Plot type specific considerations

V2017-06

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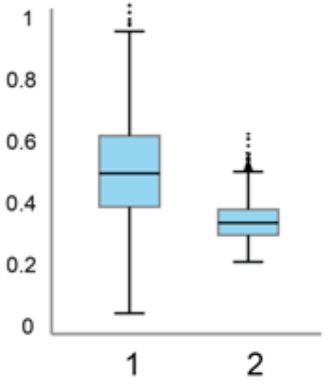
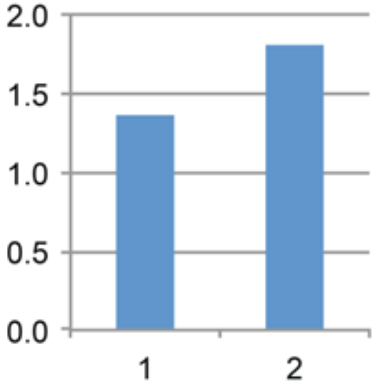
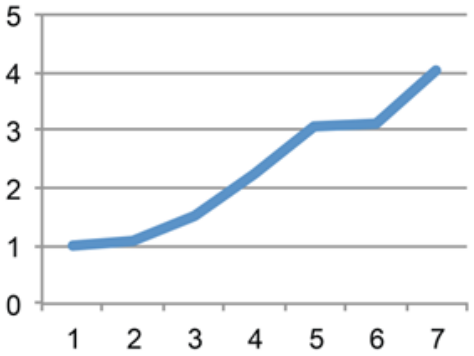
Types of plot
Things you can illustrate



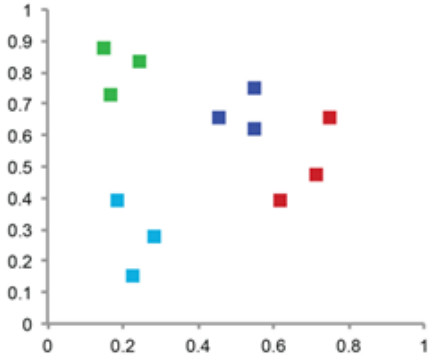
Distribution



Comparison



Relationship



Composition

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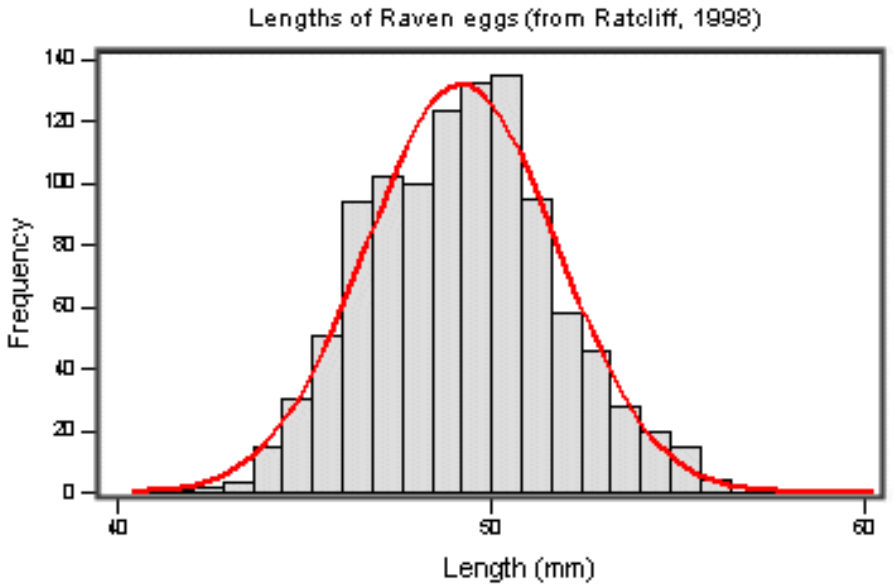
Plot types – Distribution/Exploration

Histograms



- **<u>Very good for</u>** exploring data. Better on big dataset.
- Rules: Number of intervals ≈√*N* and Interval width ≈ Range ÷√*N*
- **Histograms are great but** careful with the resolution (= number of bins) as it affects the shape of the distribution.

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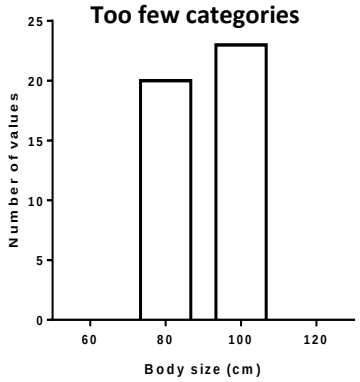
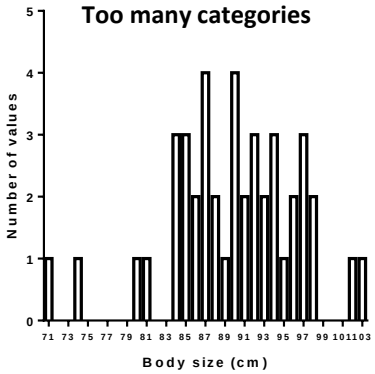
Plot types – Distribution/Exploration

