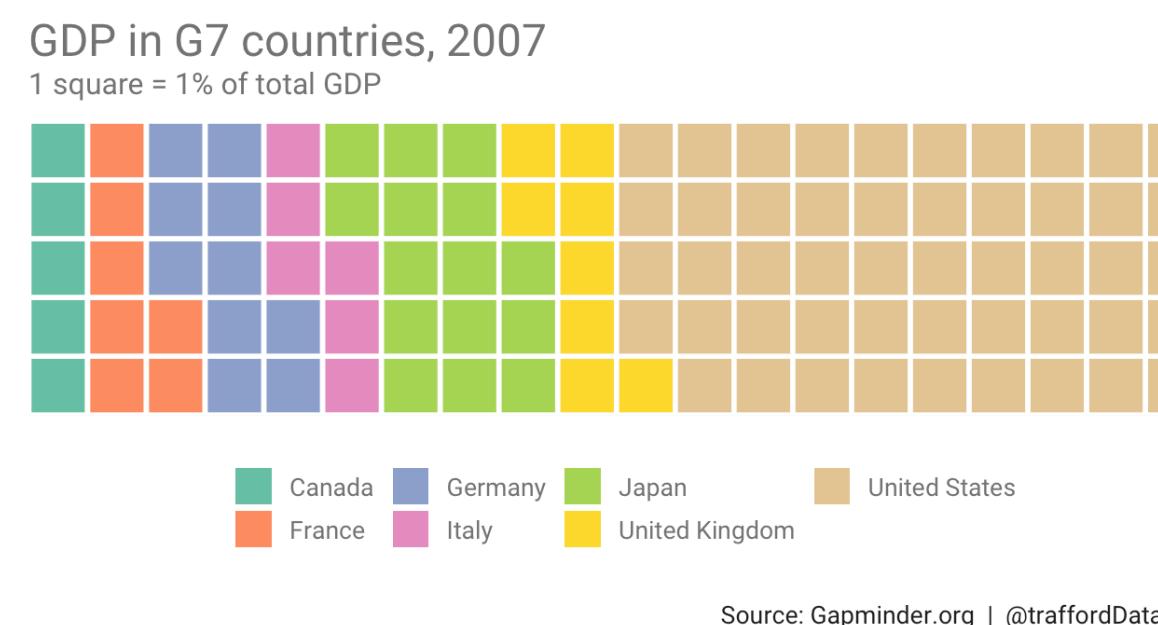
Bubble chart



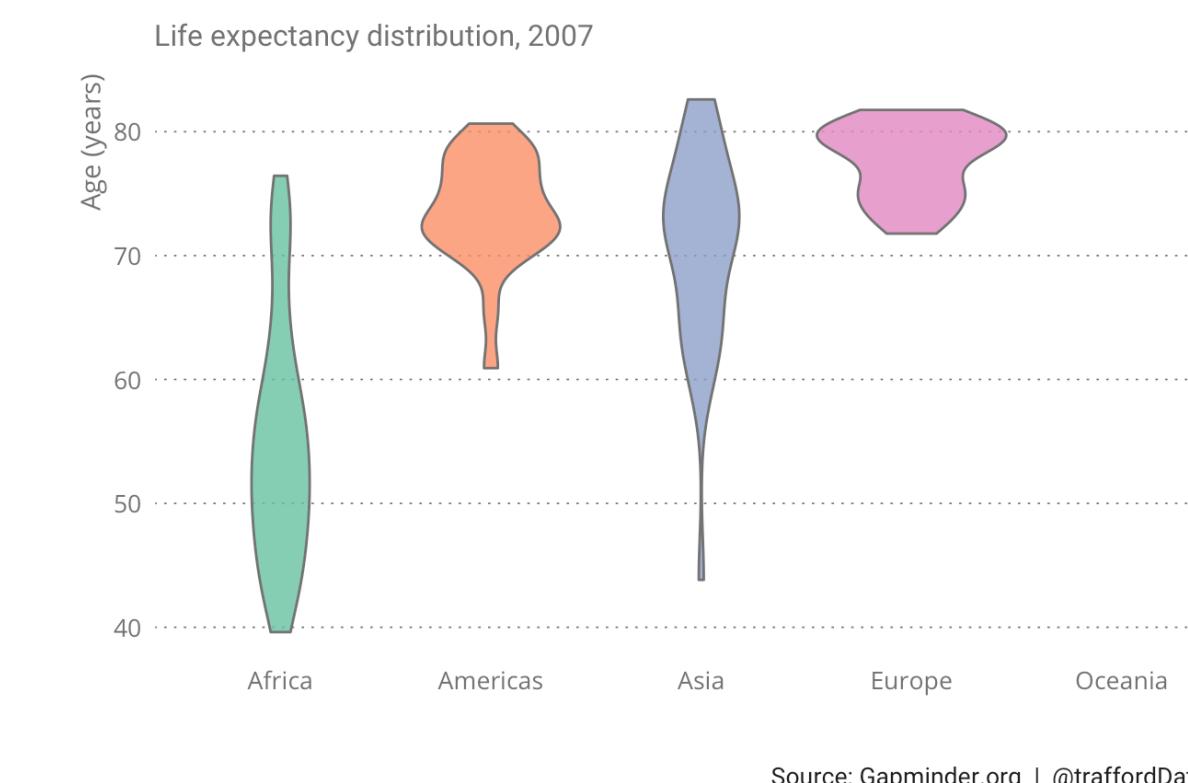
Lollipop chart



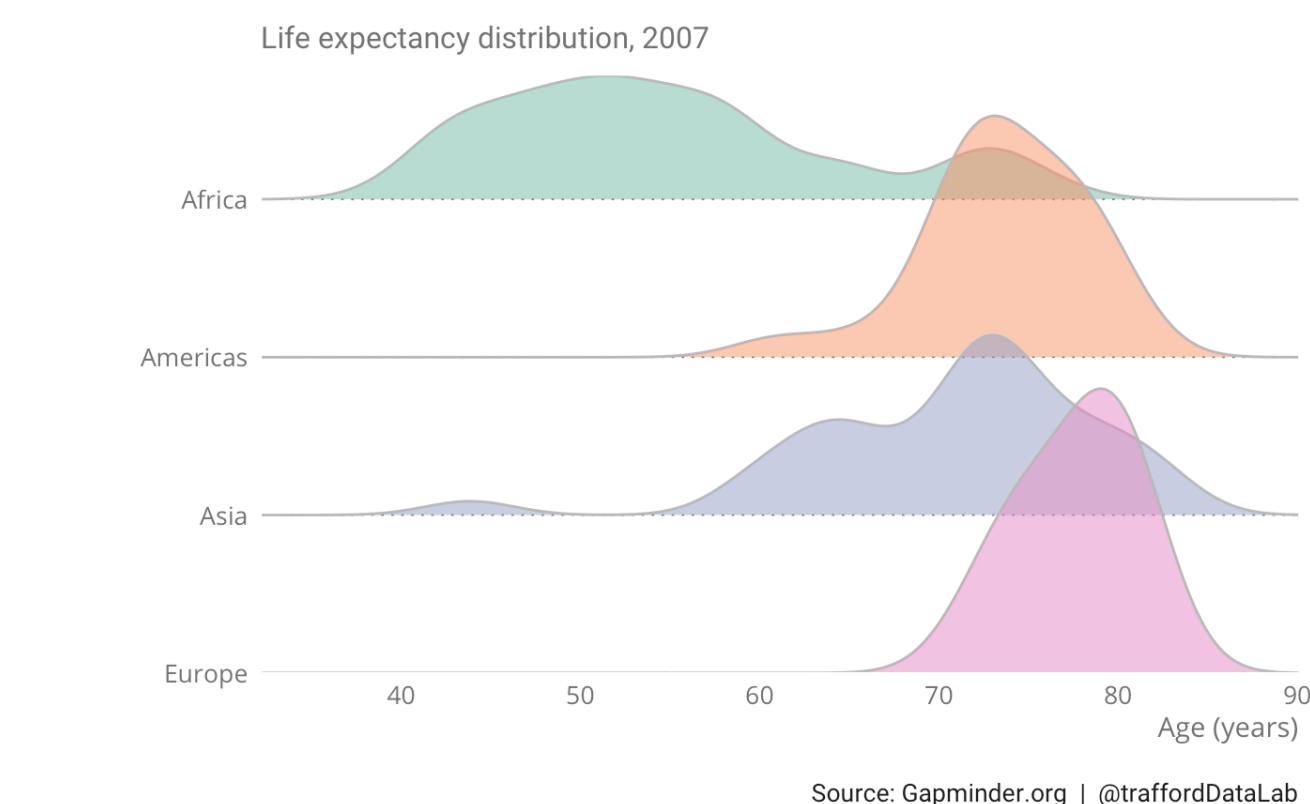
Waffle chart



Violin plot



Ridgeline plot



..... **LUNCH** .....

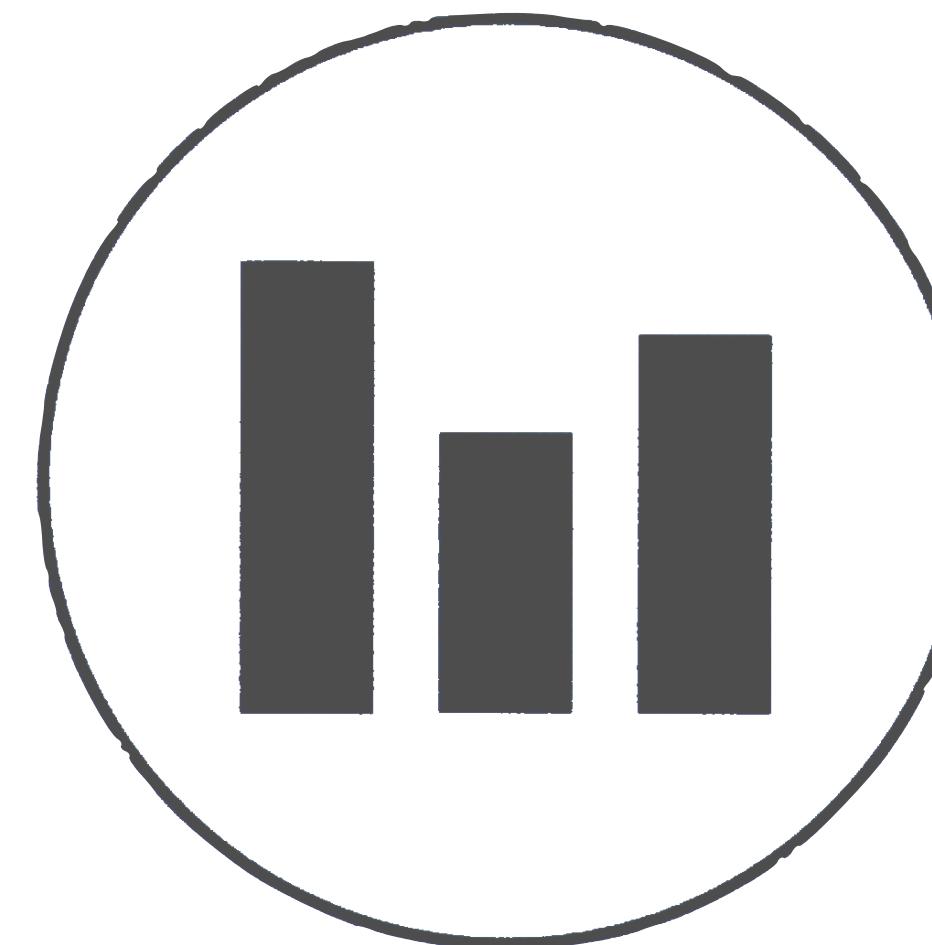
# DETAILS & EXAMPLES FOR CHART TYPES

a non-exhaustive catalogue of examples

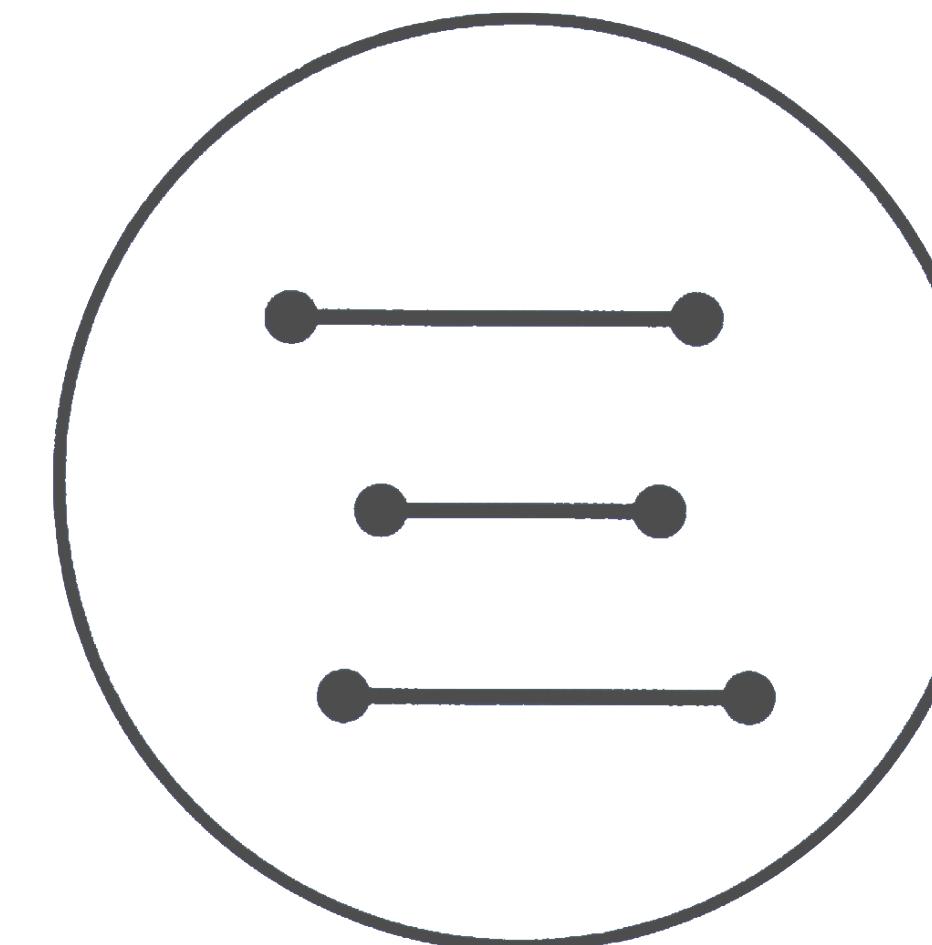
# MAGNITUDE & RANK

Compare single values across categories

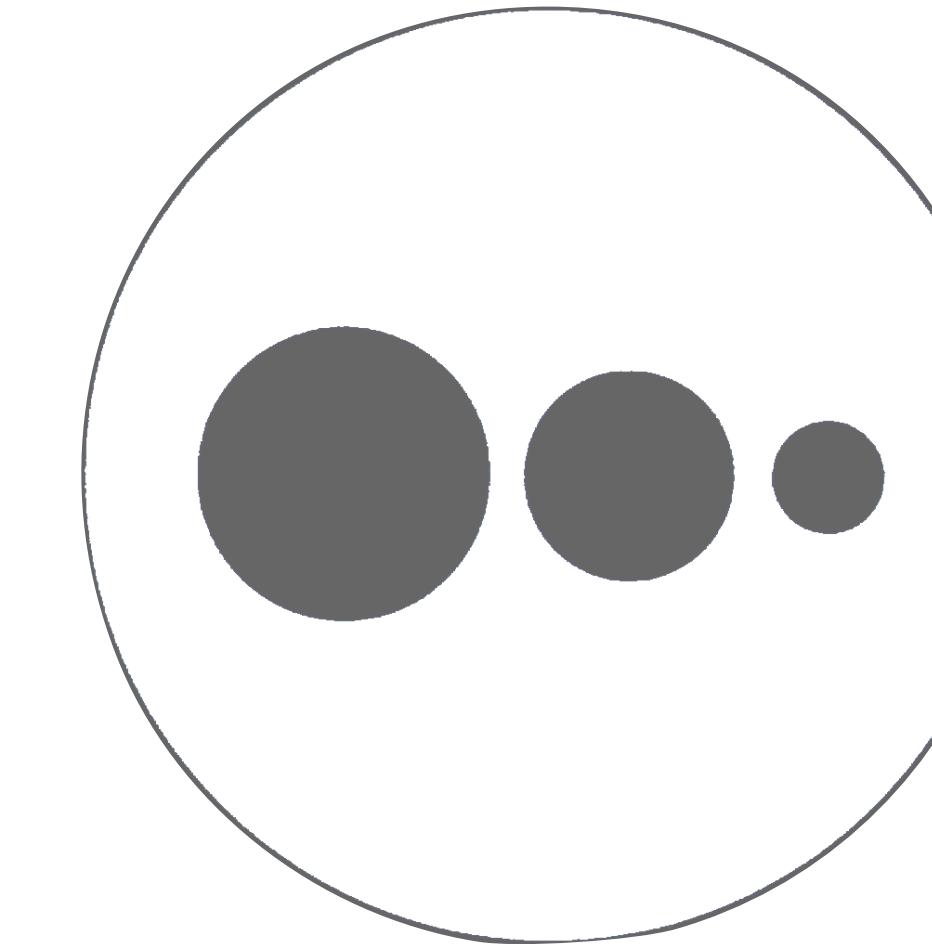
Bar  
Chart



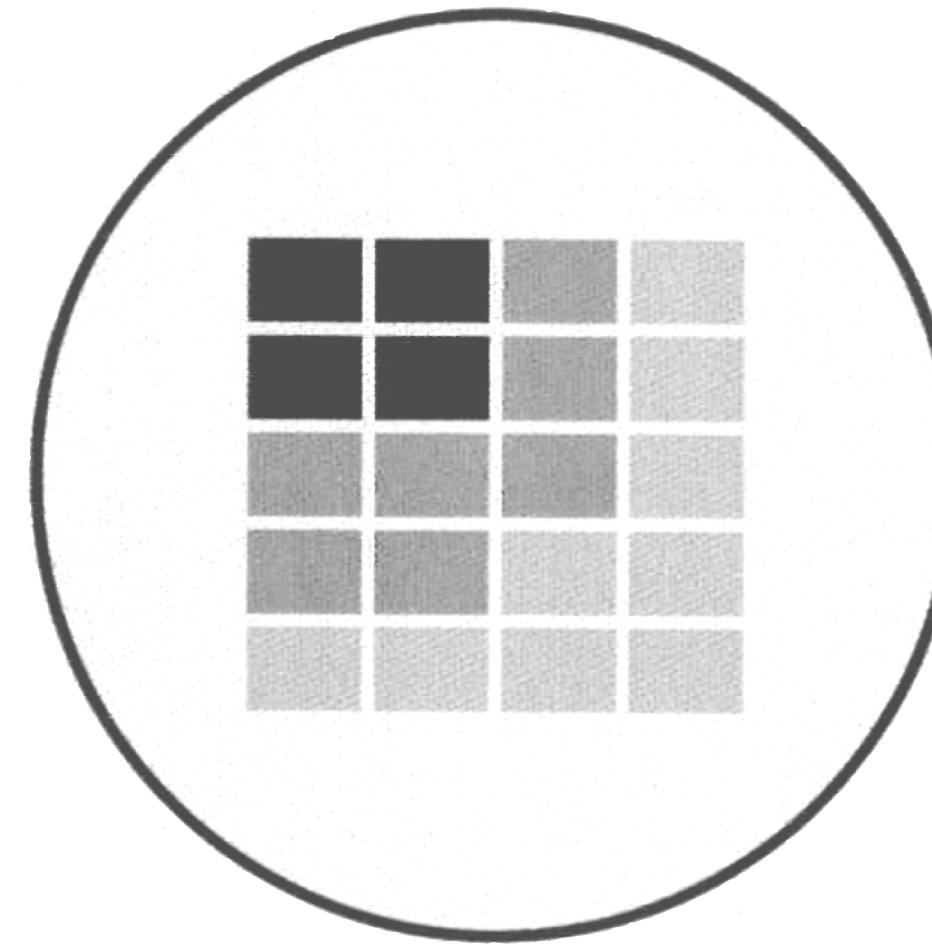
Dot  
Plot



Bubble  
(Area)



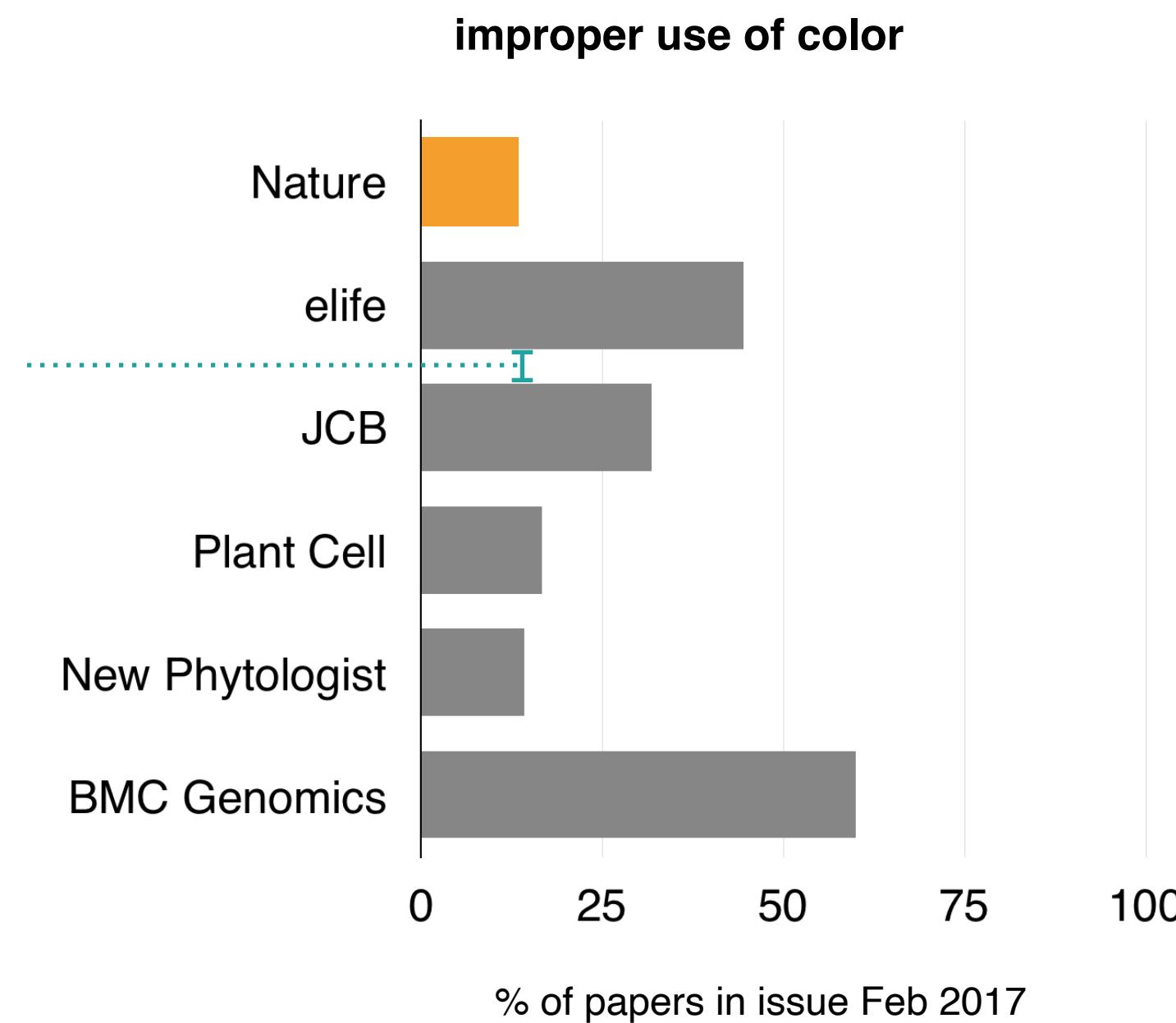
Heatmap



# GUIDELINES TO CONSIDER FOR BARS

**Integrity:** bars always start at 0!

**Proximity:** ideal 1:0.5



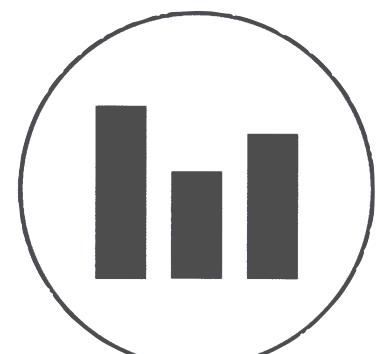
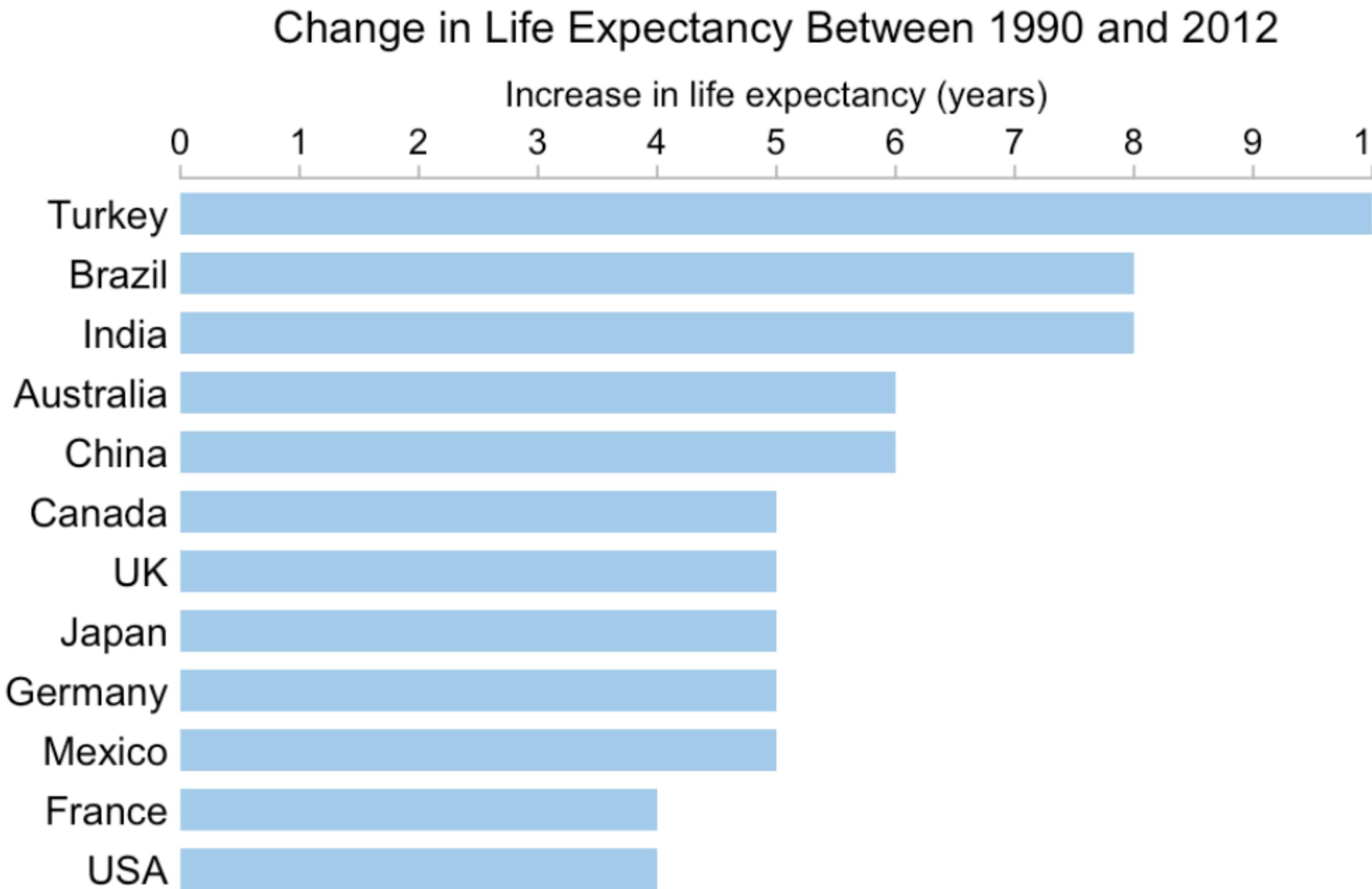
**Colors**  
clearly distinct  
balanced in intensity

**Avoid chart junk:**  
no border  
no filling patterns

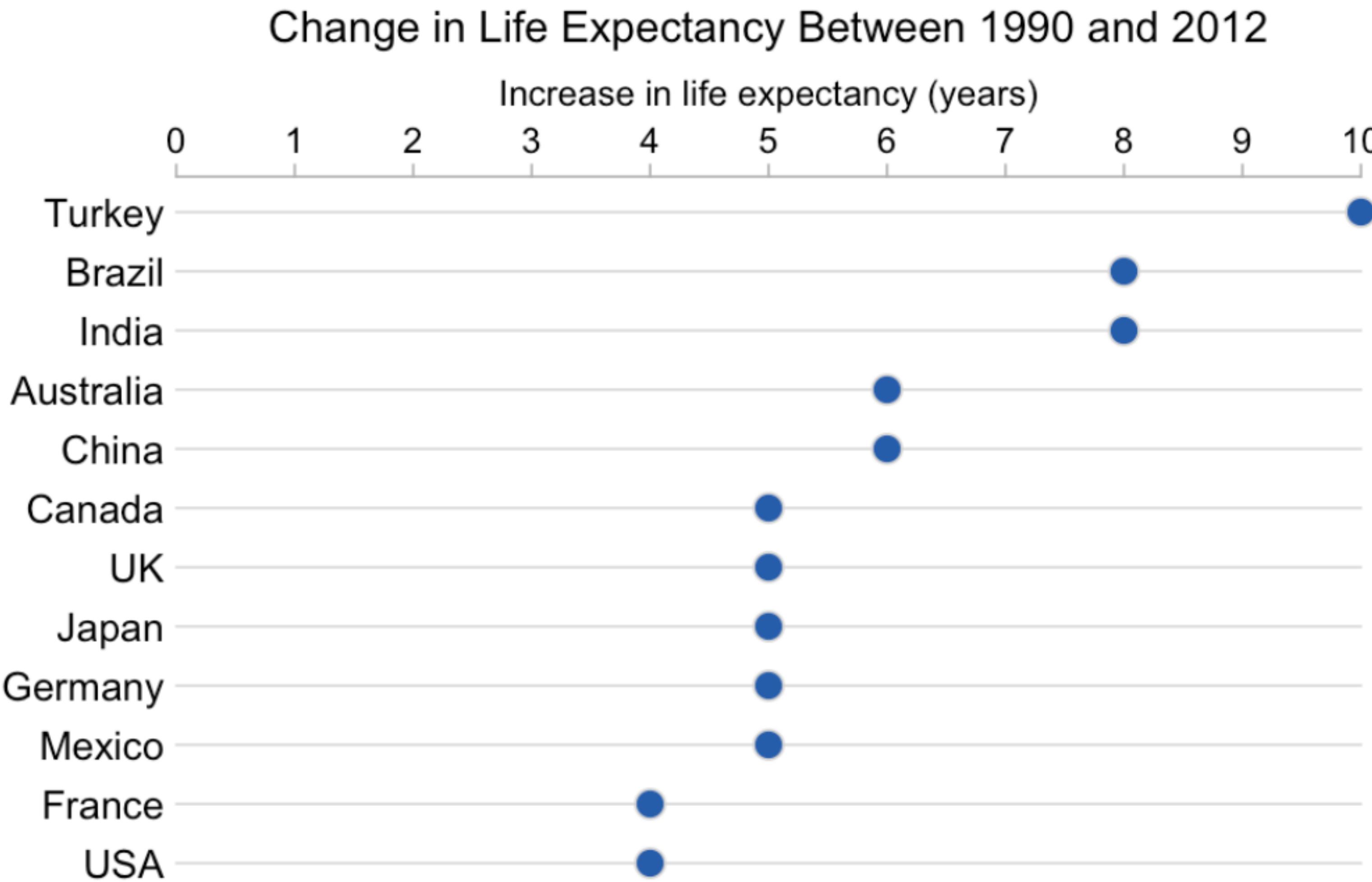
**Orientation:** horizontal for long names



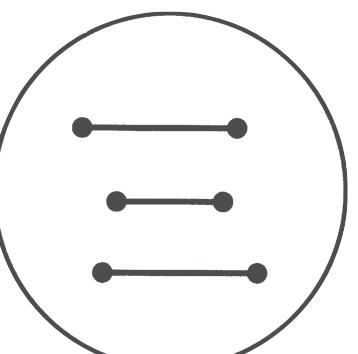
# DOT PLOTS AS AN ALTERNATIVE TO BARS



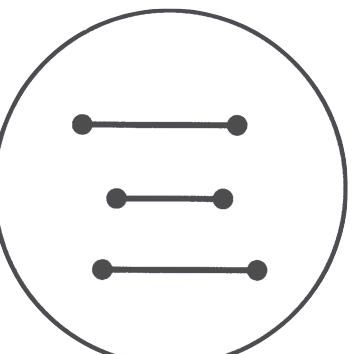
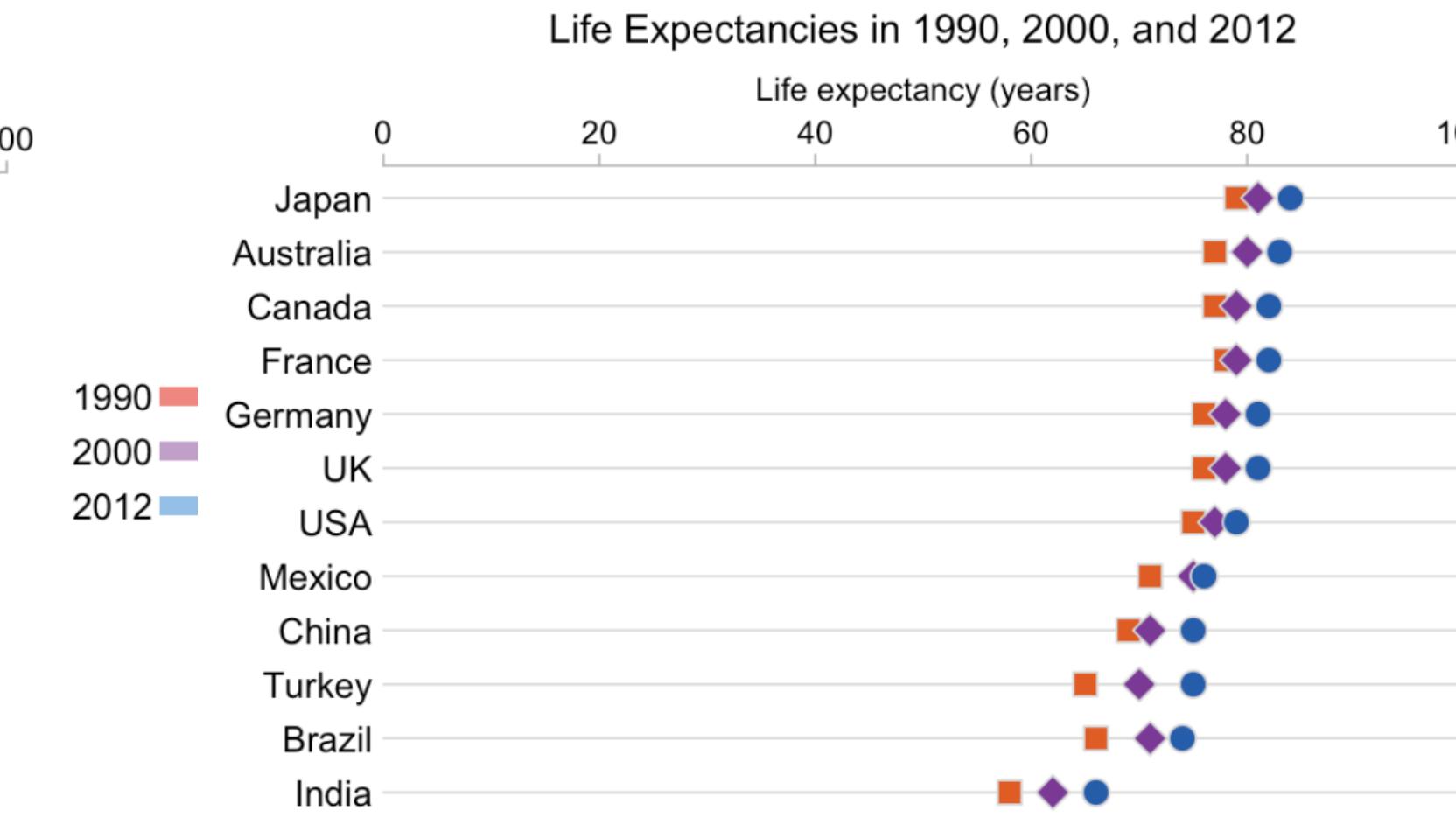
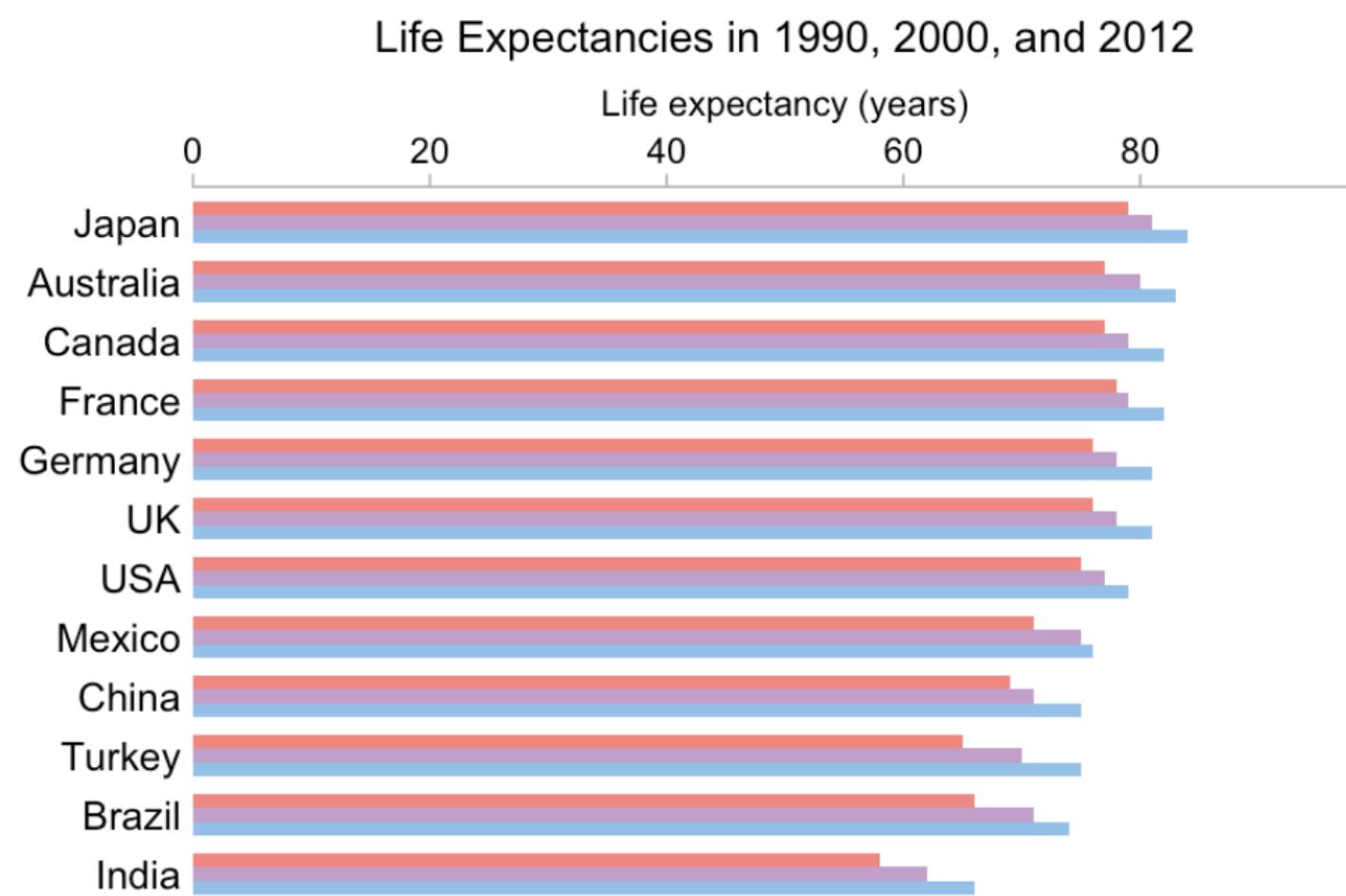
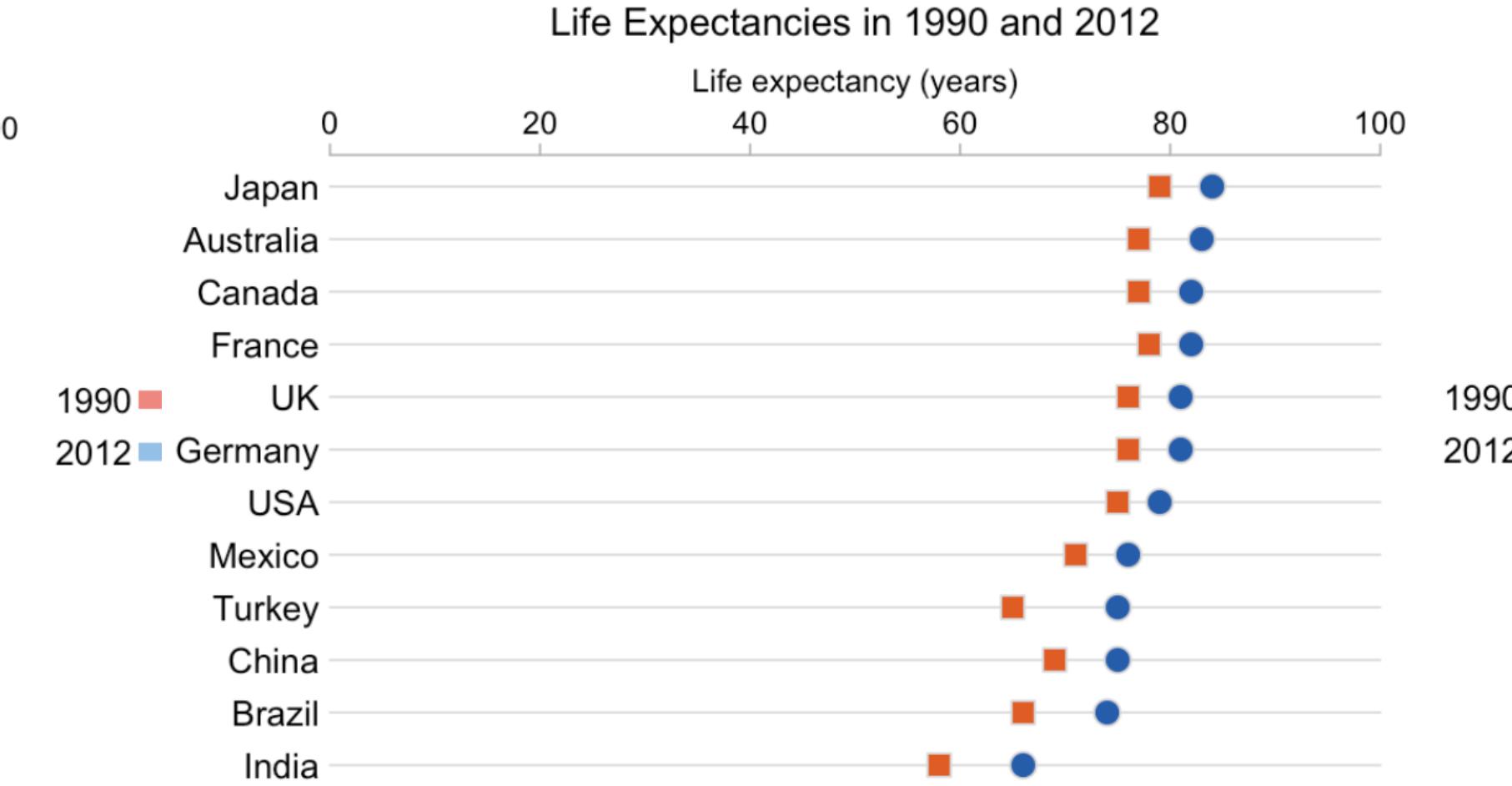
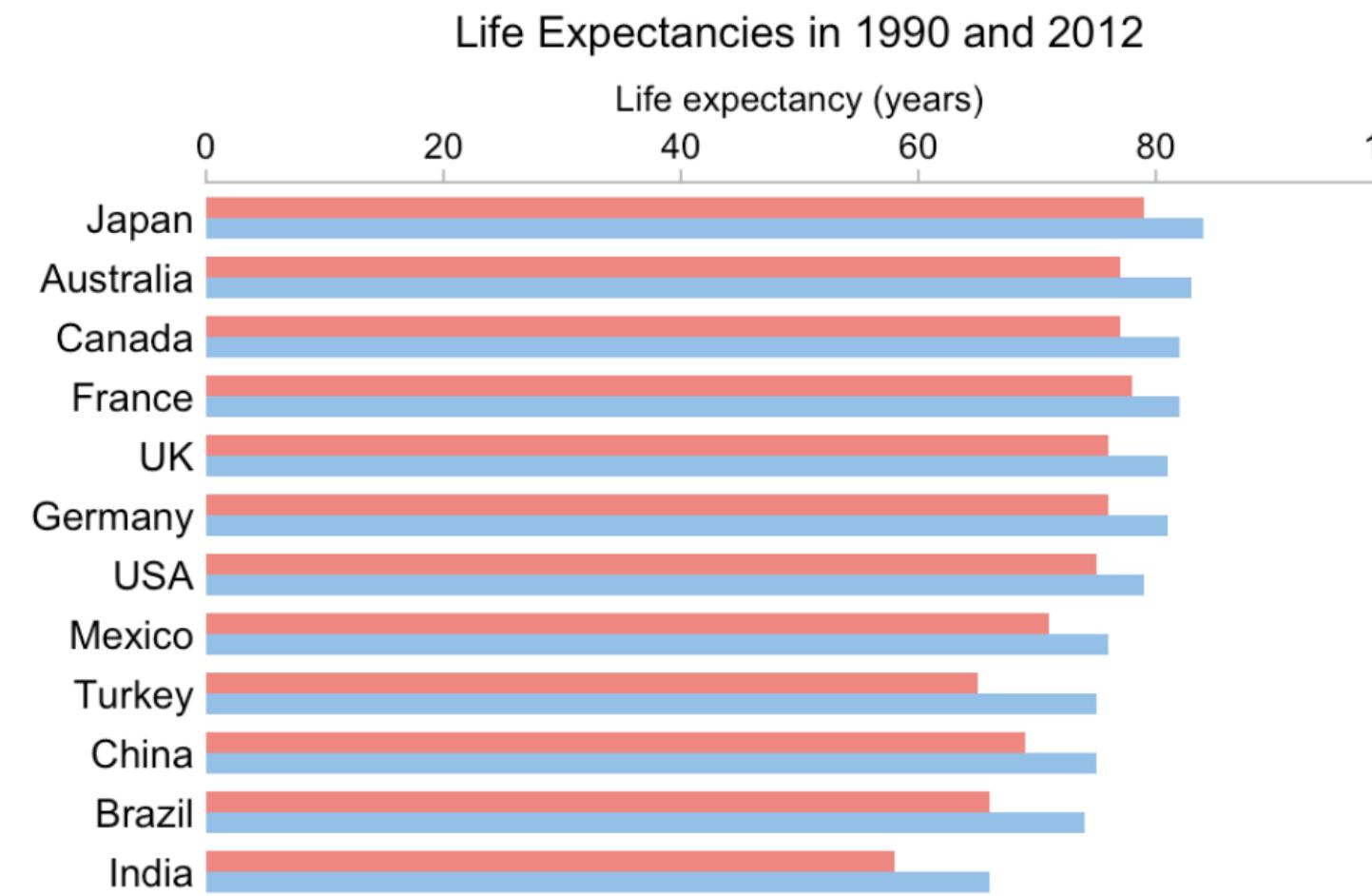
# DOT PLOTS AS AN ALTERNATIVE TO BARS