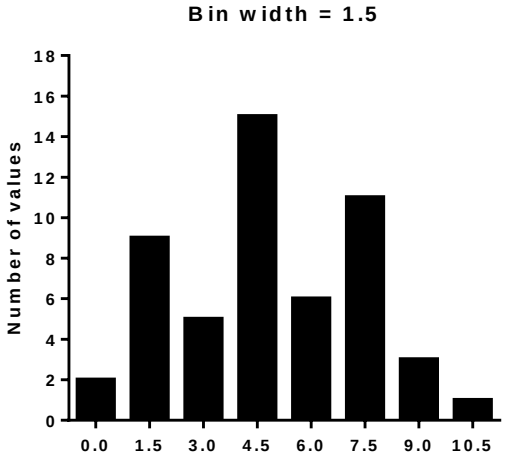
Histograms

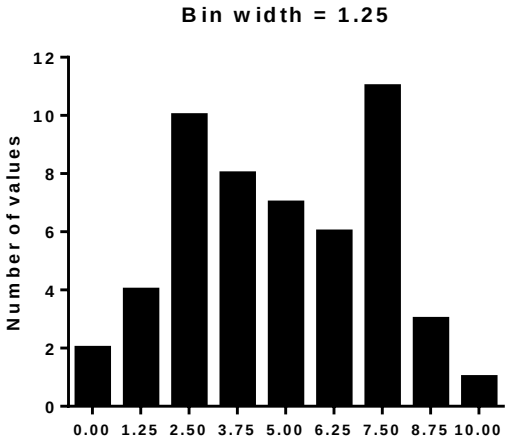
- Be careful with the resolution …

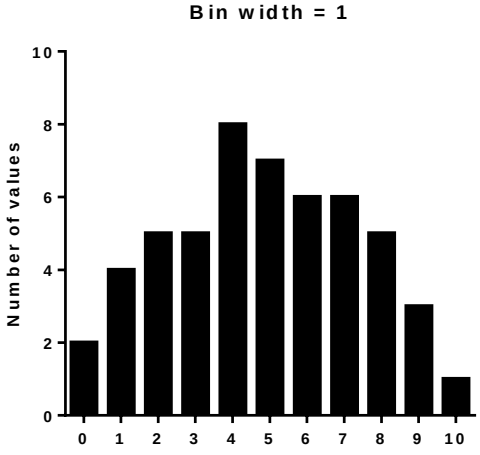




… and the type of data you are dealing with.







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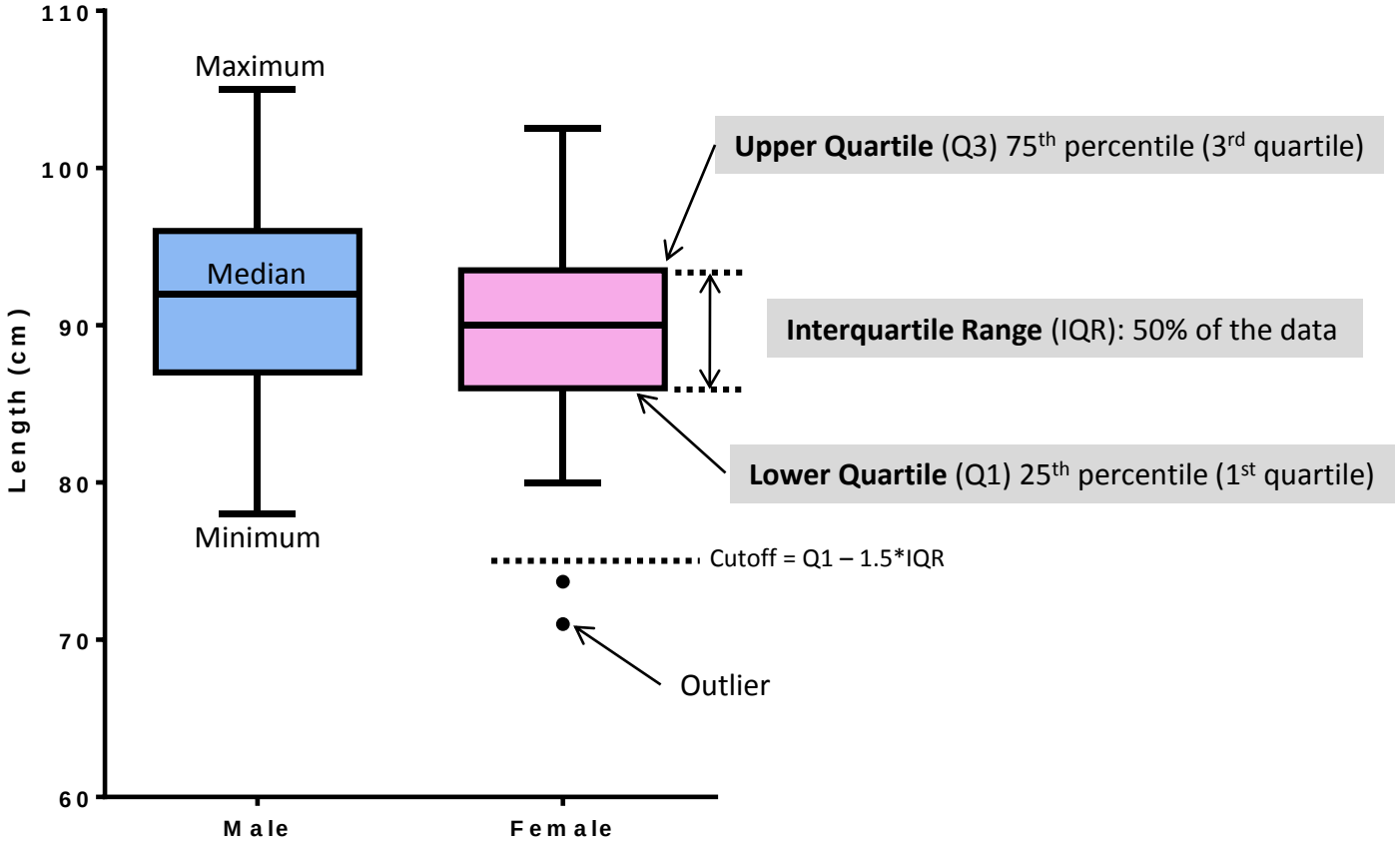
- **Histograms are great <u>but</u>** careful with discrete data.

Plot types – Distribution/Exploration

Boxplots and Bean plots



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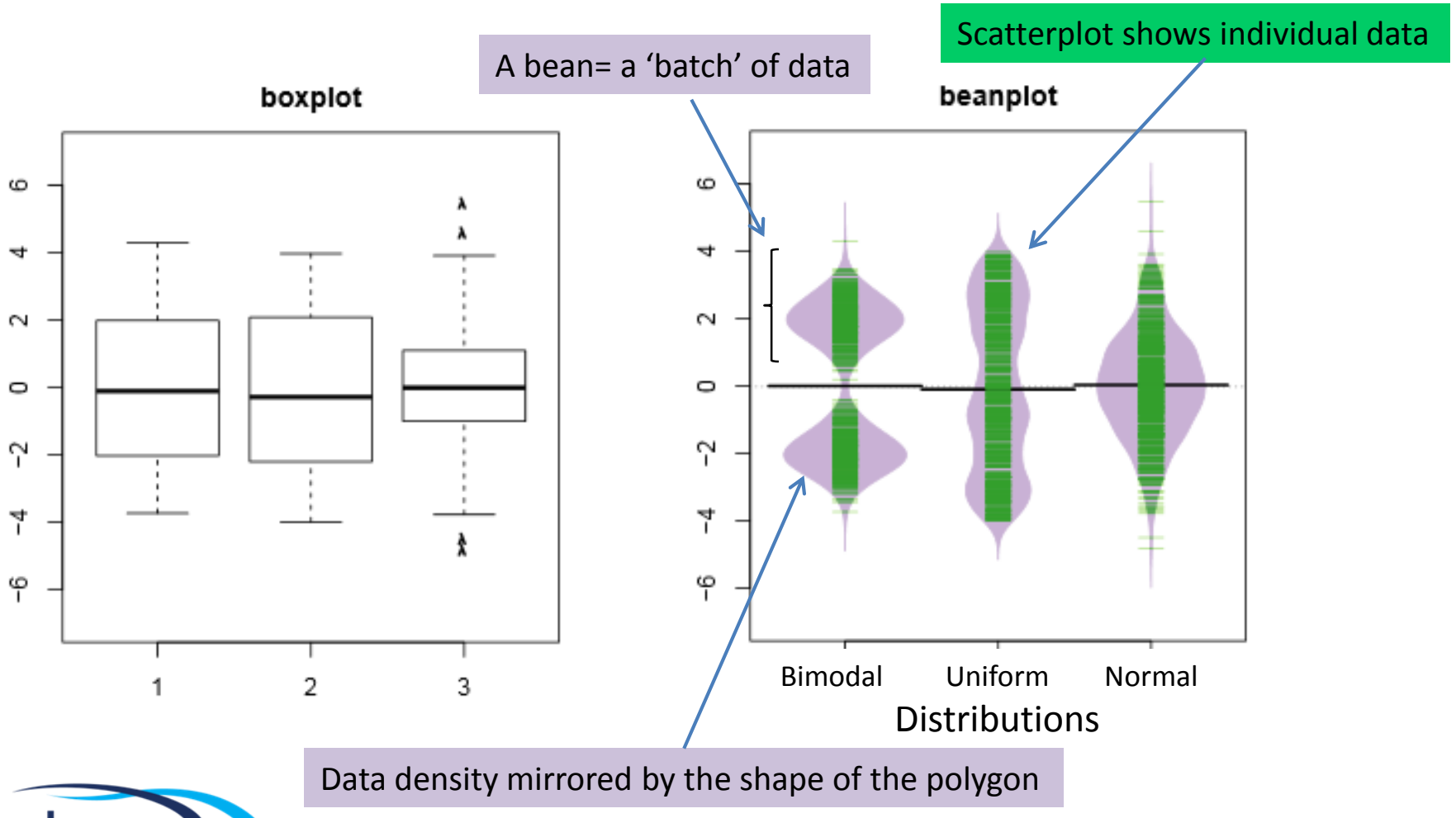
Plot types – Distribution/Exploration

Boxplots and Bean plots



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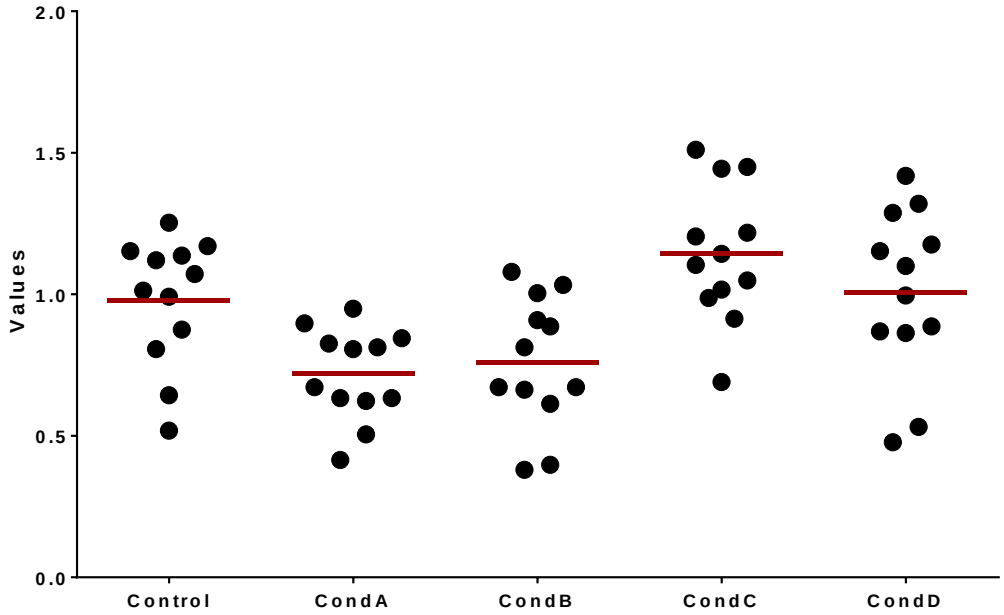
- **Very good for** exploring data. Better on medium size dataset.
- **Boxplots are great but** be careful with underlying distribution.

Plot types – Exploration/Comparison

Stripcharts/Scatterplots



- **Very good for** exploring data. Better on small/medium dataset (up to 100-ish).
- Very informative: exploration AND comparison.
- Very hard to cheat with these.
- **Stripcharts are great but** they don't work so well with big samples.