Better data-ink ratio

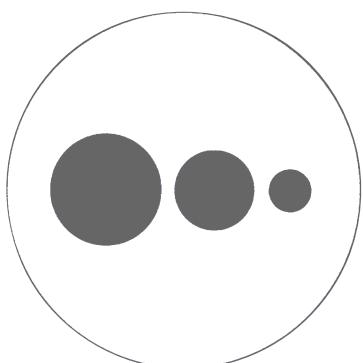
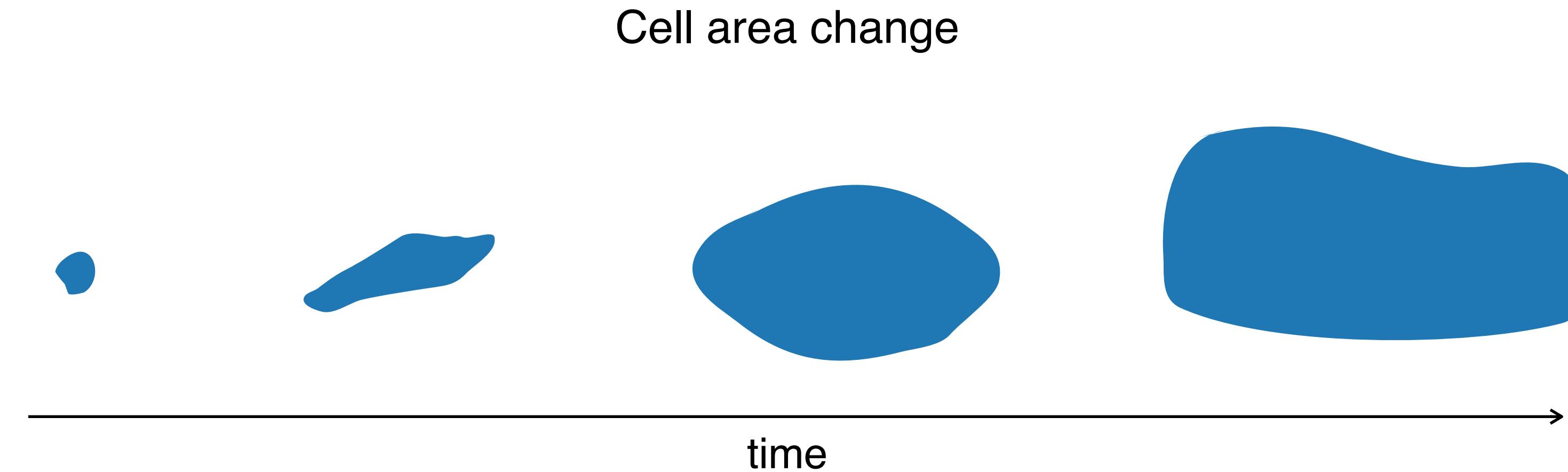


# DOT PLOTS AS AN ALTERNATIVE TO BARS



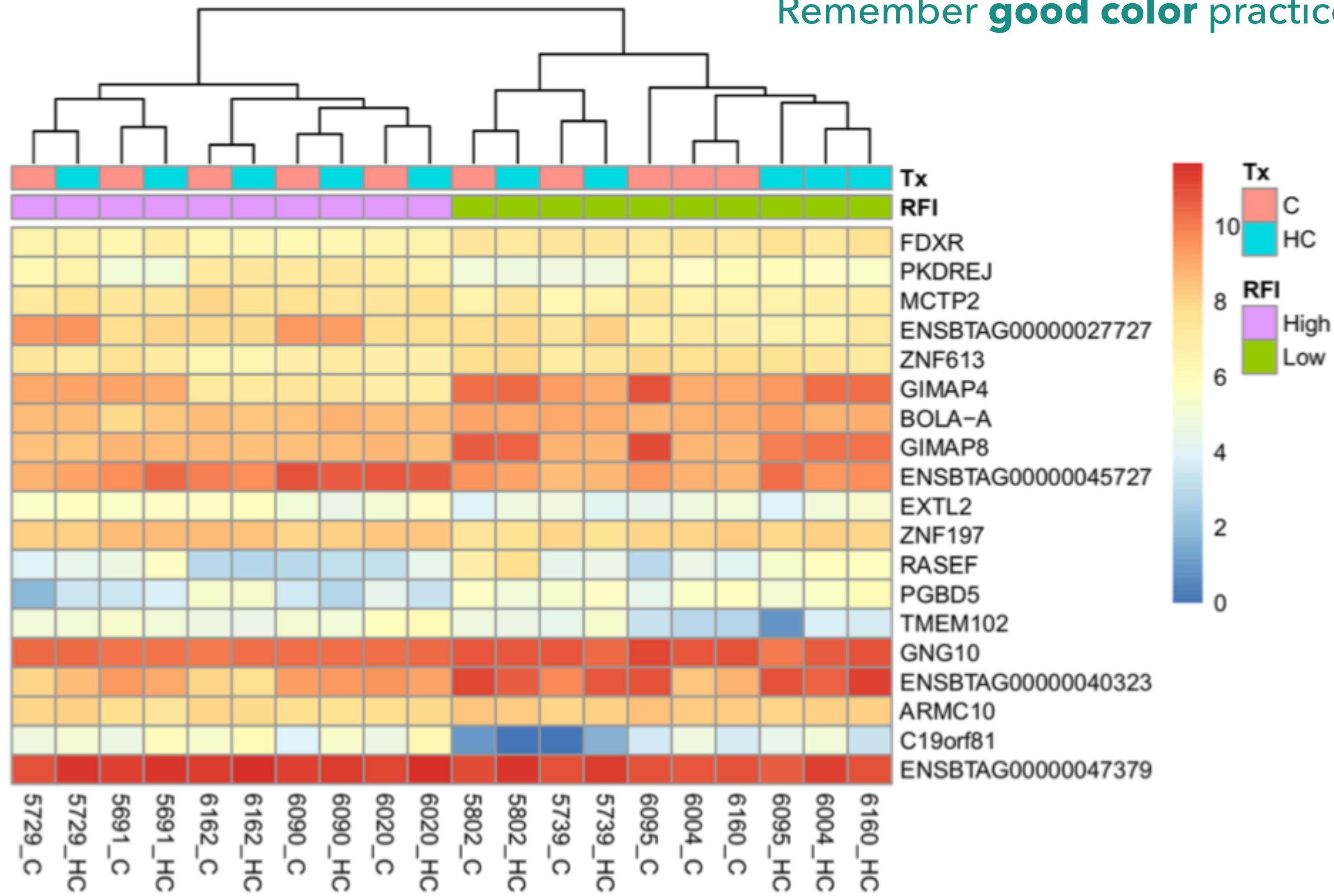
Better to see trends within & across categories

## AREA CHARTS, NOT SO PRECISE BUT SOMETIMES USEFUL

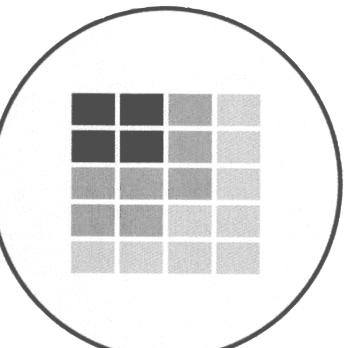


# HEATMAPS

Remember **good color practice!**

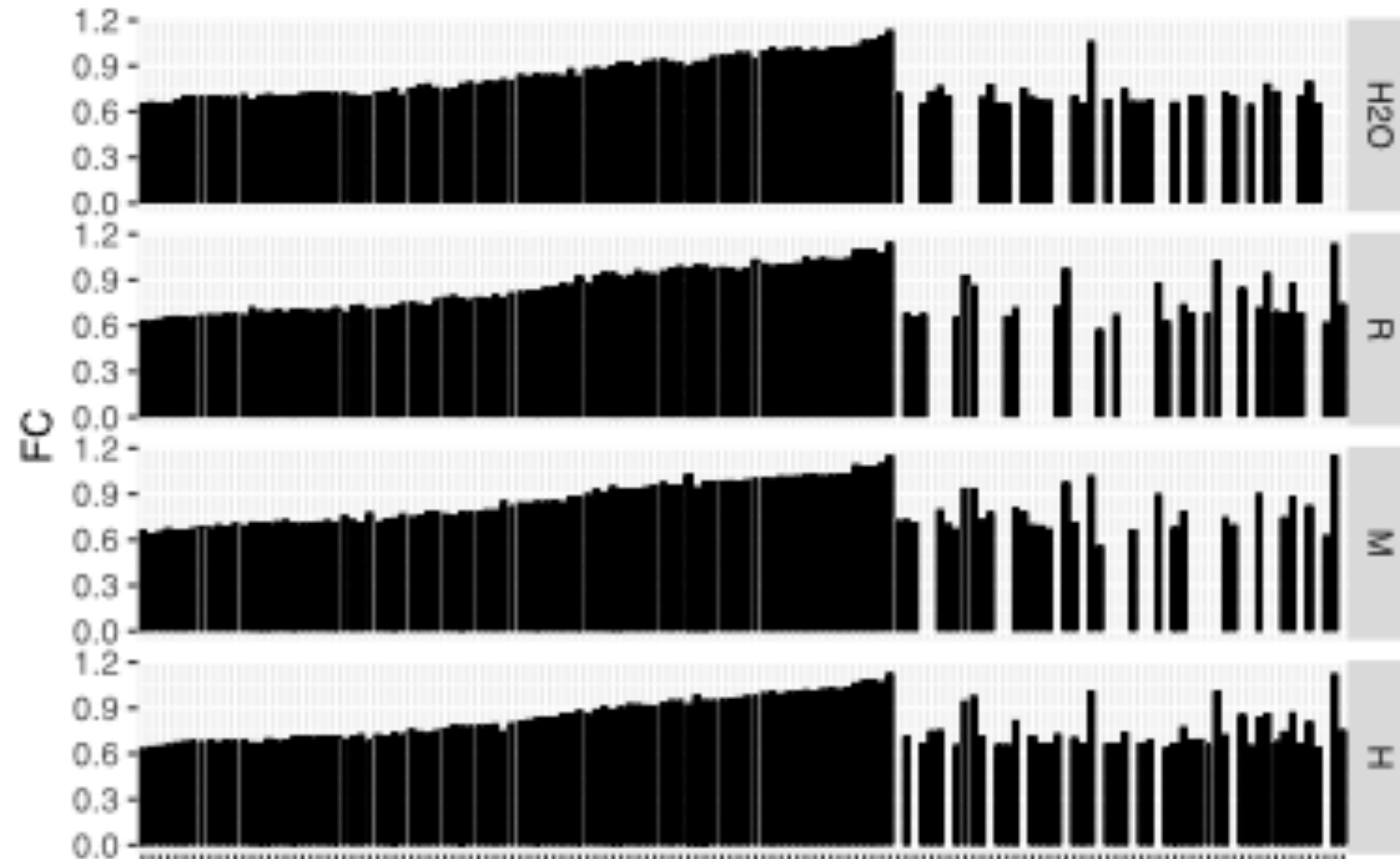


BMC genomics, 2017

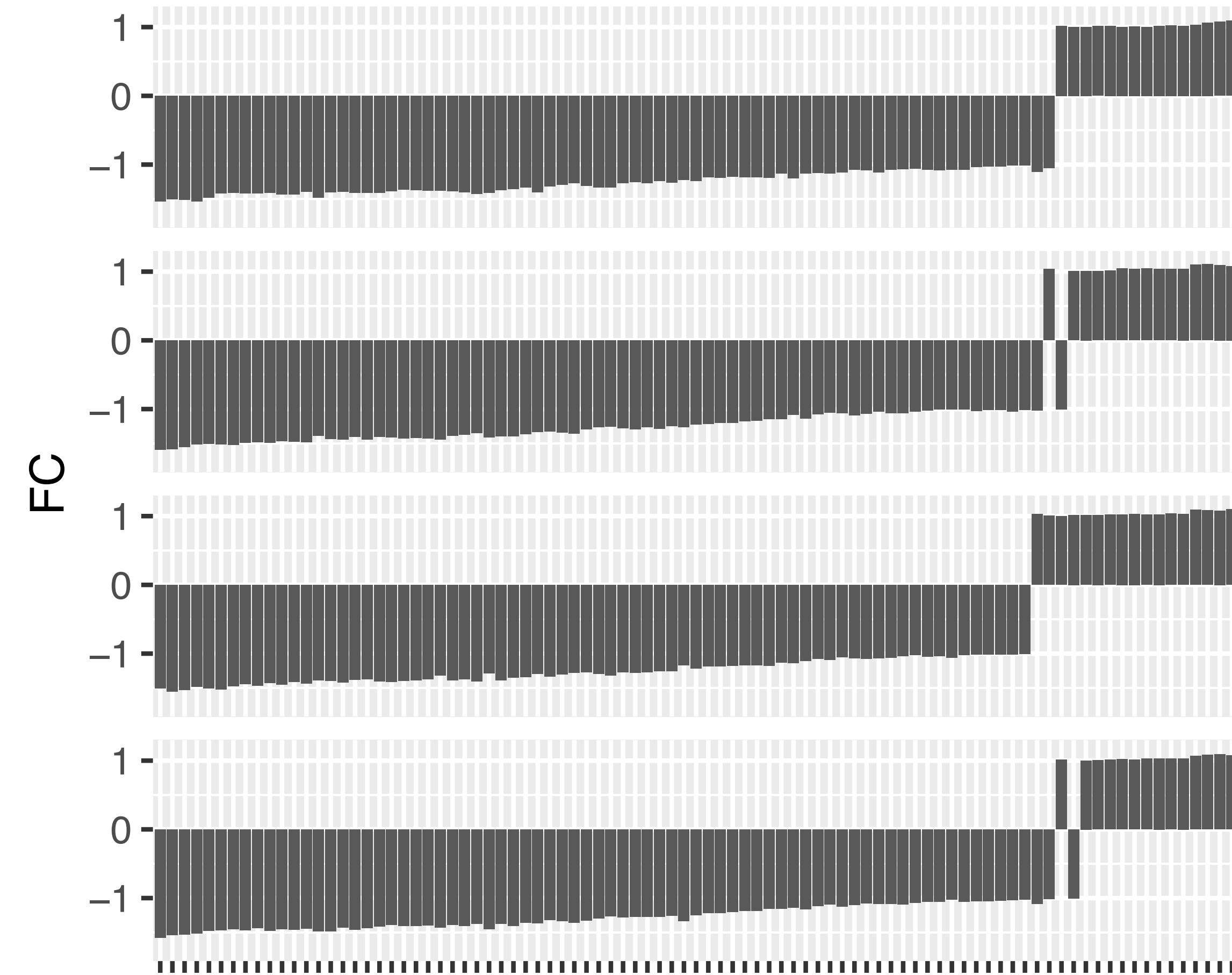


# MAGNITUDE VS. DEVIATION

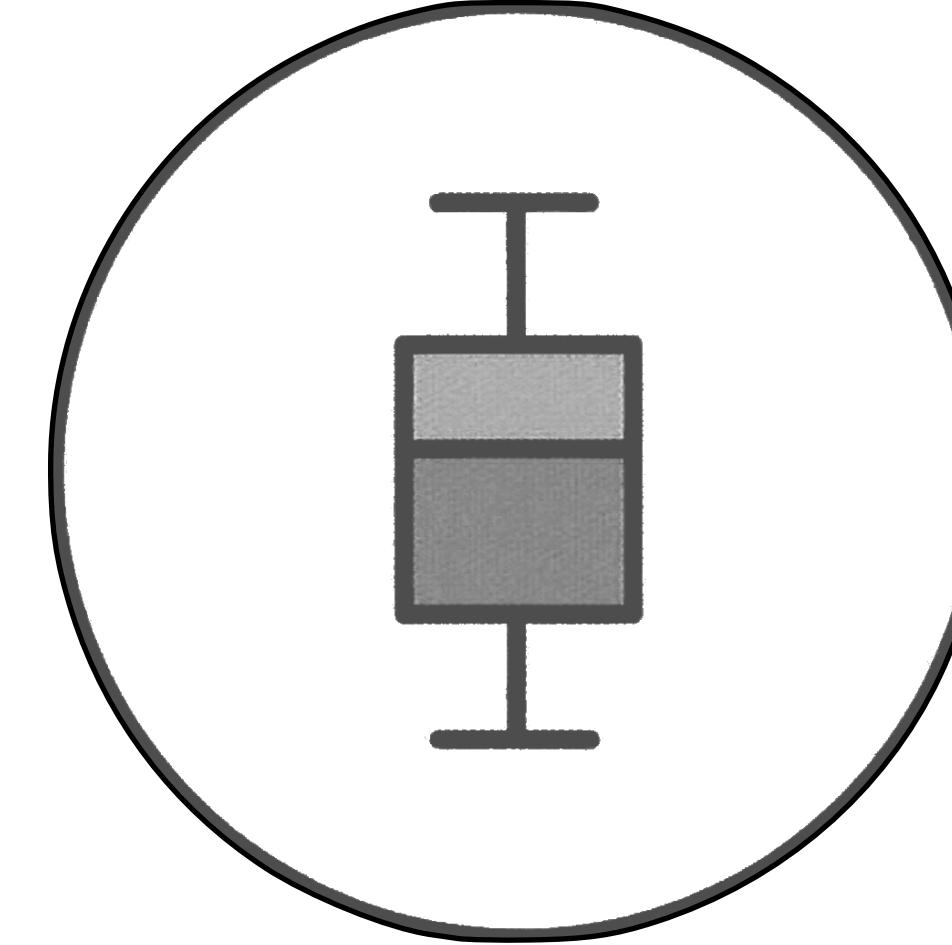
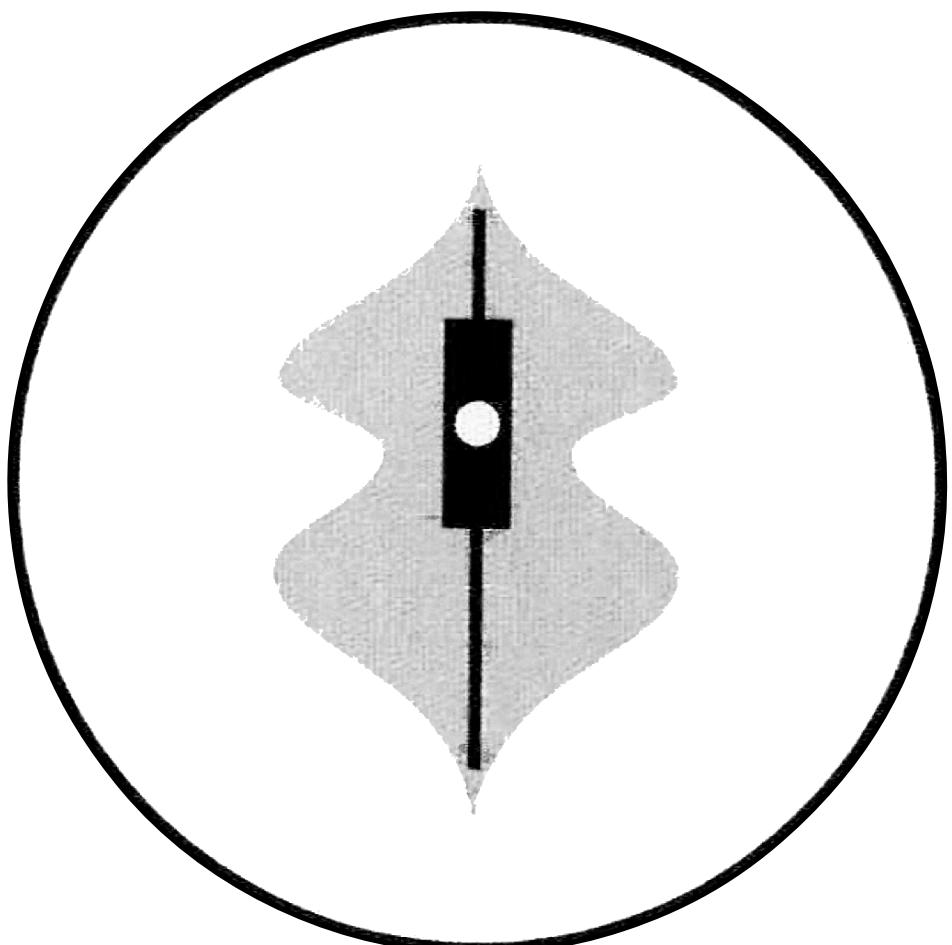
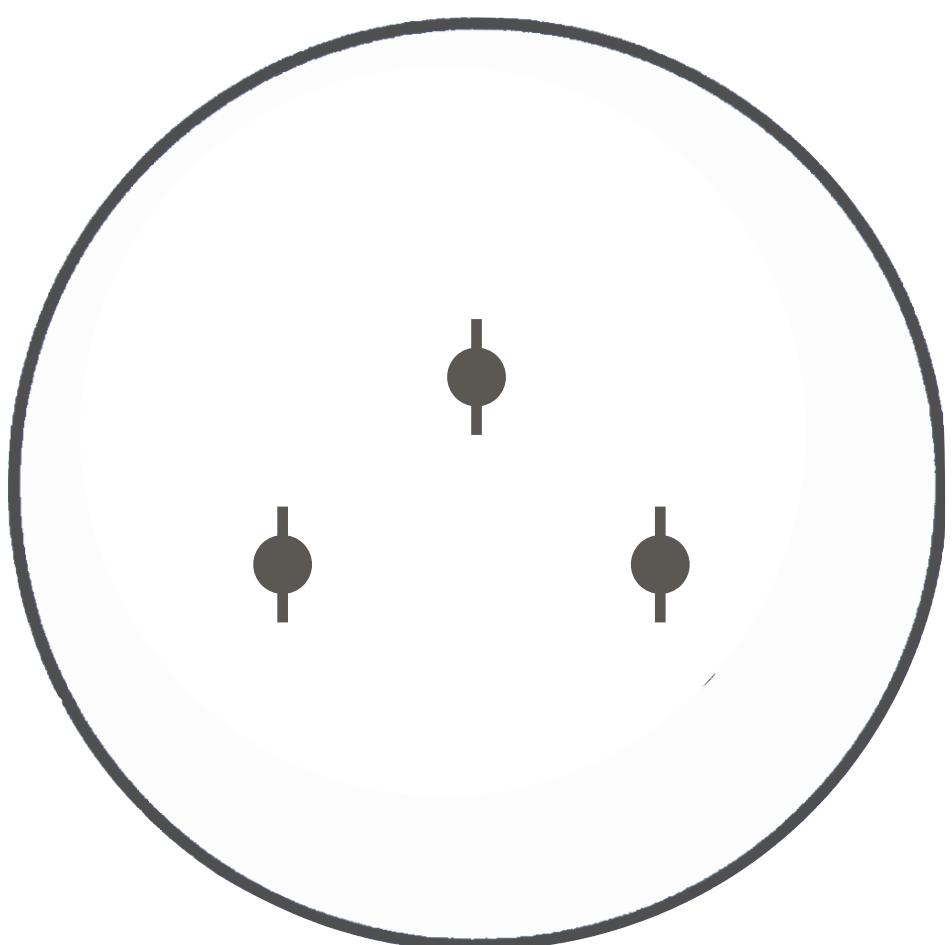
Effect size?



# MAGNITUDE VS. DEVIATION



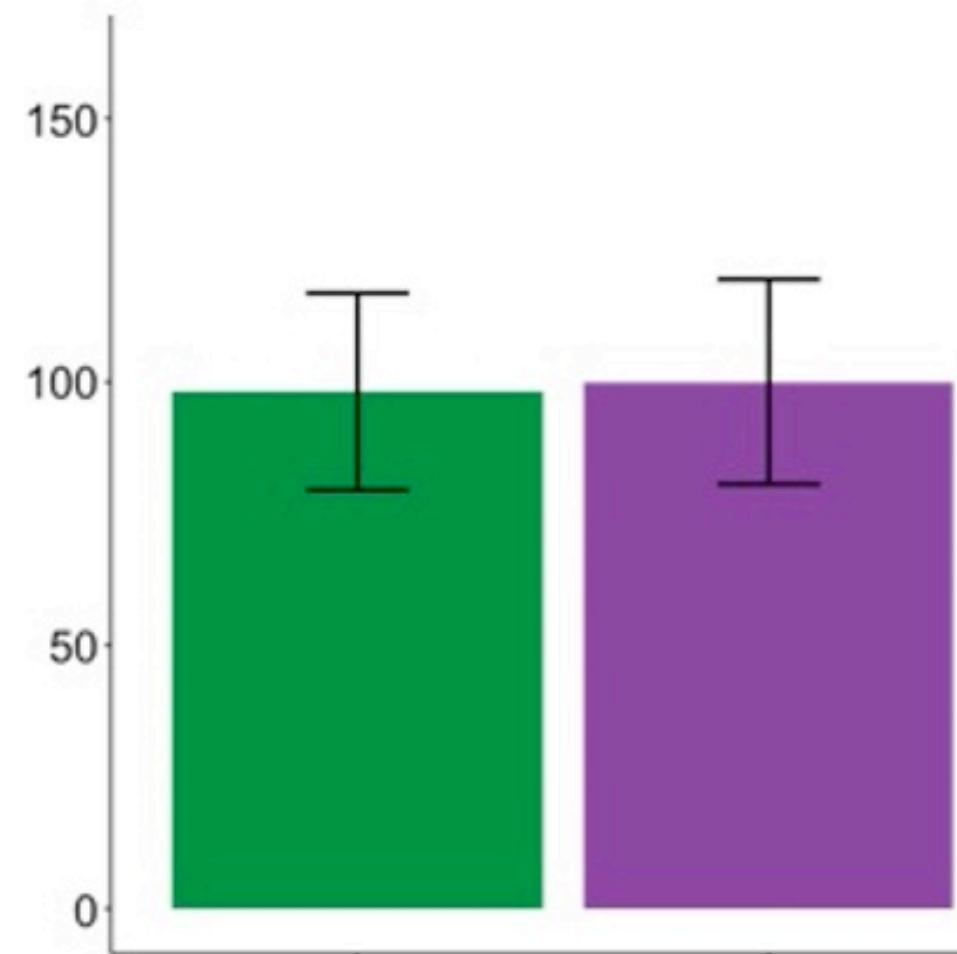
# DISTRIBUTIONS



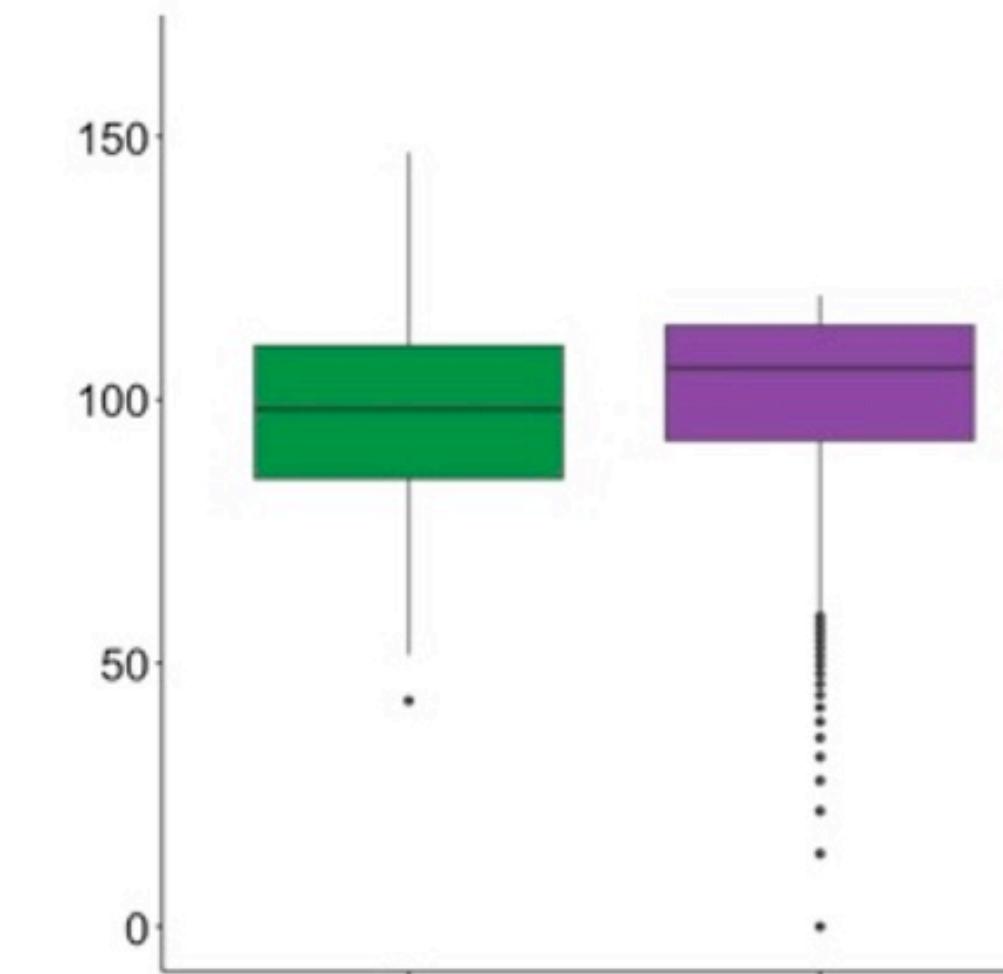
# #BARBARPLOTS

**Friends don't let friends make bar plots.**

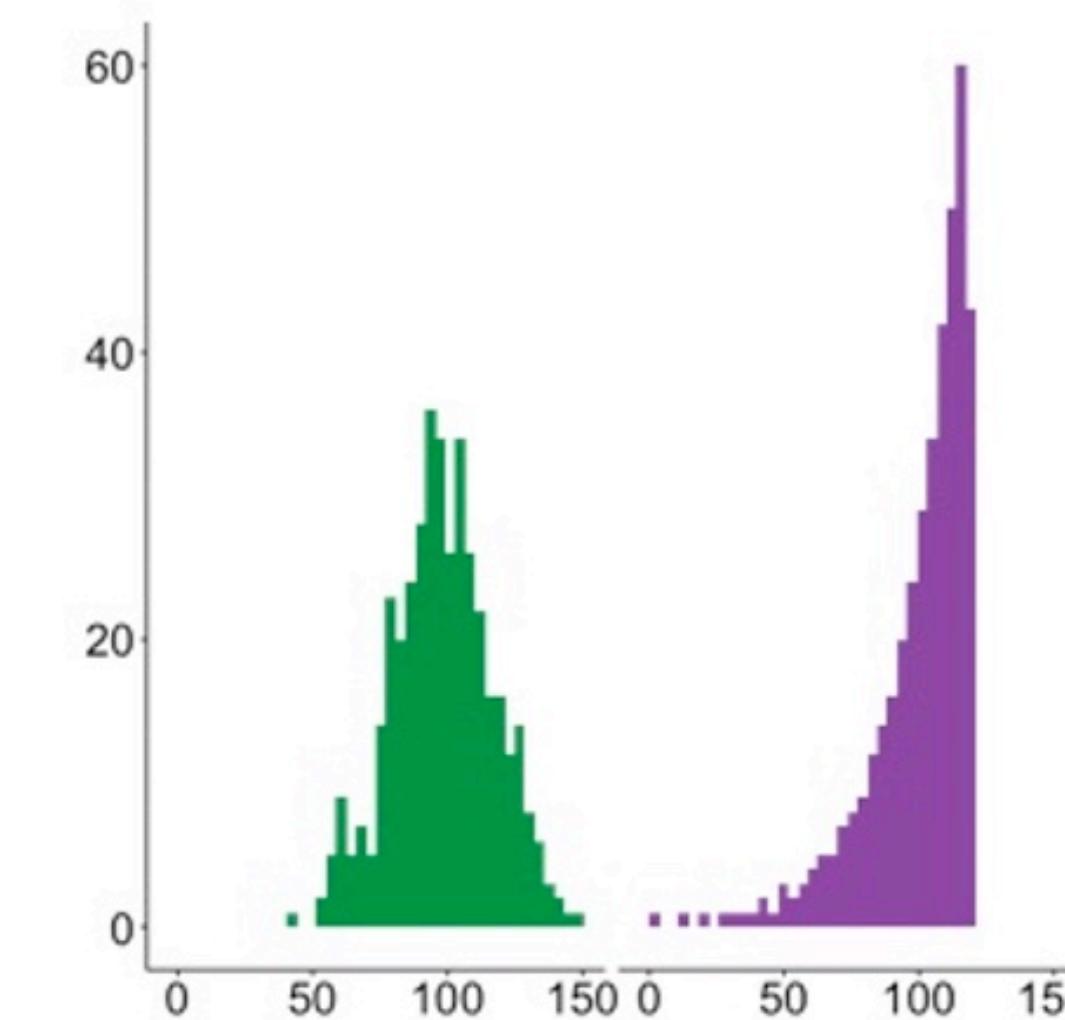
These look the same!



Wait a minute...



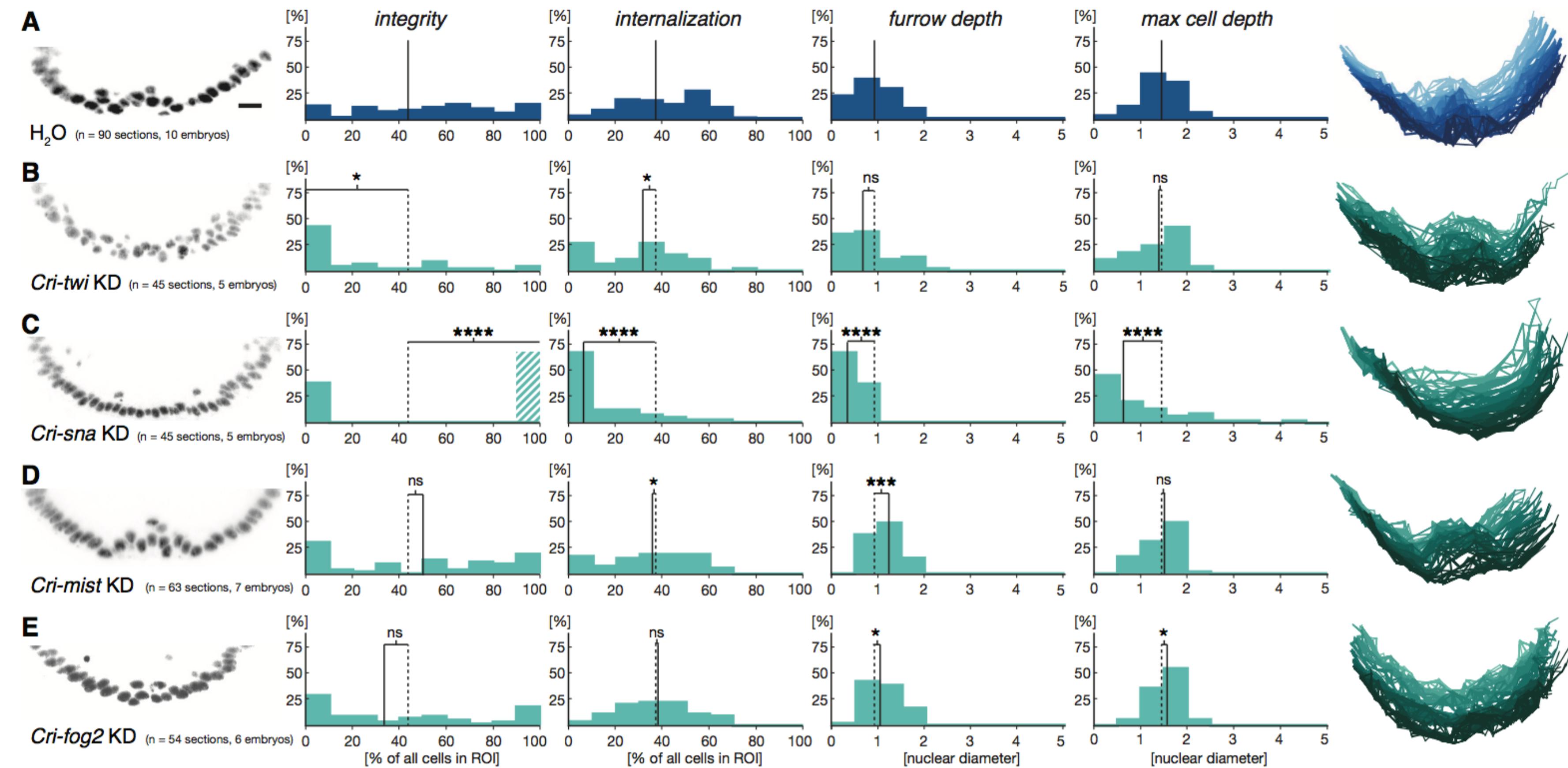
Oooh!



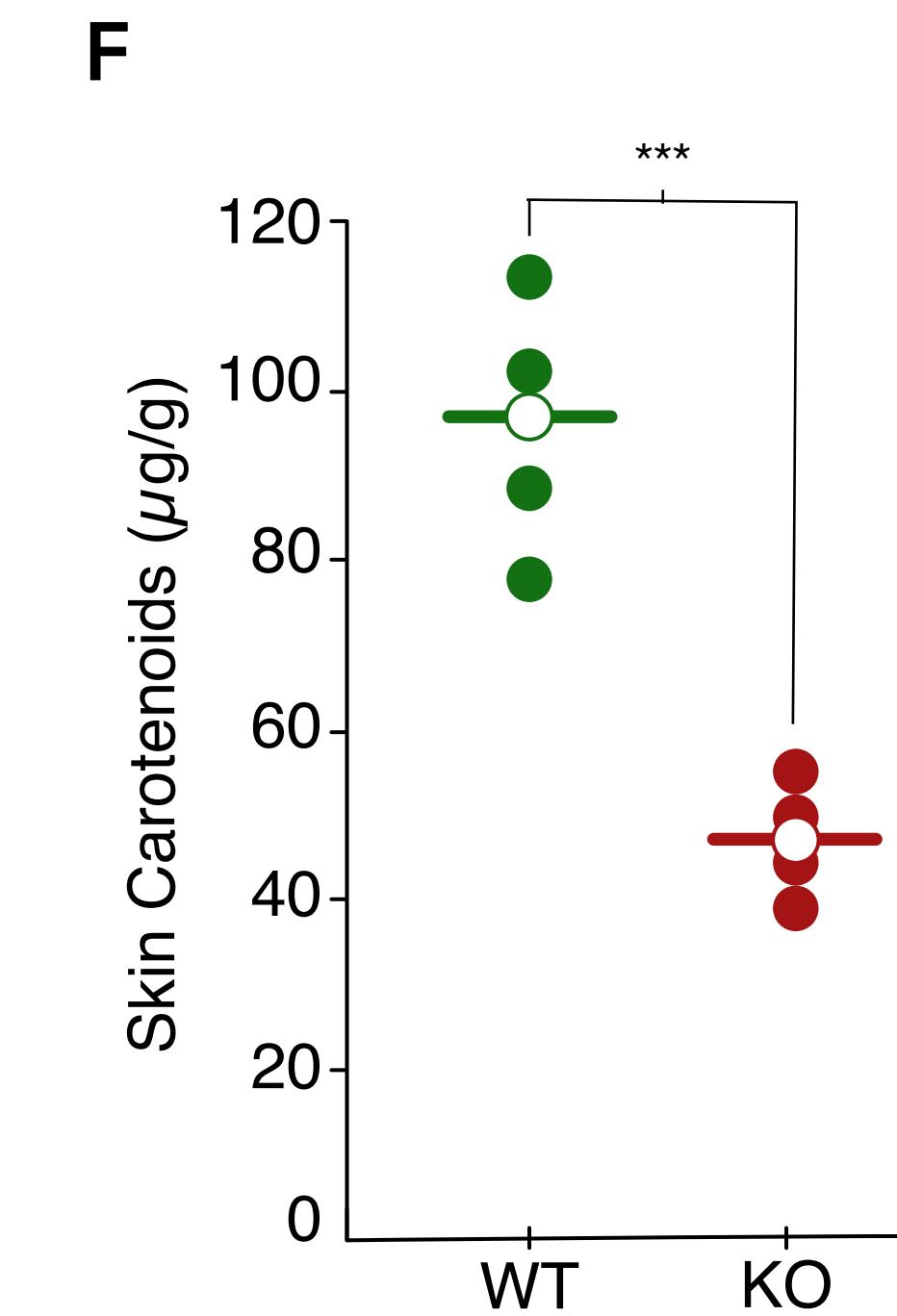
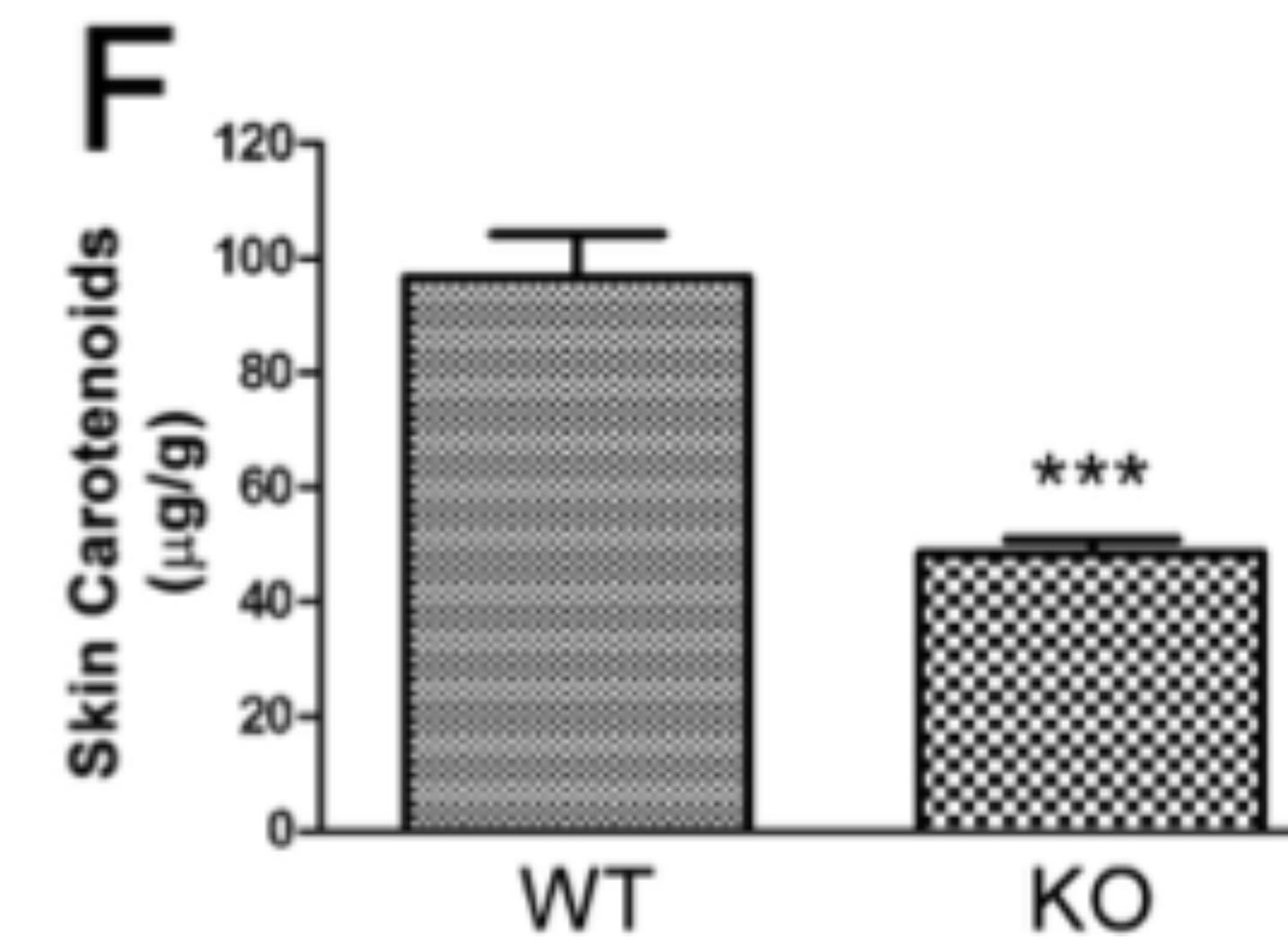
**KICKSTARTER**

€3,479  
pledged of €3,000 goal  
173  
backers

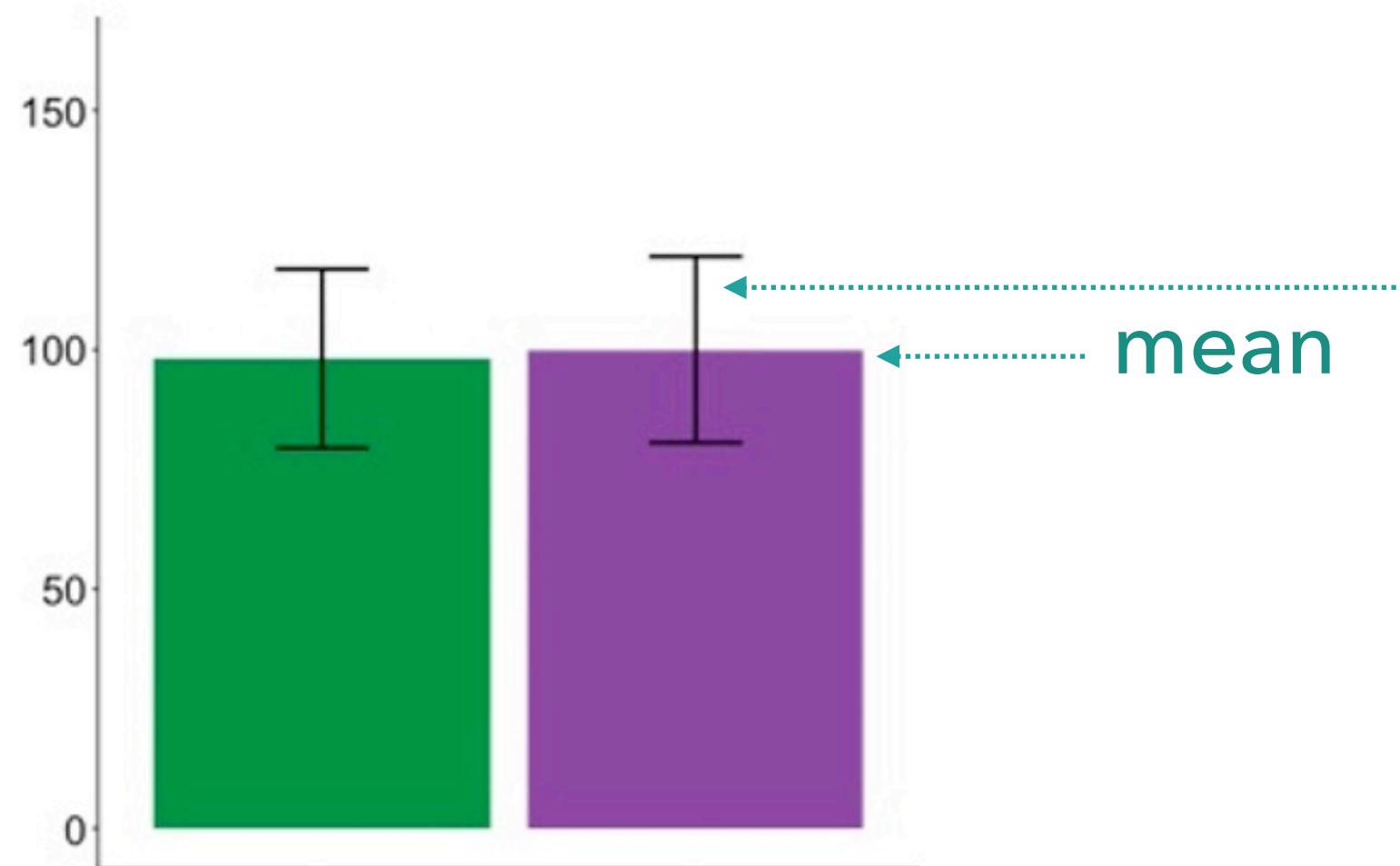
# USE HISTOGRAMS TO COMPARE THE WHOLE SHAPE OF DISTRIBUTIONS



# SHOW ALL DATA POINTS FOR SMALL N



# ERROR BARS & VISUALIZING STATISTICS



standard deviation, standard error, confidence interval?