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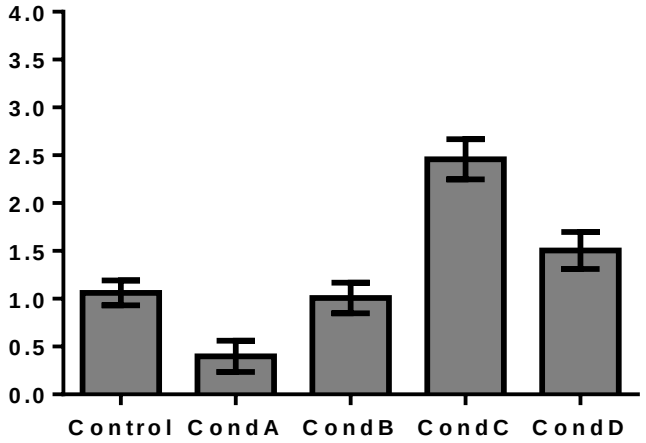
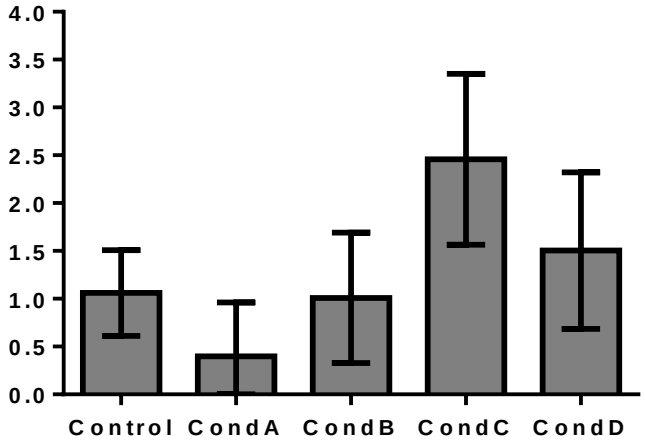
Plot types – Comparisons

Barcharts *(not for exploration!)*

Standard error



Standard deviation



- **<u>Very good for</u>** presenting results and emphasizing differences.
  - Effectiveness: most important info with the most effective channel.
- **Barcharts are great <u>but</u>** higher bars get more attention.

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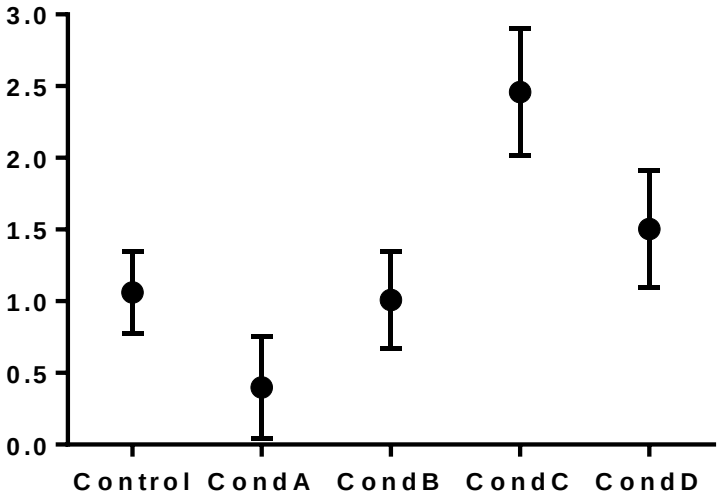
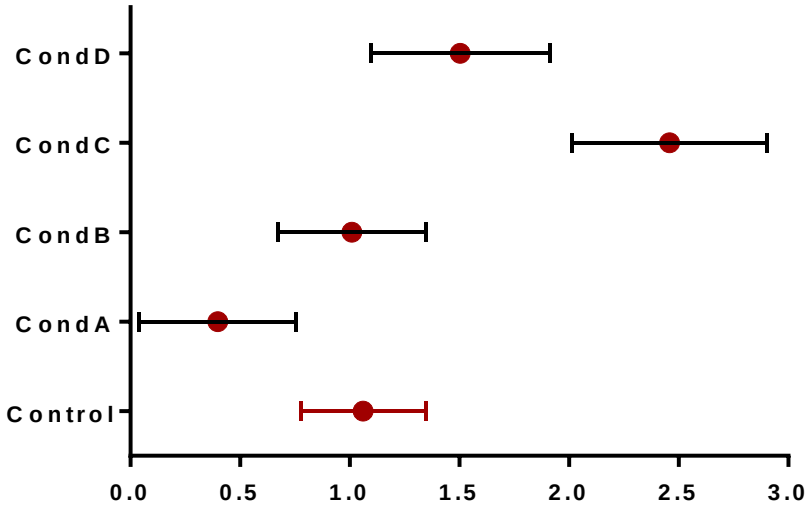
Plot types – Comparisons
Alternative to **Barcharts**

Confidence interval



Star wars



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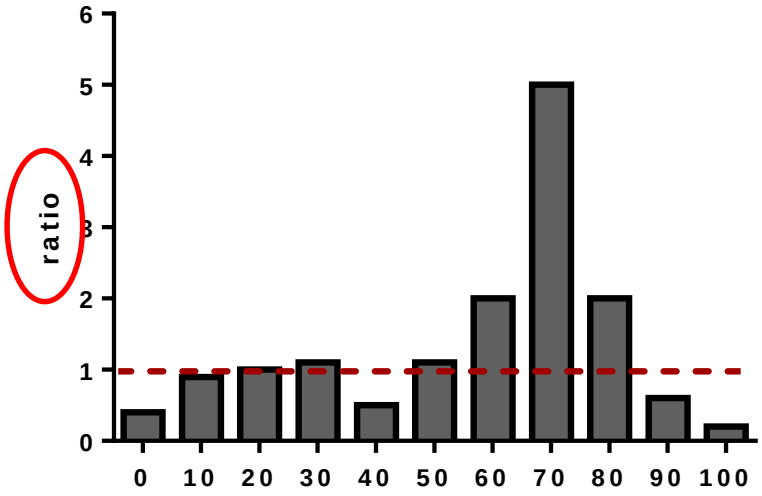
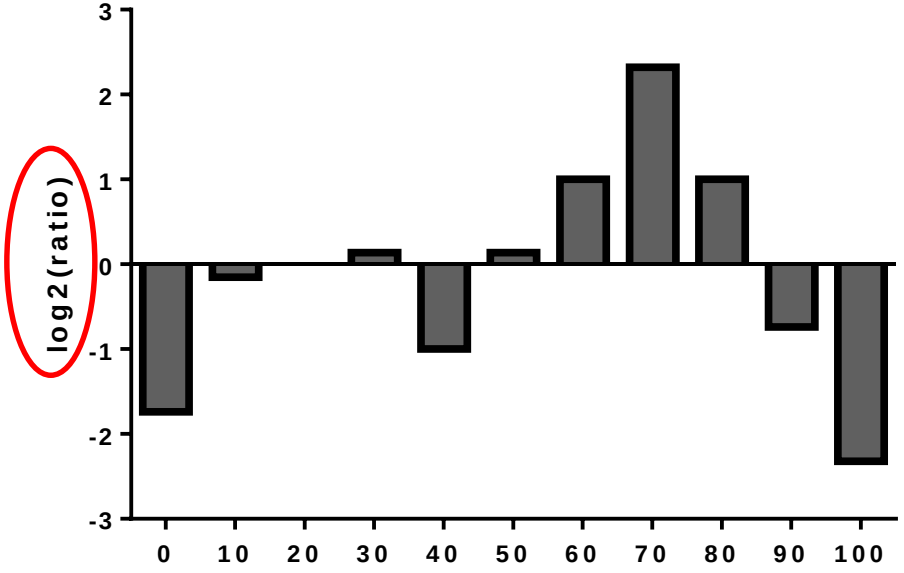
Plot types – Comparisons
Barcharts

- Be careful with the scale when plotting ratio





- **<u>Very good for</u>** presenting results and emphasizing differences.
- **Barcharts are great <u>but</u>** after data exploration and the y-axis needs to be chosen wisely.

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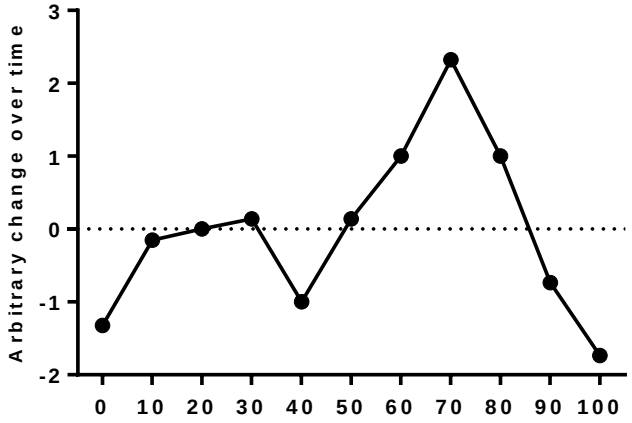
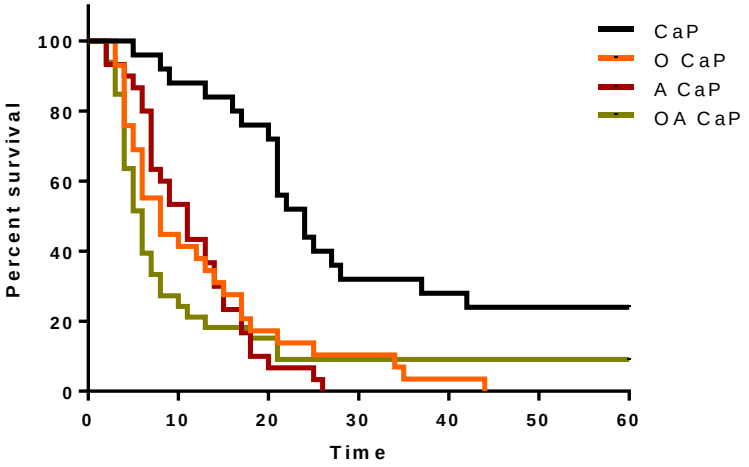
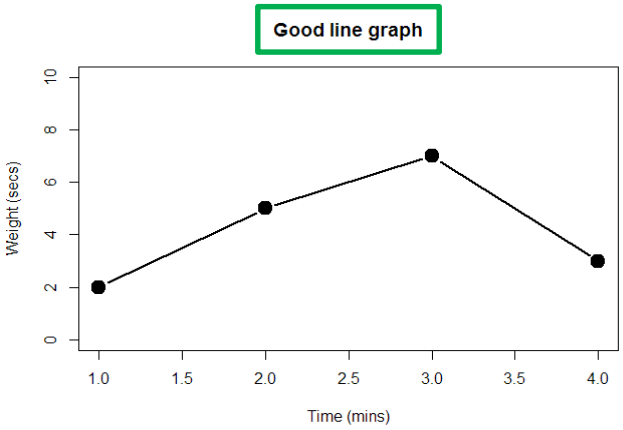
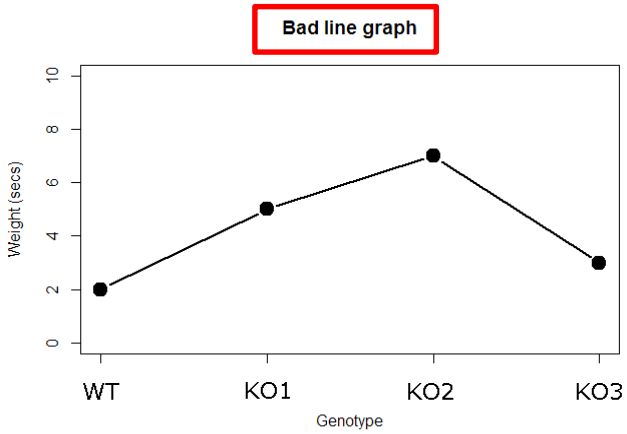
Plot types – Relationship/Comparison