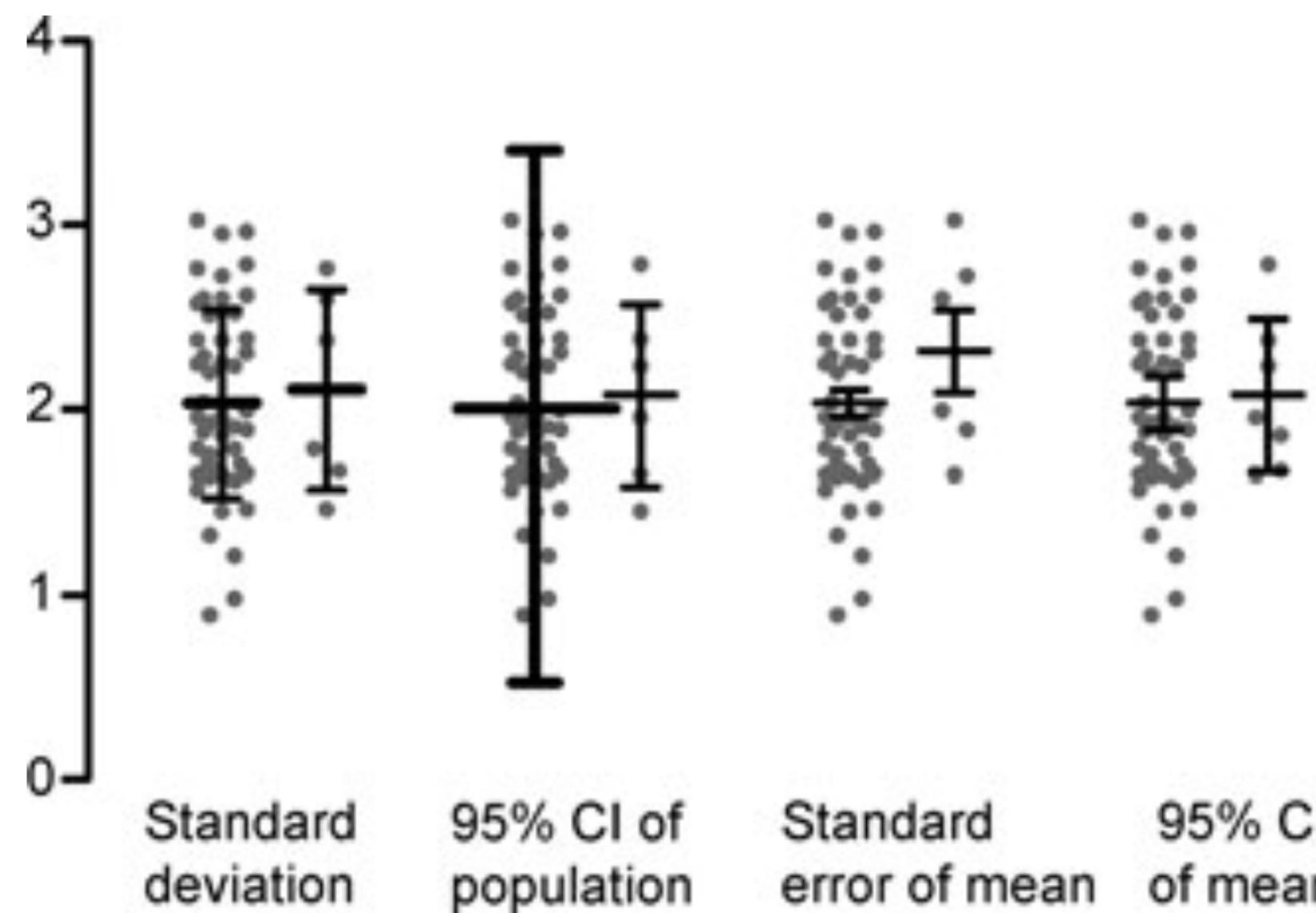
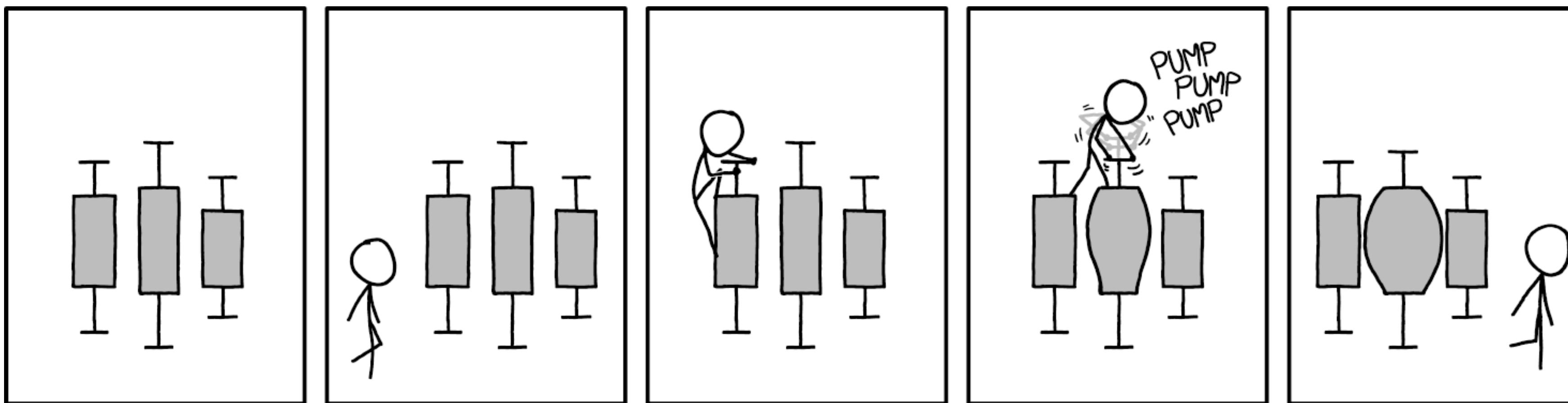


Table I. Common error bars

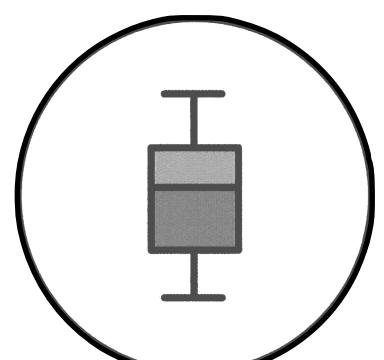
Error bar	Type	Description	Formula
Range	Descriptive	Amount of spread between the extremes of the data	Highest data point minus the lowest
Standard deviation (SD)	Descriptive	Typical or (roughly speaking) average difference between the data points and their mean	$SD = \sqrt{\frac{\sum(X - M)^2}{n-1}}$
Standard error (SE)	Inferential	A measure of how variable the mean will be, if you repeat the whole study many times	$SE = SD/\sqrt{n}$
Confidence interval (CI), usually 95% CI	Inferential	A range of values you can be 95% confident contains the true mean	$M \pm t_{[n-1]} \times SE$ , where $t_{[n-1]}$ is a critical value of $t$ . If $n$ is 10 or more, the 95% CI is approximately $M \pm 2 \times SE$ .

# BOX PLOTS

Q1: I have seen box plots in the papers/  
presentations in the last 12 months

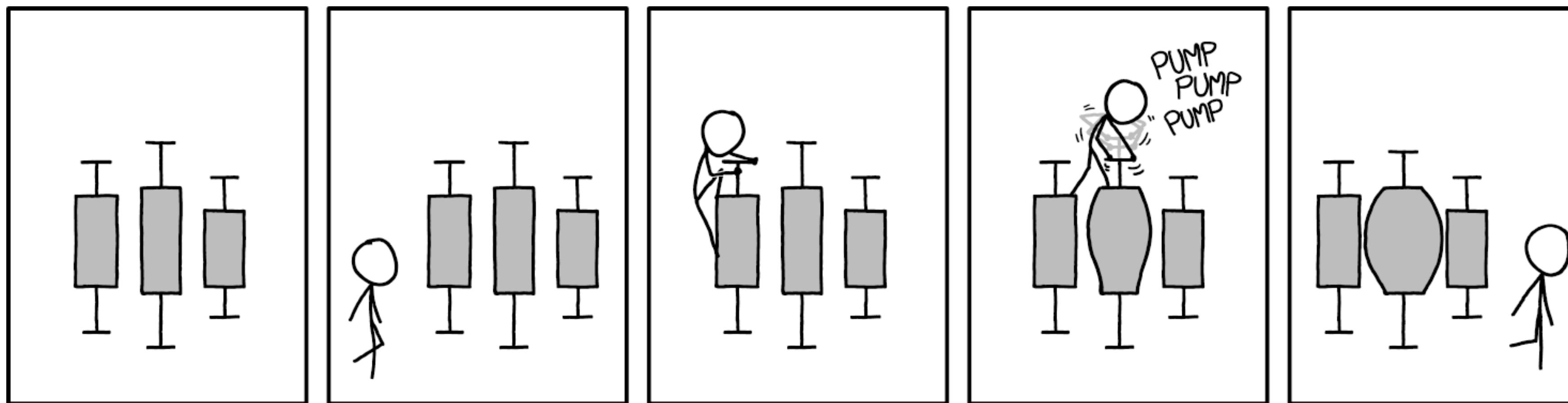


[xkcd.com](http://xkcd.com)

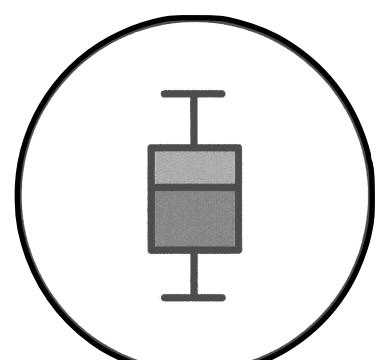


# BOX PLOTS

Q2: I know by heart what the boxes and whiskers in box plots mean

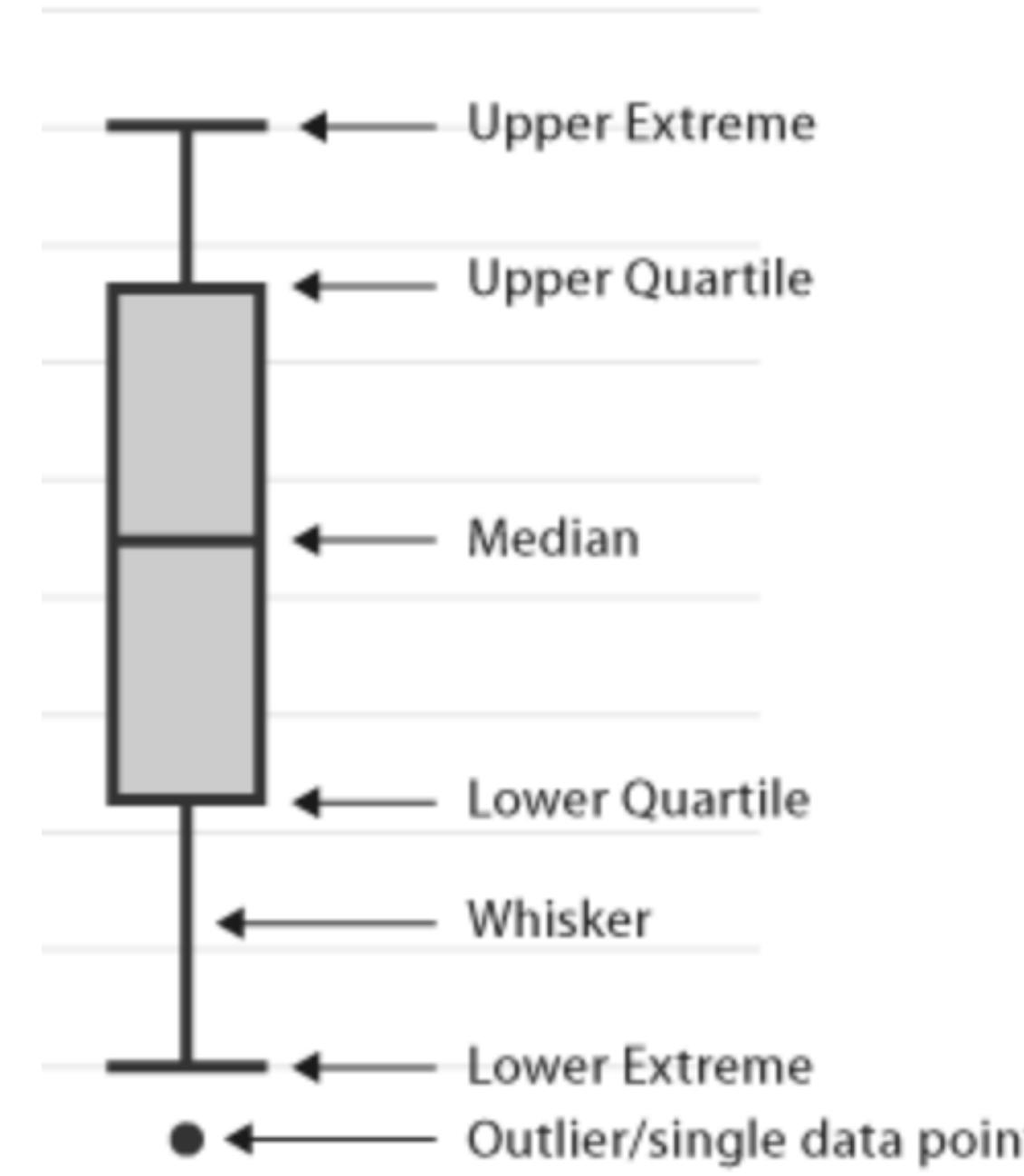


[xkcd.com](http://xkcd.com)



# ANATOMY OF BOX PLOTS

## Box plot



## Notched plot

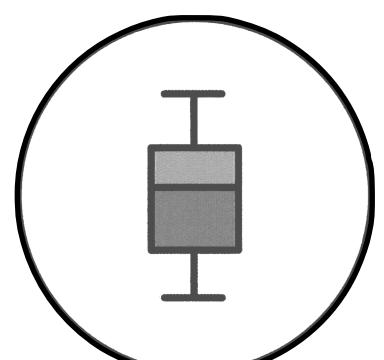
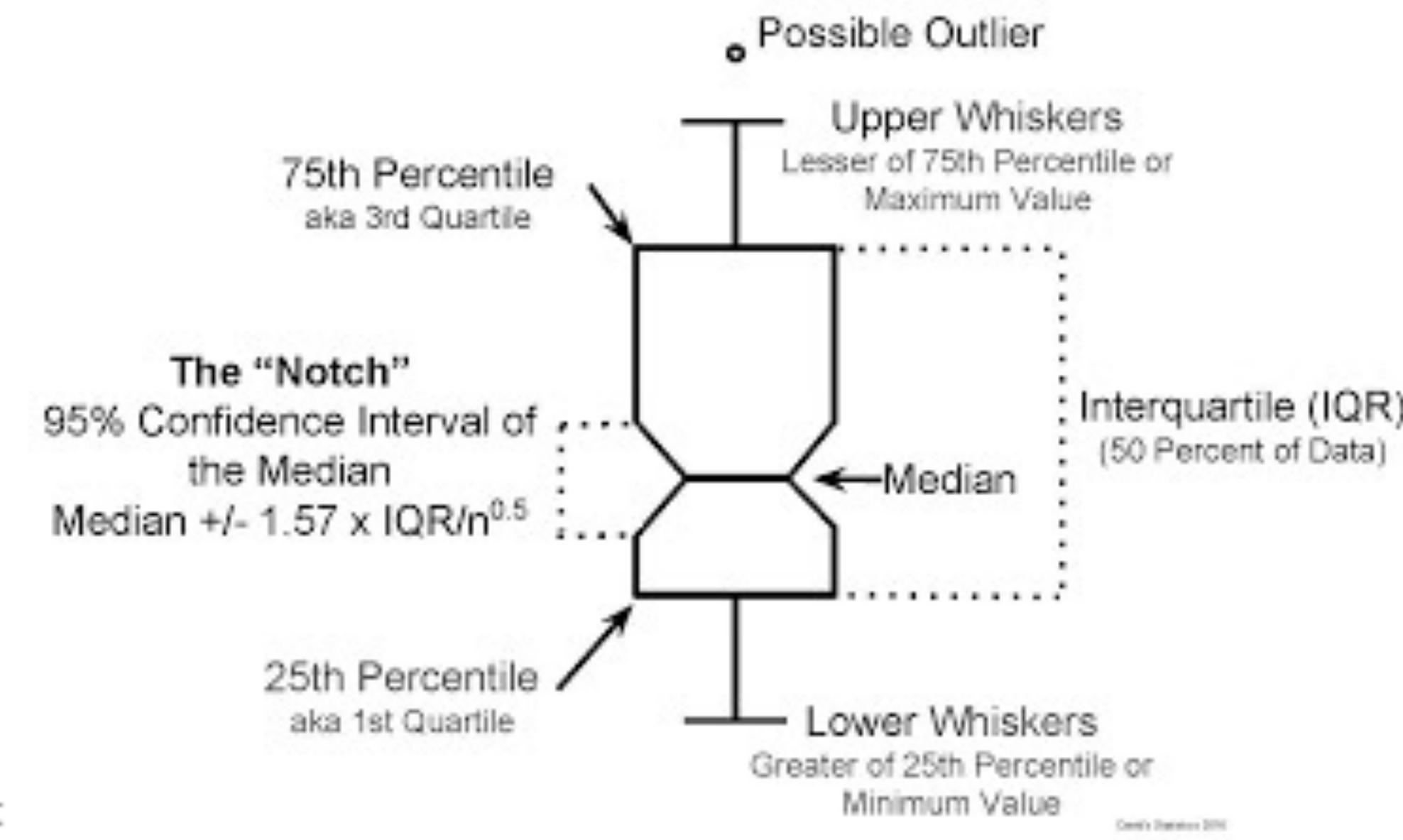
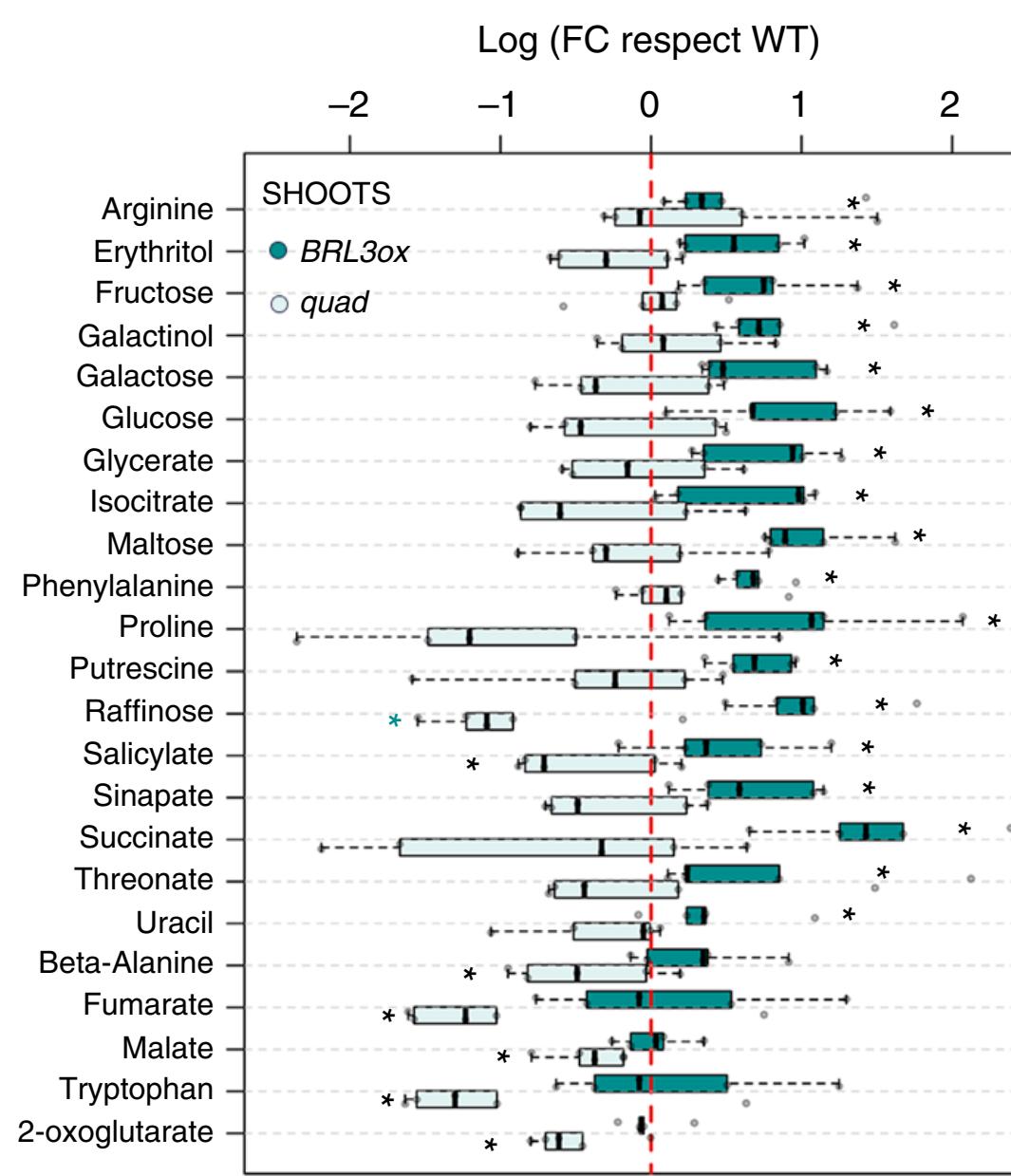
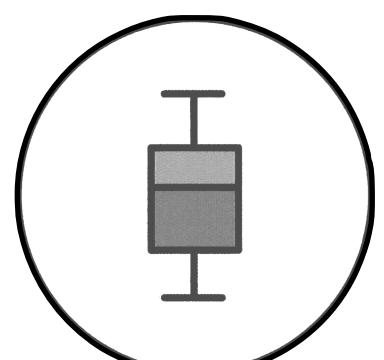
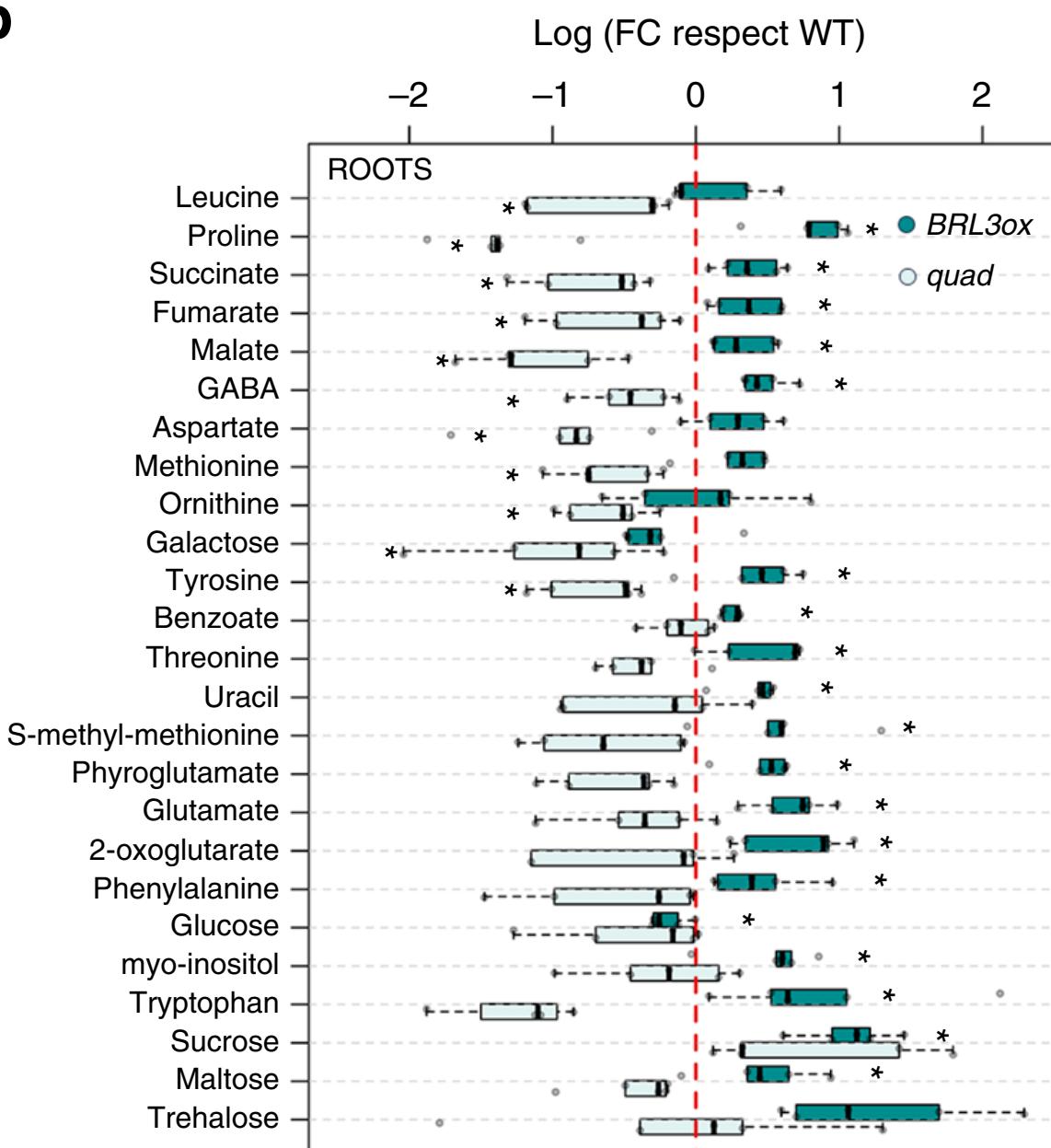


Fig. 4

a

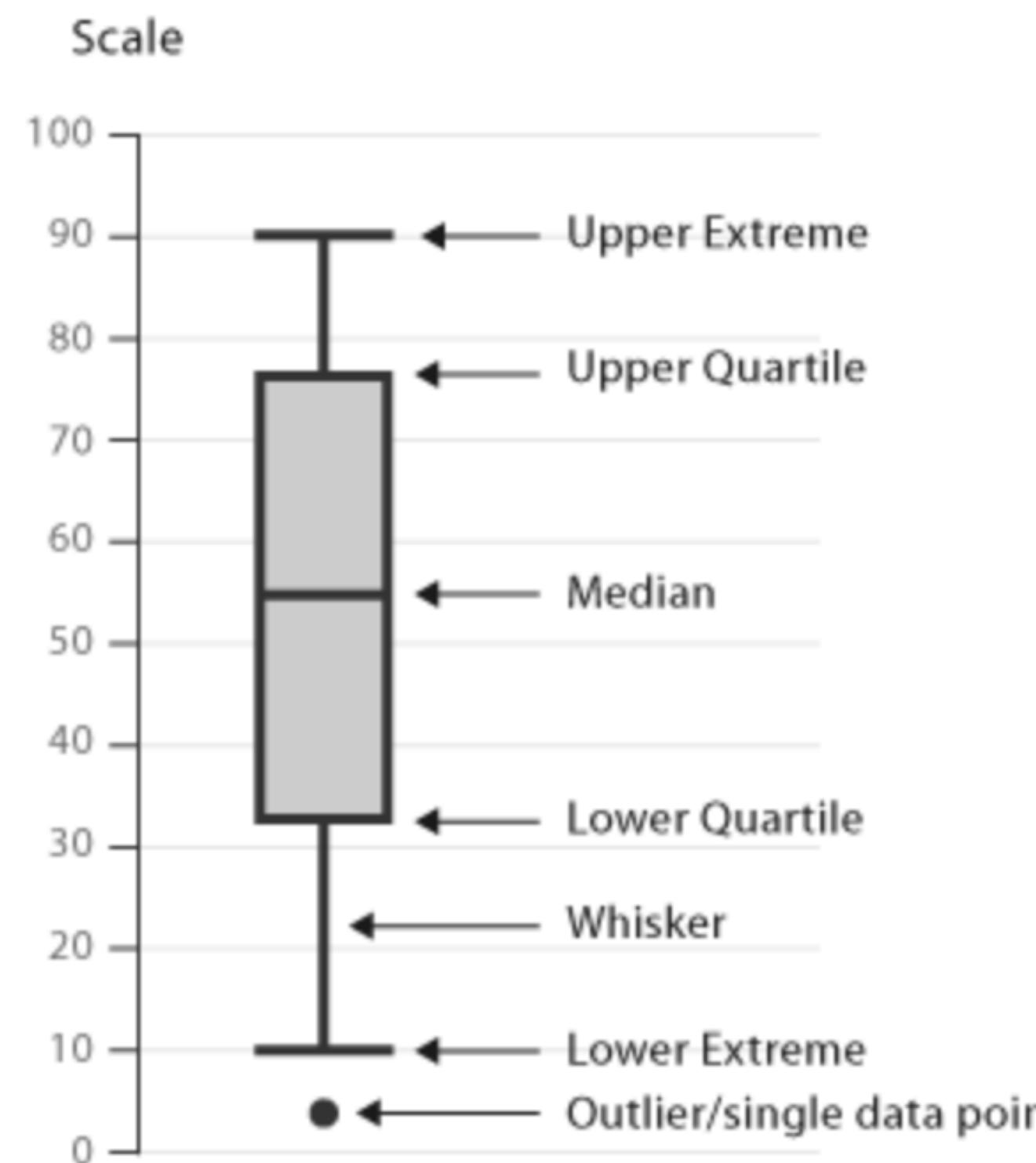


b

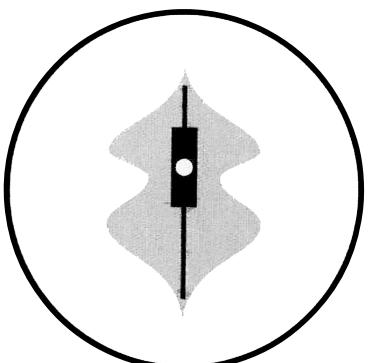
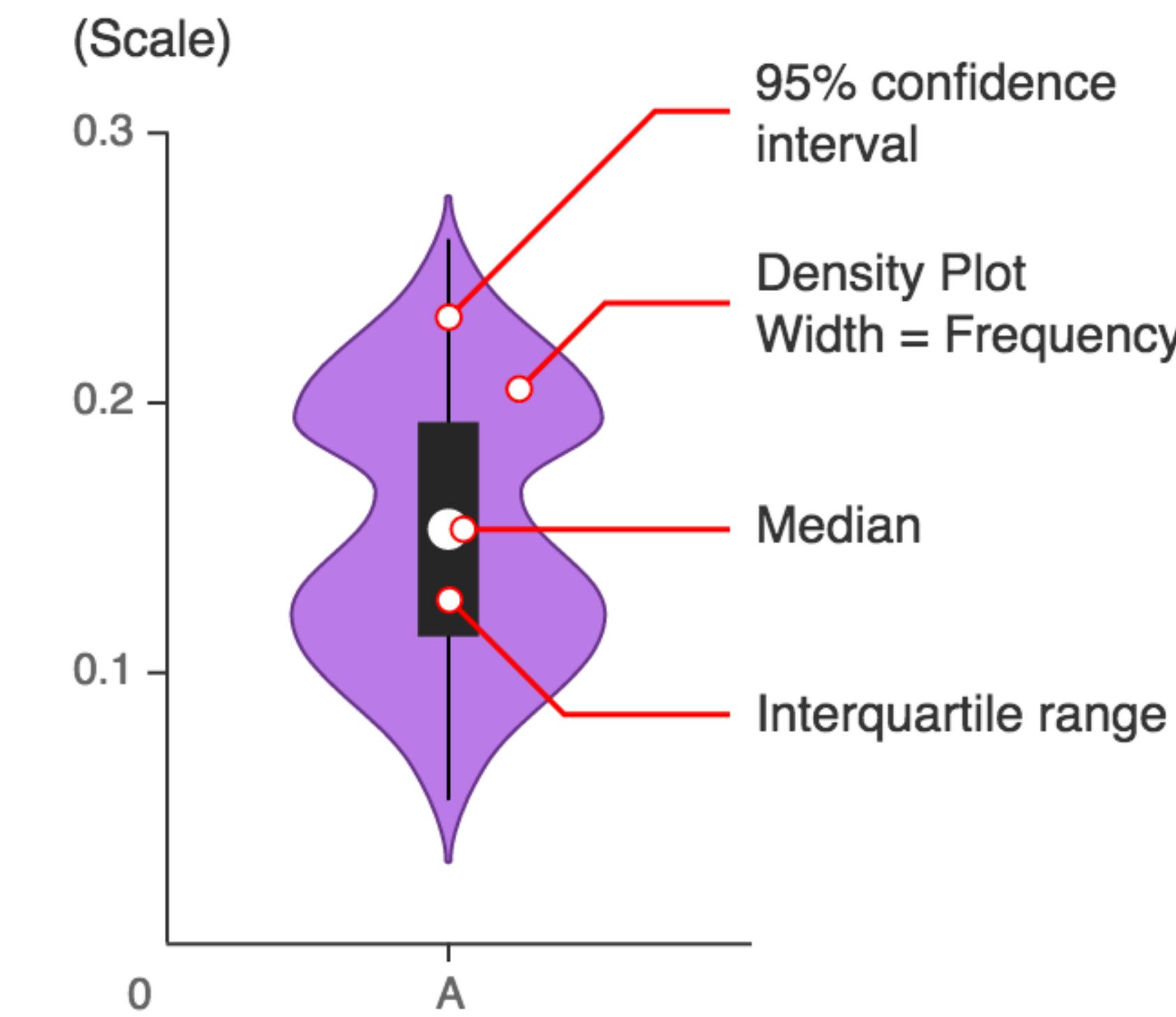


# ANATOMY OF BOX PLOTS & VIOLIN PLOTS

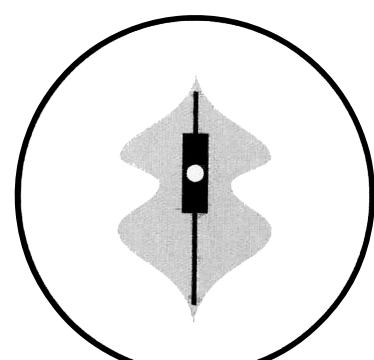
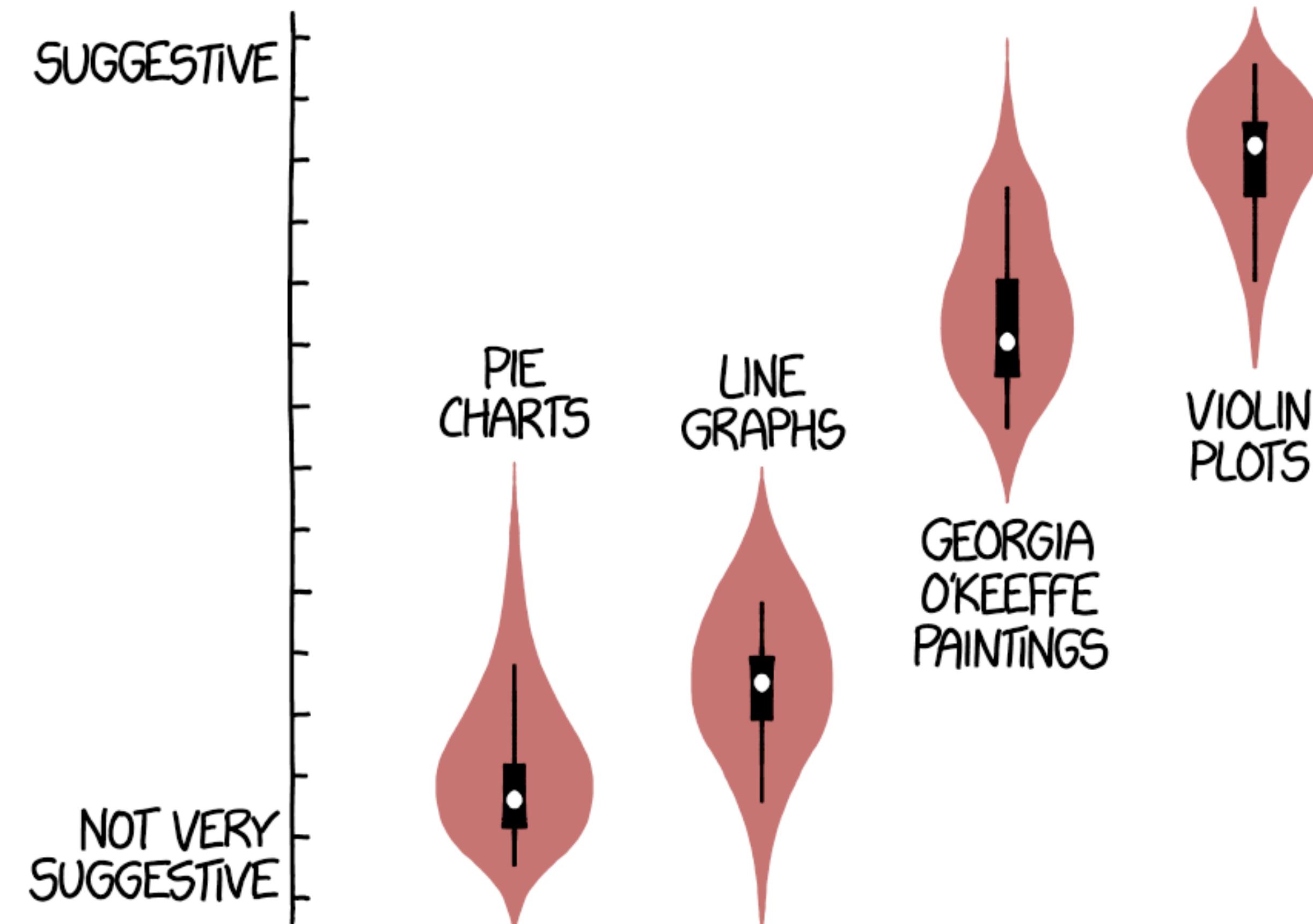
## Box plot



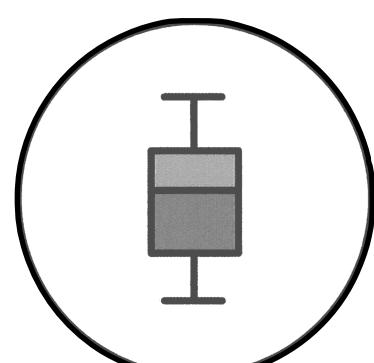
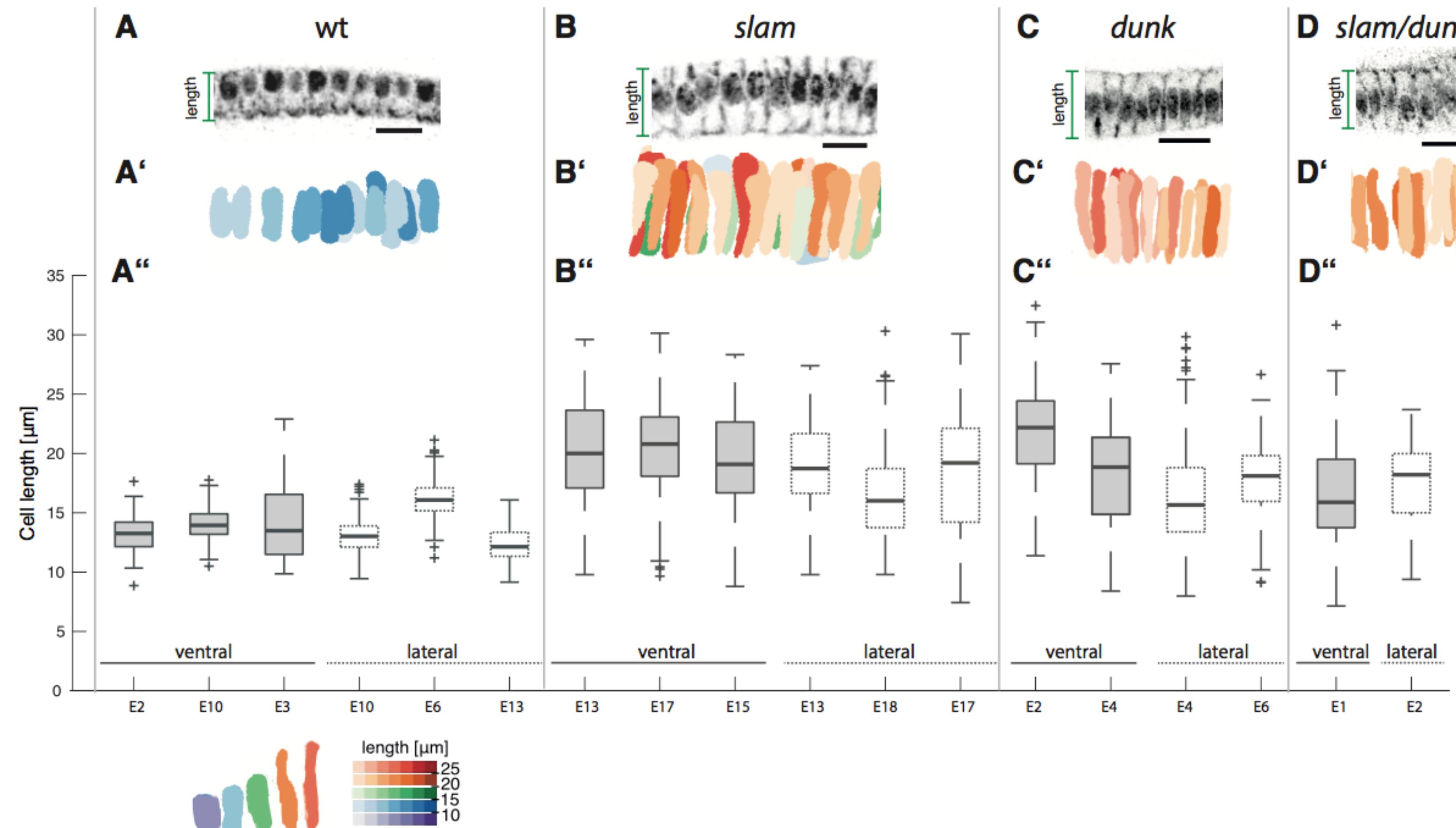
## Violin plot



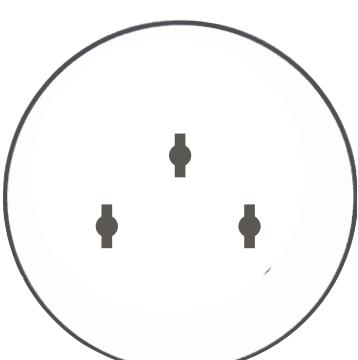
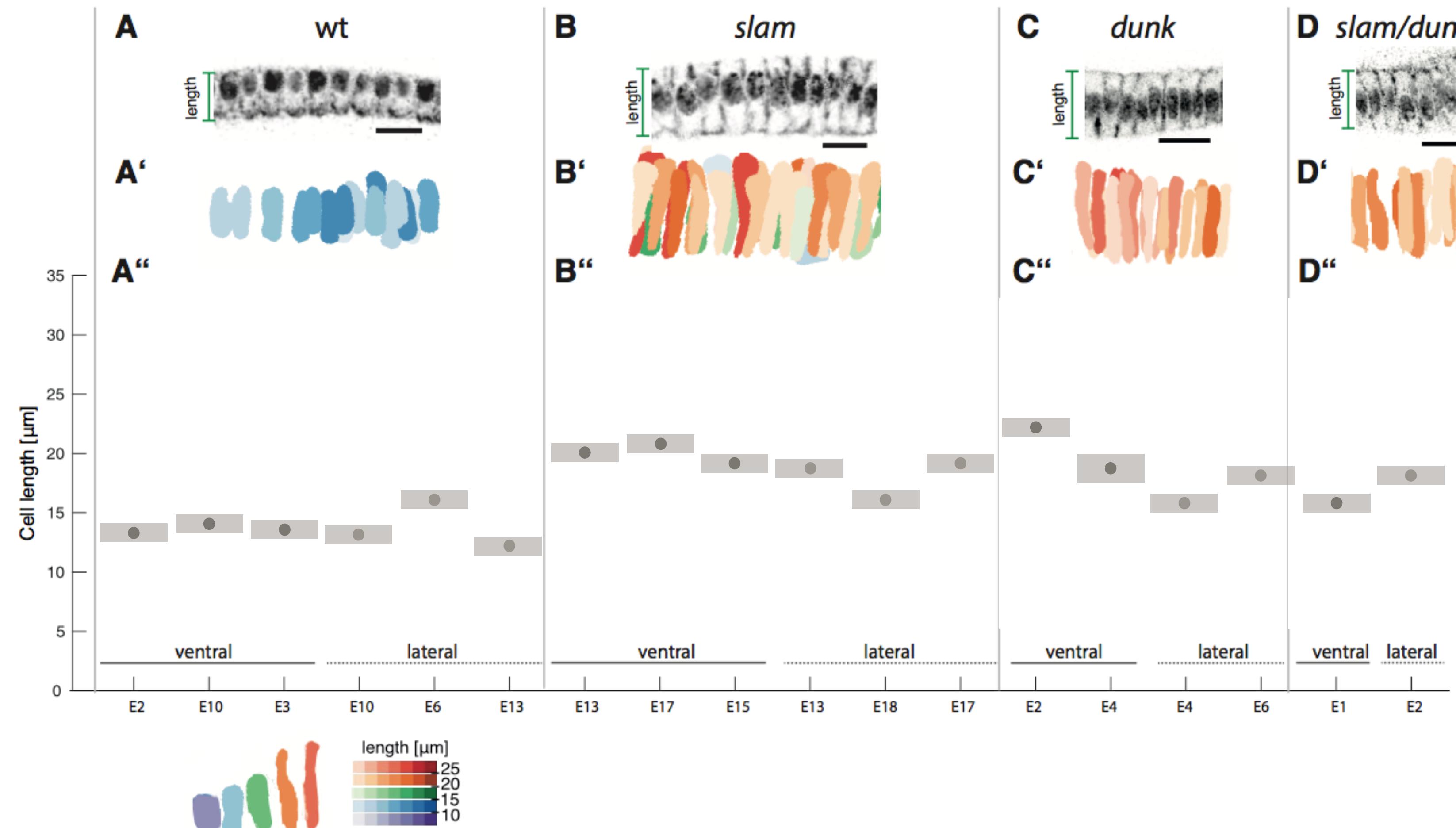
# SUGGESTIVENESS OF VISUALIZATION TYPES

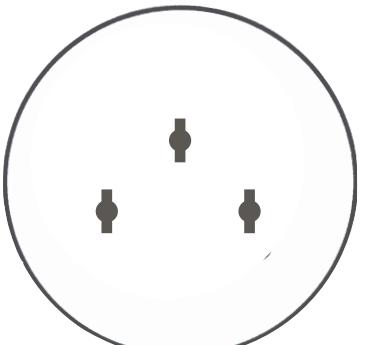
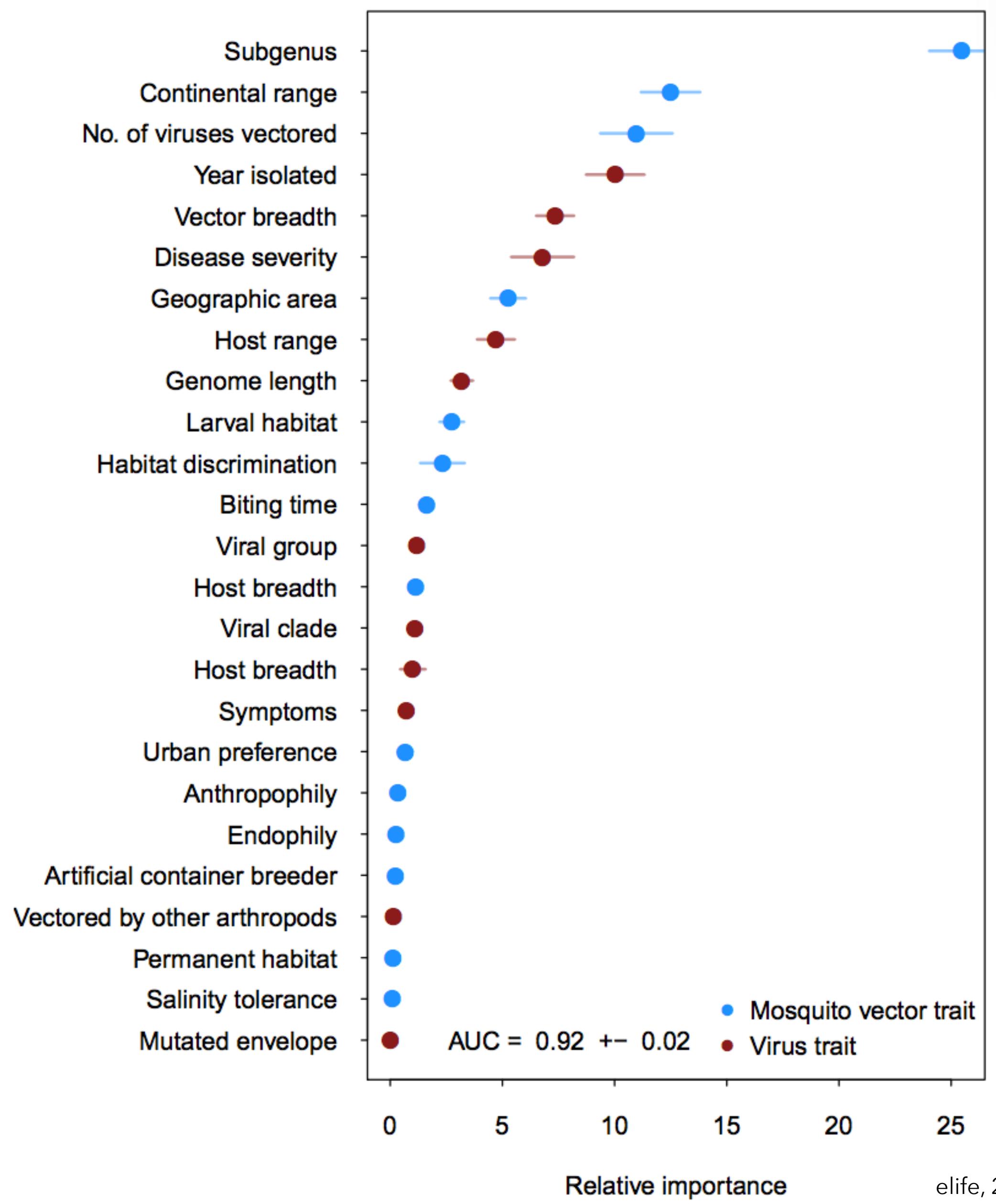