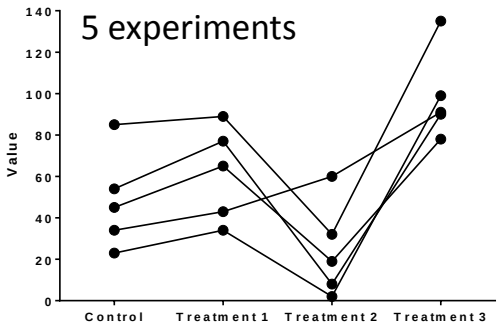
Line graphs











Except for exploration …

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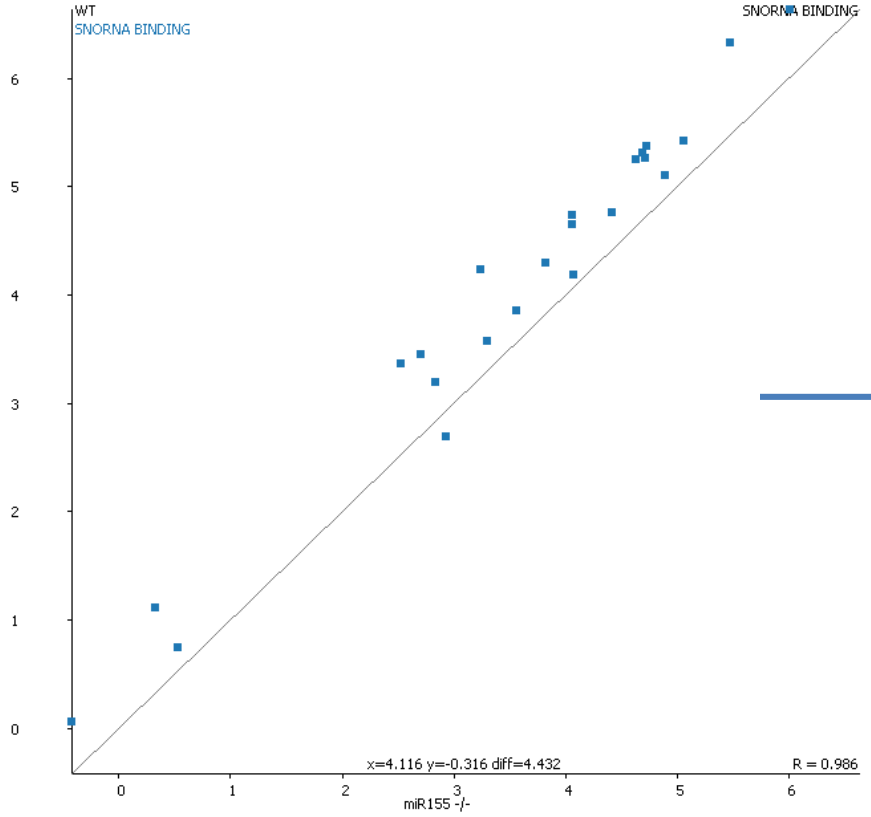
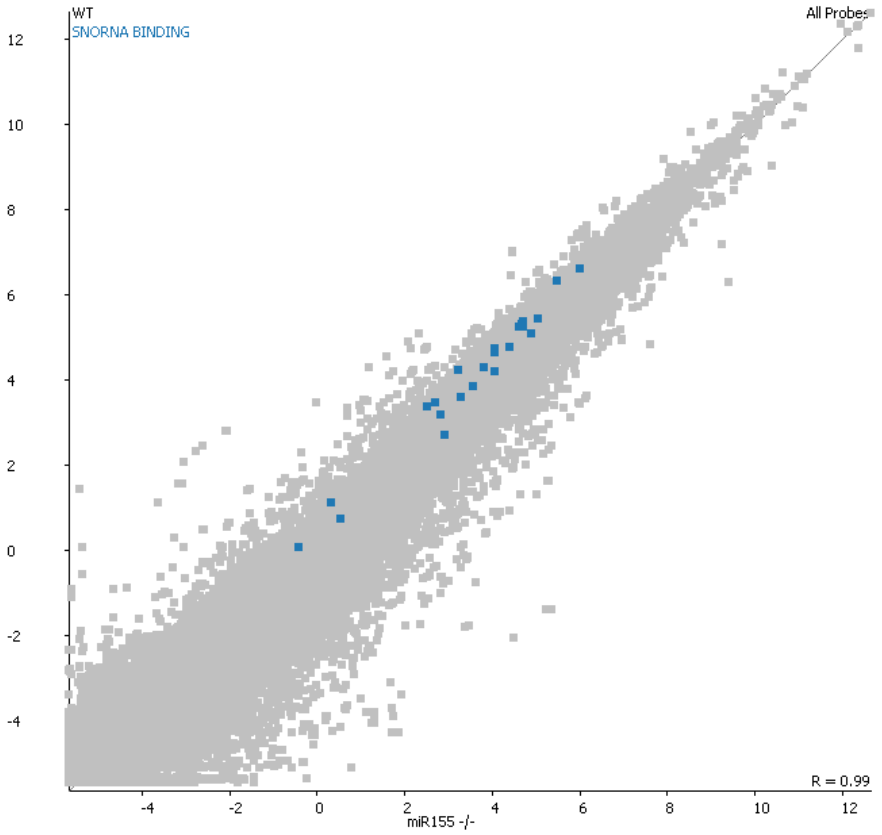
- **<u>Very good for</u>** presenting results of matched/paired/repeated data.
- **Linecharts are great <u>but</u>** careful with the axes.