# BOX PLOTS ARE NOT ALWAYS USEFUL



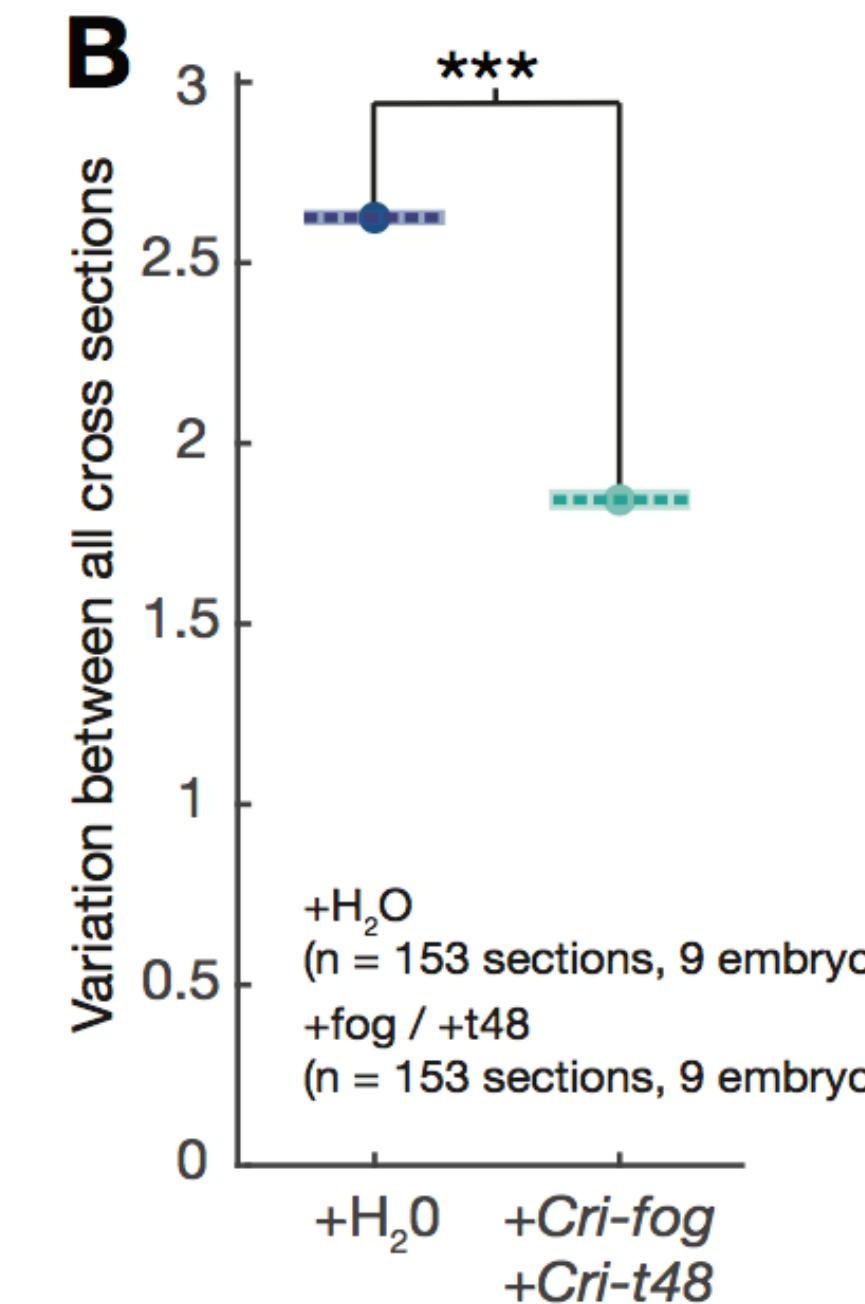
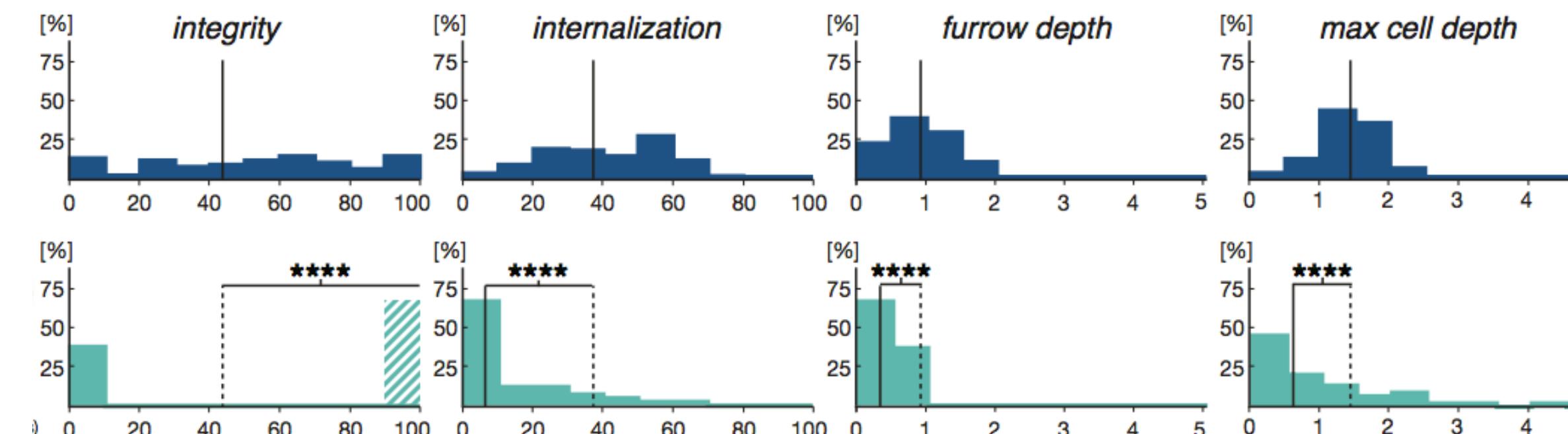
# DOT PLOTS AS AN ALTERNATIVE



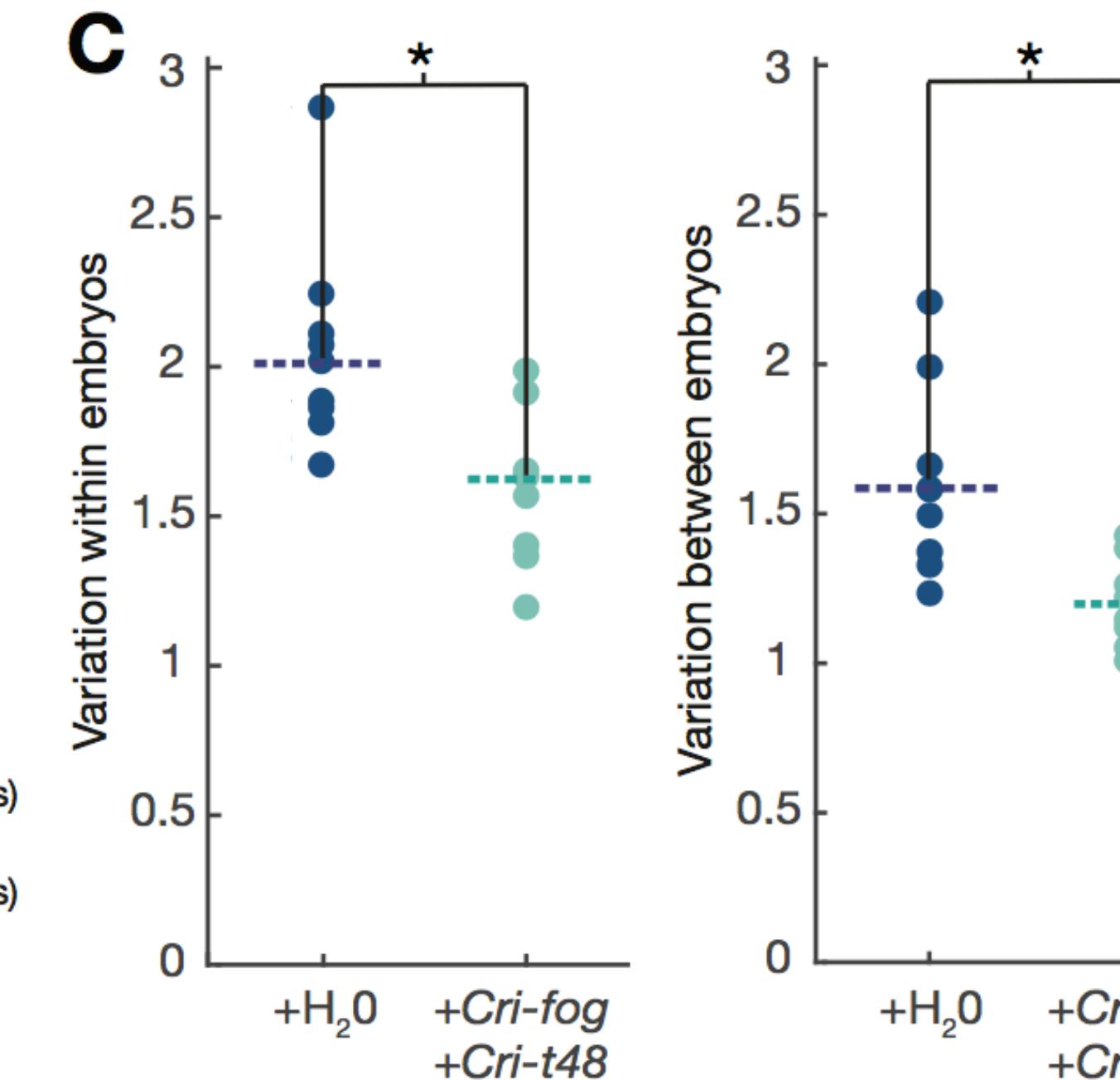


# FINAL POINT ON DISTRIBUTIONS

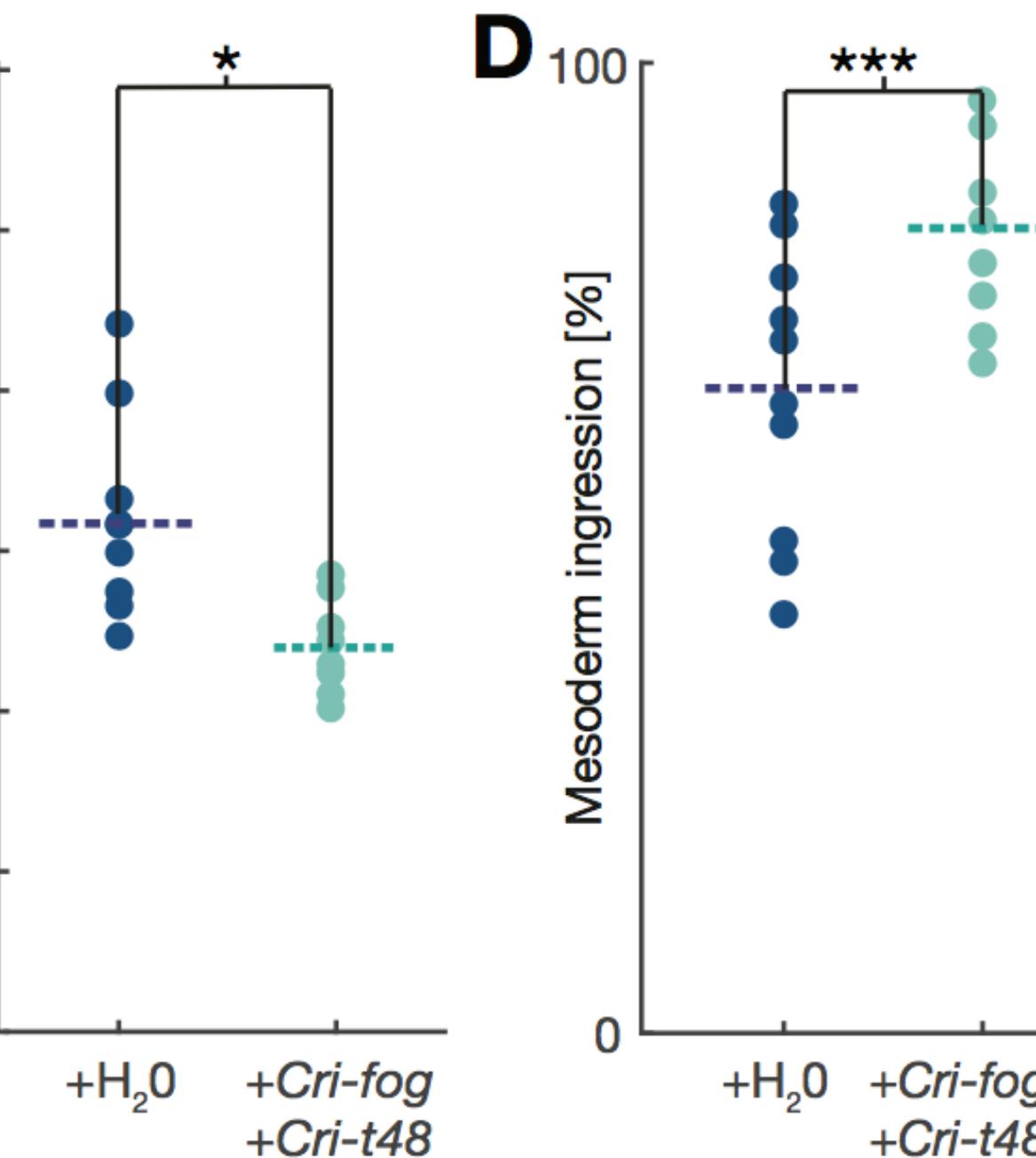
Histograms to  
see/show/compare  
overall shapes



Dot plot + 95% CI for large n

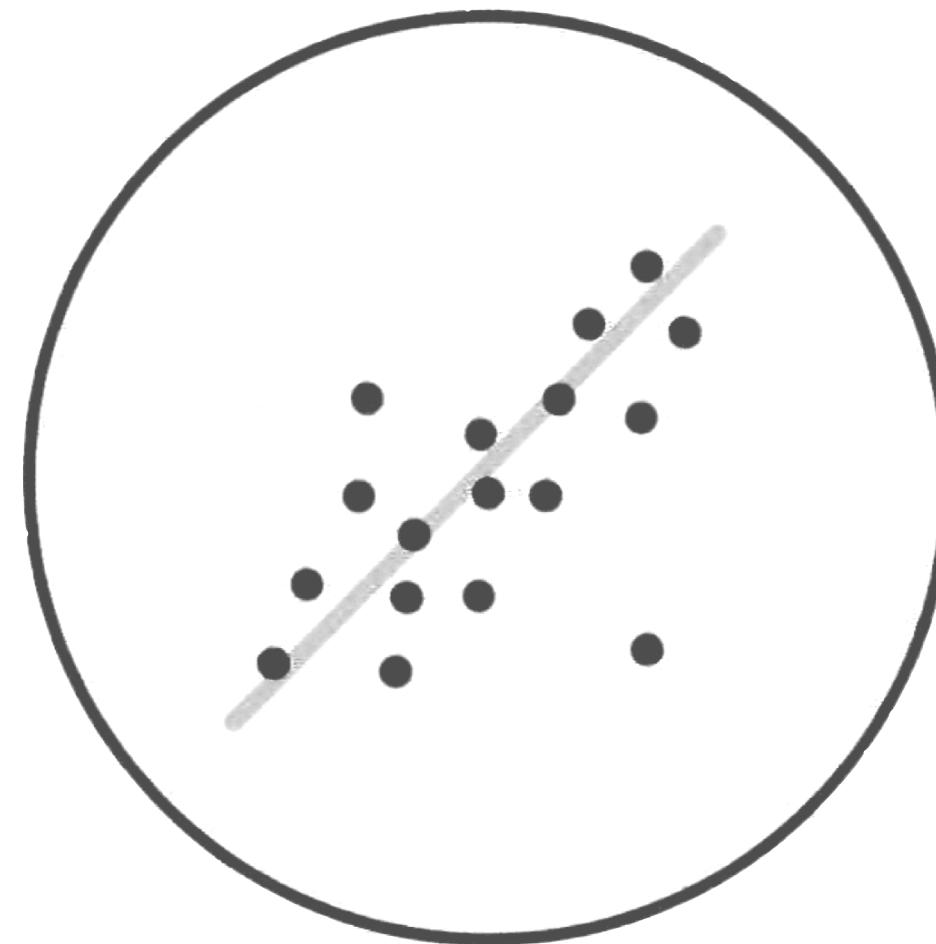


Show all data points for small (<12) n

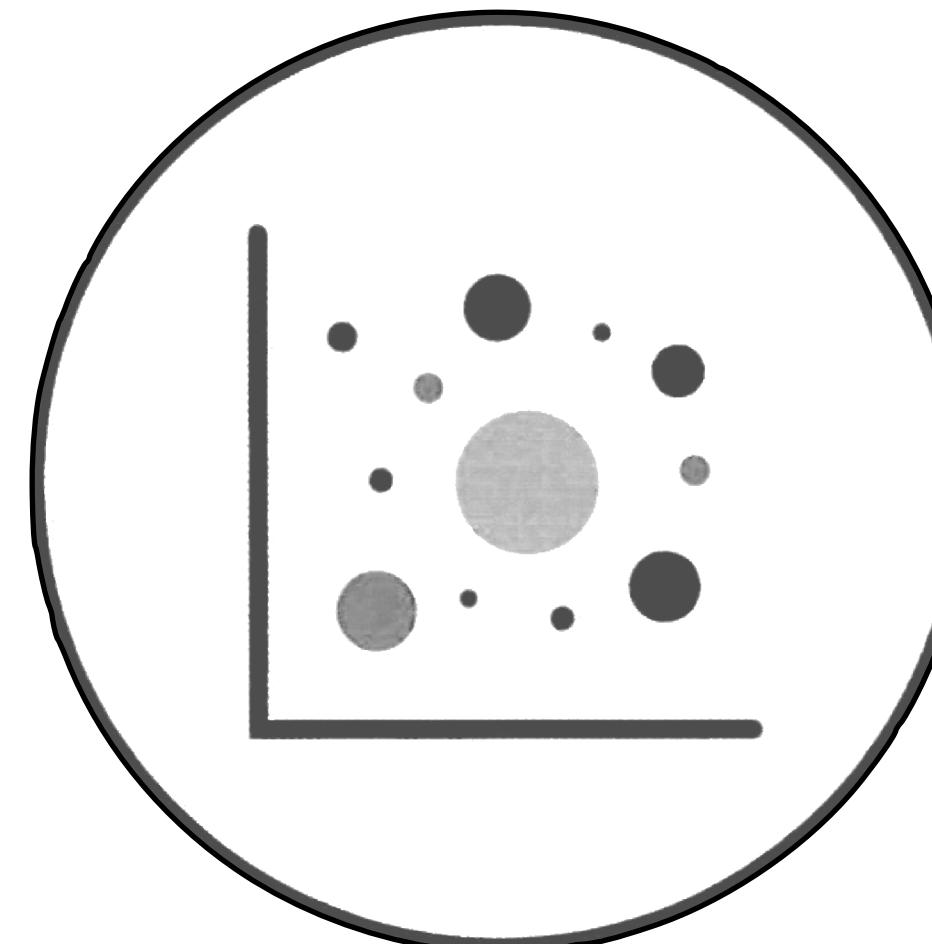


# CORRELATION

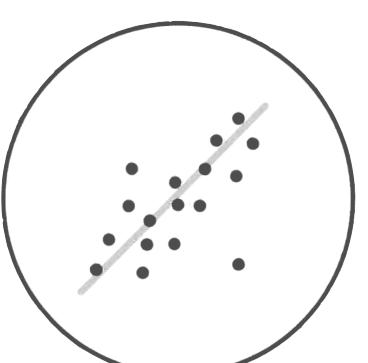
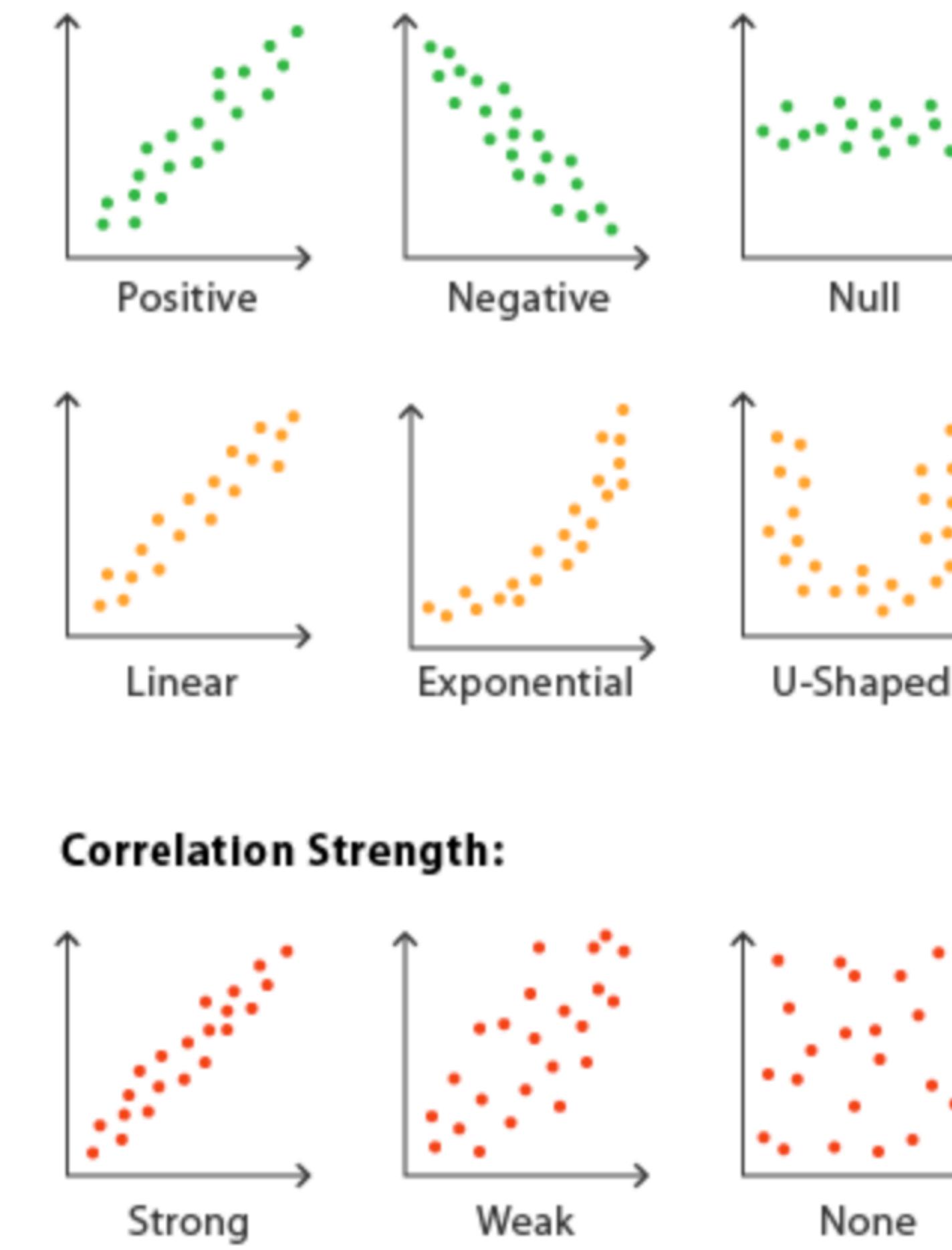
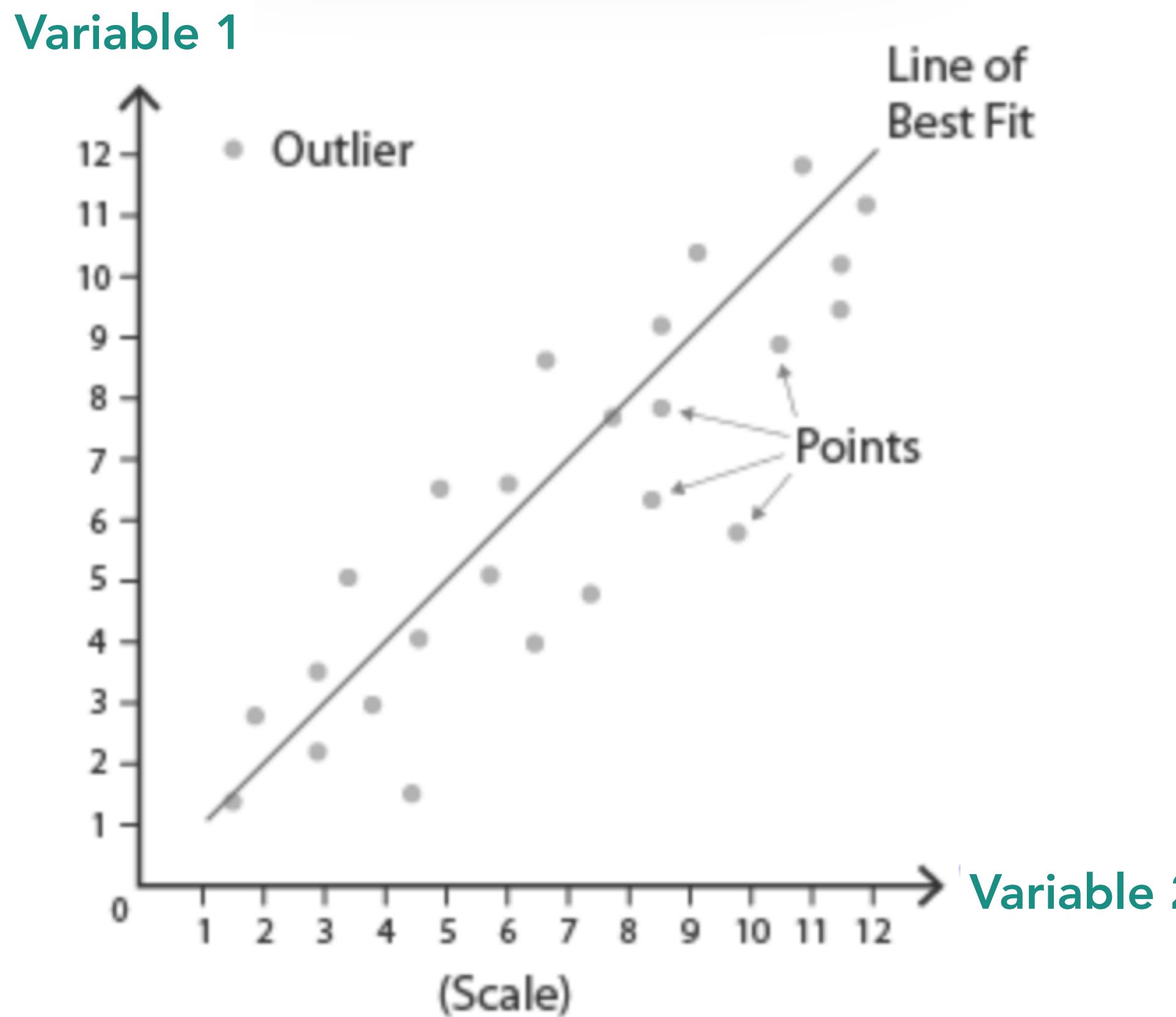
Scatter plot



Bubble plot

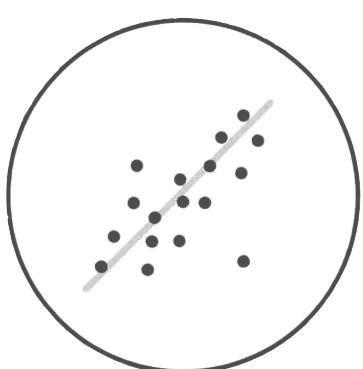
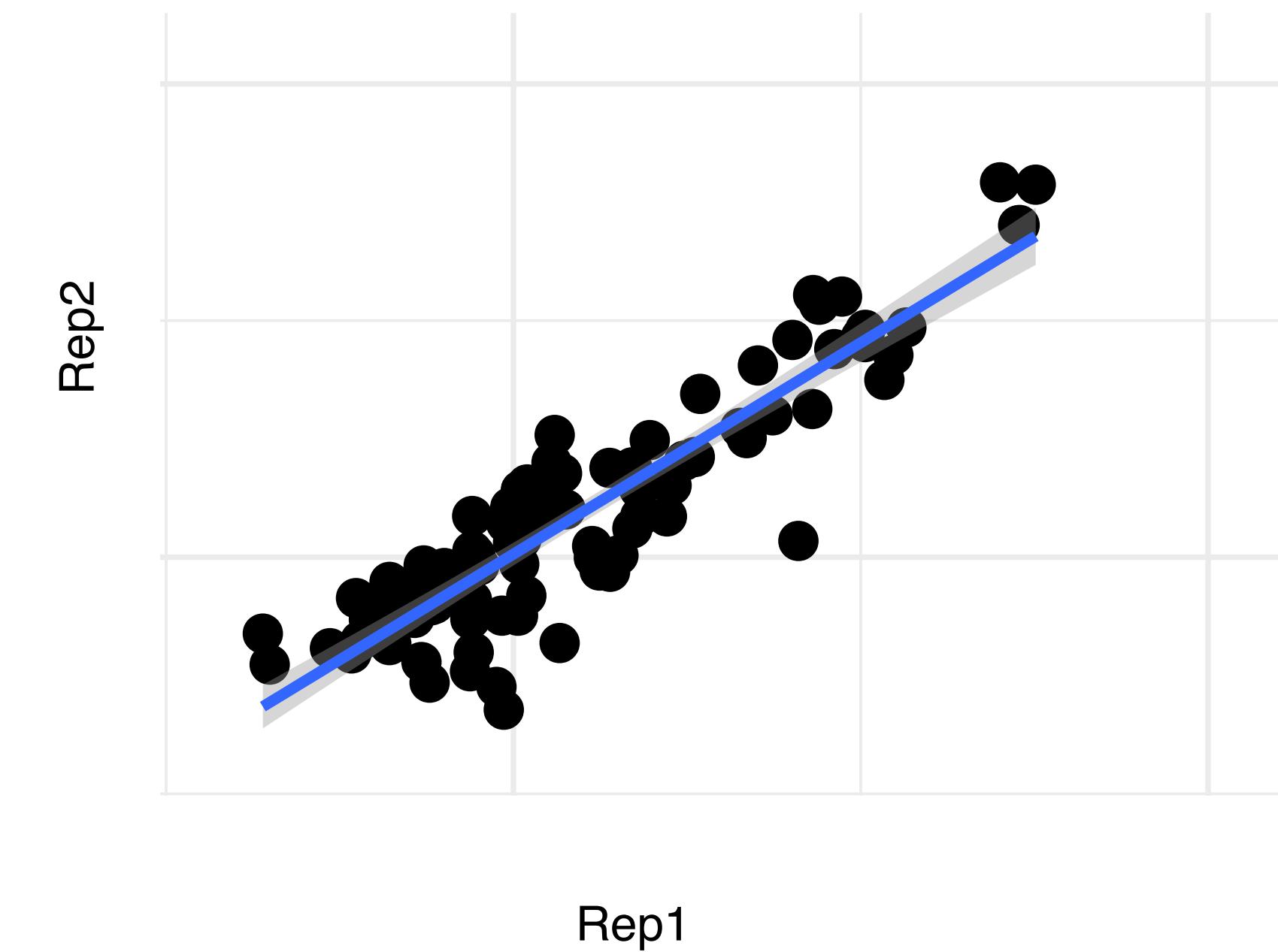
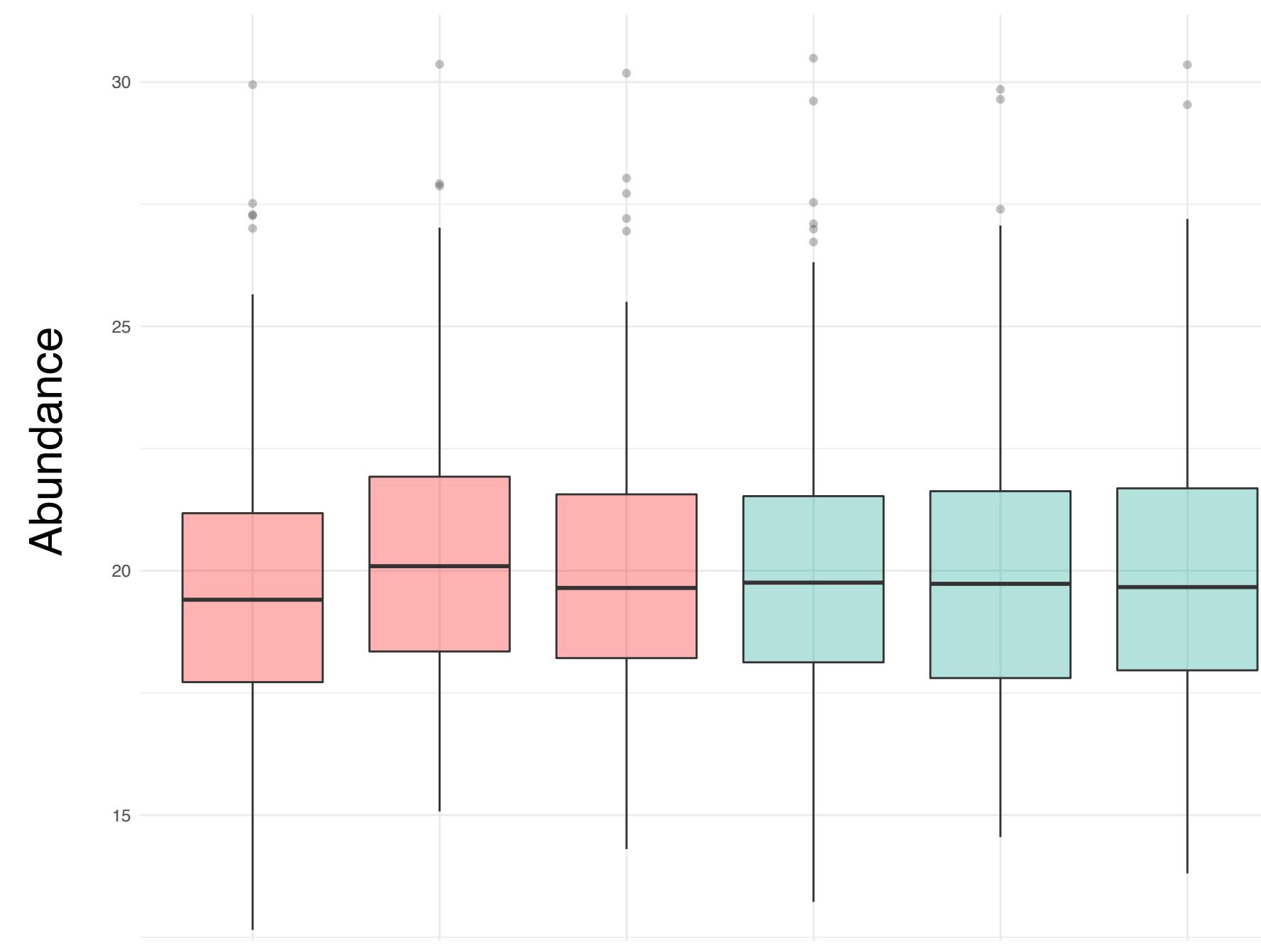


# ❤️ SCATTER PLOTS ❤️



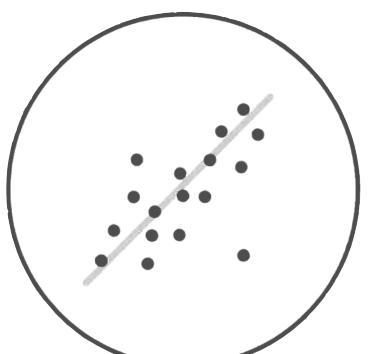
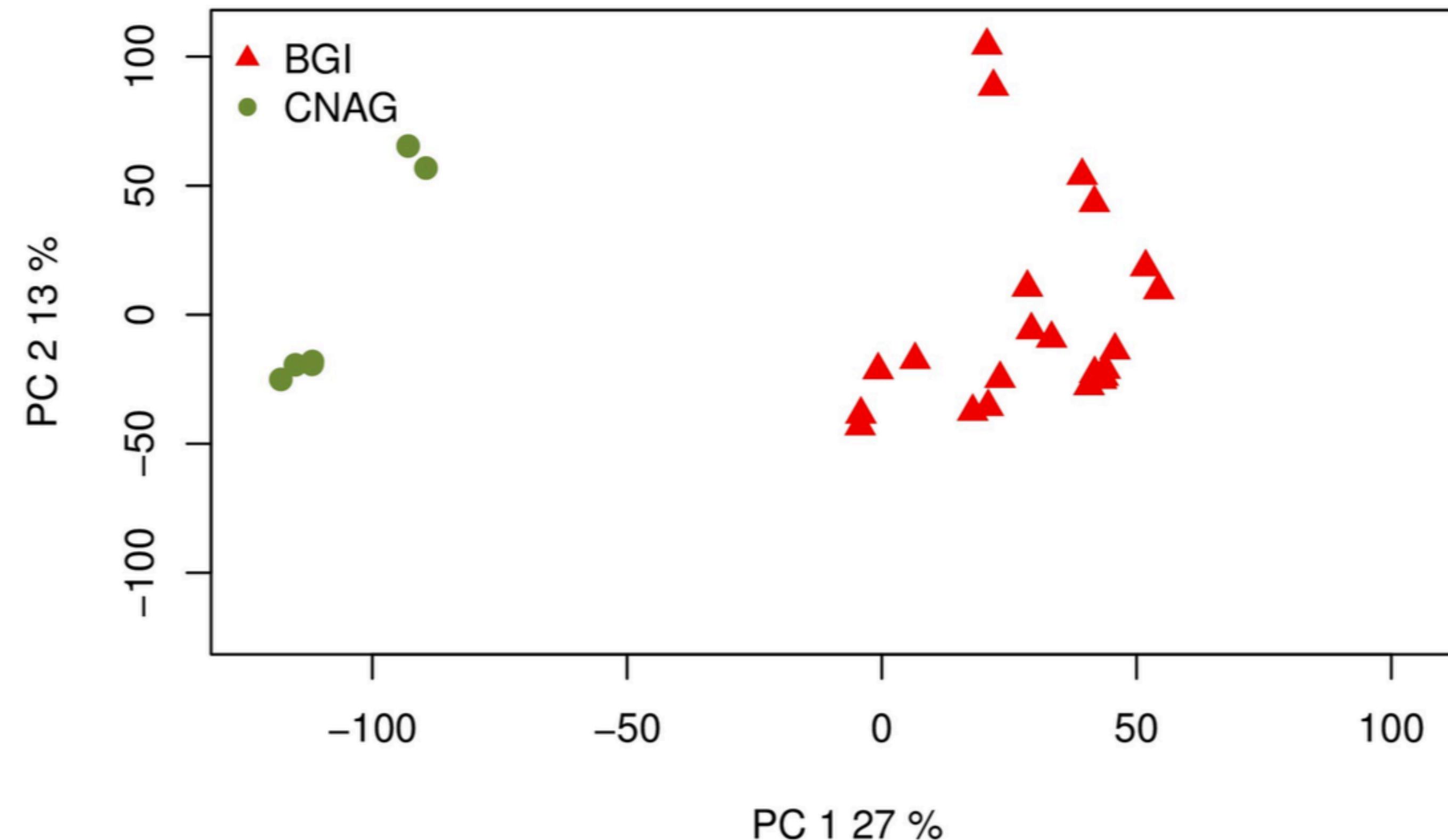
# EXPLORING BIAS WITH SCATTERPLOTS I

And a note about normalisation



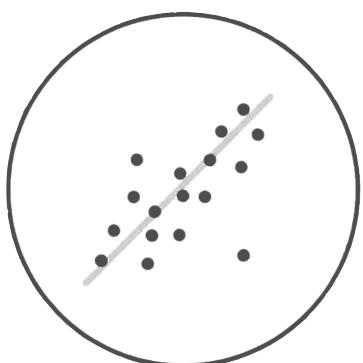
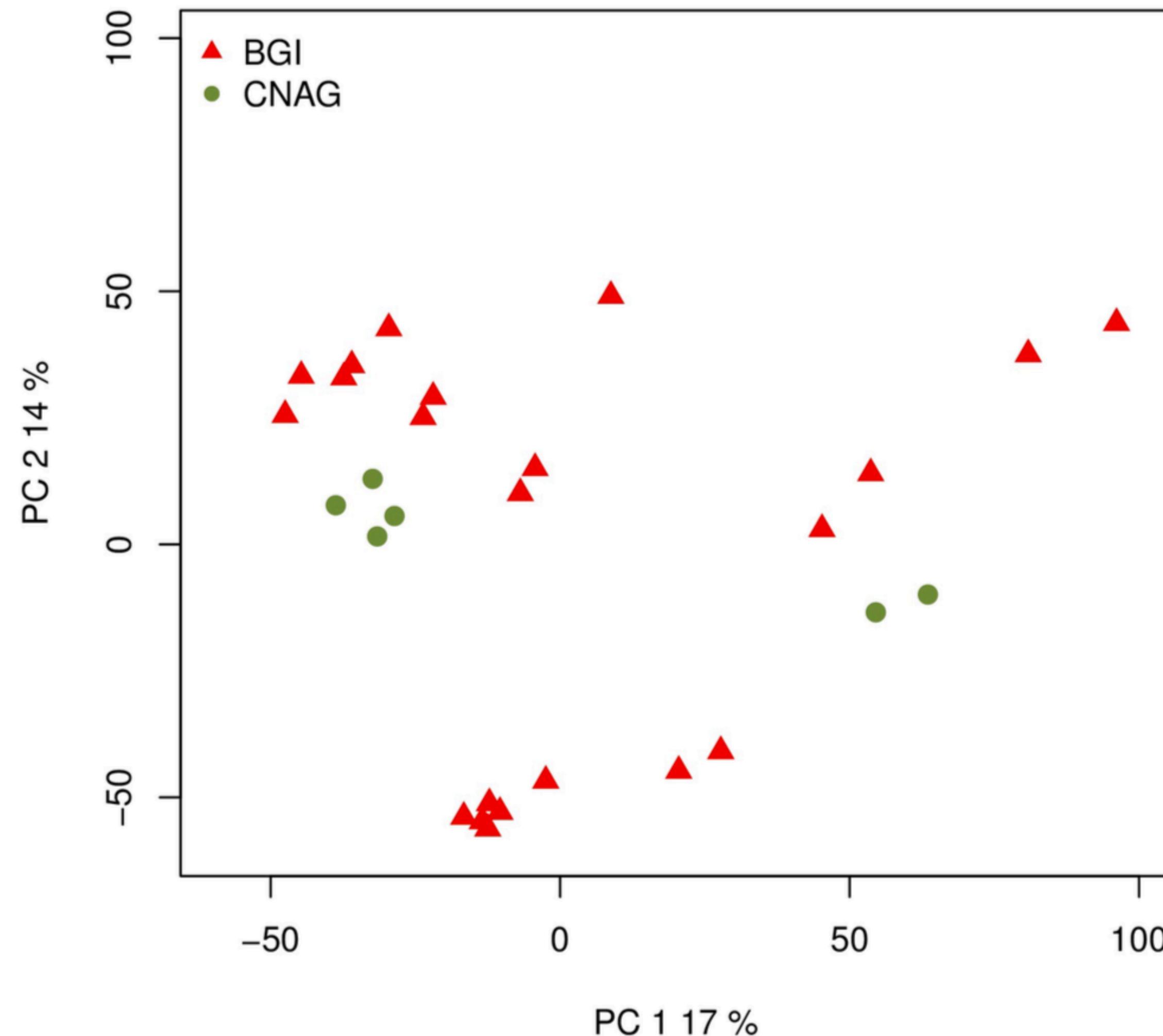
# EXPLORING BIAS WITH SCATTERPLOTS II

And a note about RNASeq



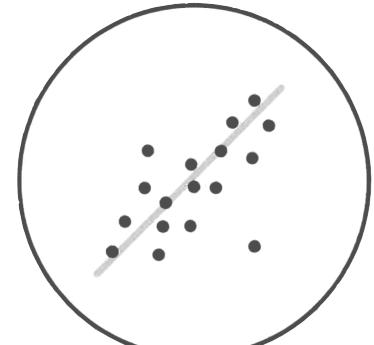
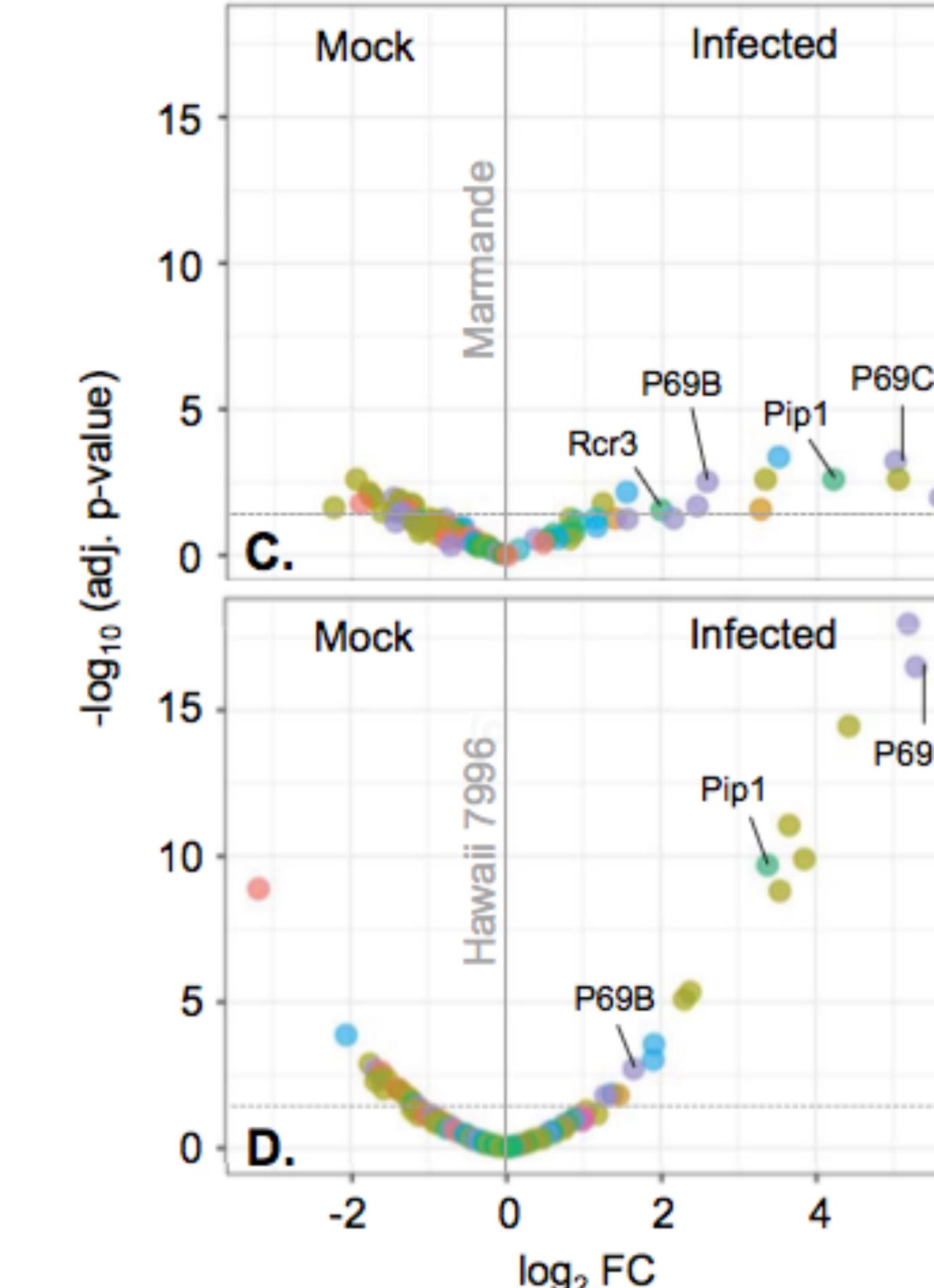
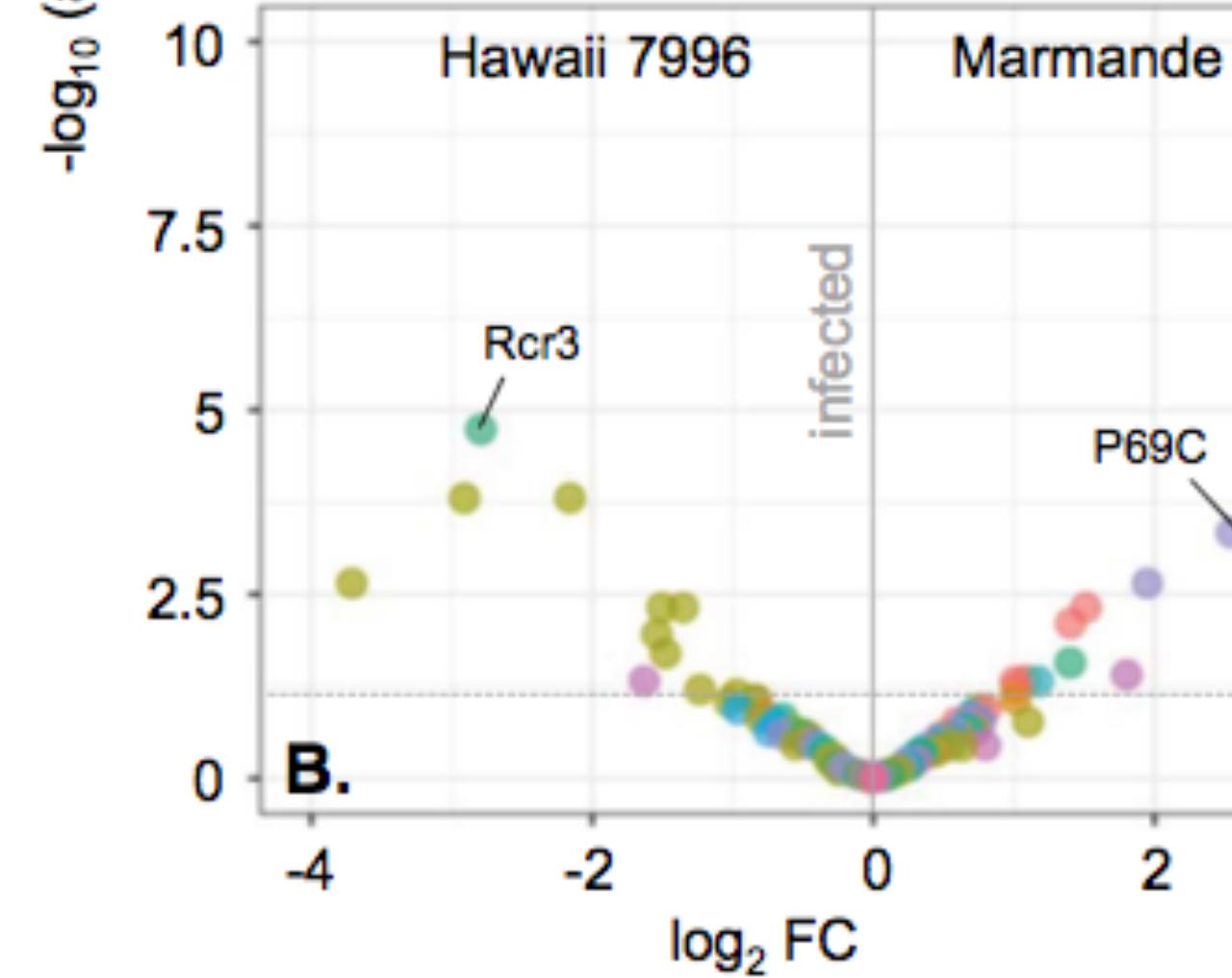
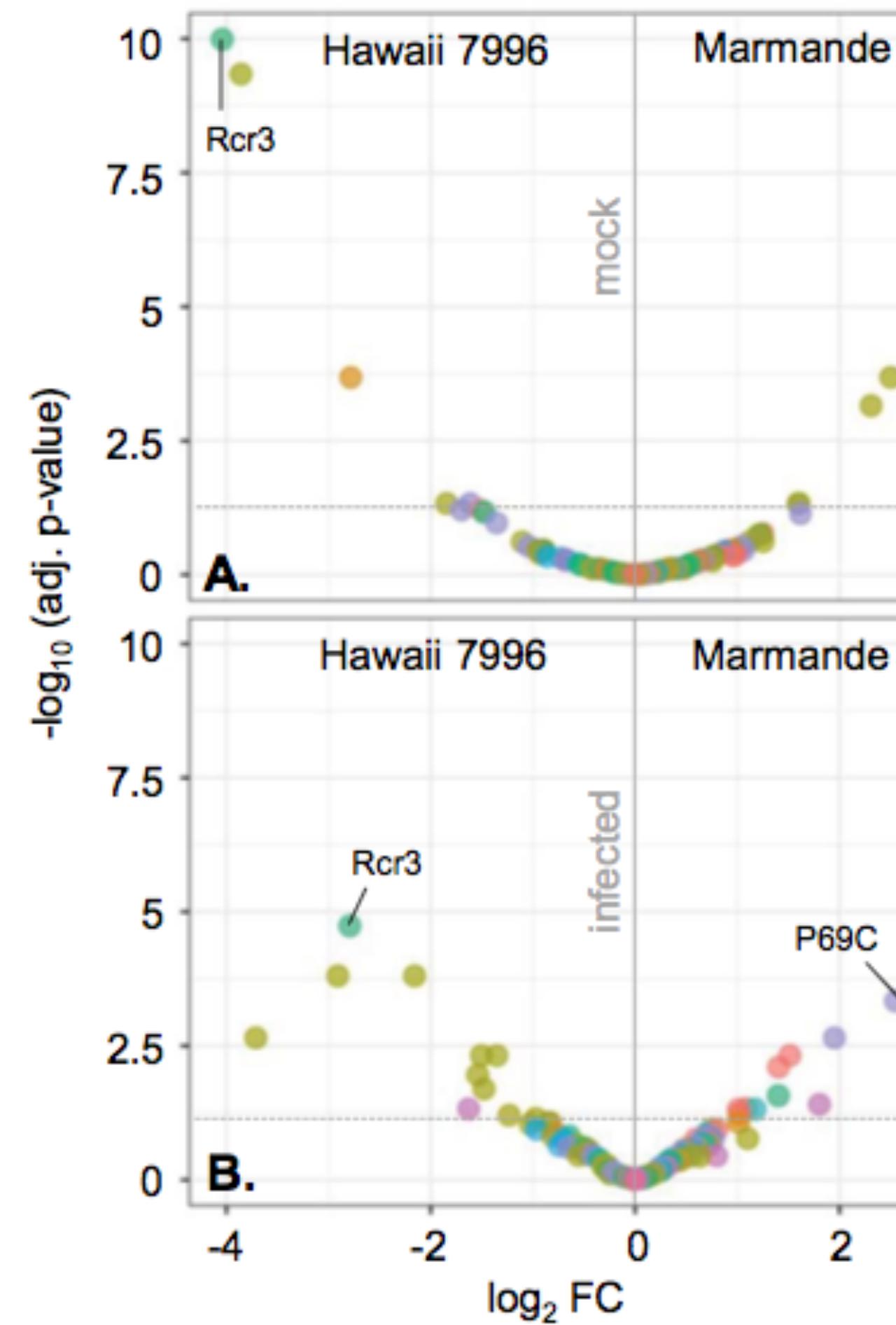
# EXPLORING BIAS WITH SCATTERPLOTS II

And a note about RNASeq



# EXPLORING BIAS WITH SCATTERPLOTS III

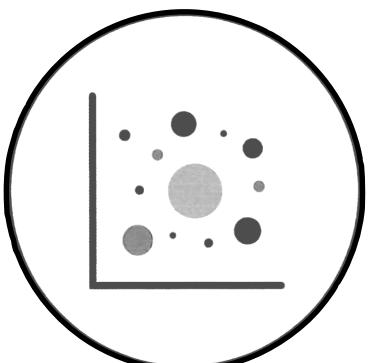
The very special volcano plot



Good practice:

“Differential”  
“p-value”

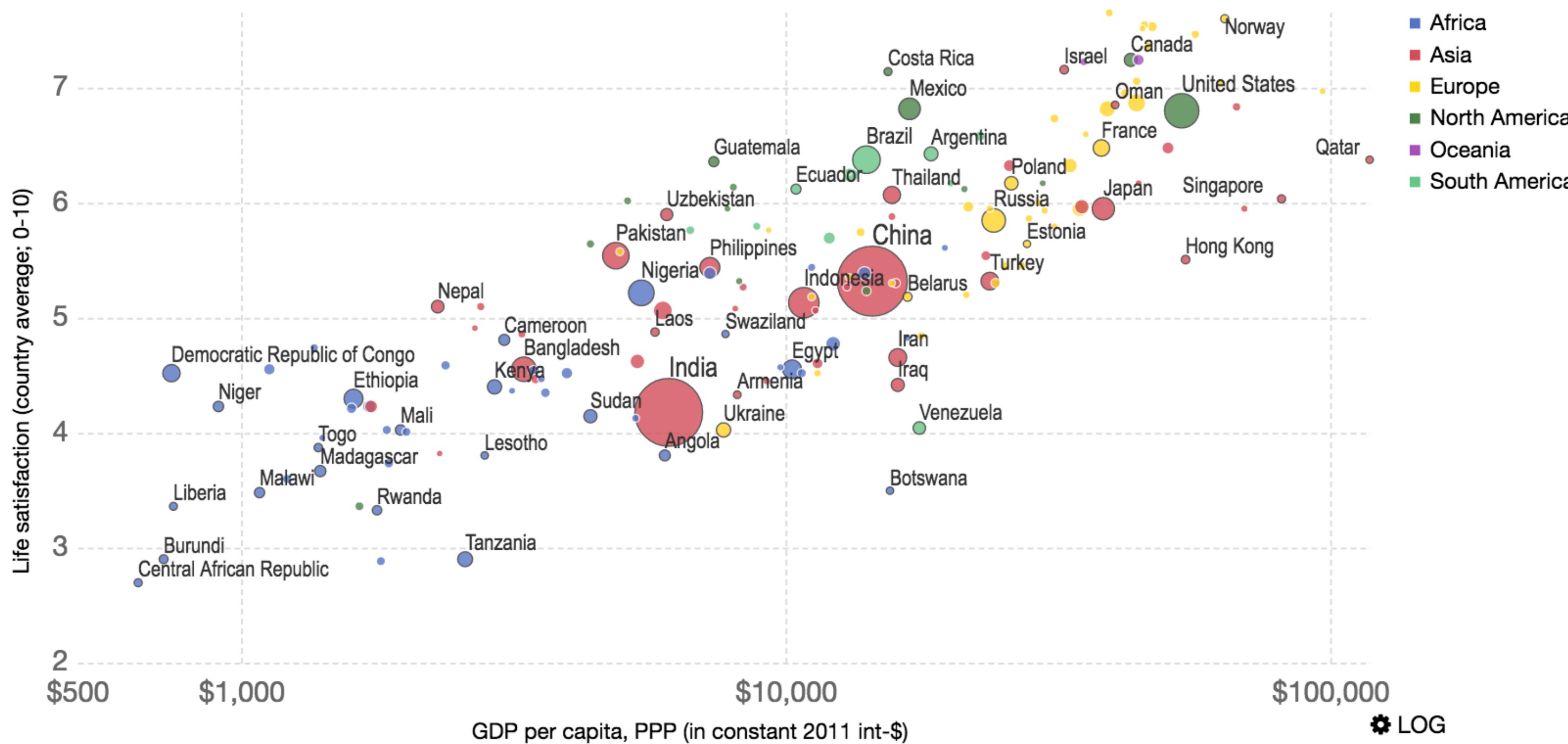
# BUBBLE PLOT



# GDP per capita vs Self-reported Life Satisfaction, 2016

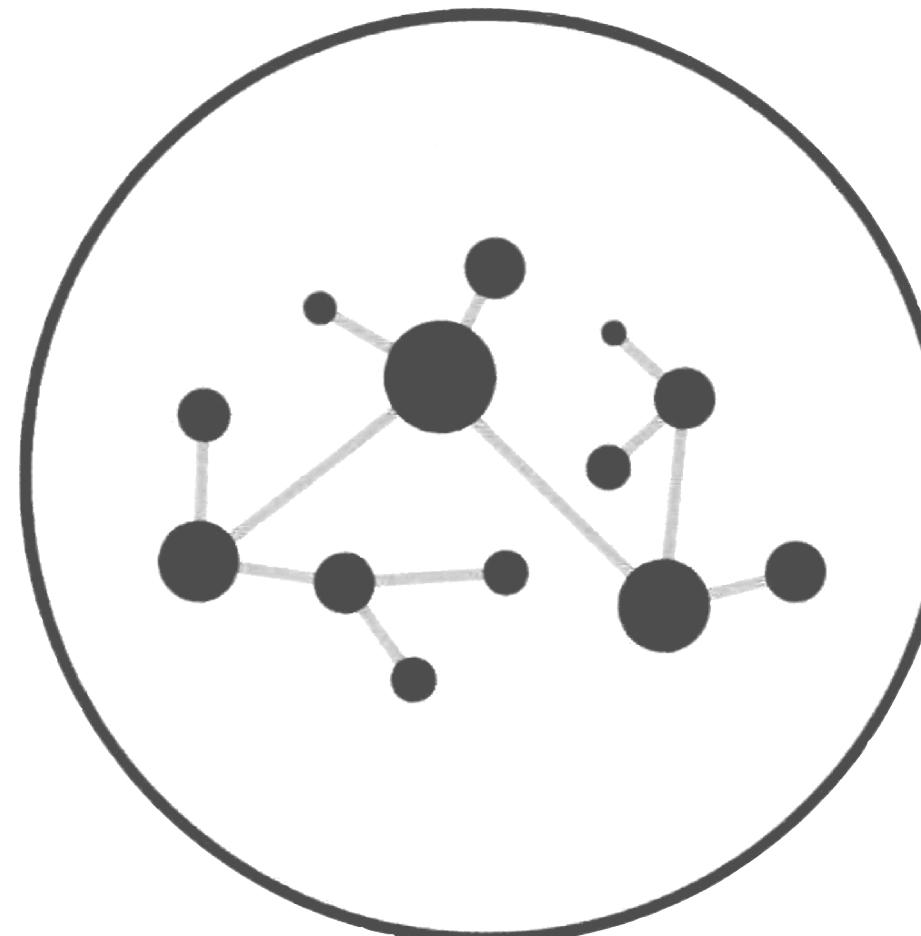
OurWorld  
in Data

Vertical axis shows national average self-reported life satisfaction in the Cantril Ladder (a scale ranging from 0-10 where 10 is the highest possible life satisfaction). Horizontal axis shows GDP per capita based on purchasing power parity (i.e. GDP per head after adjusting for inflation and cross-country price differences).

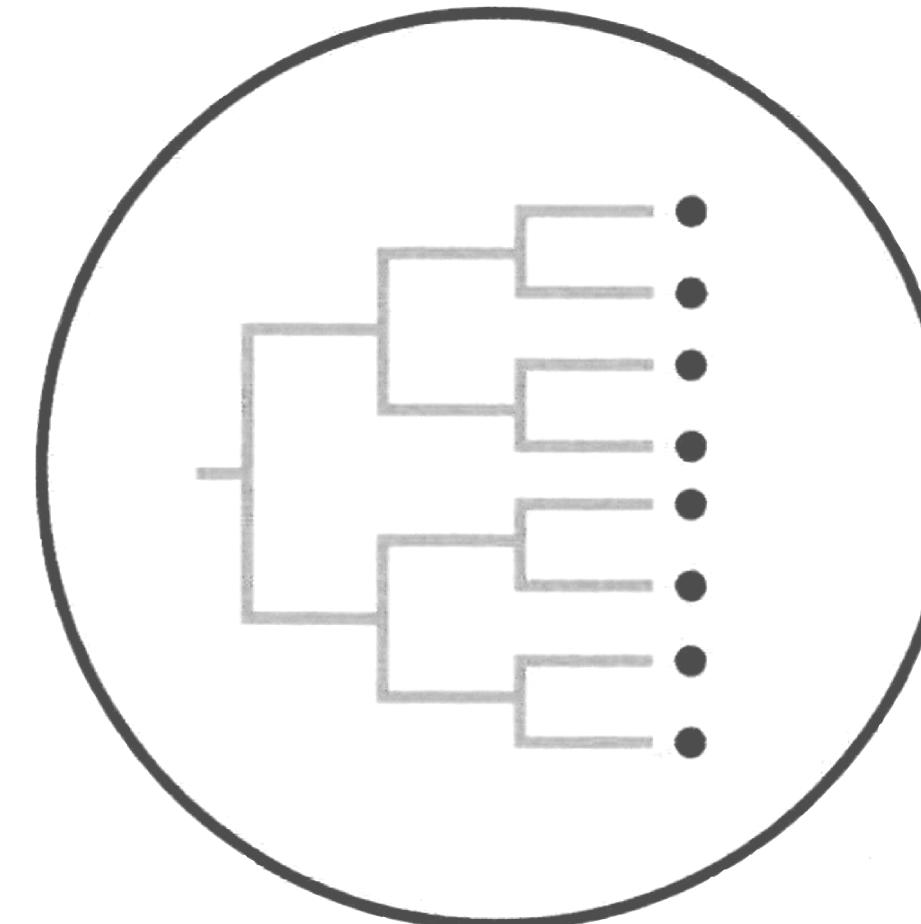


# RELATIONSHIP AND FLOW

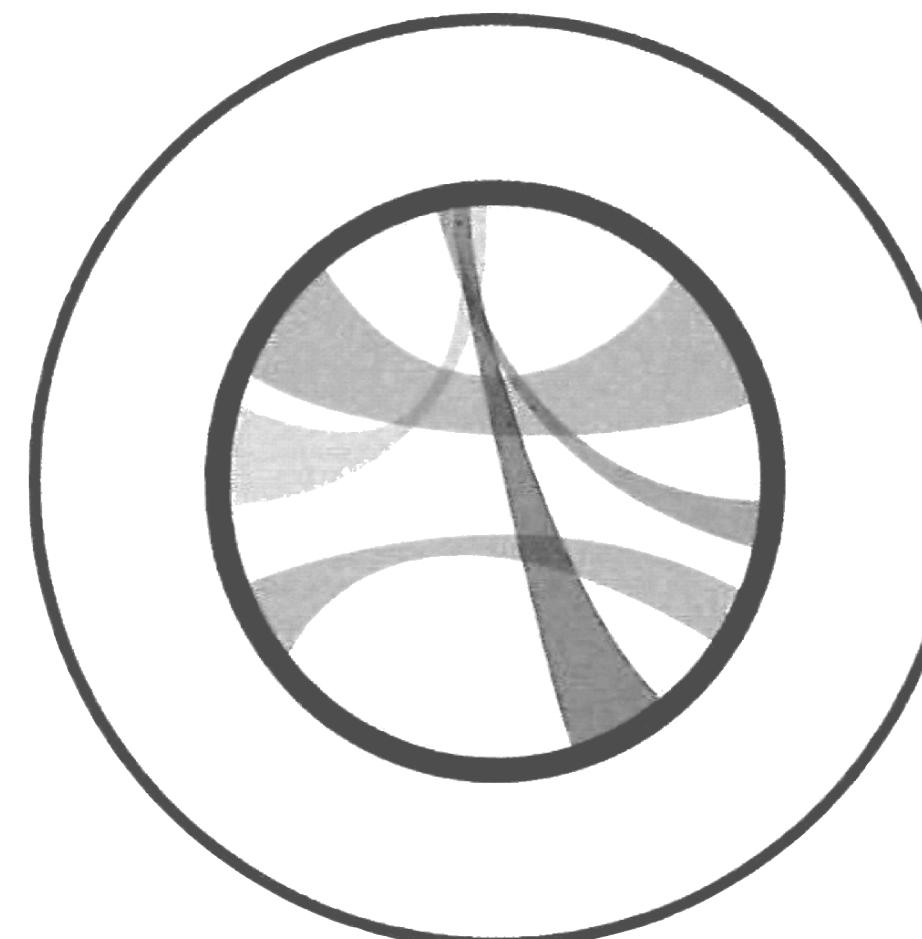
Networks



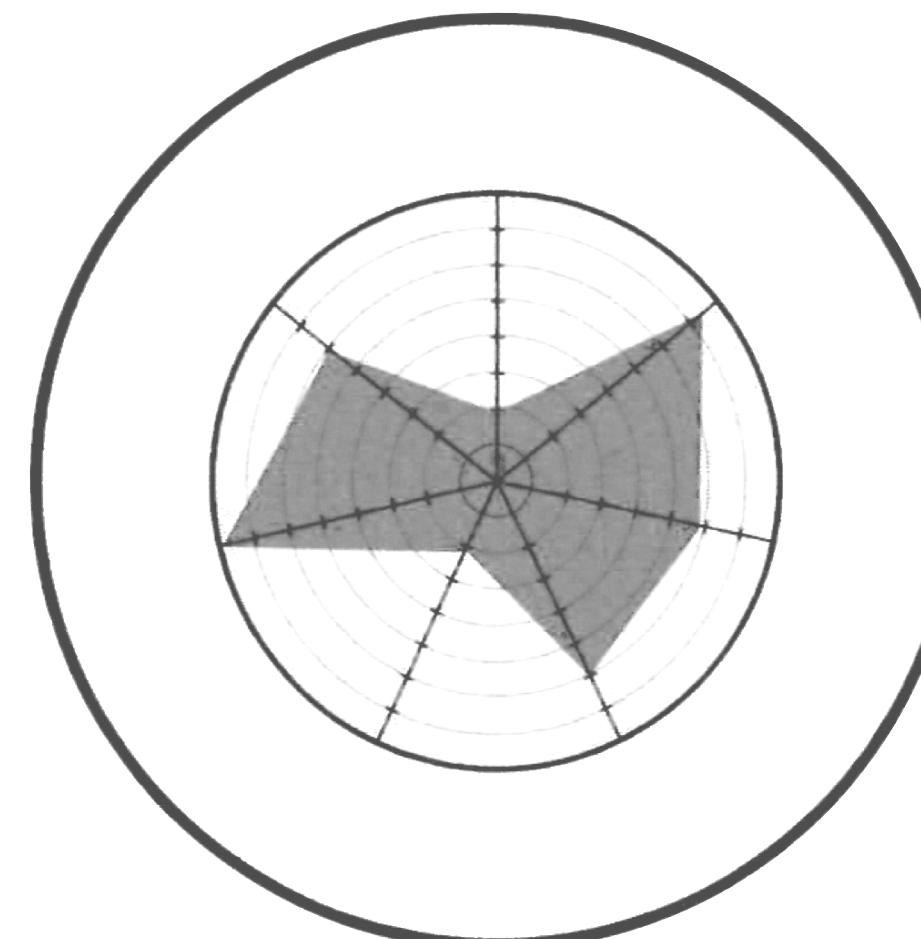
Trees



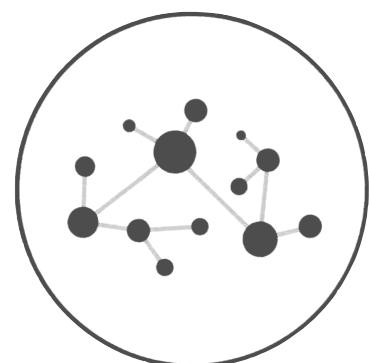
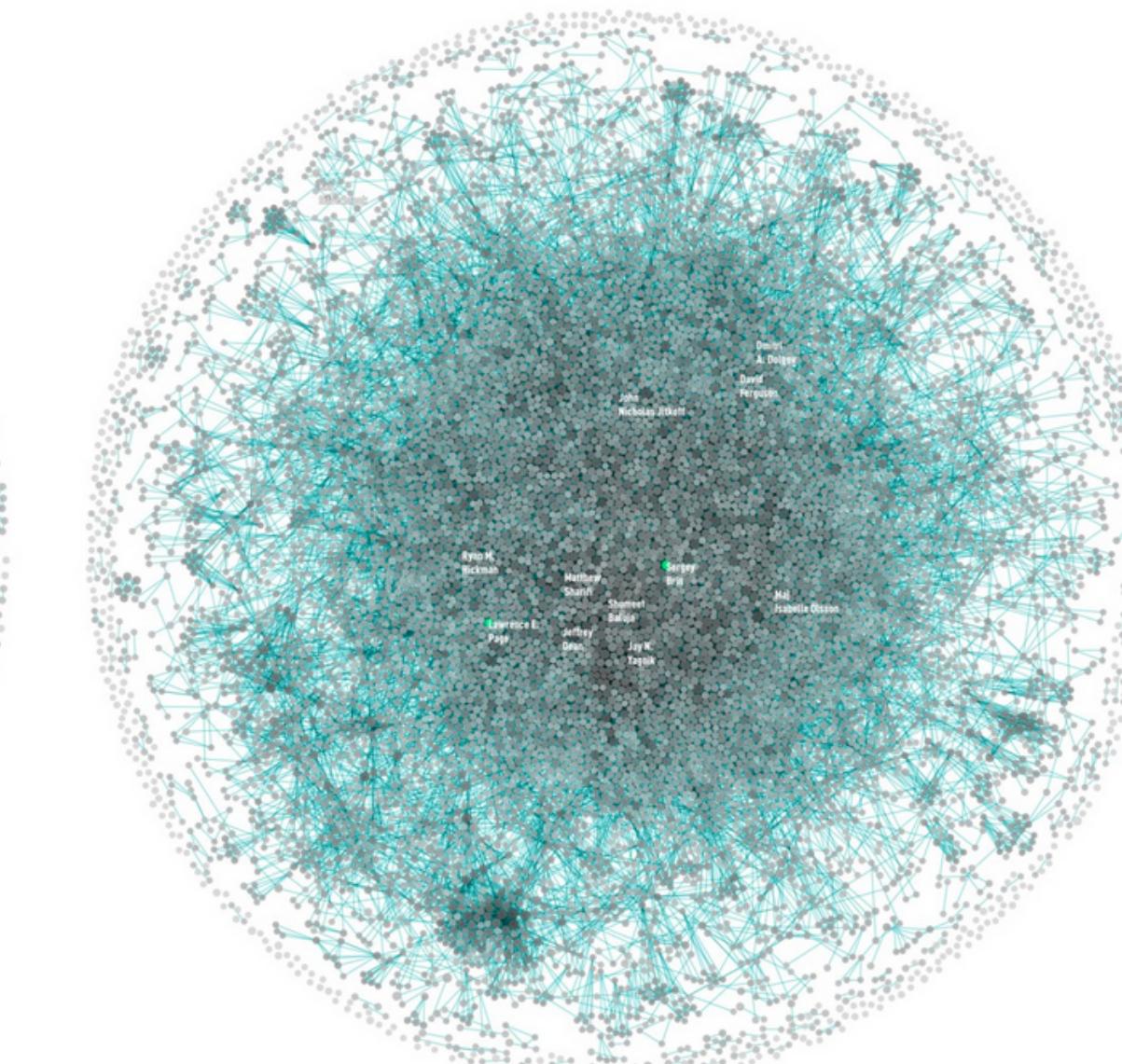
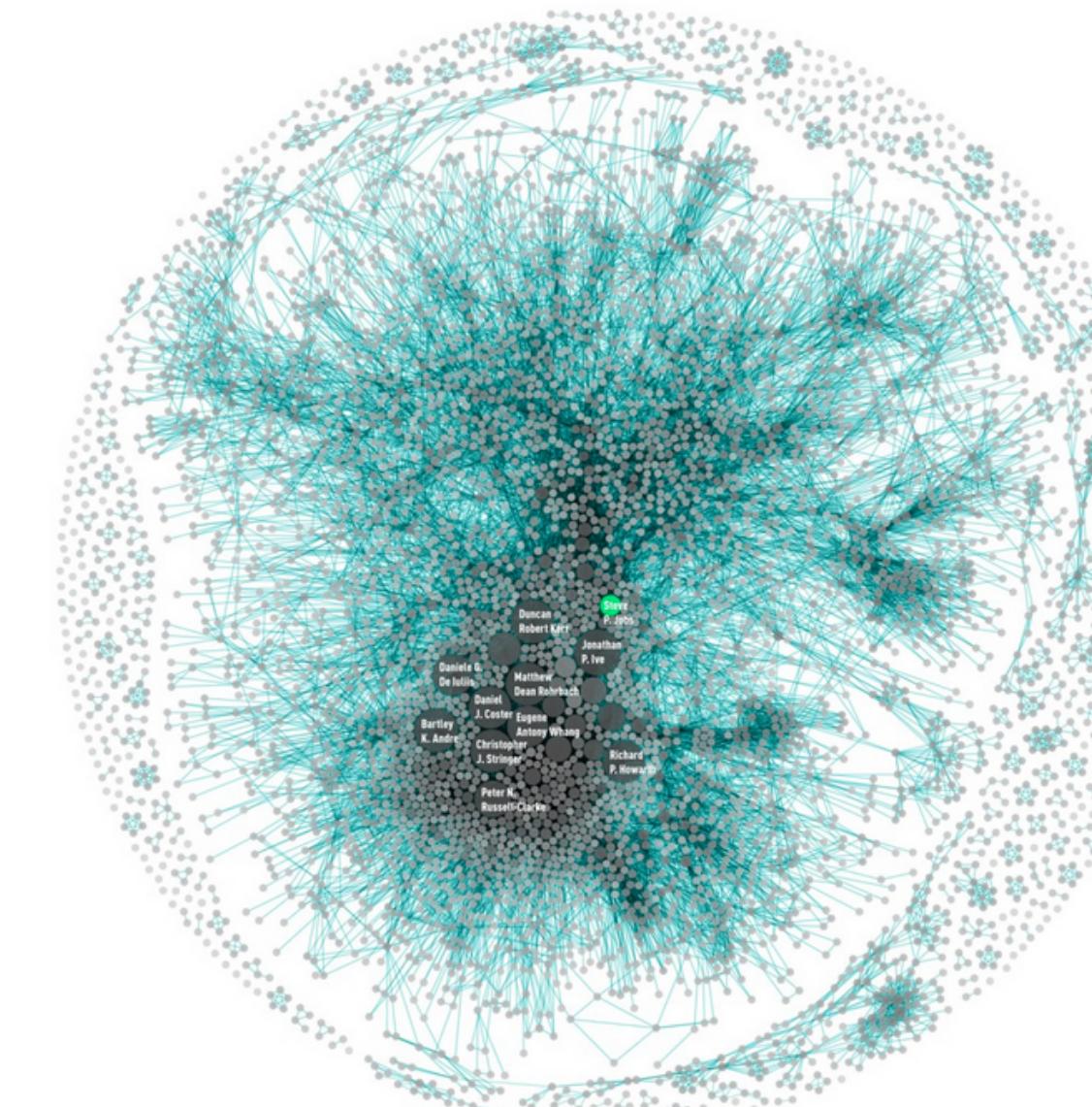
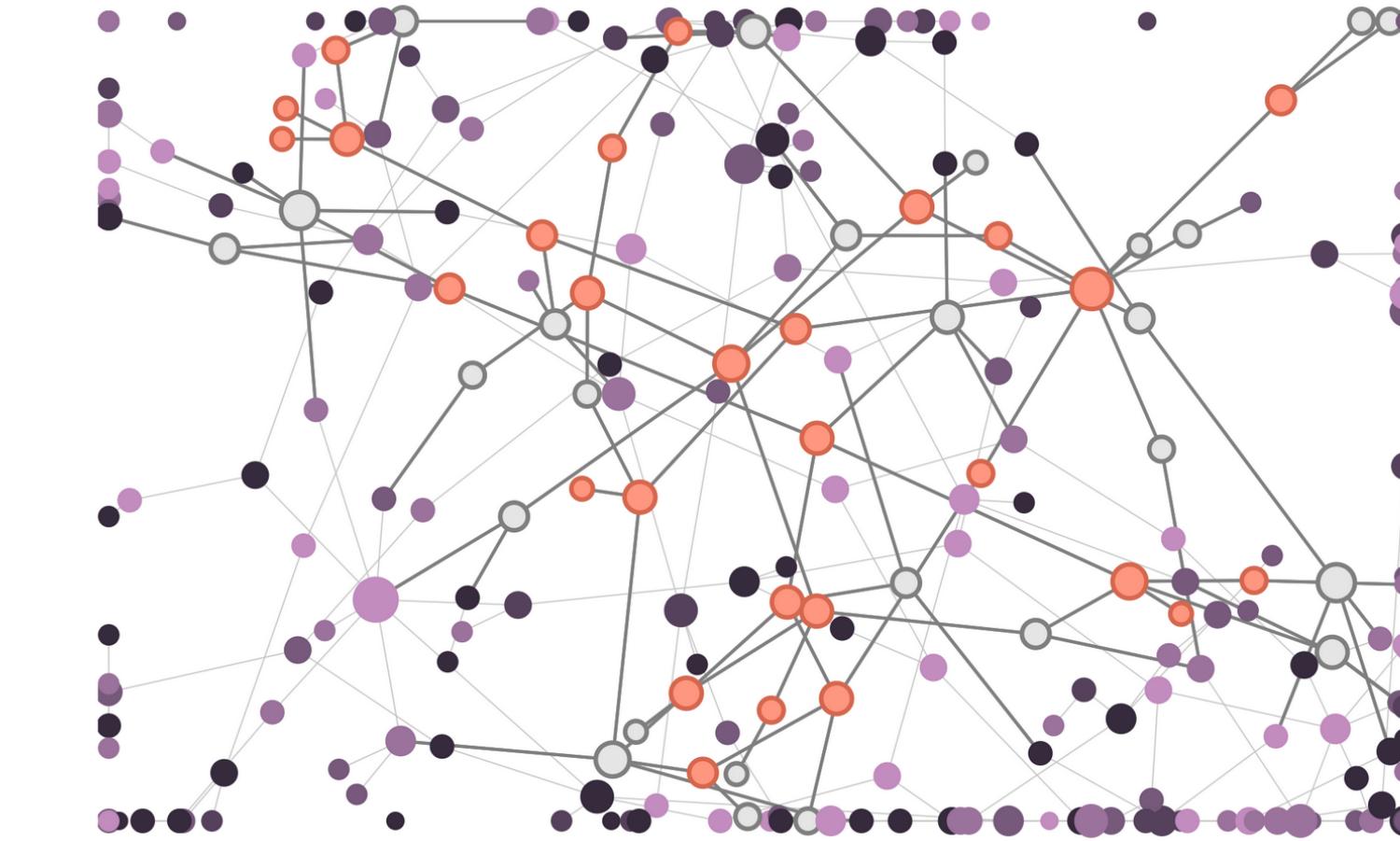
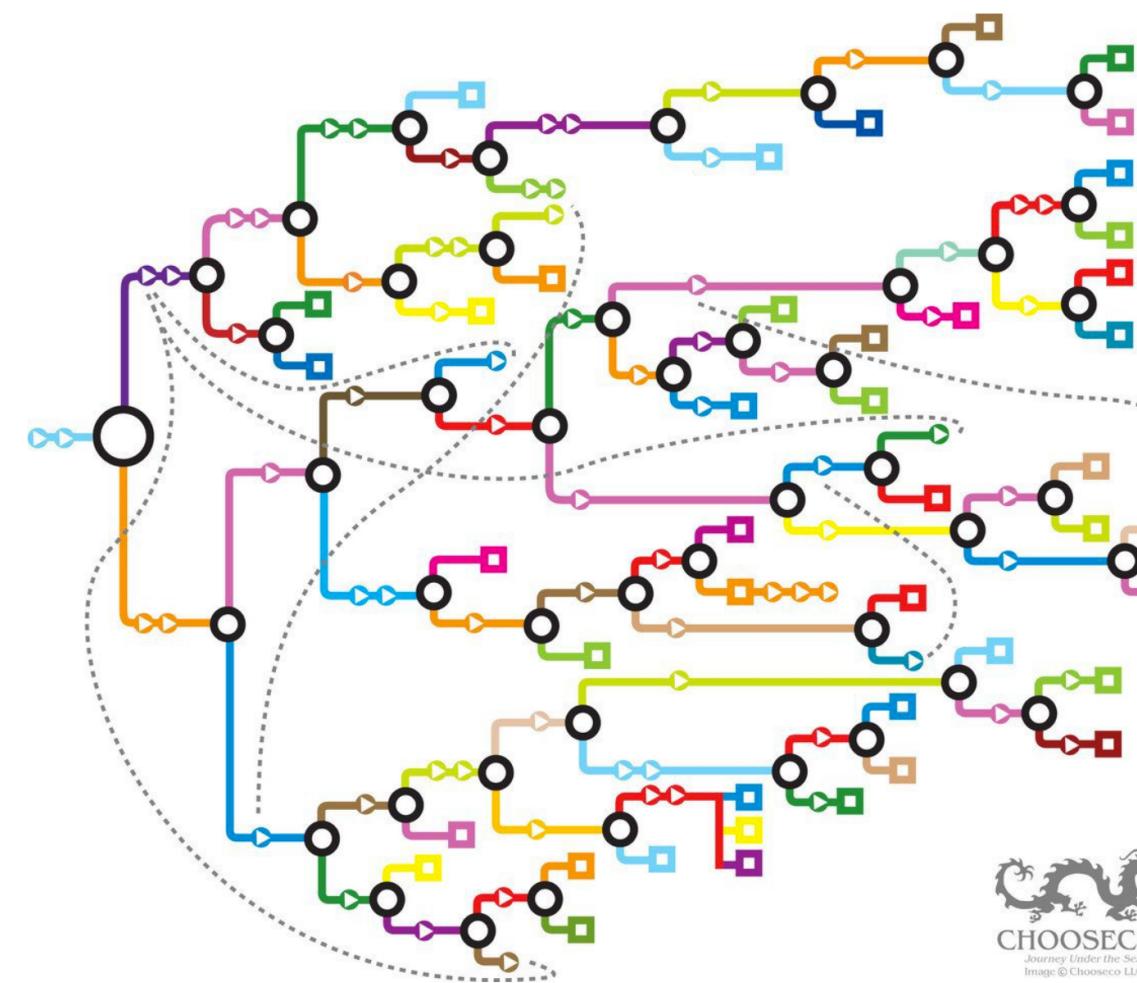
Chords



Radar

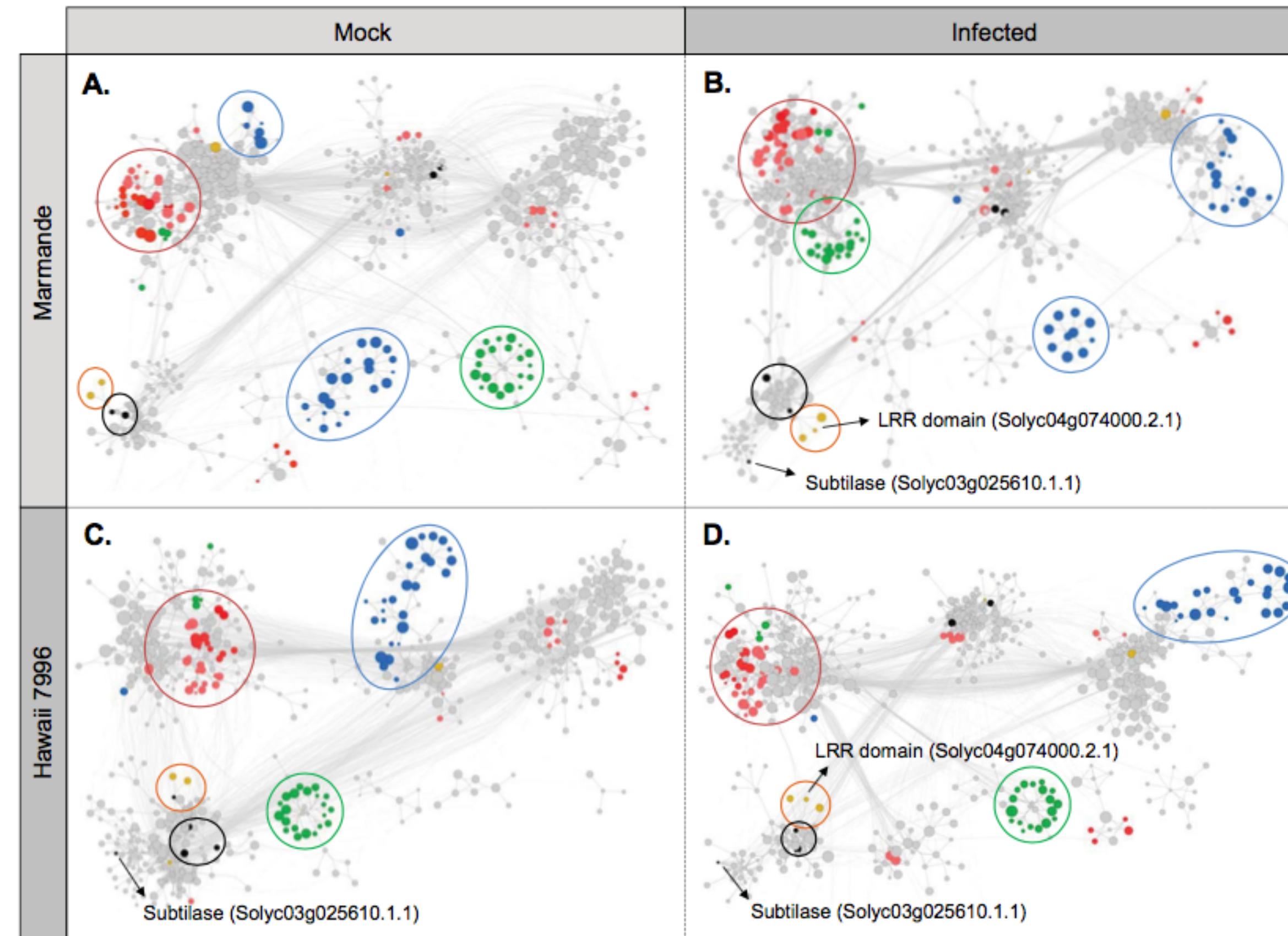


# NETWORKS ARE BEAUTIFUL!

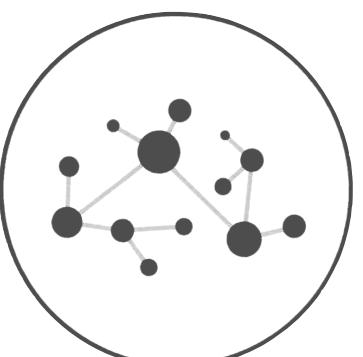


# NETWORK VISUALIZATION

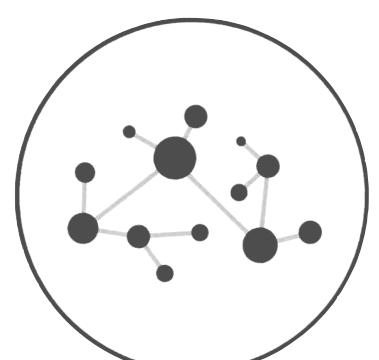
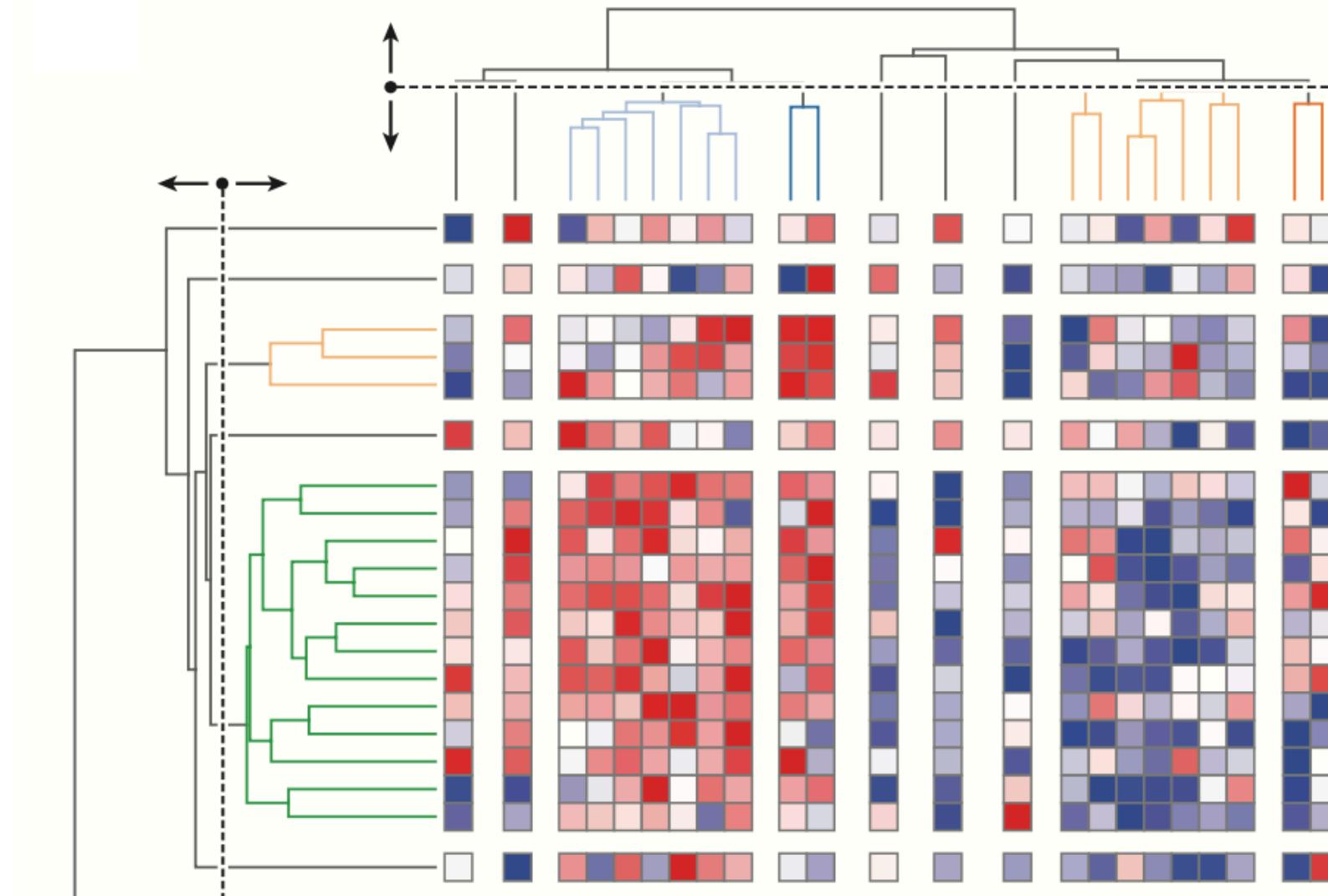
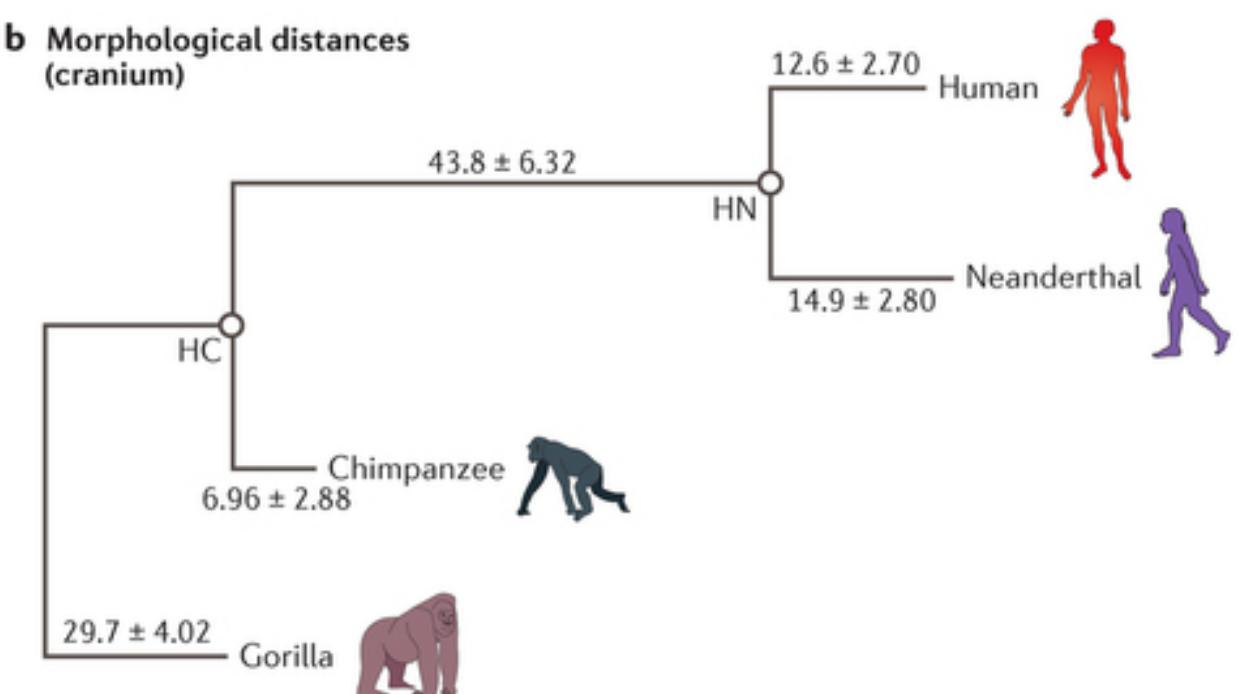
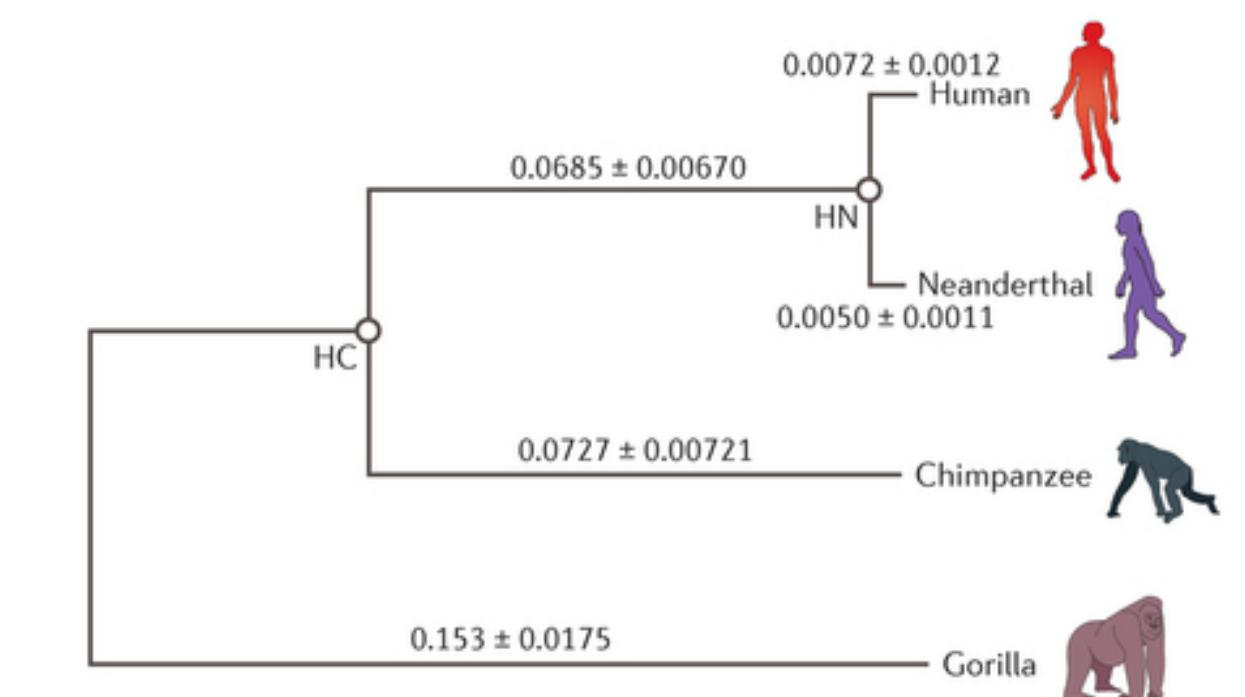
## a success story