Plot types – Relationships
Two conditions - **Scatterplot**





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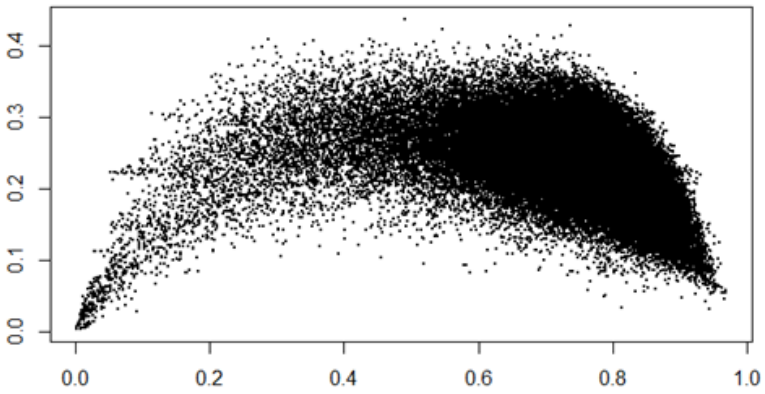
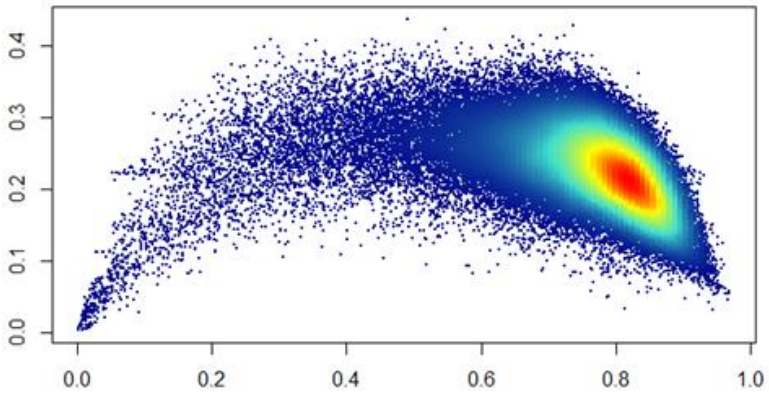
- **<u>Very good for</u>** understanding the relationship between quantitative variables.

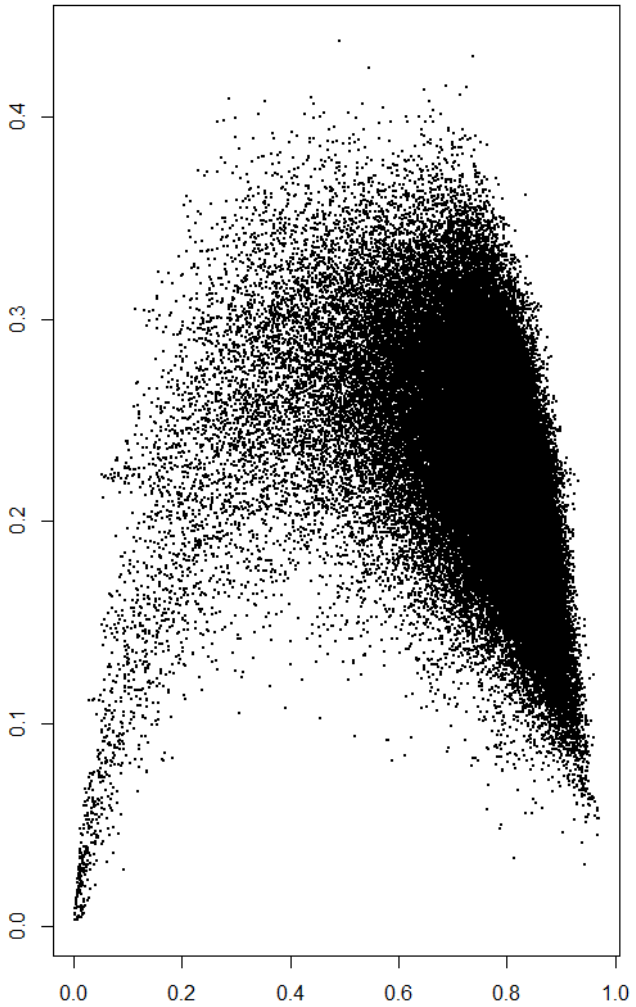
Plot types – Relationships
Scatterplots

- Problem: very big dataset



- Solution: smoothed **densities** colour representation





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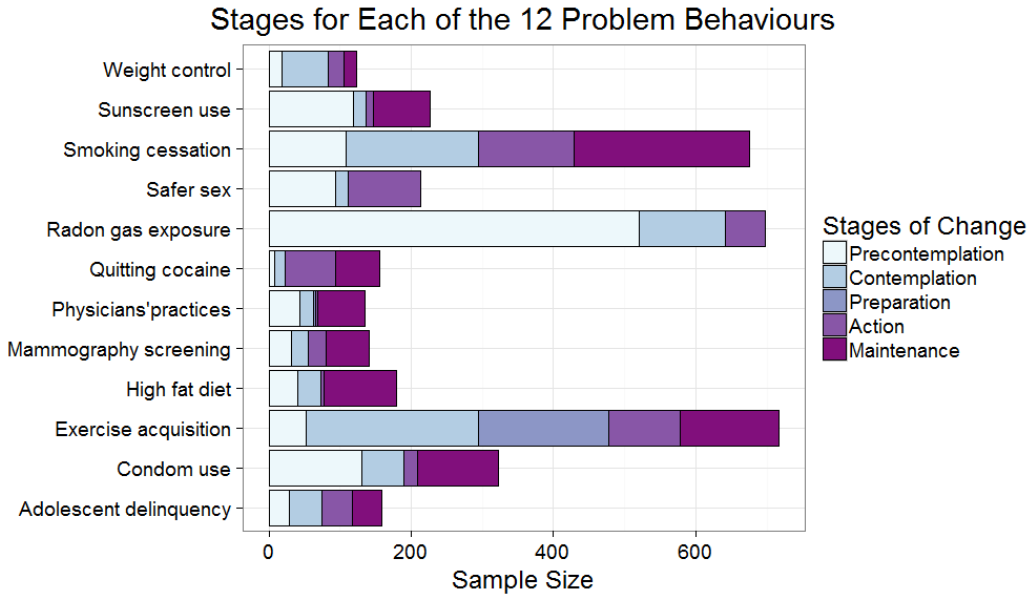
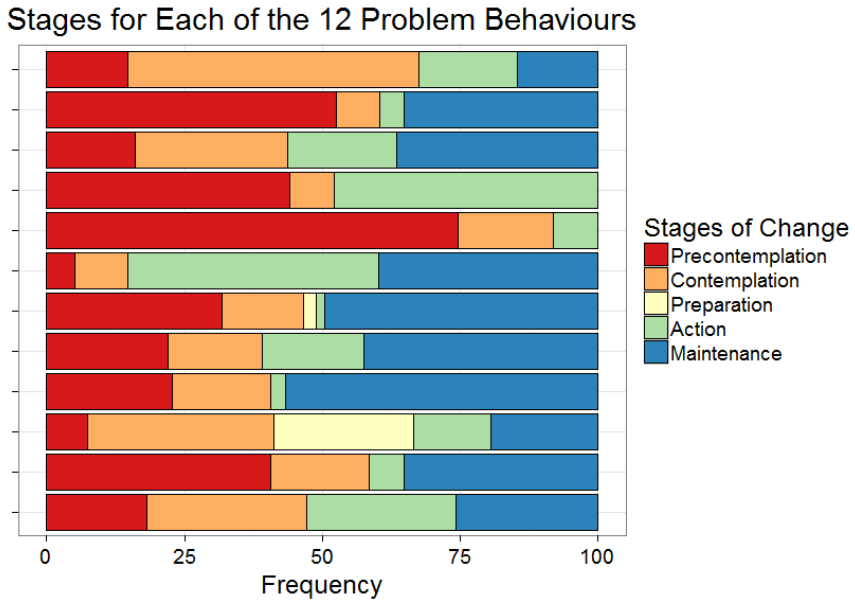
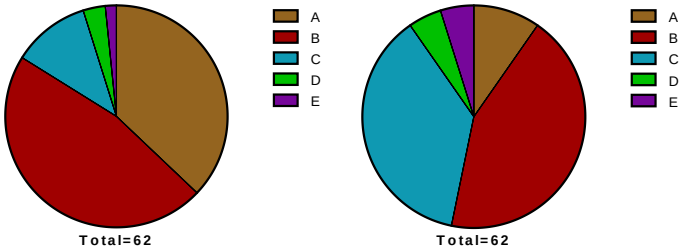
- **Scatterplots are great <u>but</u>** big data can be tricky.