- Oxidative stress response module
- LRR module
- Plant-Pathogen interaction module
- Peroxidase module
- Glycosyl hydrolase module



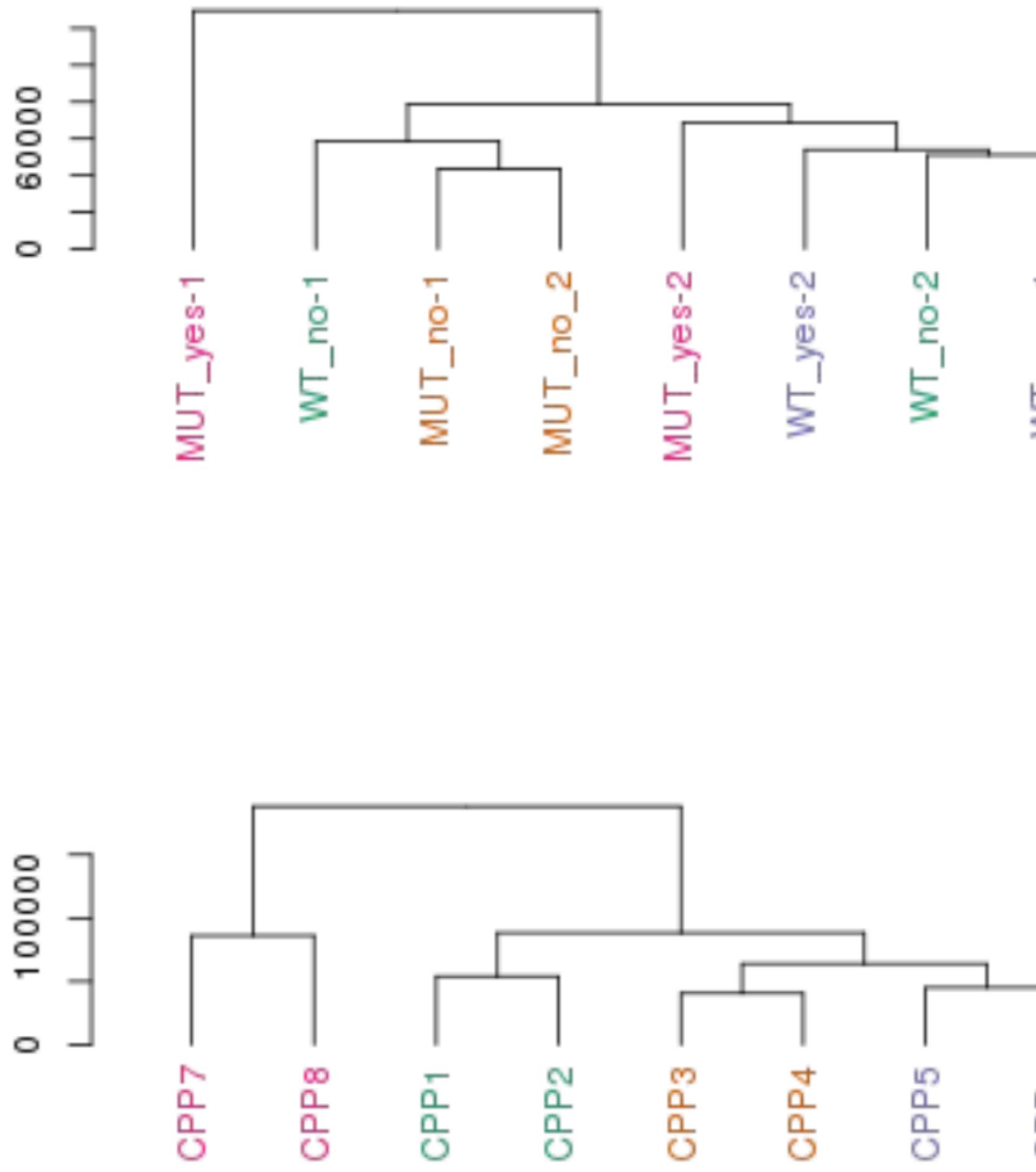
# TREES: SEQUENCE IDENTITY, PHYLOGENY AND MORE



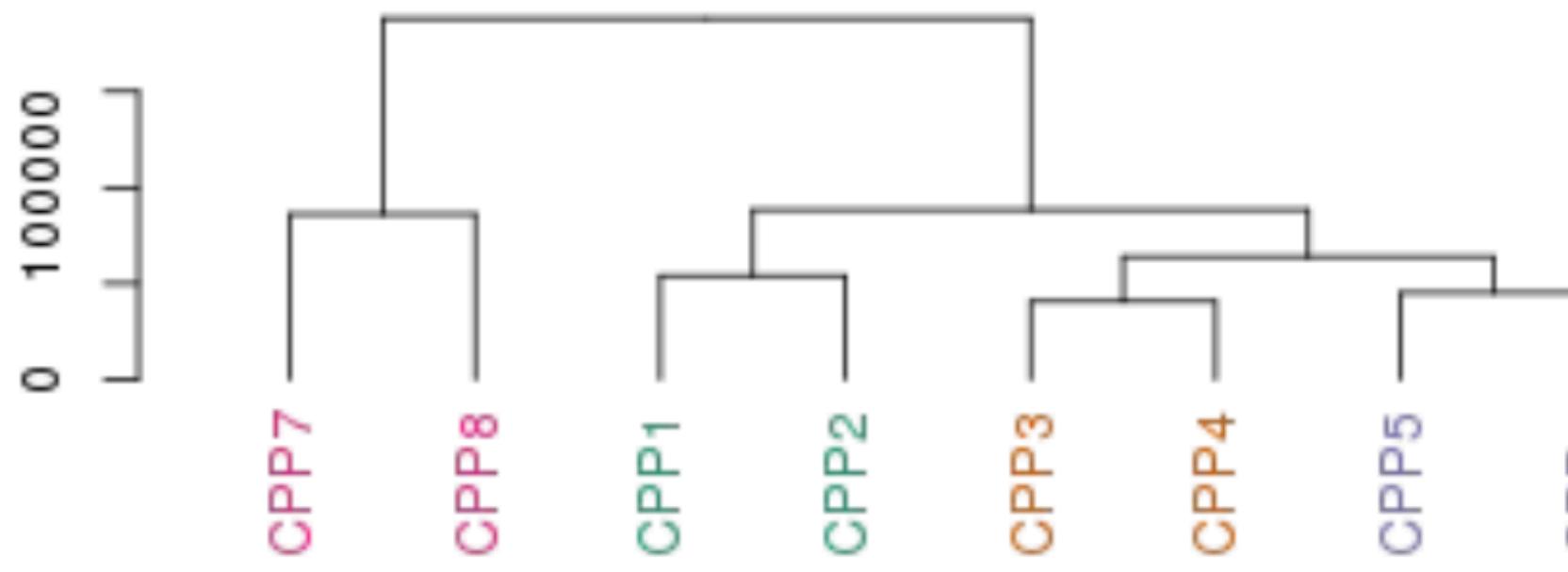
Nature Reviews, 2017

Nature, 2012

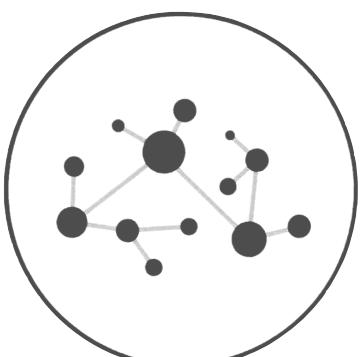
# TREES: SEQUENCE IDENTITY, PHYLOGENY AND MORE



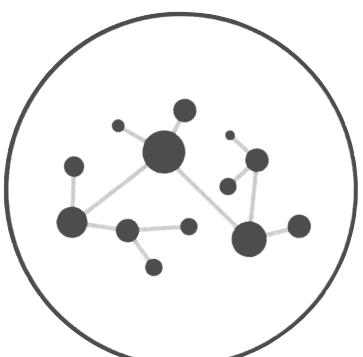
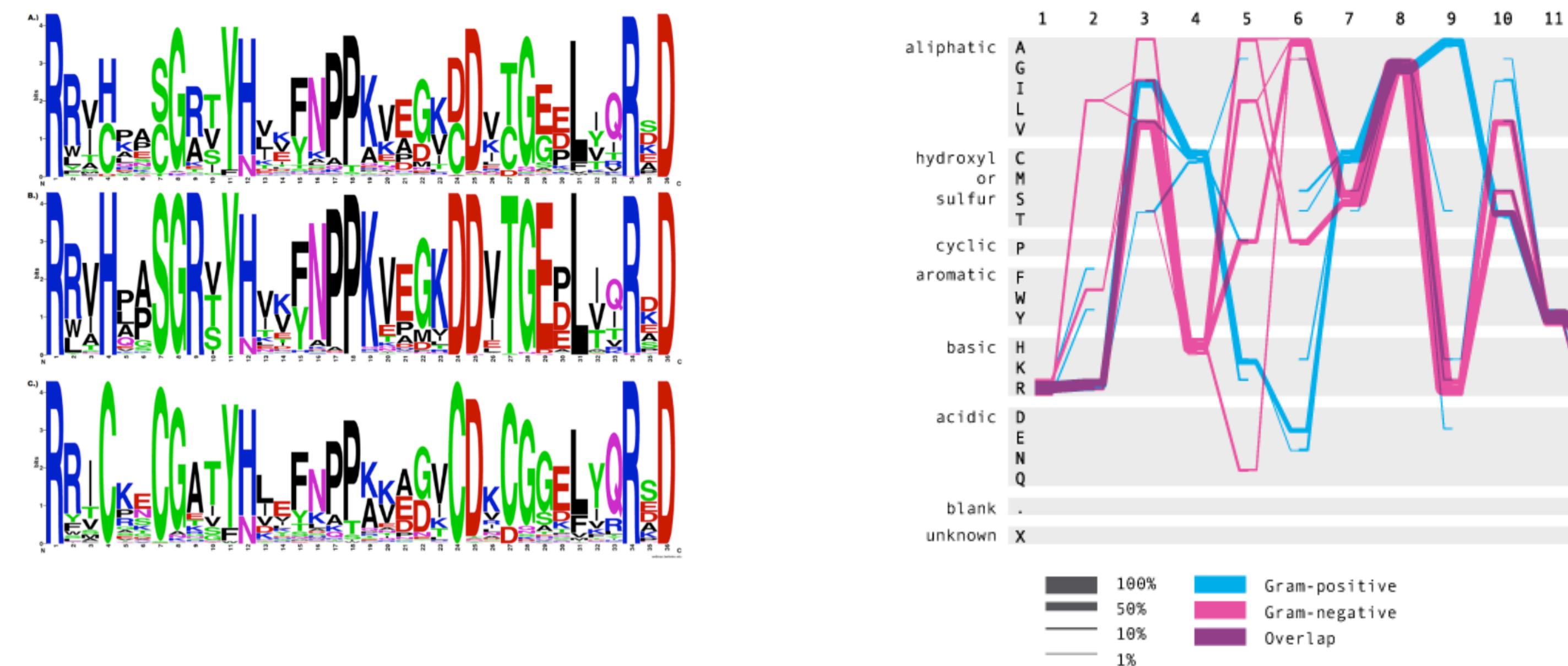
low count genes removed



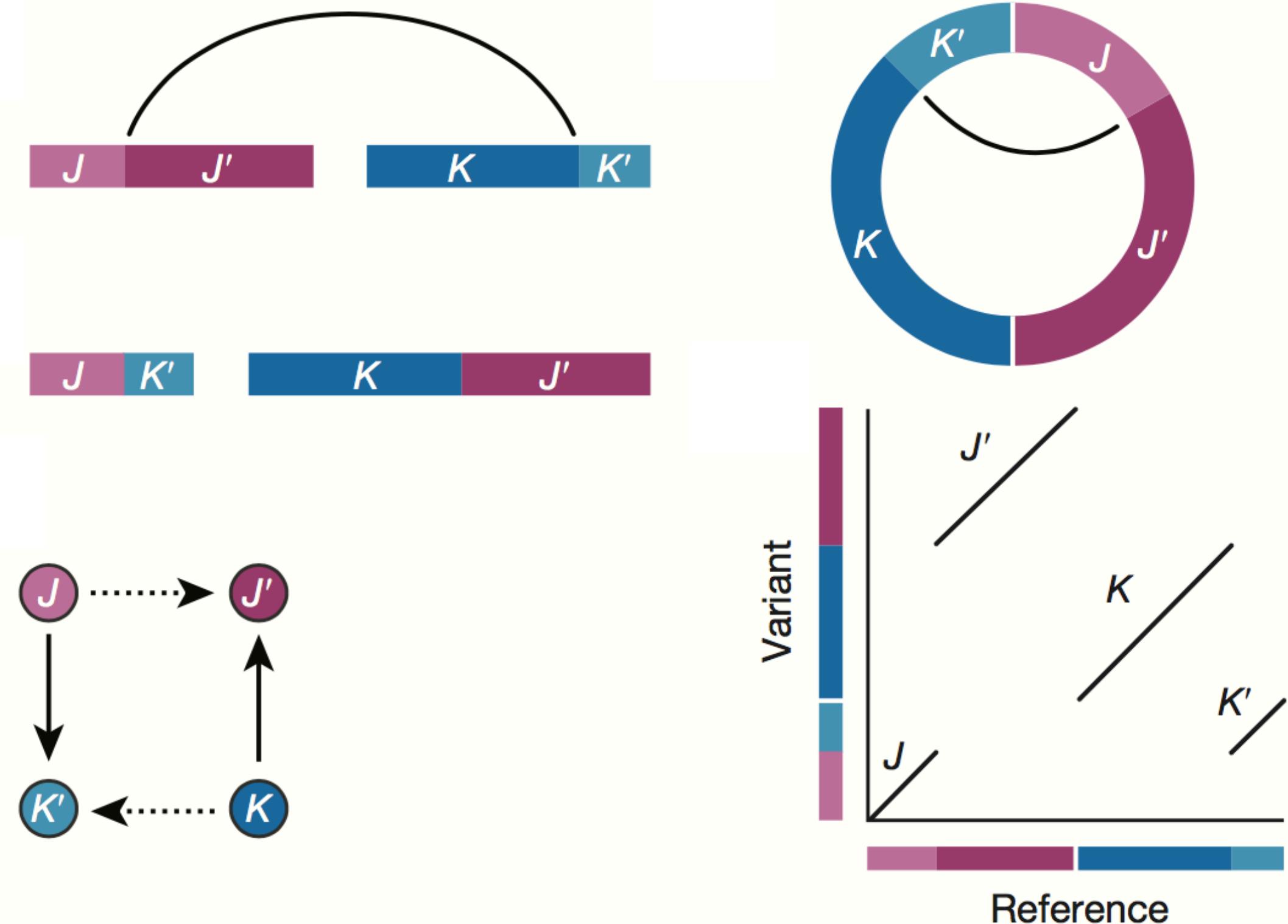
TMM normalized data



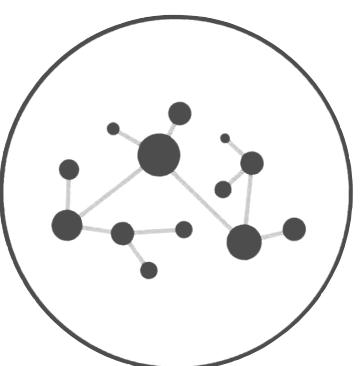
# ALTERNATIVES TO TREES FOR SEQUENCE IDENTITY: LOGO AND DIVERSITY DIAGRAM



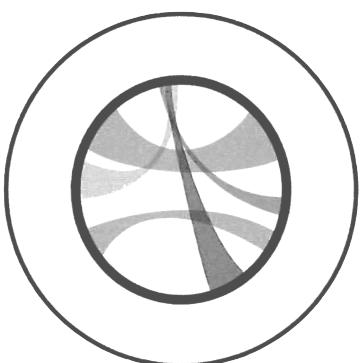
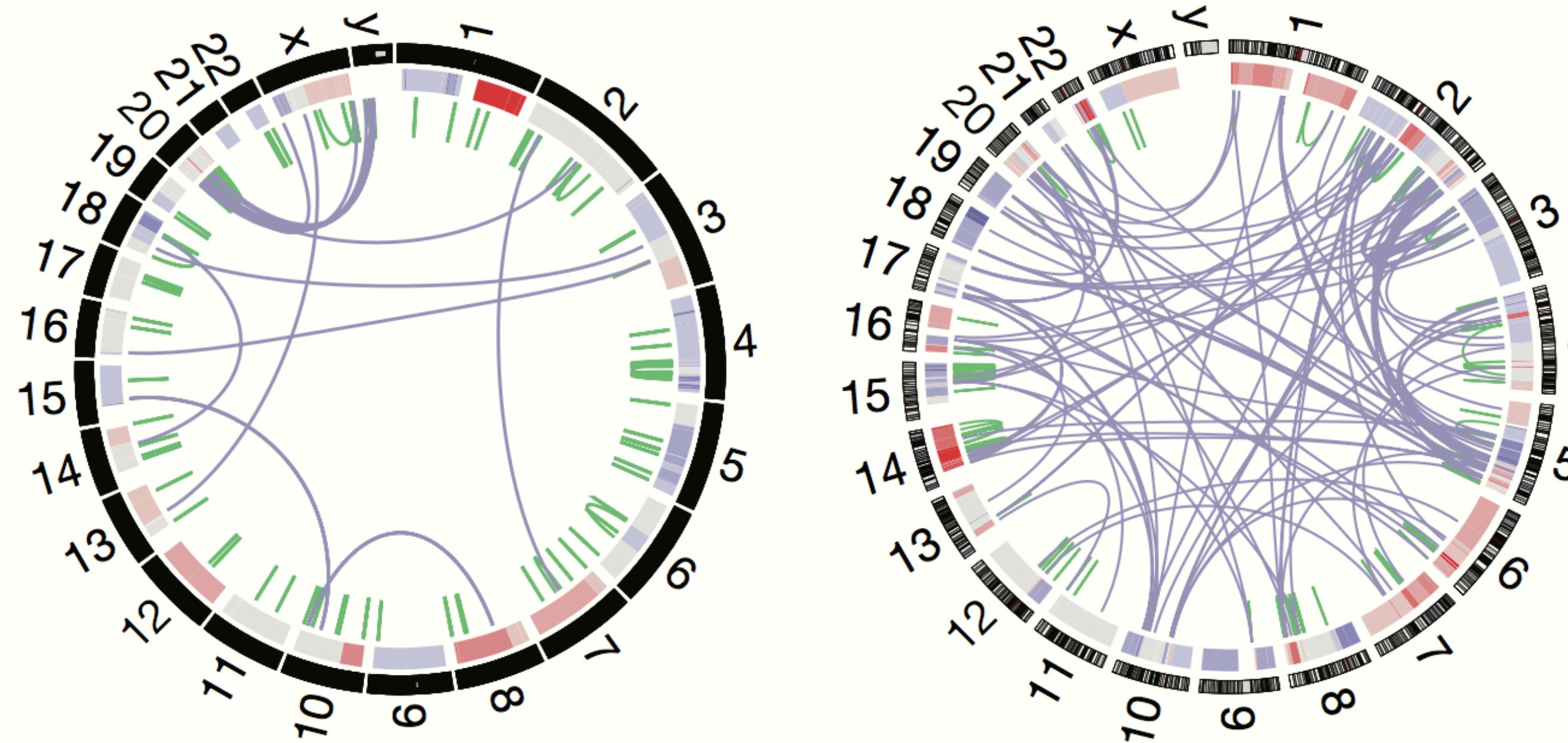
# LINEAR, COLOURED AND CIRCULAR GENOMES AND DOT PLOTS



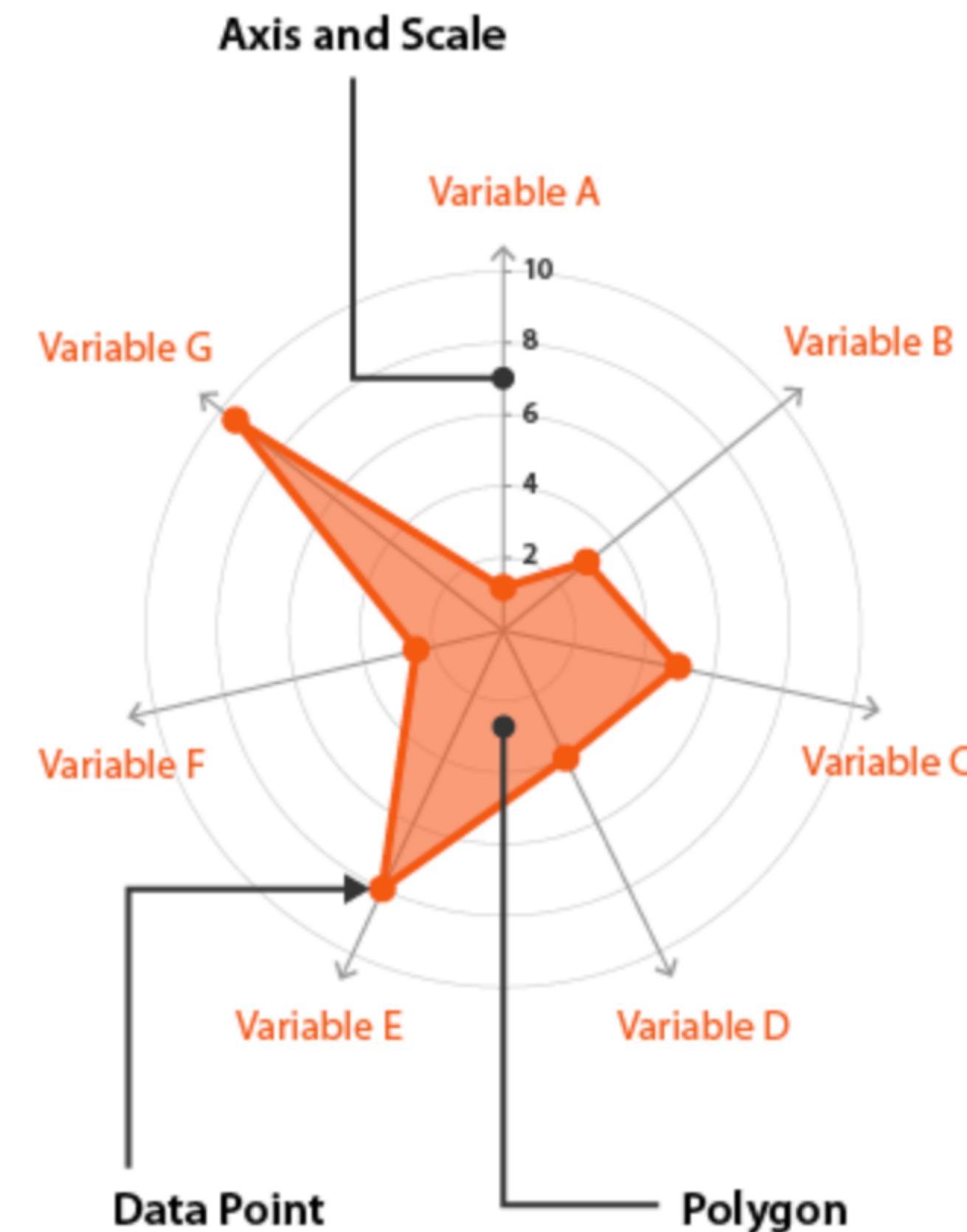
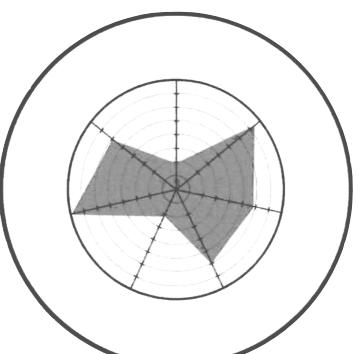
Nature, 2012



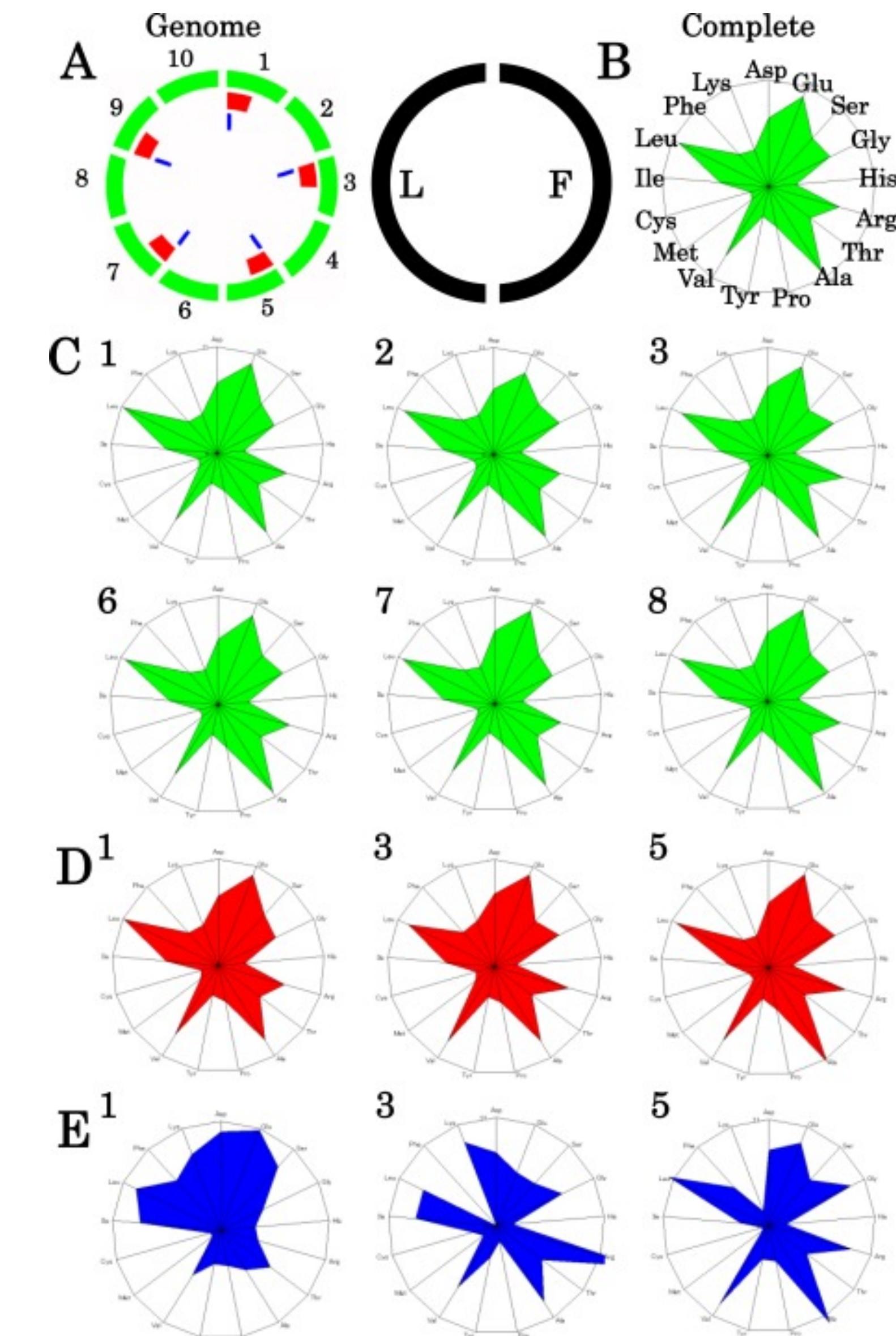
# THE CIRCOS PLOT: GENE DUPLICATIONS AND REARRANGEMENTS



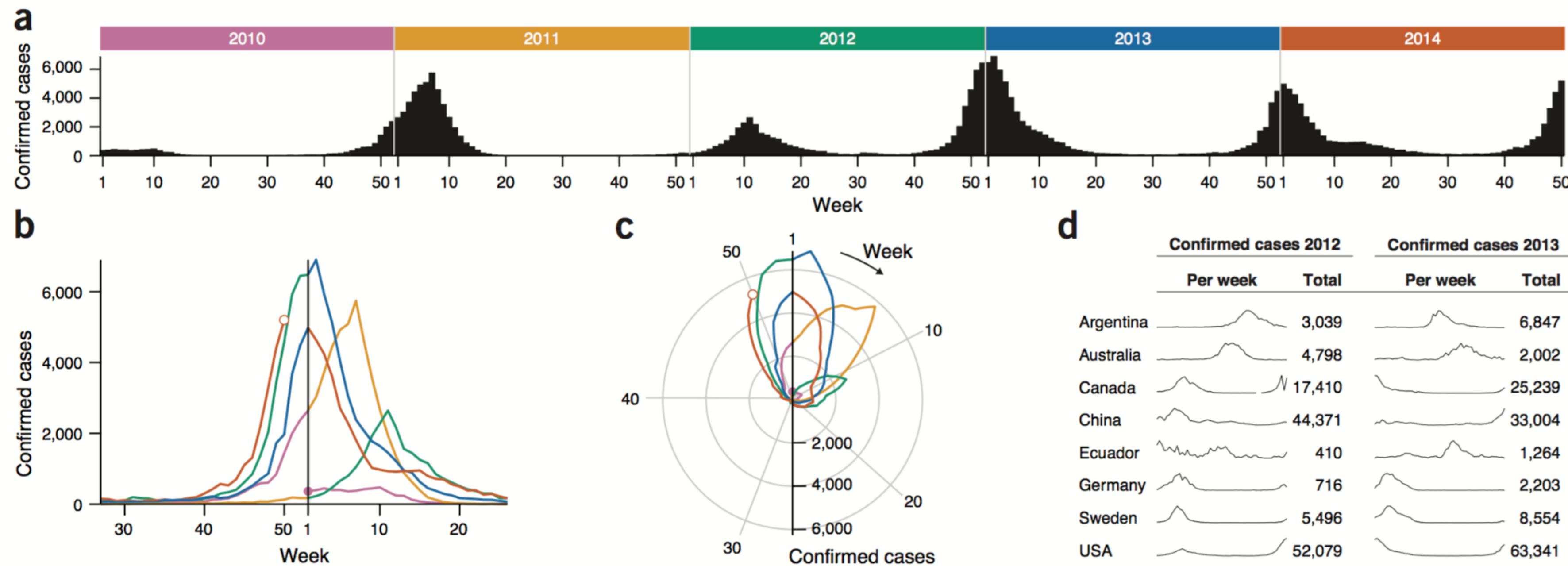
# RADAR PLOTS



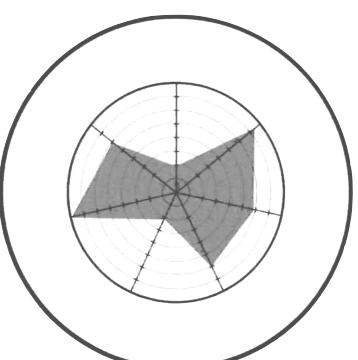
Current genomics, 2015



# RADAR PLOTS

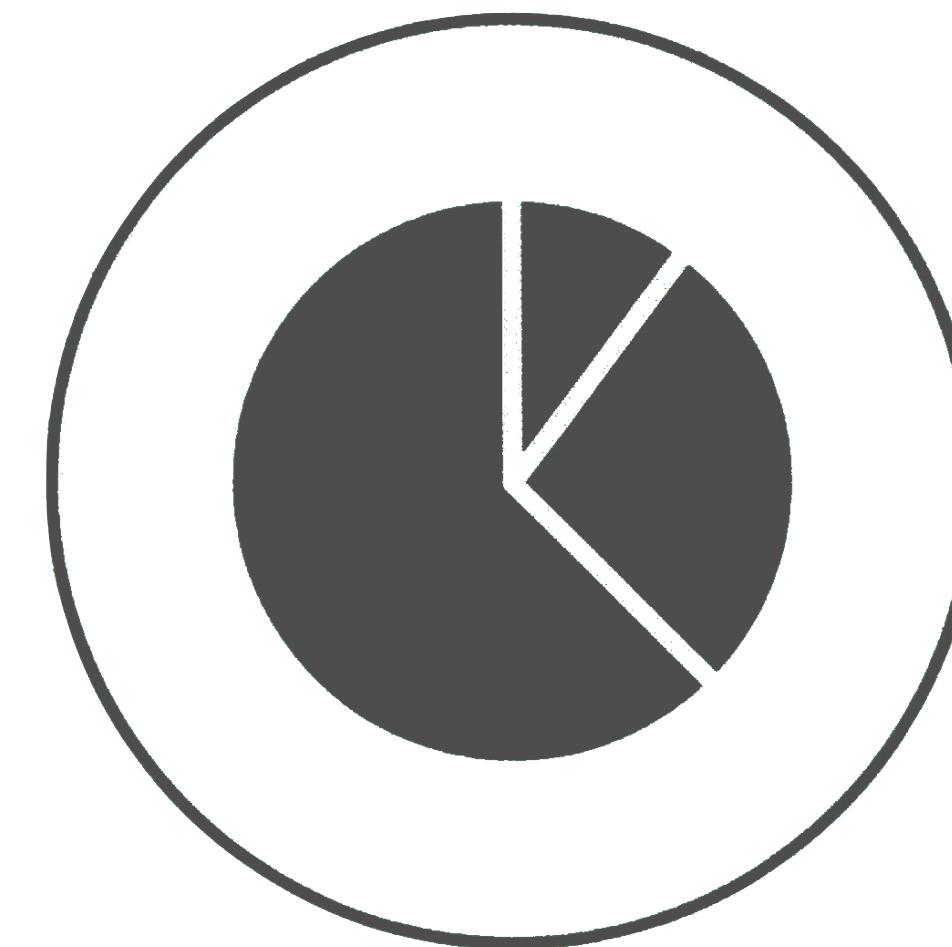


Points of View, Nature Methods 2014

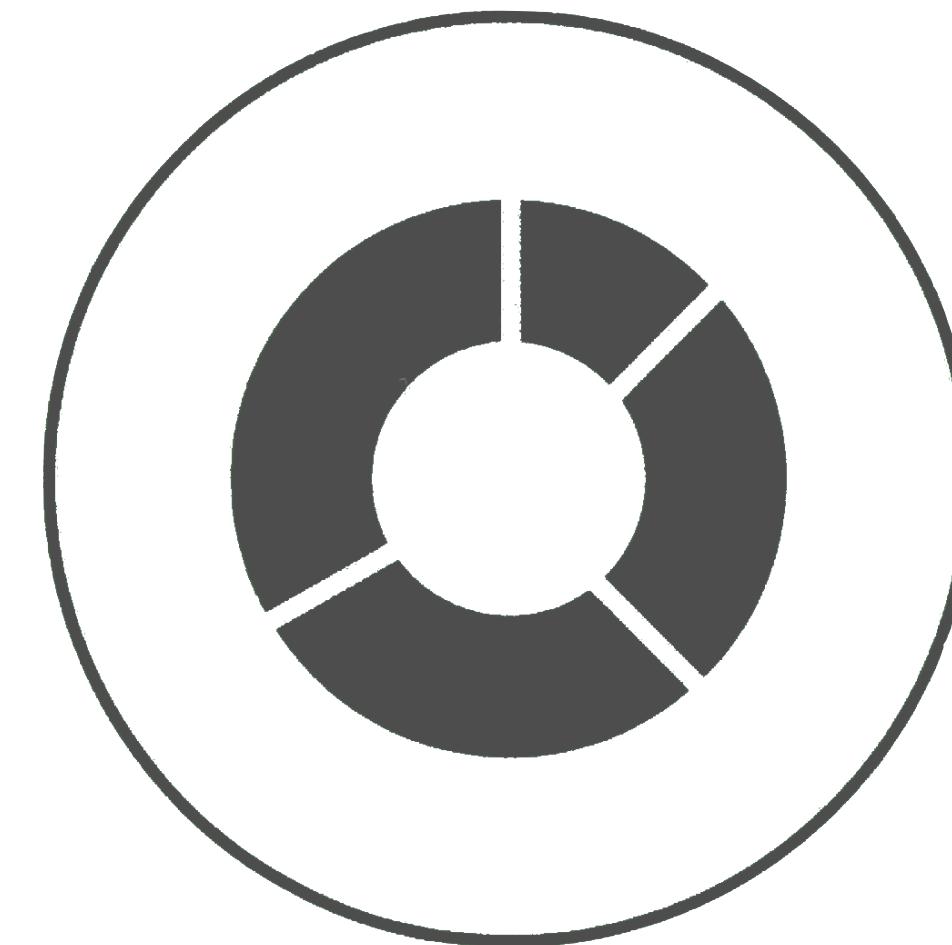


## PART TO WHOLE

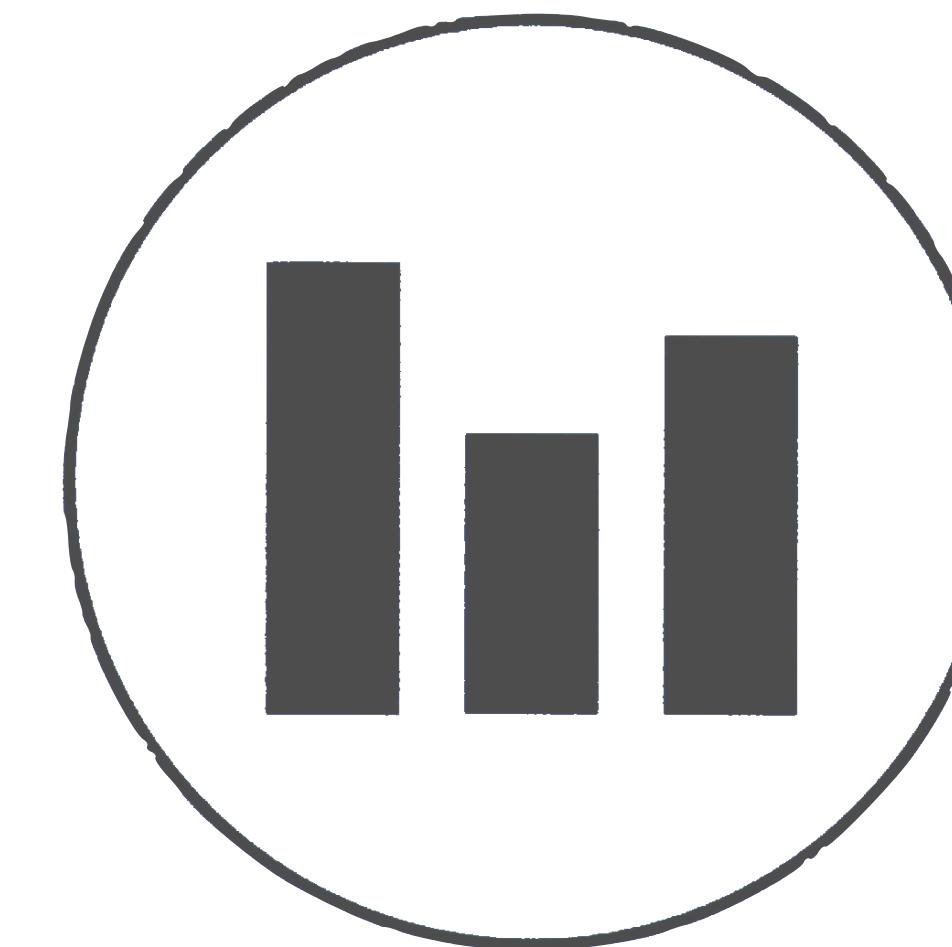
Pie chart



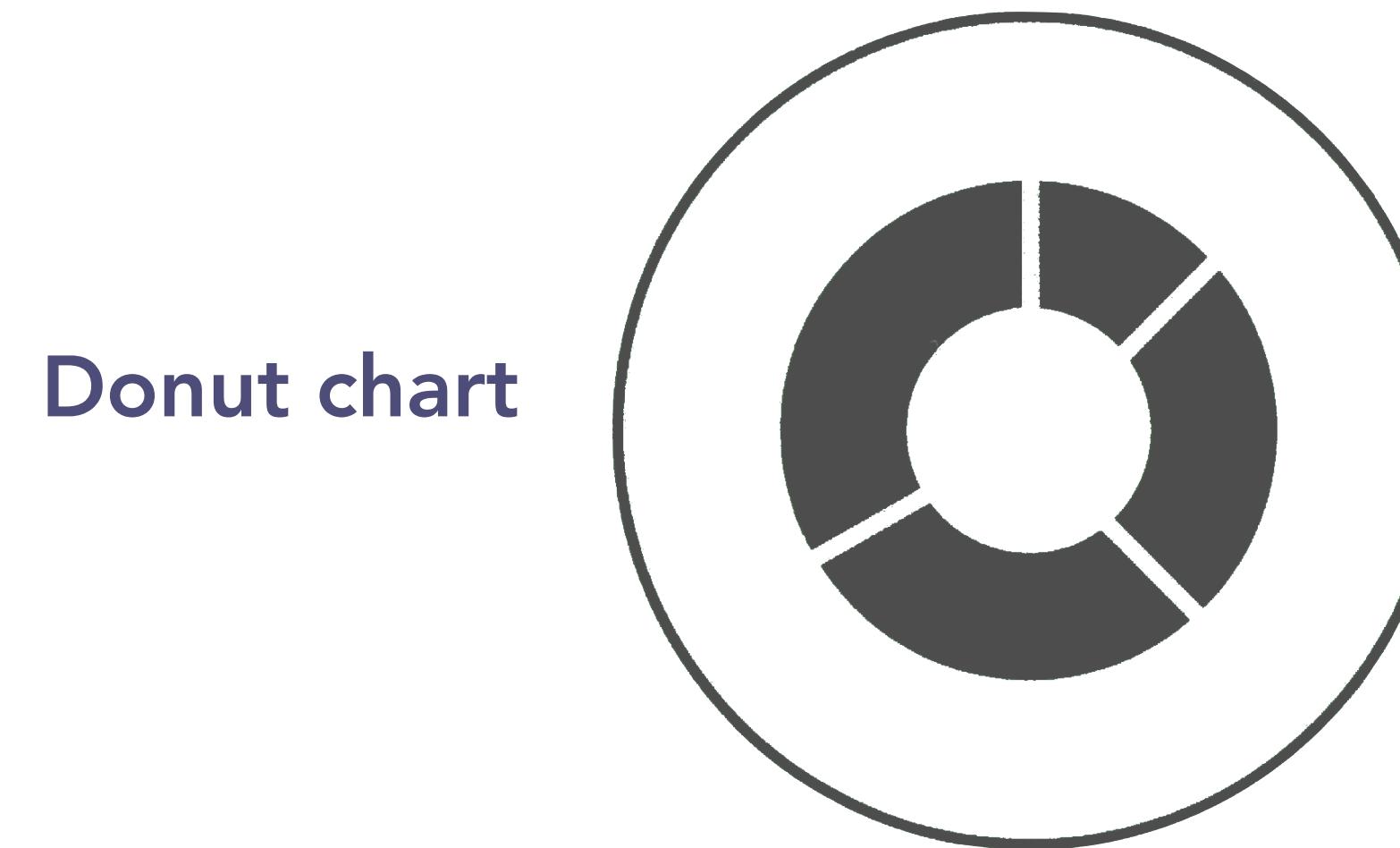
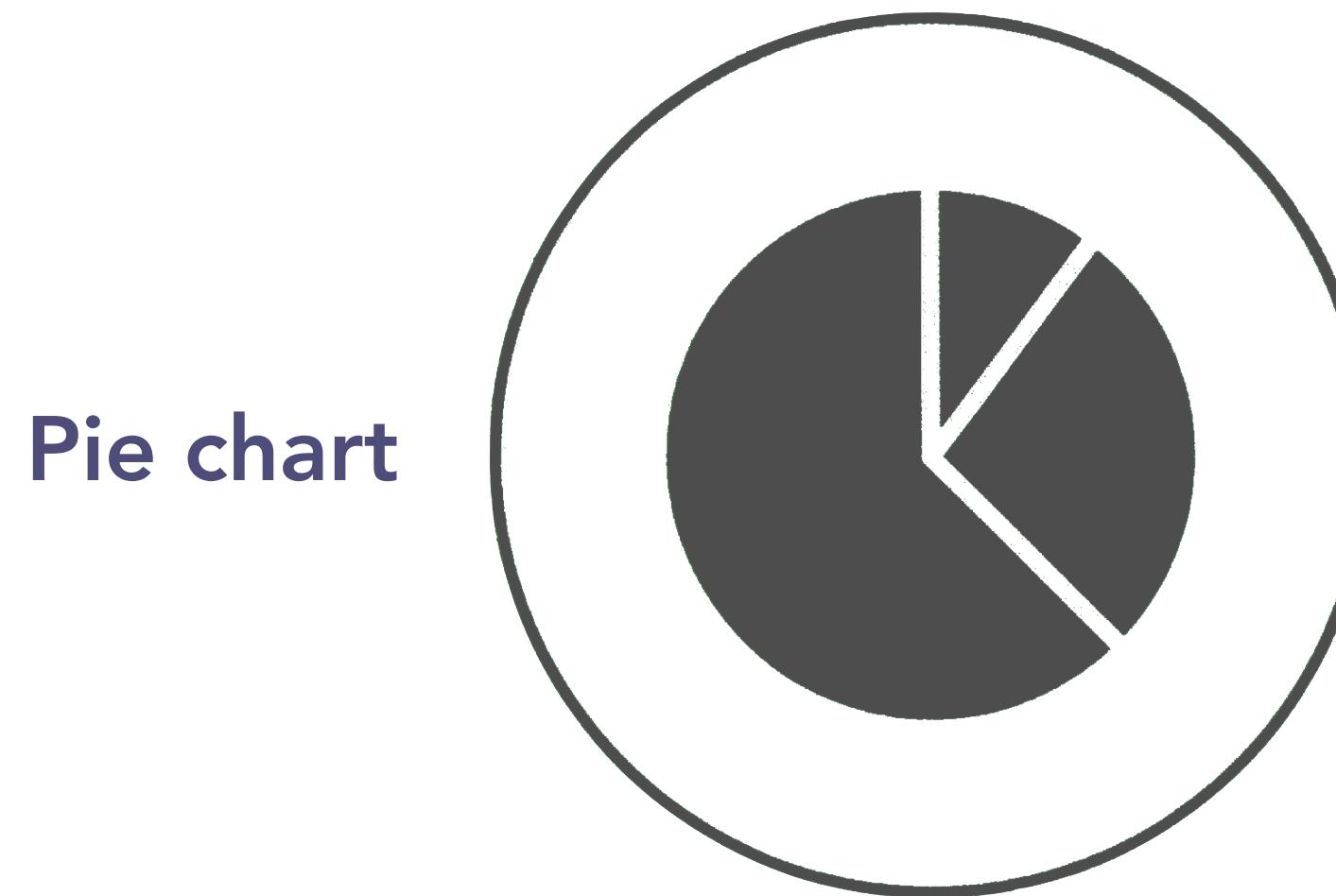
Donut chart



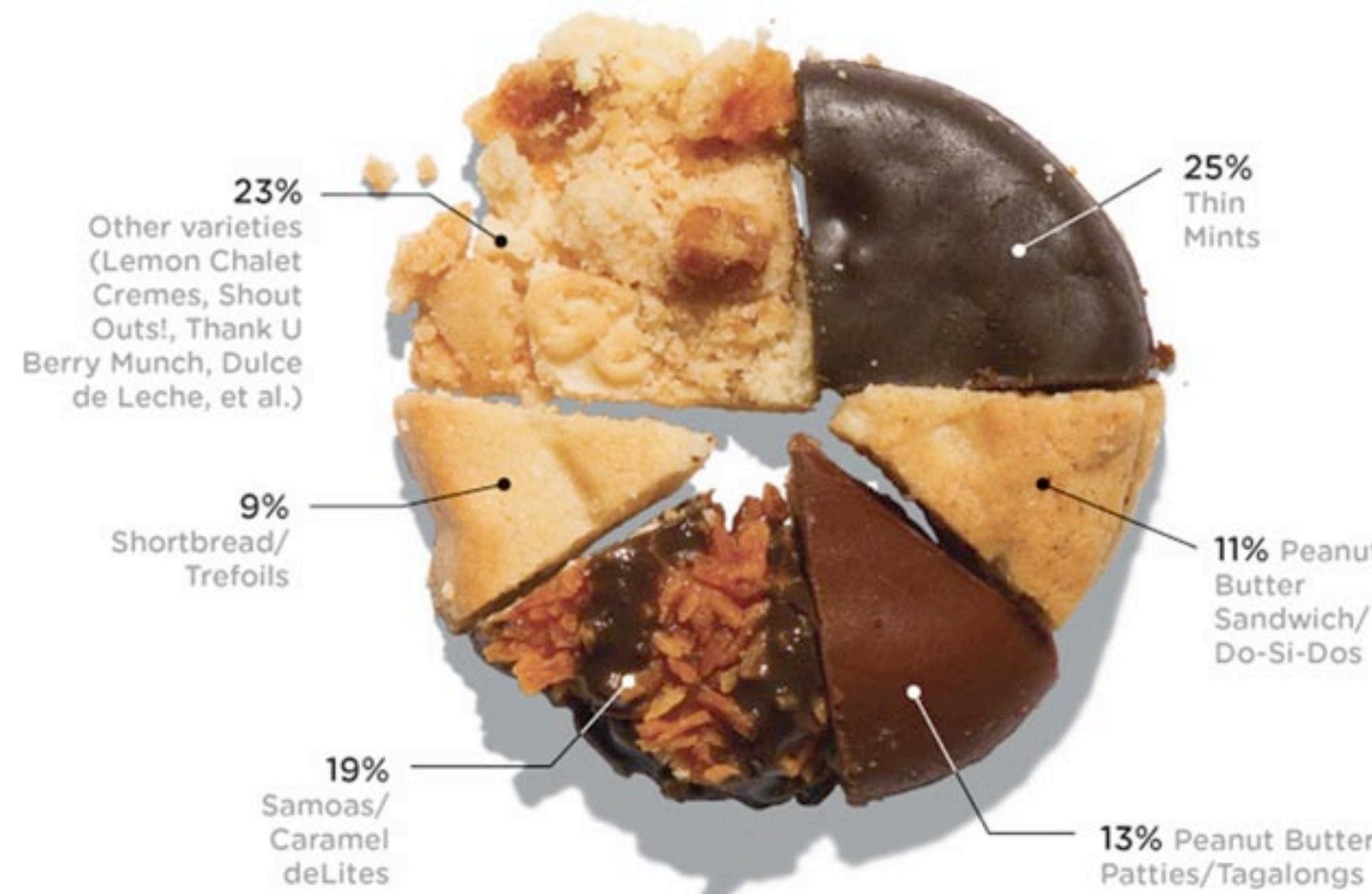
(Stacked)  
Bars



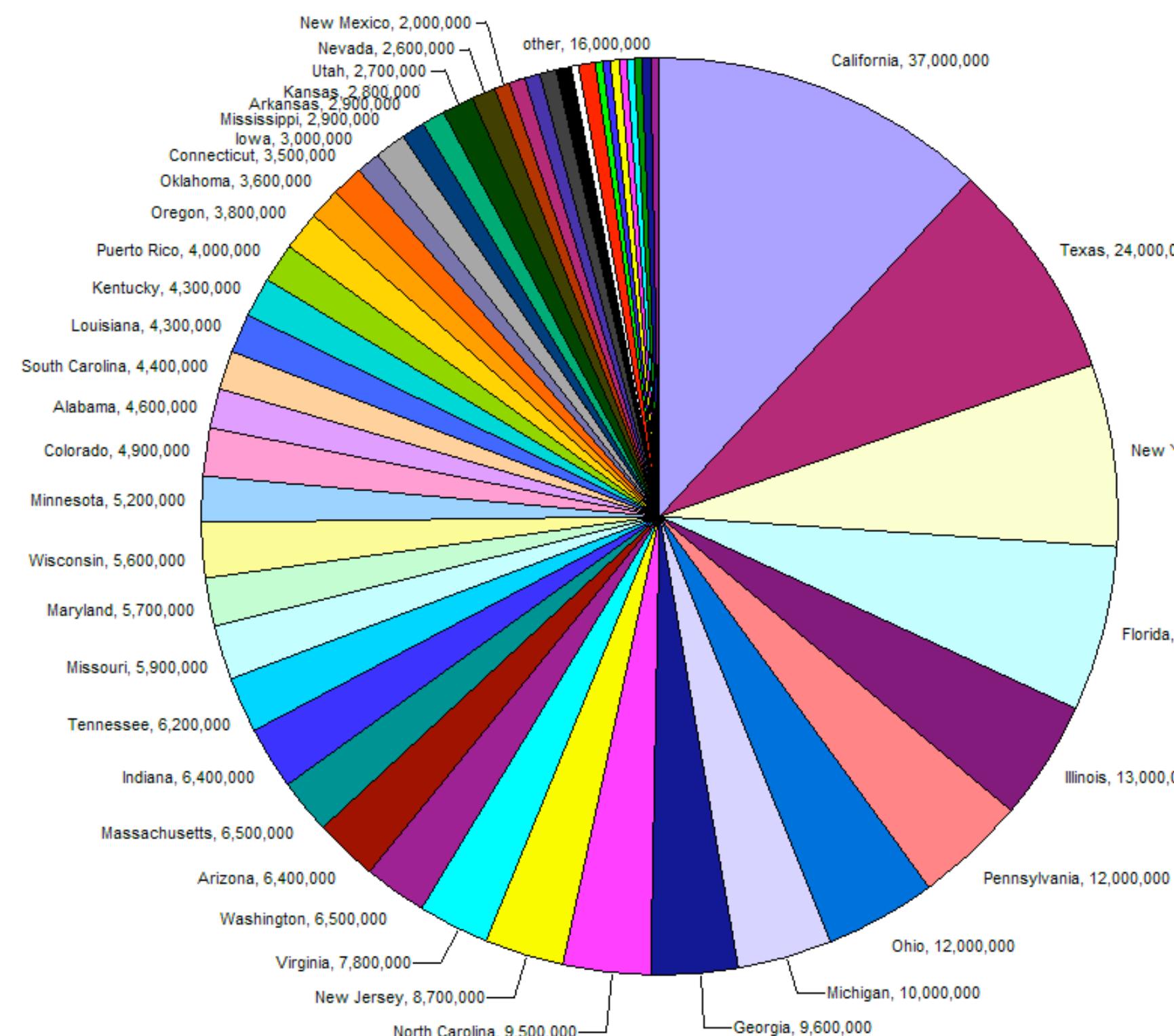
# PART TO WHOLE



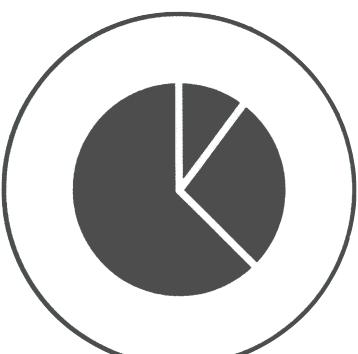
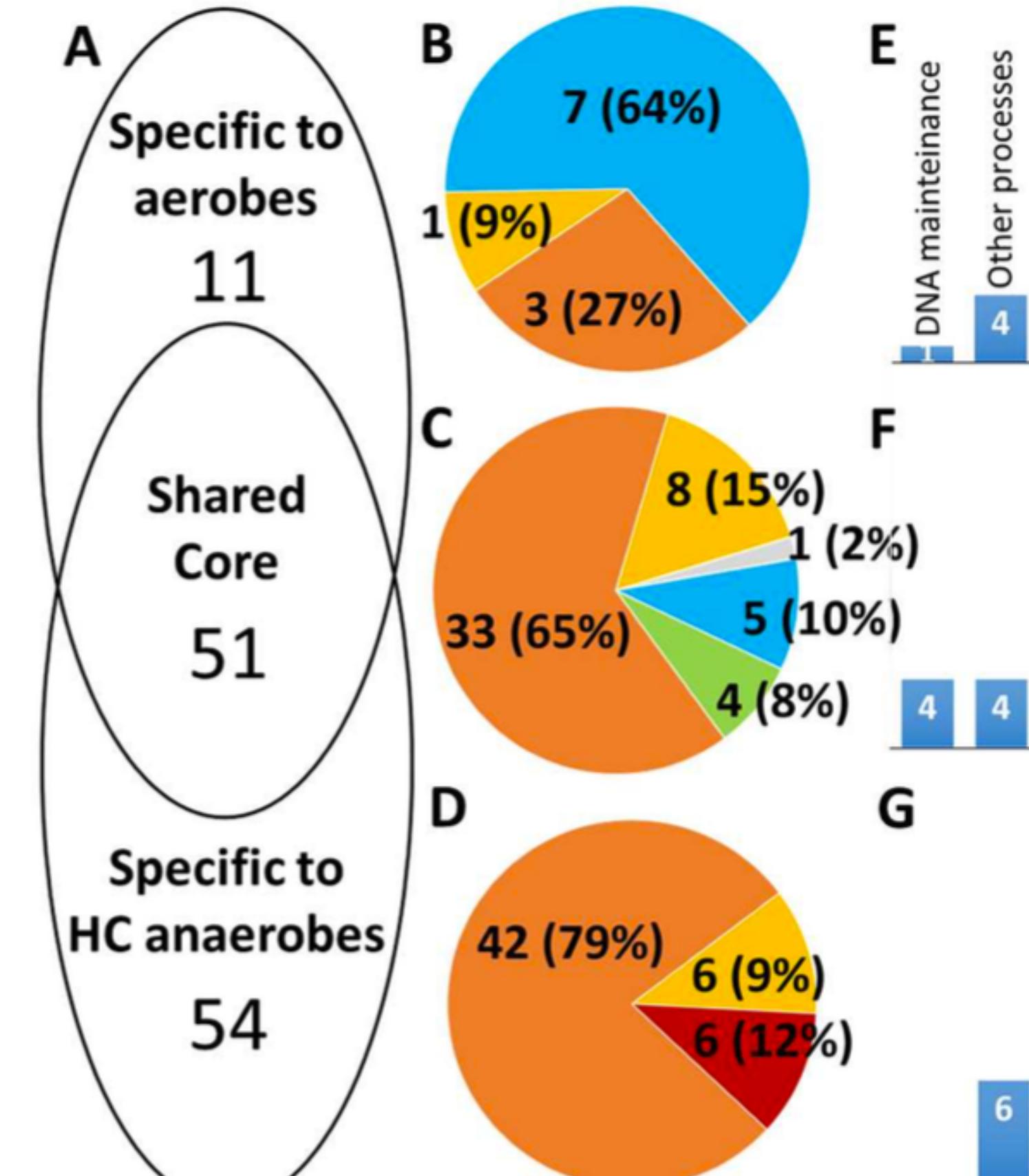
**"Silly plots which should be avoided"?**



# PIE CHARTS ARE DIFFICULT TO READ



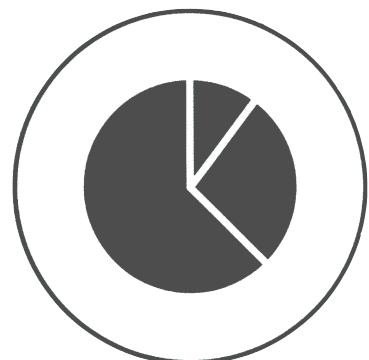
## Aerobes (62)



# Percentage of chart which looks like Pac-man



- Looks like Pac-man
- Does not look like Pac-man





## Pie says no 🍰📈

@pie\_says\_no

I'm just an innocent pie chart, protesting my abuse in bad data visualisations.

📍 Cambridge, England

🔗 [klmr.me/pie](http://klmr.me/pie)

📅 Joined October 2016

📸 6 Photos and videos

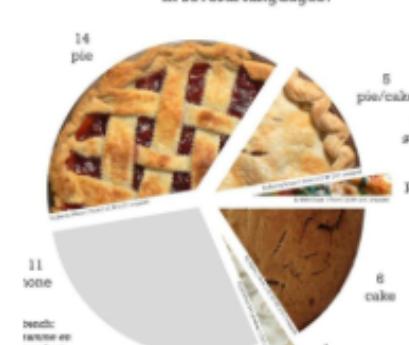


[Tweets](#)   [Tweets & replies](#)   [Media](#)

 **Pie says no 🍰📈** @pie\_says\_no · Apr 10

“A pie chart, by any other name, would look just as confusing.”  
—Shakespeare, probably.

Which foods are associated to circle charts in several languages?



Simon Kuestenmacher @simongerman600

Pie chart proves that pie chart is most commonly called pie chart: Which foods are associated to circle charts in several languages? The French name of Camembert Chart is of course the best... Source: [buff.ly/2EtA4Fk](http://buff.ly/2EtA4Fk)

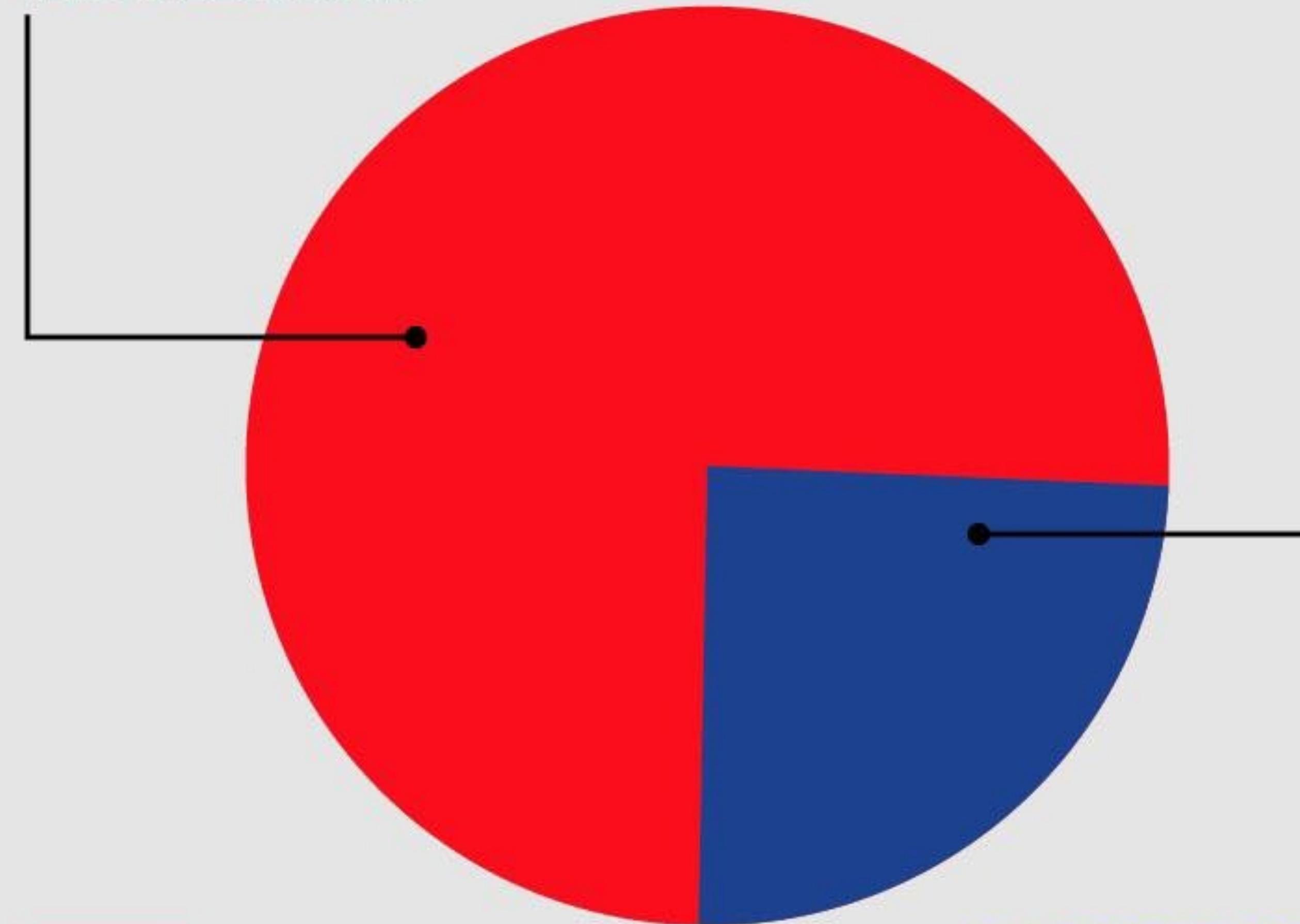
💬   ↑ 1   ❤️

 **Pie says no 🍰📈** @pie\_says\_no · Apr 6

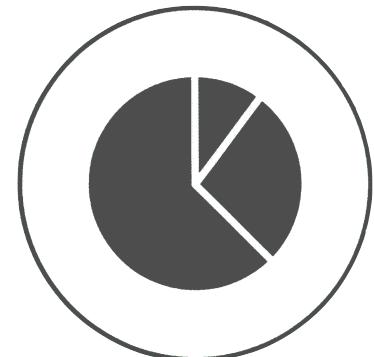
See also

[Pie Charts](#)
**G. Elliott Morris** 📈 🧑‍💻 @gelliottmorris

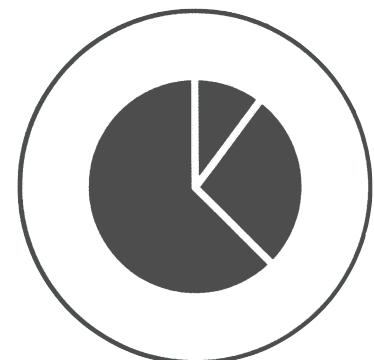
**LA PARTE ROJA SON  
LAS PROBABILIDADES  
DE MÉXICO PARA PERDER  
CON ALEMANIA**



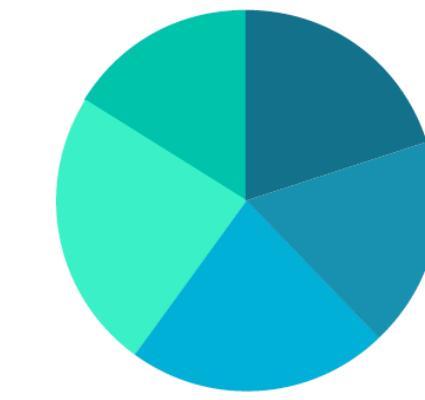
**LA PARTE AZUL,  
TAMBIÉN,  
PERO EN AZUL**



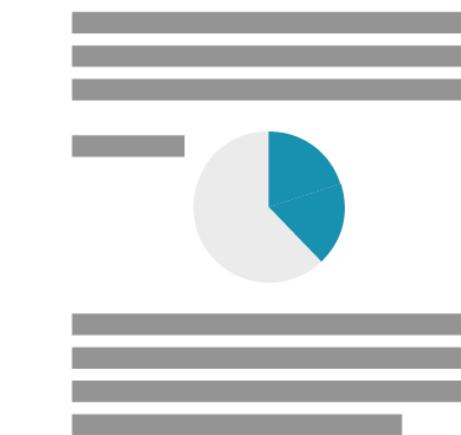
# PIE CHART GUIDELINES



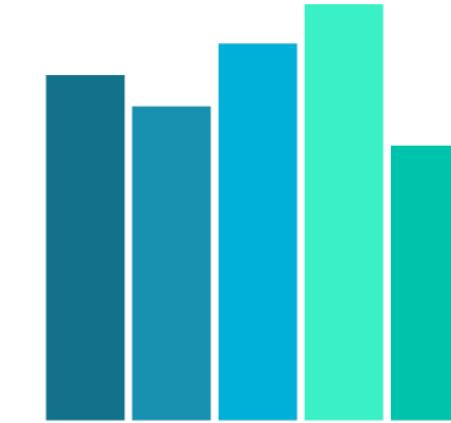
NOT IDEAL



NOT IDEAL



BETTER



NOT IDEAL



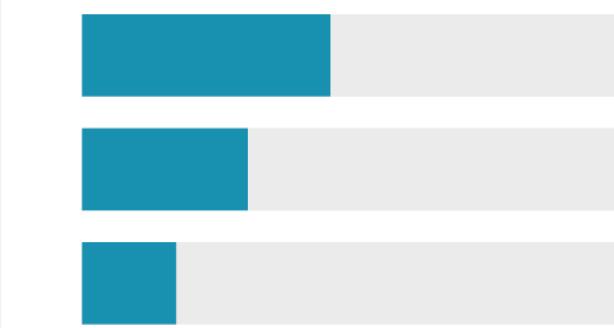
BETTER



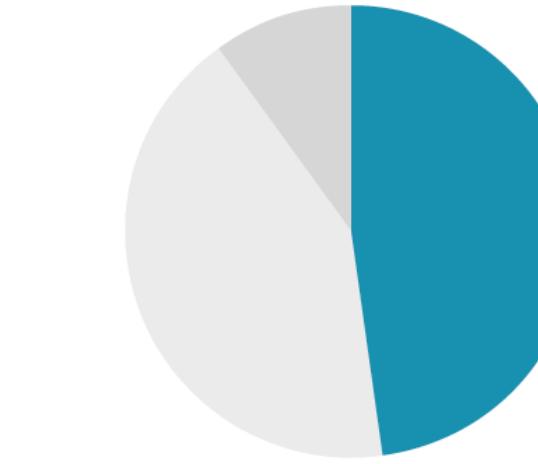
NOT IDEAL



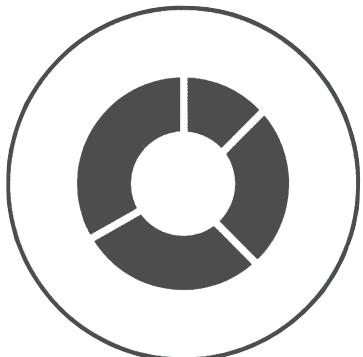
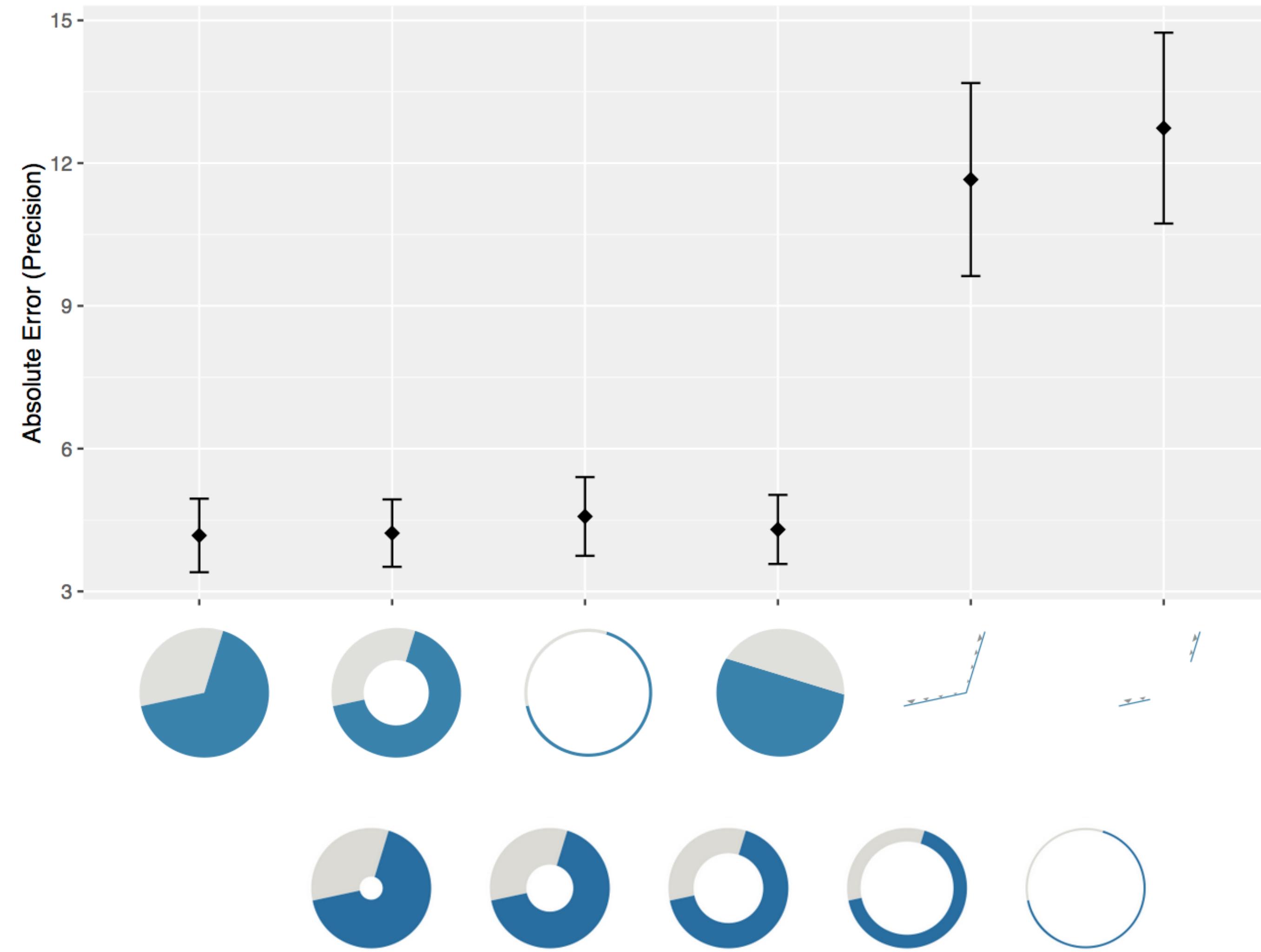
BETTER



BETTER



# WHAT ABOUT THE DONUT?



# SHOW PRECISE PART TO WHOLE RELATIONSHIPS

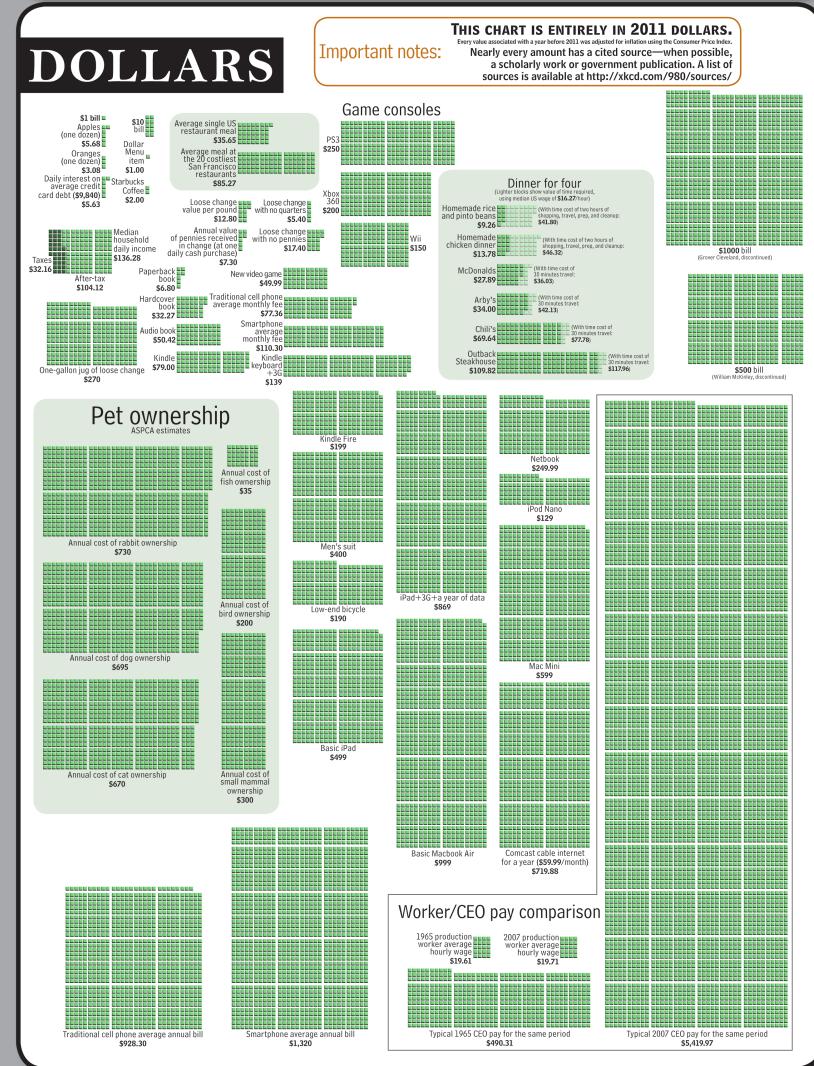


# MONEY

## A chart of almost **all of it**, where it is, and what it can do

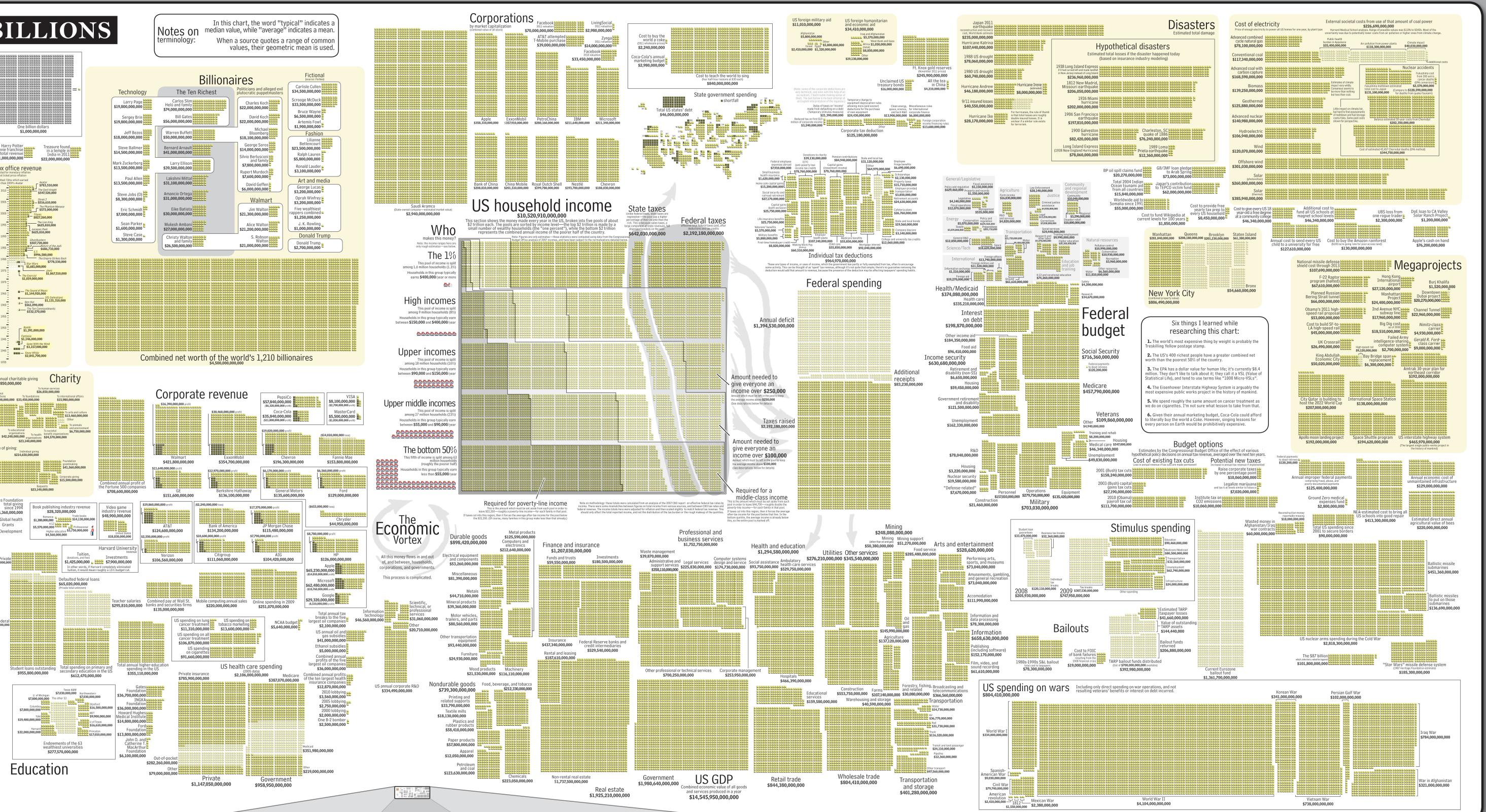
## DOLLARS

**THIS CHART IS ENTIRELY IN 2011 DOLLARS**  
Every value associated with a year before 2011 was adjusted for inflation using the Consumer Price Index.  
Nearly every amount has a cited source—when possible.

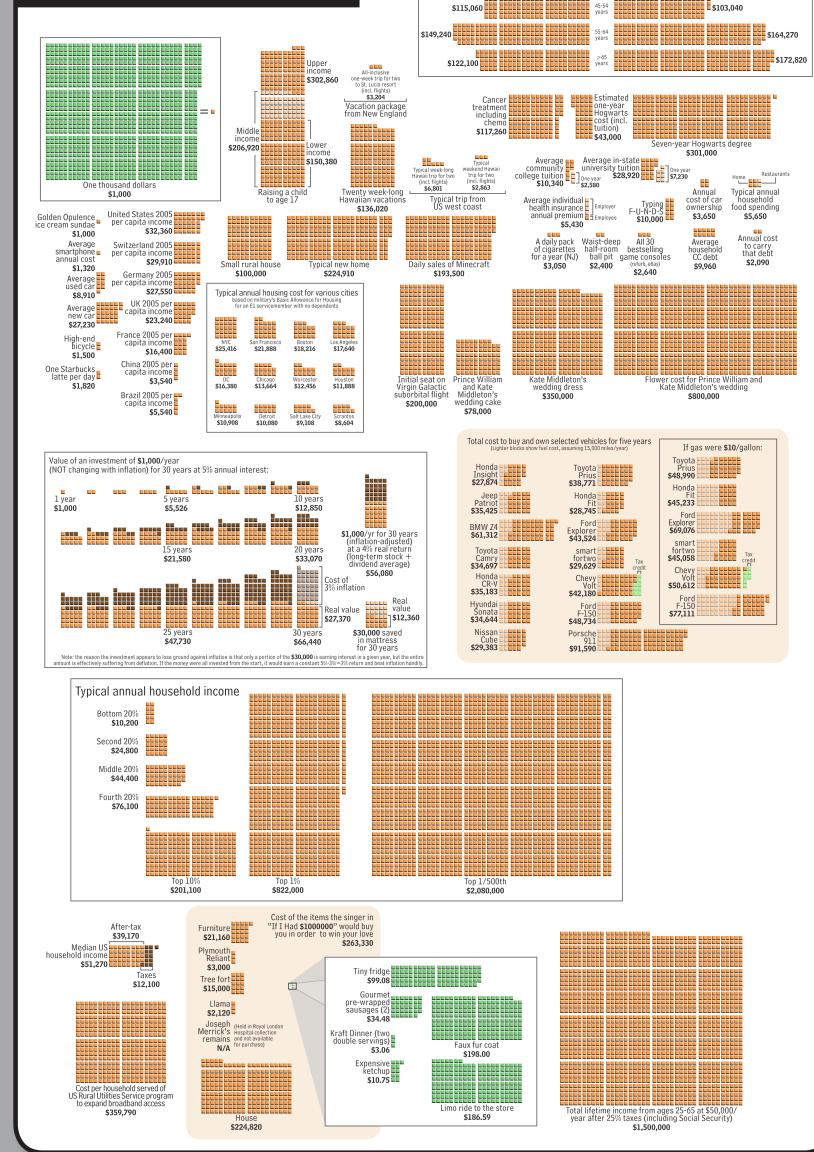


## ILLIONS

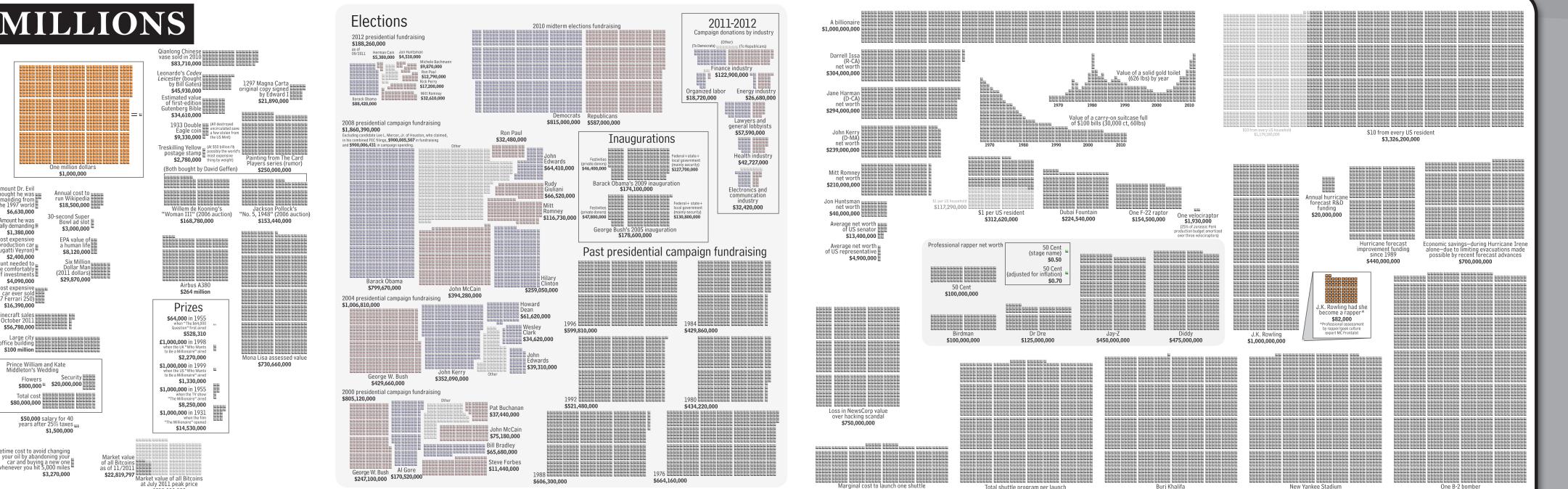
**Notes on terminology:** In this chart, the word "typical" means median value, while "average" means mean value. When a source quotes a number, it is usually the mean value.



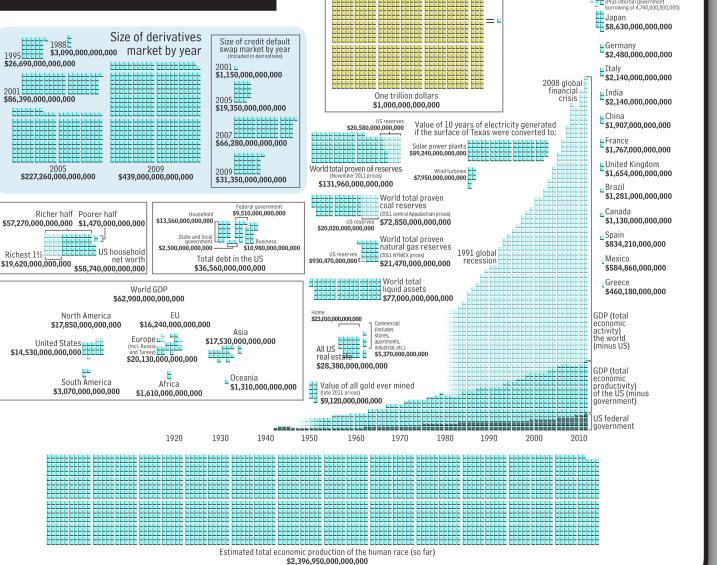
## THOUSANDS



## MILLIONS

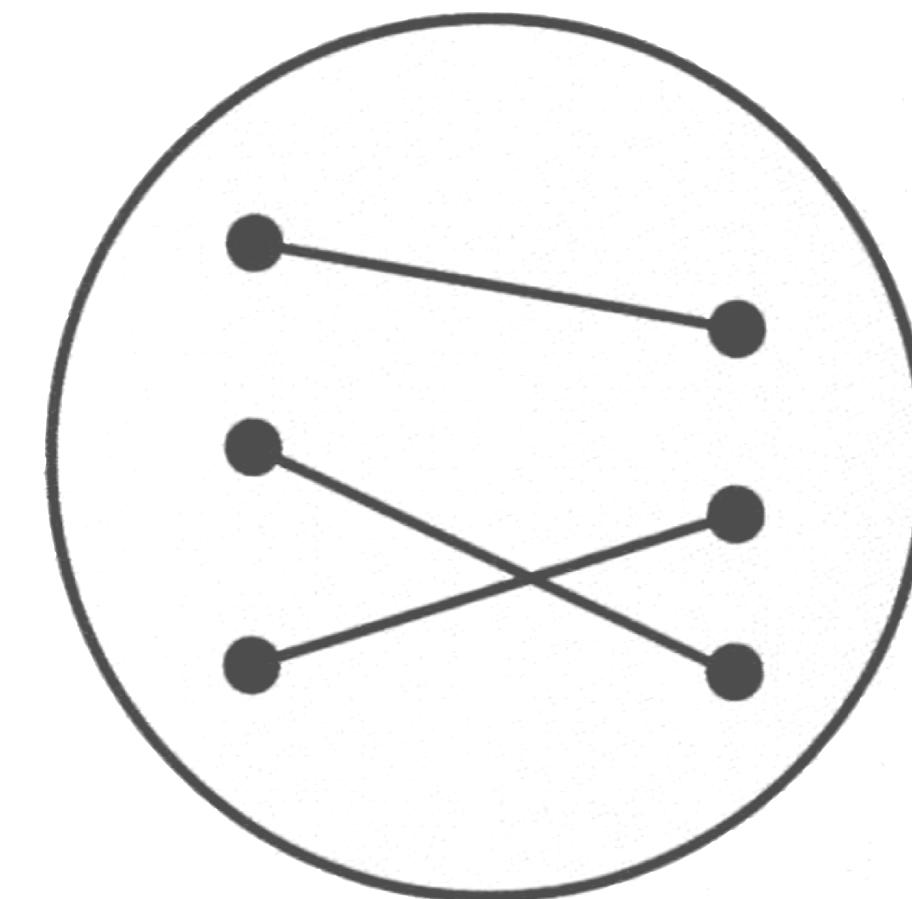


## TRILLIONS

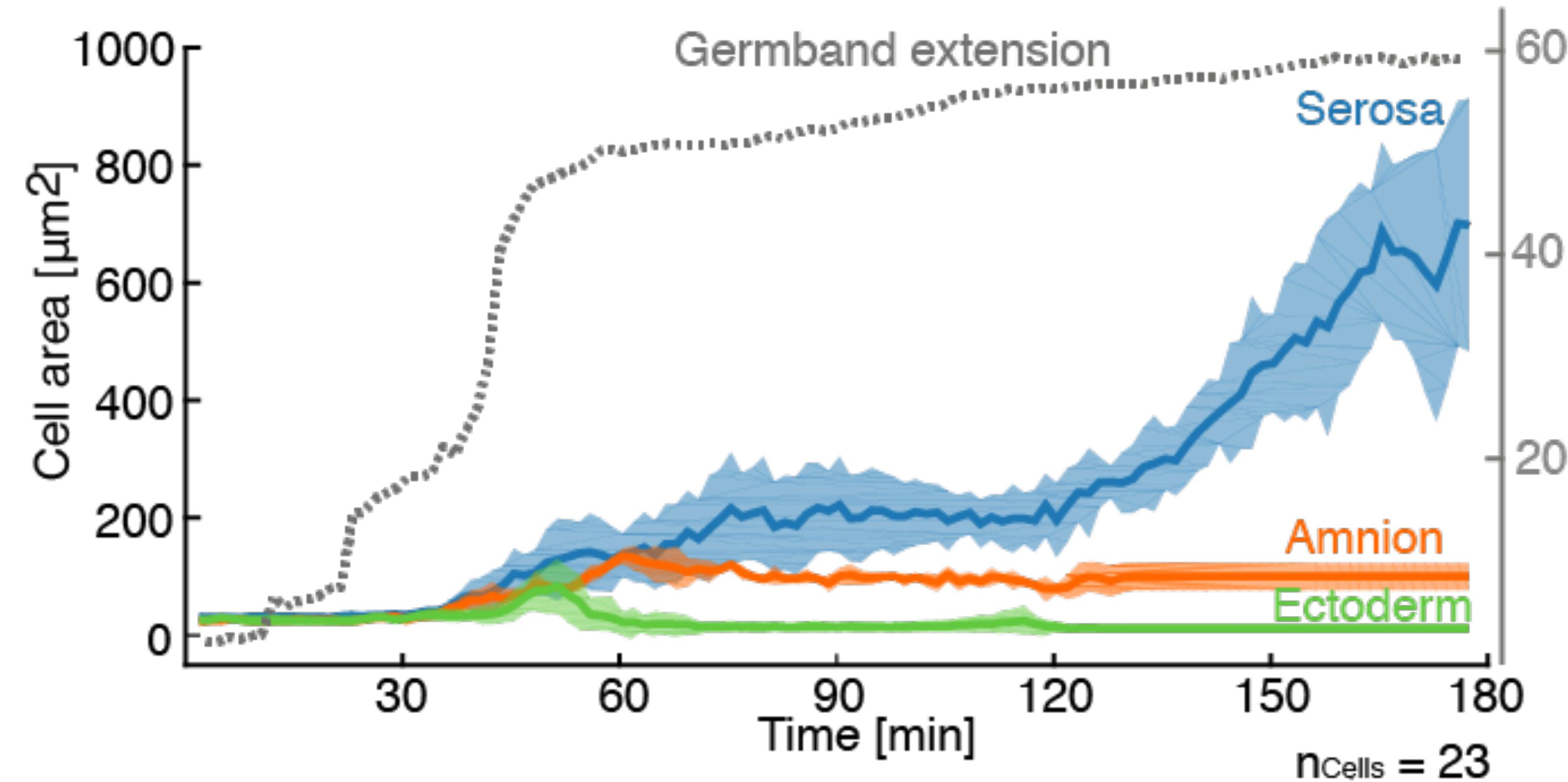


# CHANGE OVER TIME

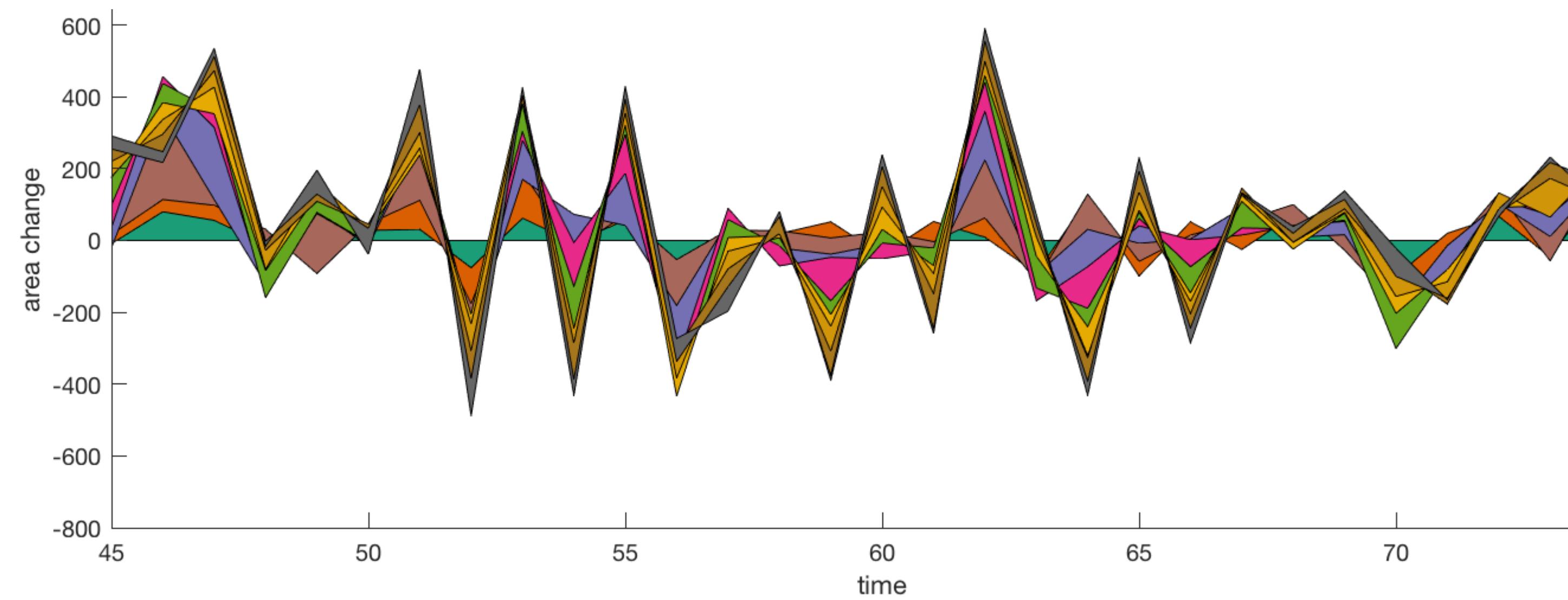
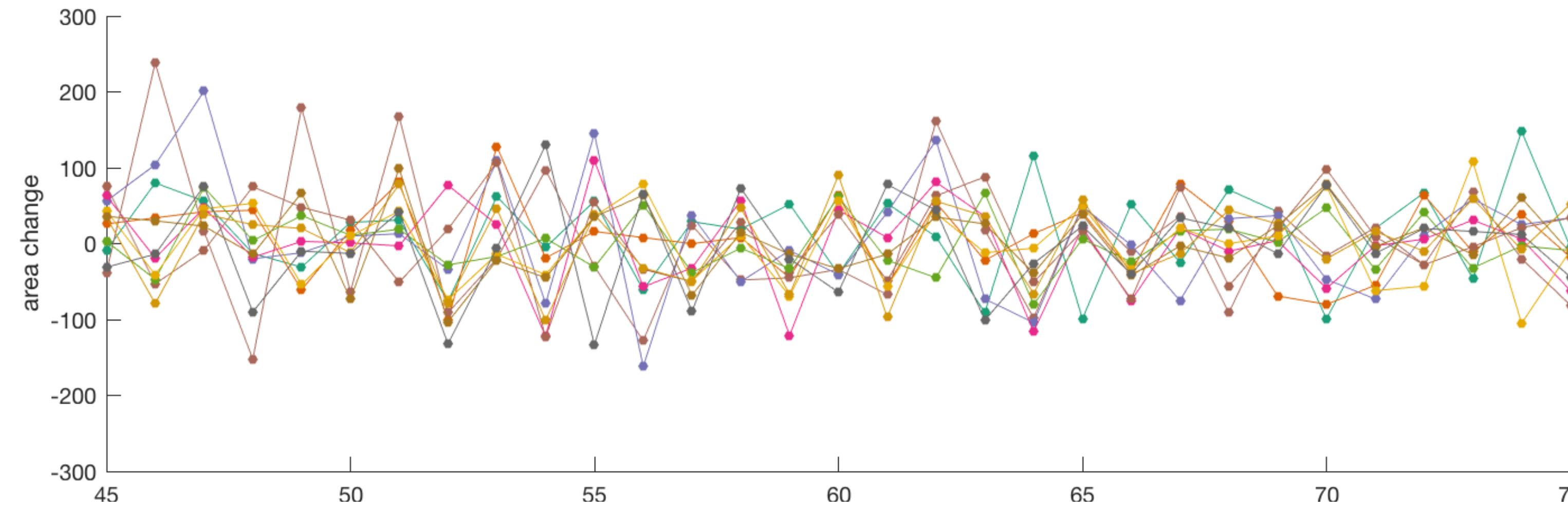
Line, column, slope, area



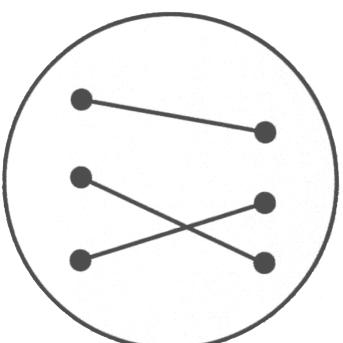
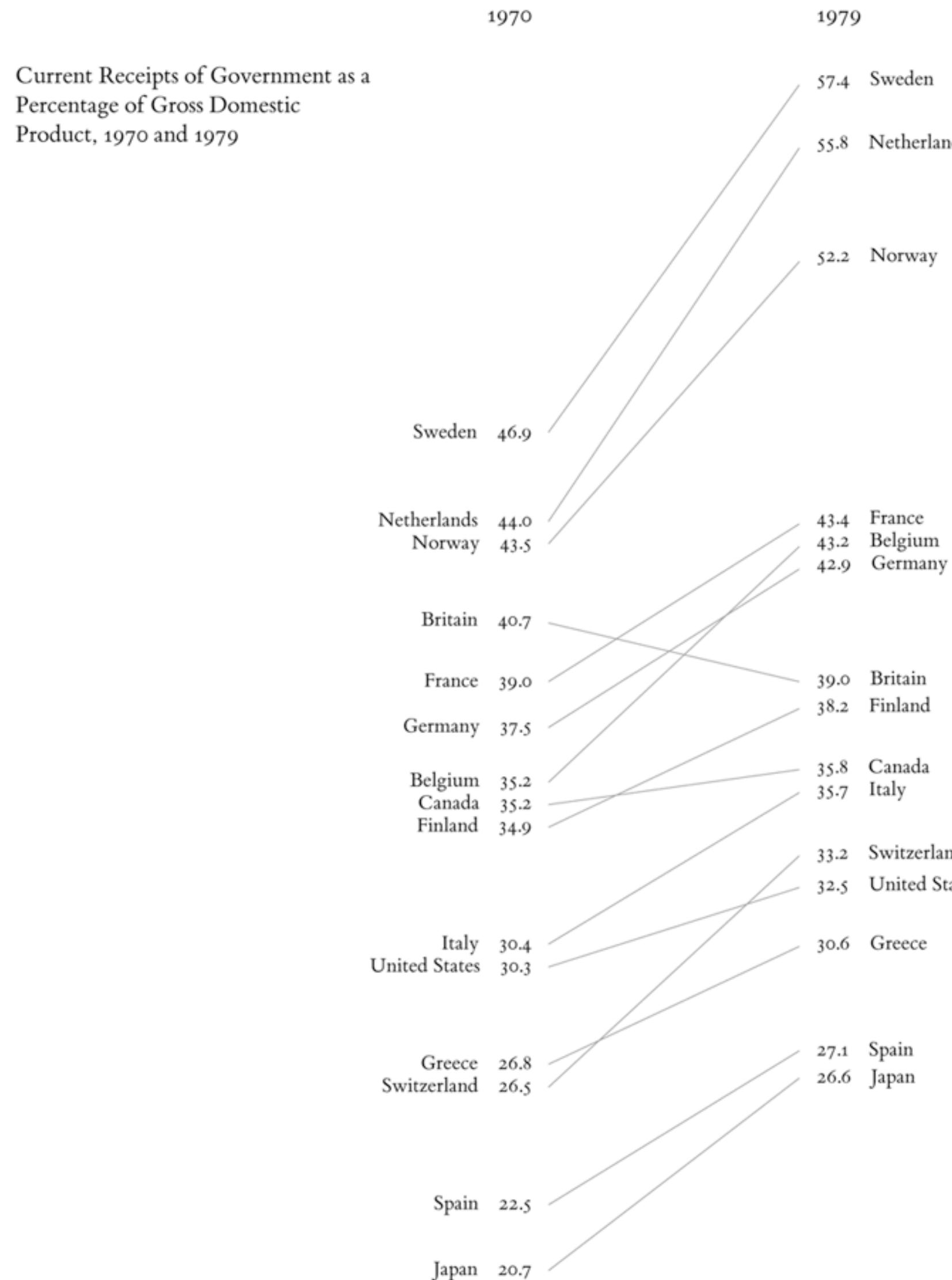
# LINE CHART



# AREA PLOTS

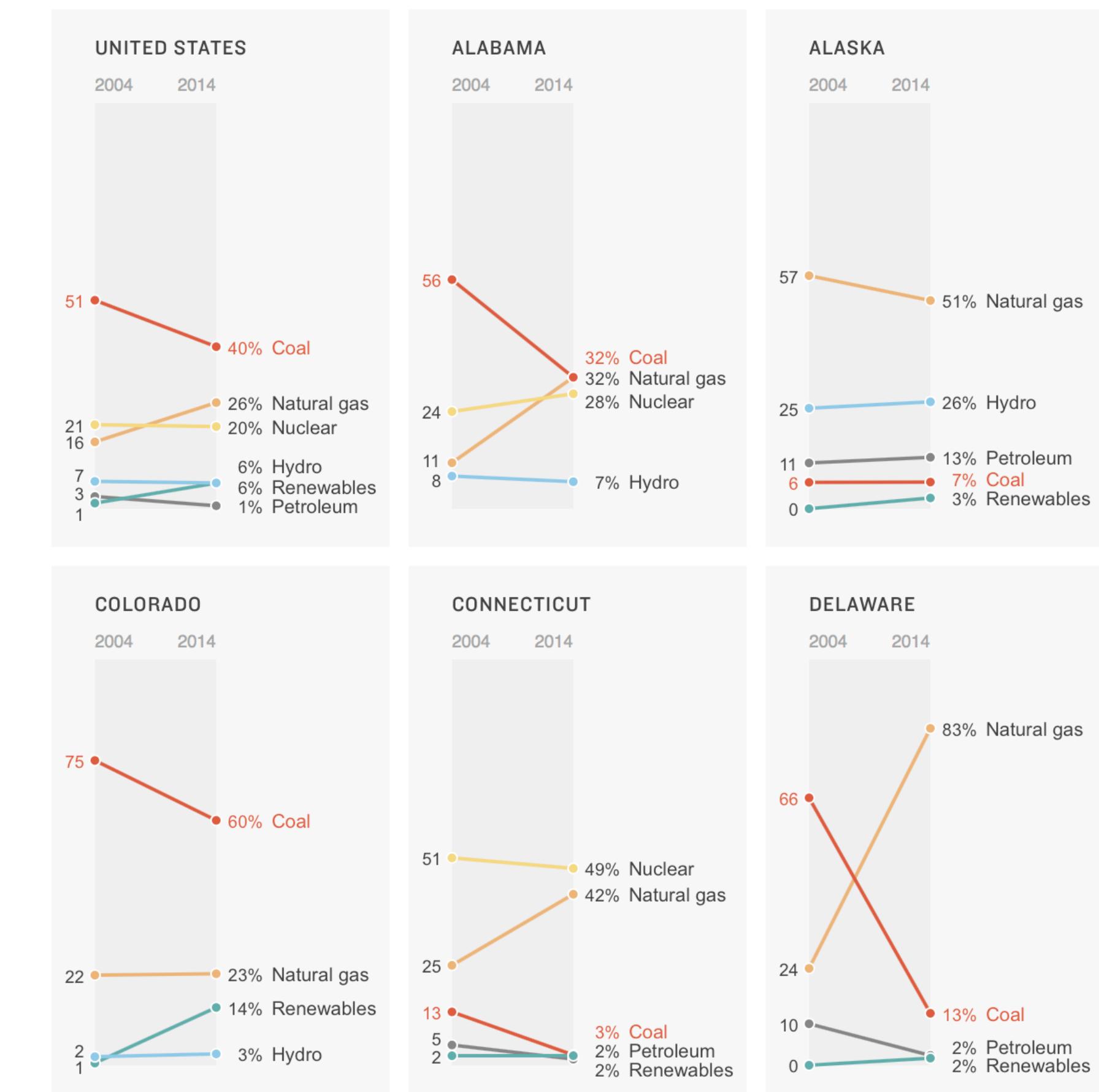


# SLOPEGRAPHS



Tufte, Edward. *The Visual Display of Quantitative Information*. Cheshire, Connecticut: Graphics Press: 1983

## How Each State Generates Electric Power (2004-2014)

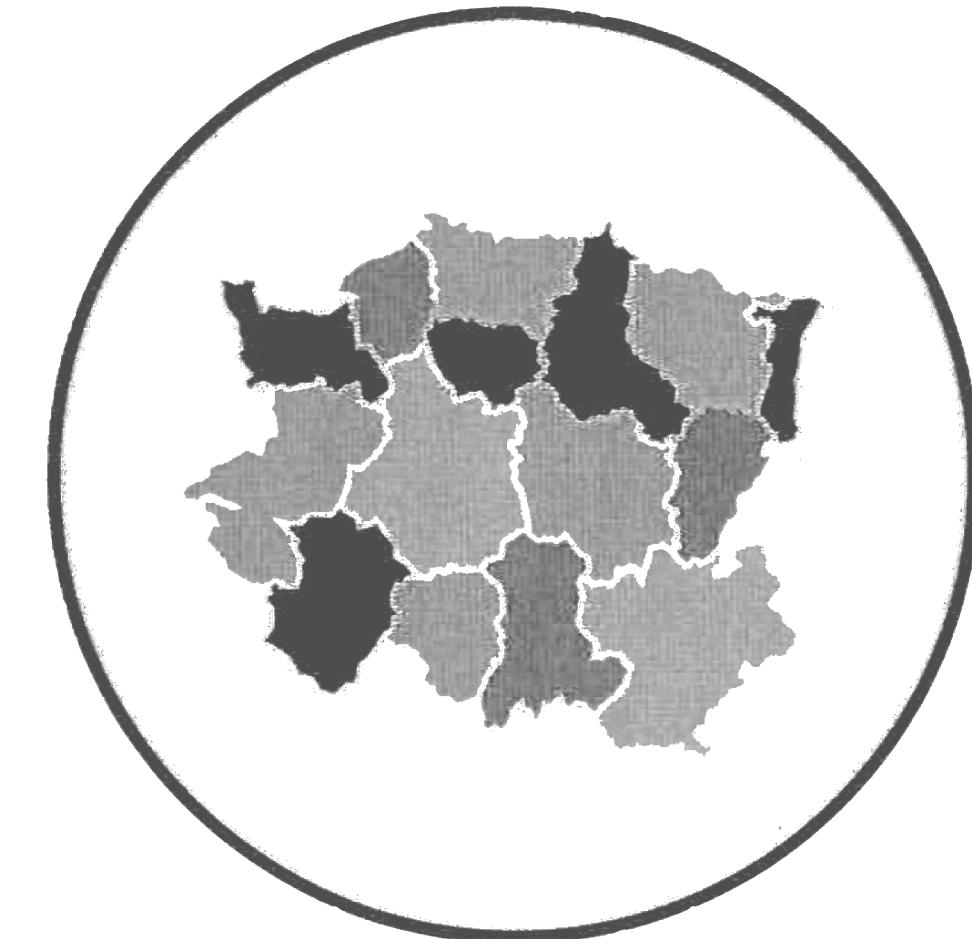


# SPATIAL

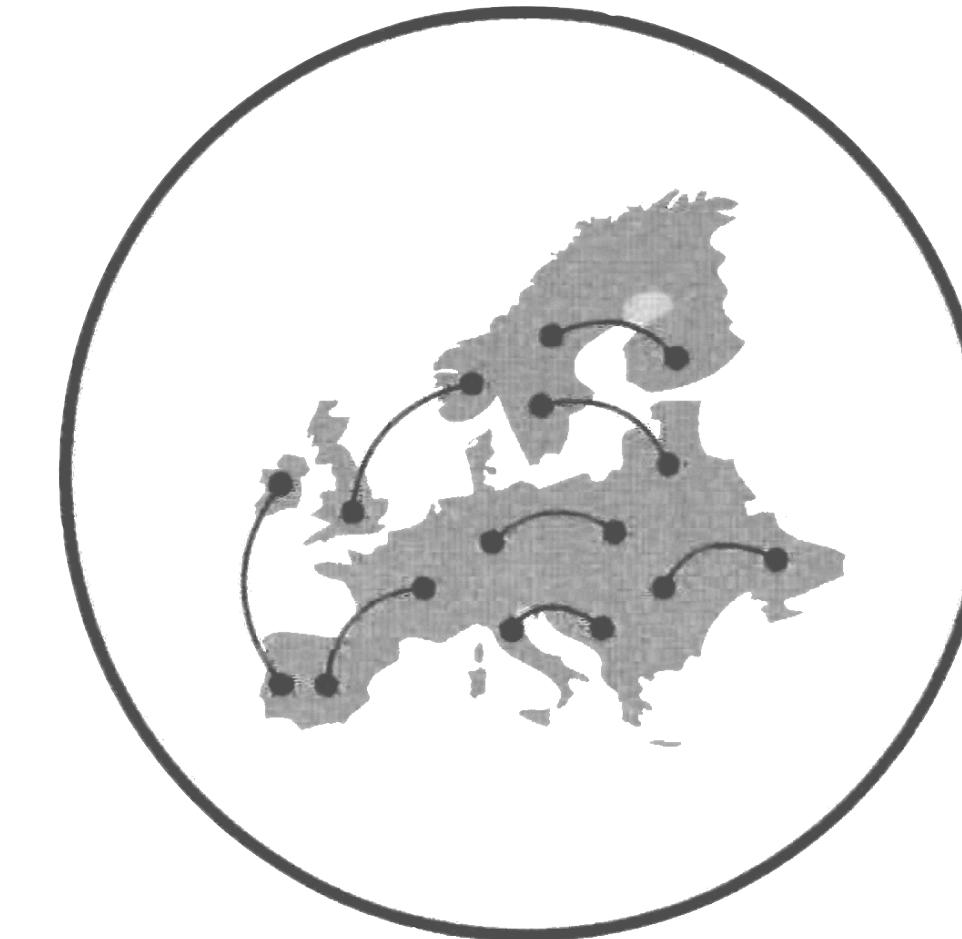
Bubble  
map



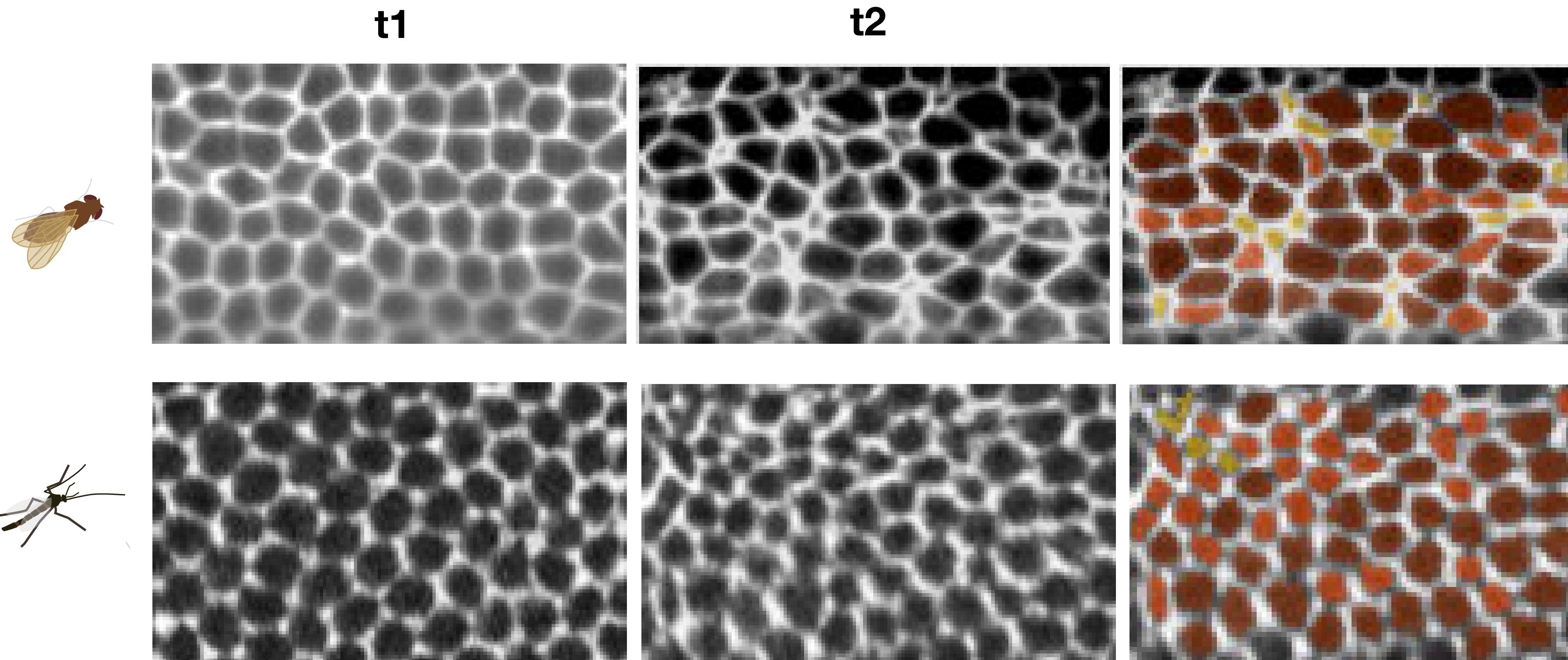
Choropleth

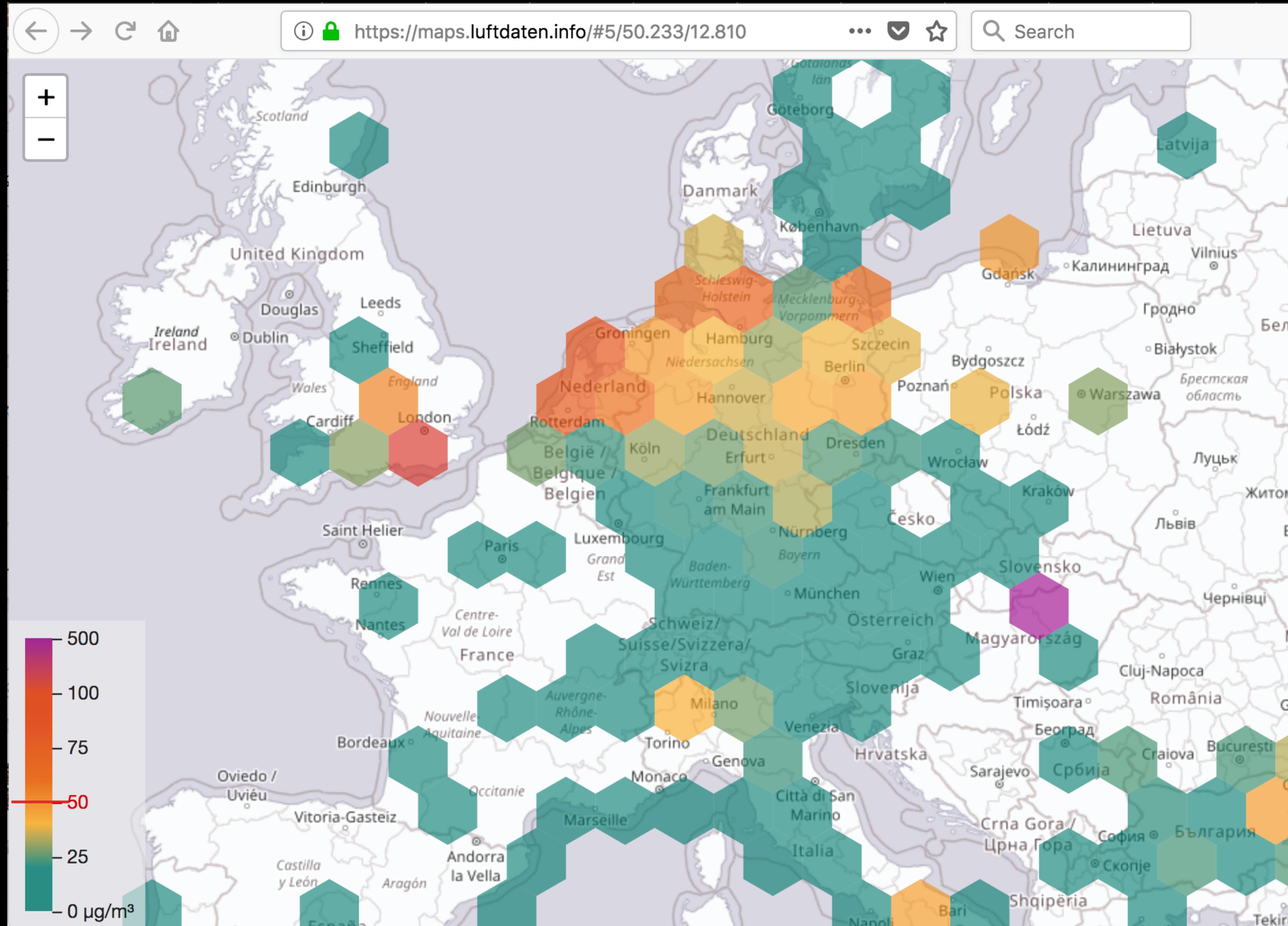


Connection  
map



# CLOROPLETH



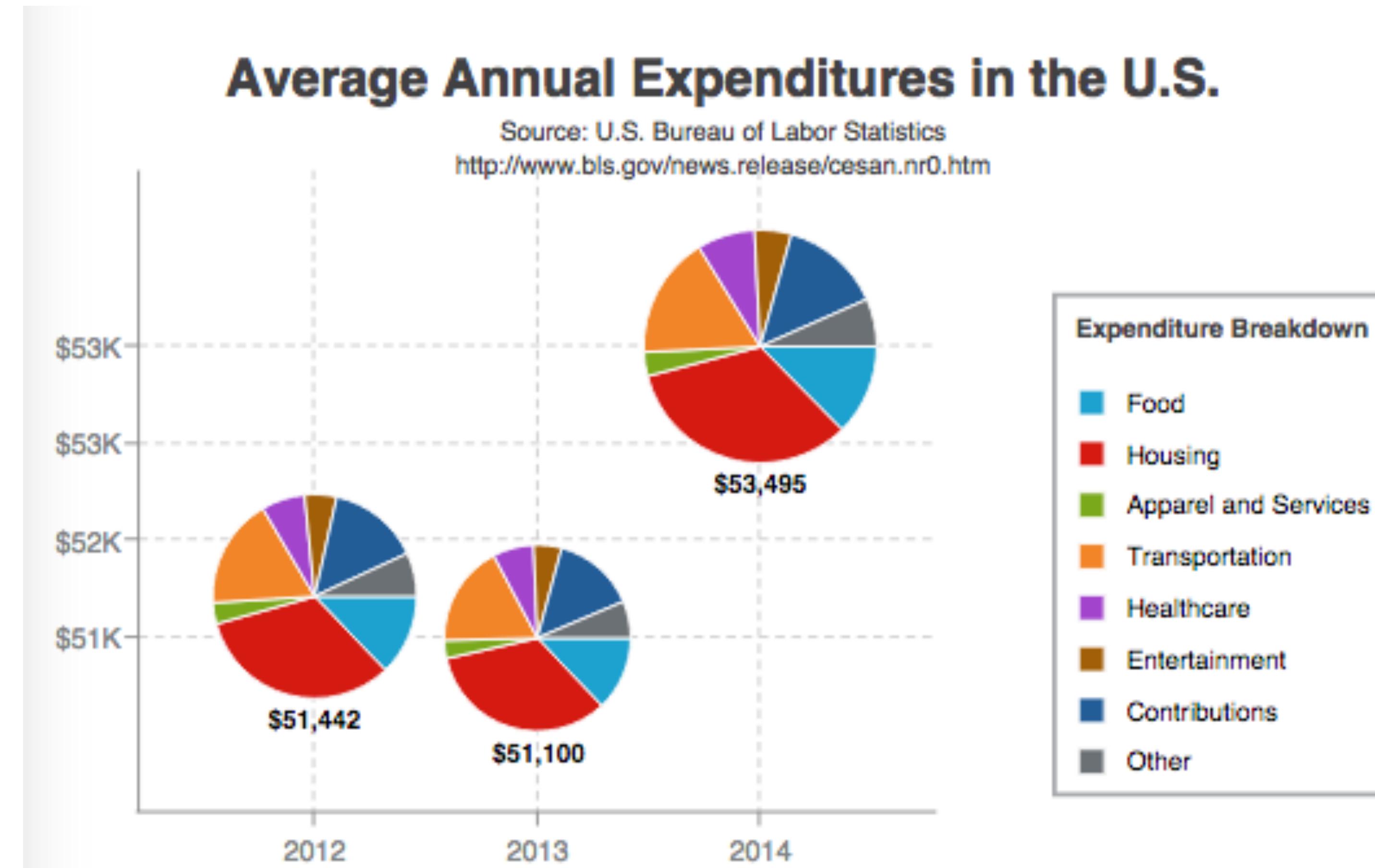


# UNDERSTAND YOUR DATA

# DEFINE YOUR MESSAGE

# CHOOSE YOUR PLOT TYPE

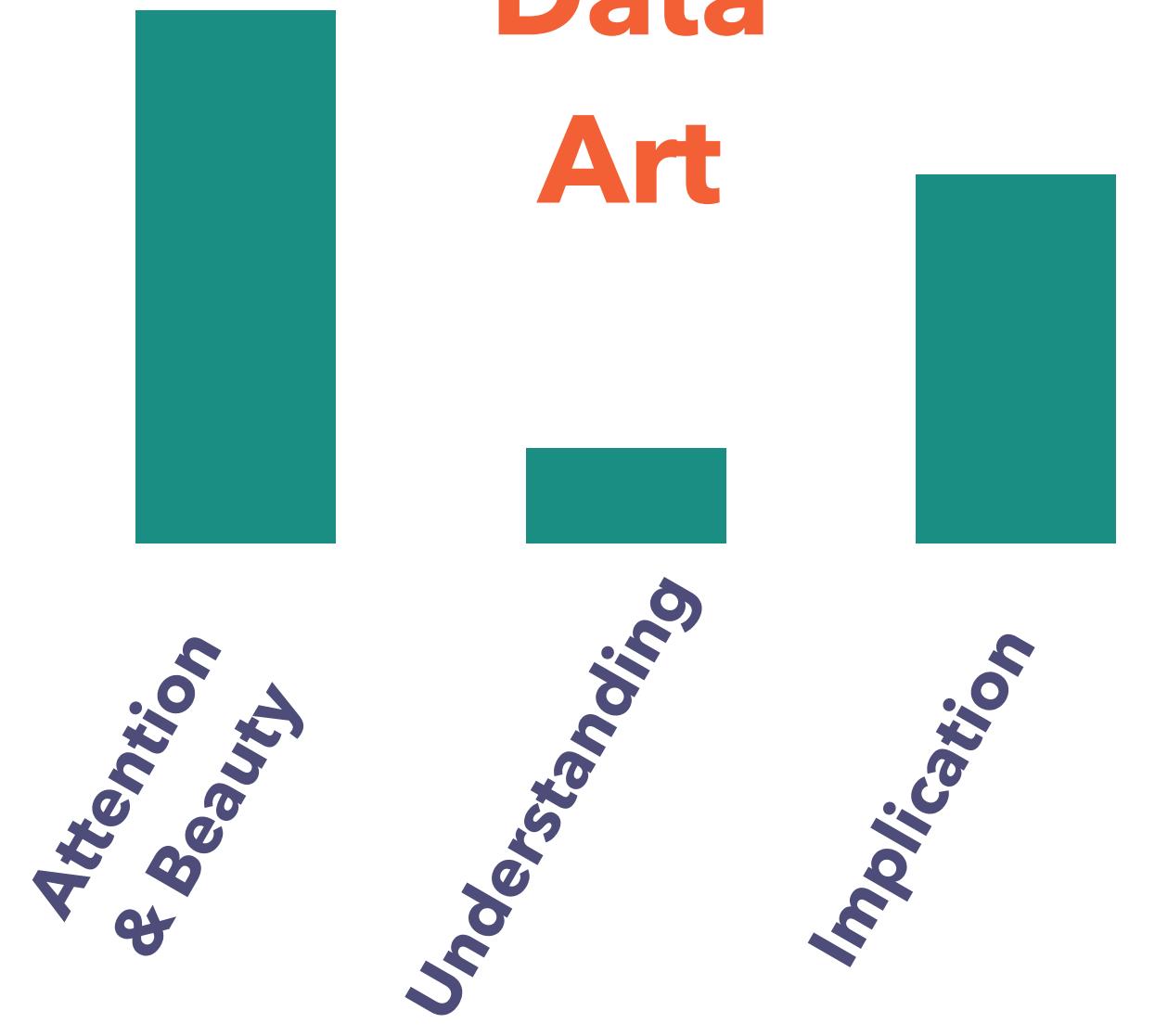
AND  
AVOID  
THIS



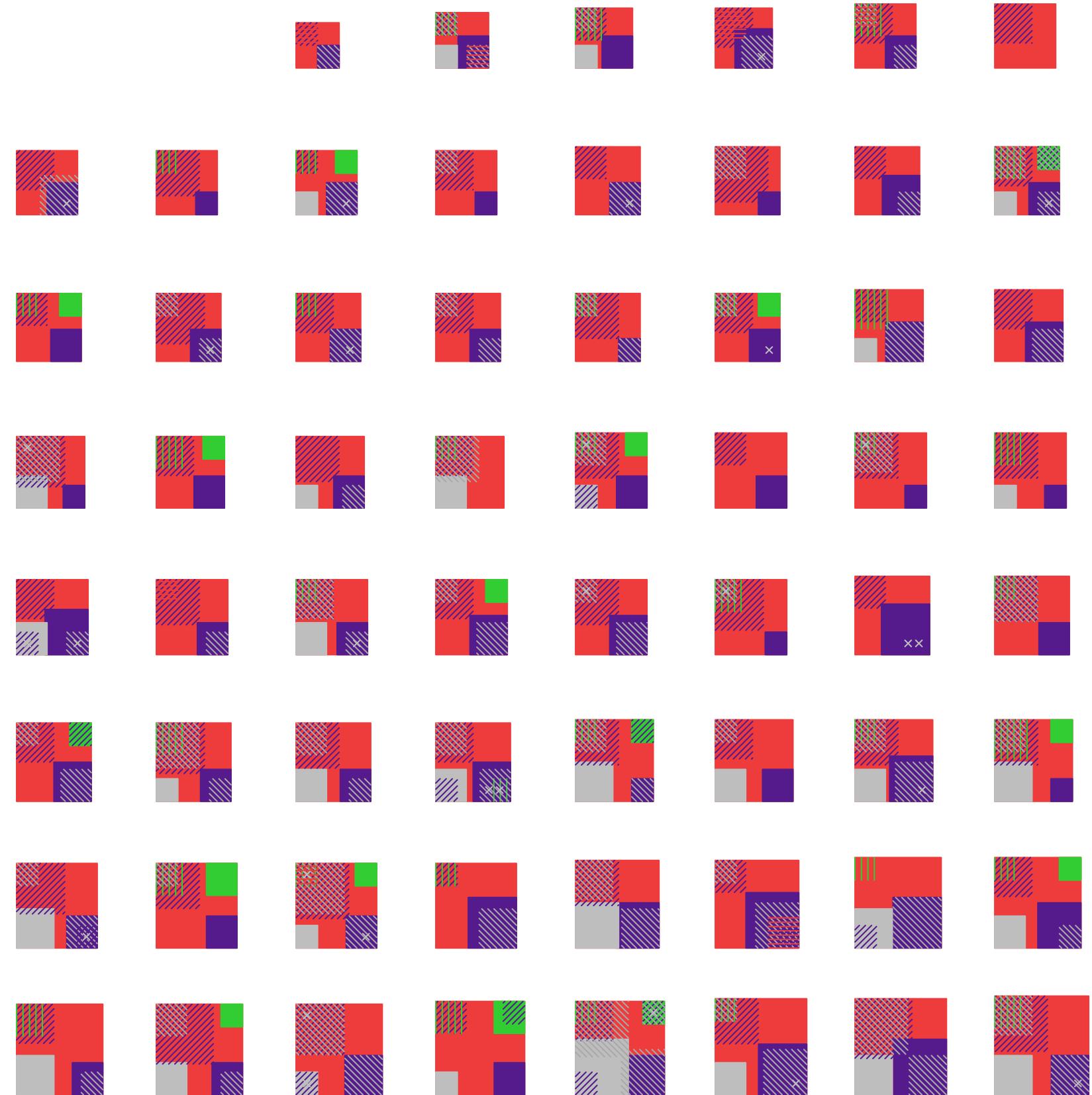
# GOING BEYOND STANDARD GRAPHS

combine, conquer and turn your data into art

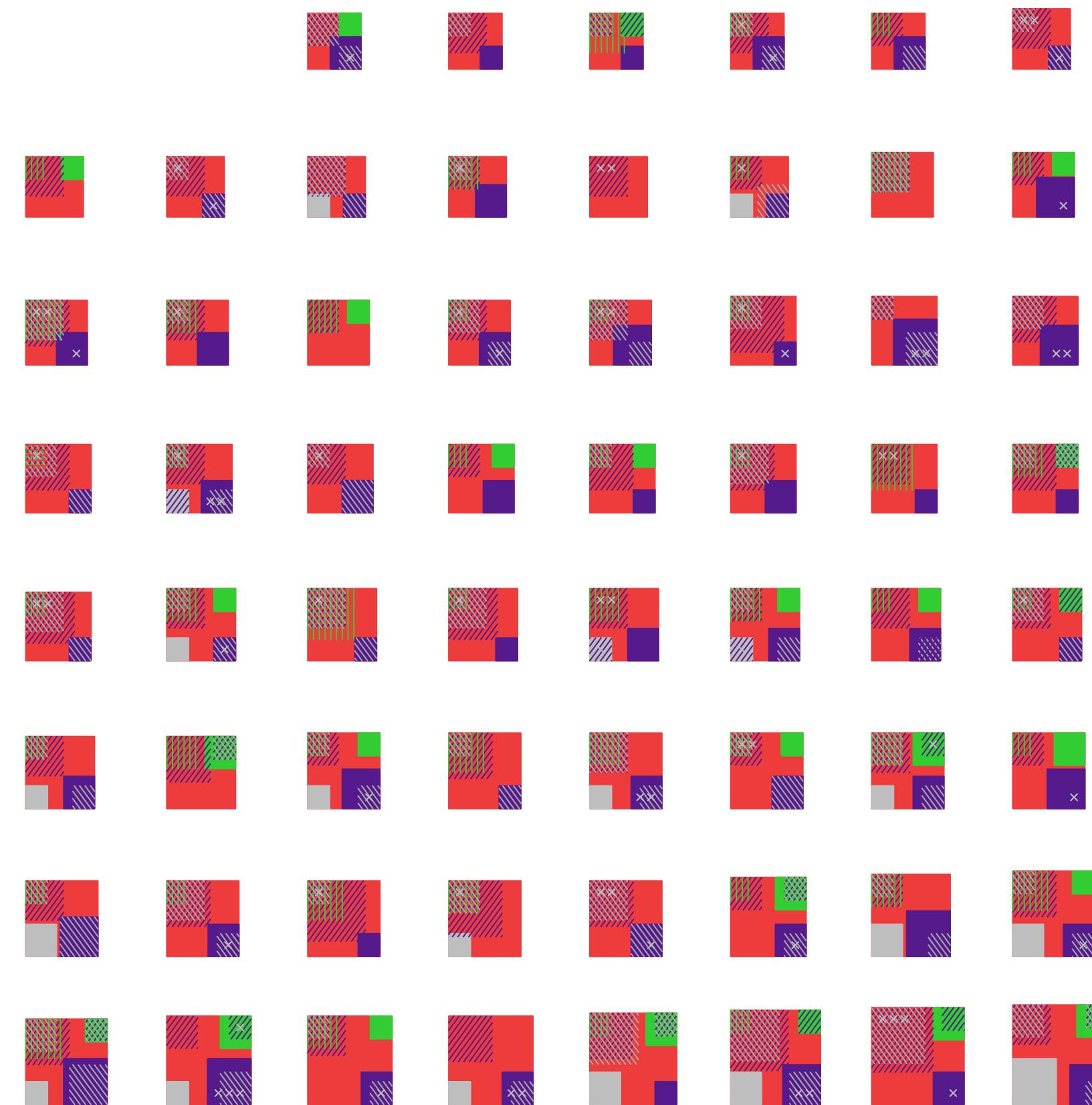
# Data Art



Spanish



German



## Syntaktische Ebenen

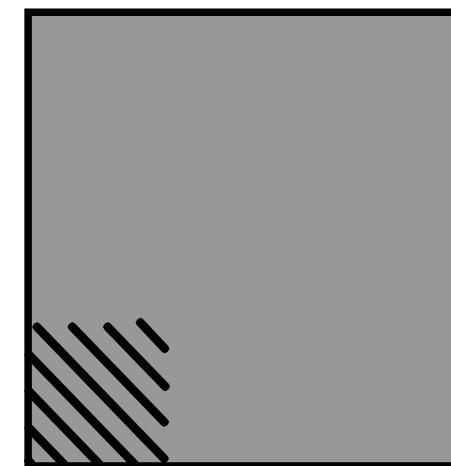
kodiert als Flächen mit Mustern



Text



Äußerung



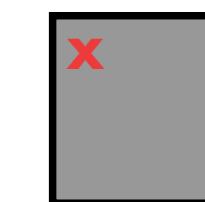
Satzteil

X

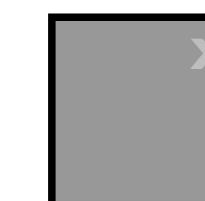
Wort

## Kombinationen

von Informationskategorien auf Äußerungs- und Wortebene



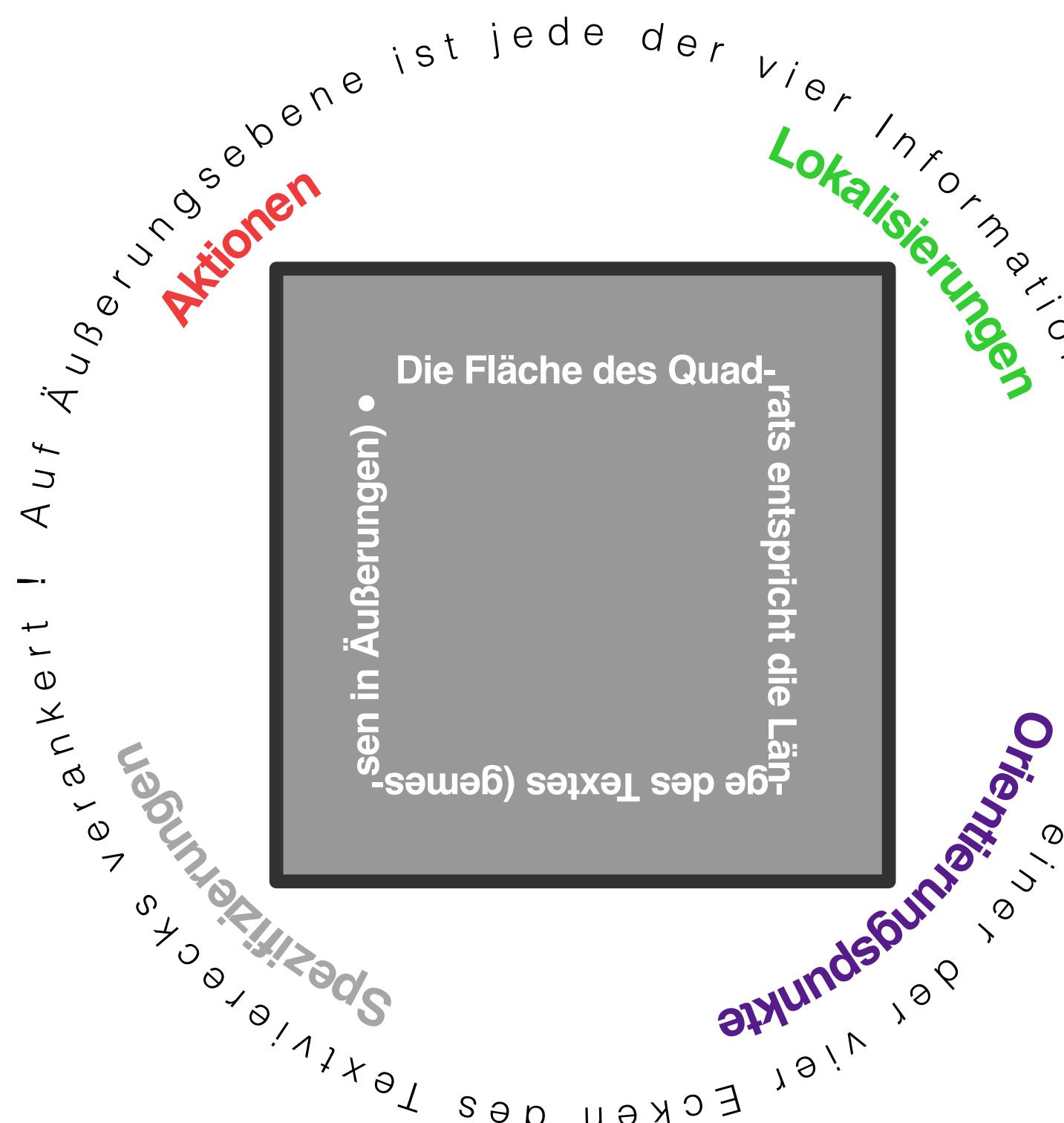
Nach dem Durchqueren gehen Sie weiter geradeaus.



[Man] steht dann vor einem grünen Schaukasten.

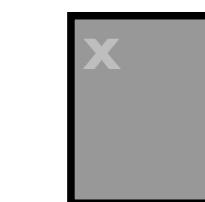
## Informationsverteilung

kodiert Position im Text

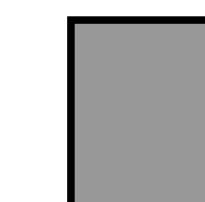


## Informationskategorien

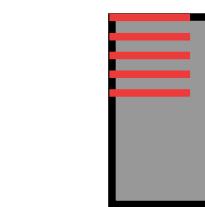
kodiert als Farben



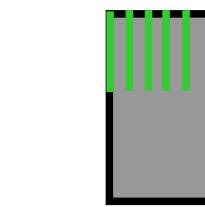
Du läufst gerade aus zur Rauchabschlusstür.



Jetzt siehst du so grüne Boxen,



Aus dem Zimmer 108 kommend gehen Sie rechts den Gang runter.



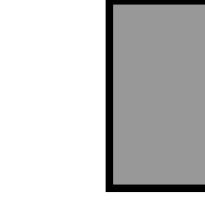
Am Ende des Ganges gehst du kurz links.



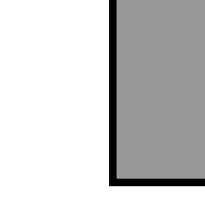
Dann musst du noch einmal durch eine Feuertür.



Du triffst auf eine weitere Tür mit der Nummer 306



Du stehst mit dem Rücken zur Tür,

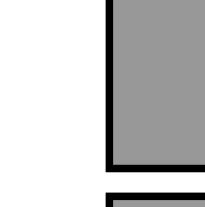


bis {Sie am Ende des Ganges vor Tür Nr. 305 stehen}.



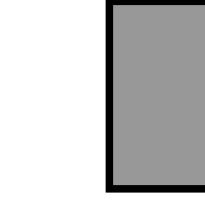
Cruzando la puerta vas a poder ver el Hall.

(Beim Durchqueren der Türe wirst du die Halle sehen können.)



Vas a ver un gran espacio con mesas.

(Du wirst ein großes Areal mit Tischen sehen)



Dann siehst du eine orangene Wand.



Das ist die [Tür] mit dem großen Rauchverbotsschild.

## Kombinationen

von Informationskategorien auf Äußerungs- und Satzebene

GIORGIA

week forty-two



66 Dear Data  
WEEK 42: Laughters!

HOW TO READ IT:

this week I was in Italy, I tracked all of the laughters I had and I provoked, and noticed also the "big" ones I heard from others.

Each element is a PERSON:

Boyfrnd  
mum  
dad  
grandma  
in-laws  
grandma friends

friends in my home town  
ex boyfriend  
toddler  
others (other people/not friends)

Accurat, guys!  
you!  
(via txt)

(the biggest =  
the biggest  
laughter)

friends  
in NY  
via txt!

you!  
(via txt)

(the biggest =  
the biggest  
laughter)

friends  
in NY  
via txt!

red dot =  
collective  
laughters

blue dot =  
it was a  
manifest

LAUGH

LAUGHING  
WITH  
PEOPLE  
(GENERALLY IN FUN!)

LAUGHING  
AT  
PEOPLE

LAUGHING  
WITH  
CONTACT

LAUGHING  
WITH  
FRIENDS  
(GENERAL  
CONTACT)

LAUGHING  
WITH  
STUDIO  
MATES

LAUGHING  
WITH  
DEAR DATA

LAUGHING  
WITH  
HUSBAND

LAUGHING  
WITH  
PARENT

LAUGHING  
WITH  
SCHADEN  
FREUDE

LAUGHING  
WITH  
PHONE  
AUTOCORRECT

LAUGHING  
WITH  
YOU!

SET TO:

STEFANIE POSAVEC

UK

ENGLAND

When data-gathering gets in the way: Giorgia laughs and then has to report it. So, is she fully enjoying her cheerful moments as they pop up?

a week of laughters

Stefanie



DEAR DATA - WEEK 42

FOR A CARD ABOUT LAUGHTER I AM SAD ABOUT HOW THIS CARD TURNED OUT

ABOUT THE DATA: I TRIED TO CAPTURE MY LAUGHS WHICH WAS REALLY HARD + GOT IN THE WAY OF ENJOYING LIFE, HENCE THE DATA VOIDS :)

HOW TO READ IT:

IN CHRONO ORDER

START

END

MARKERS INDICATE END

OF ONE DAY + BEGINNING OF

OTHER. IF MARKER IS

IN PEN

IT MEANS I HAD A

DATA VOID DUE TO THE FOLLOWING:

DRINKING W FRIENDS, MY BDAY!!

MY B-DAY DINNER

DATA VOID WITH:

MYSELF

MY HUSBAND

FRIEND

STUDIO MATES

DEAR DATA

HUSBAND

ANIMAL

PARENT

SCHADEN FREUDE

PHONE AUTOCORRECT

YOU!

WHO I WAS WITH

WHAT I WAS LAUGHING ABOUT

EACH O REPRESENTS

A LAUGH OR

MOMENT OF

LAUGHTER.

ALL LAUGHS ARE

DRAWN IN CHRONO-

LOGICAL ORDER FROM

L-T-R AS IF YOU'D

READ A BOOK.

LAUGHING WITH:

MYSELF

MY HUSBAND

FRIEND

STUDIO MATES

DEAR DATA

HUSBAND

ANIMAL

PARENT

SCHADEN FREUDE

PHONE AUTOCORRECT

YOU!

LAUGHING WITH:

LAUGHING THEM!

LAUGHING WITH

CONTACT

LAUGHING WITH

YOU!

LAUGHING WITH

CONTACT



Giorgia Lupi & Kaki King – **Bruises: The Data We Don't See**