Plot types – Composition
Stack charts/Pie charts







- **<u>Very good for</u>** presenting categorical data.
- **Stack /pie charts are great <u>but</u>** keep an eye on the sample size.

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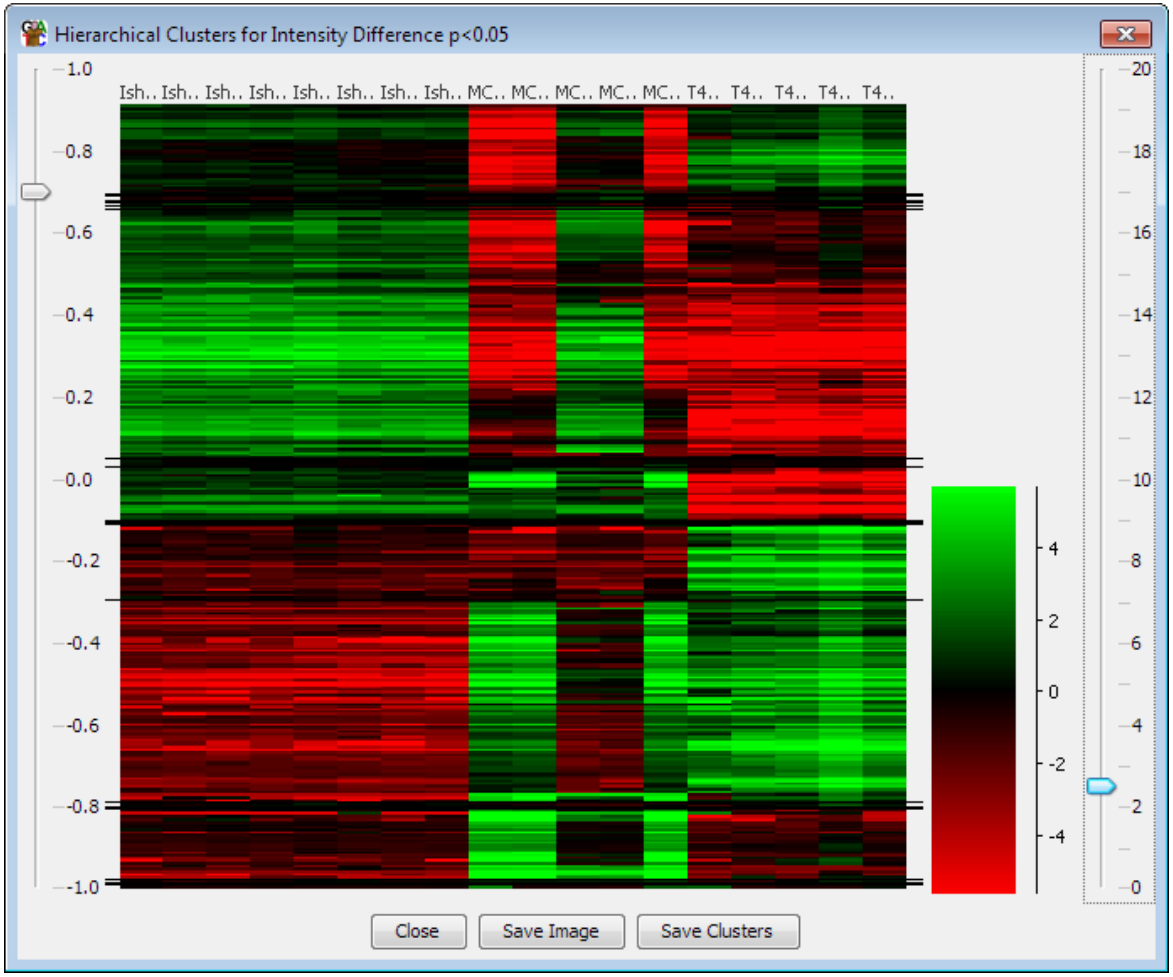
Plot types – Relationships
Many conditions - **Heatmaps**



- Normalisation
- Colouring
- Filtering
- Clustering

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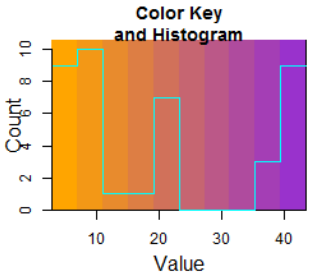
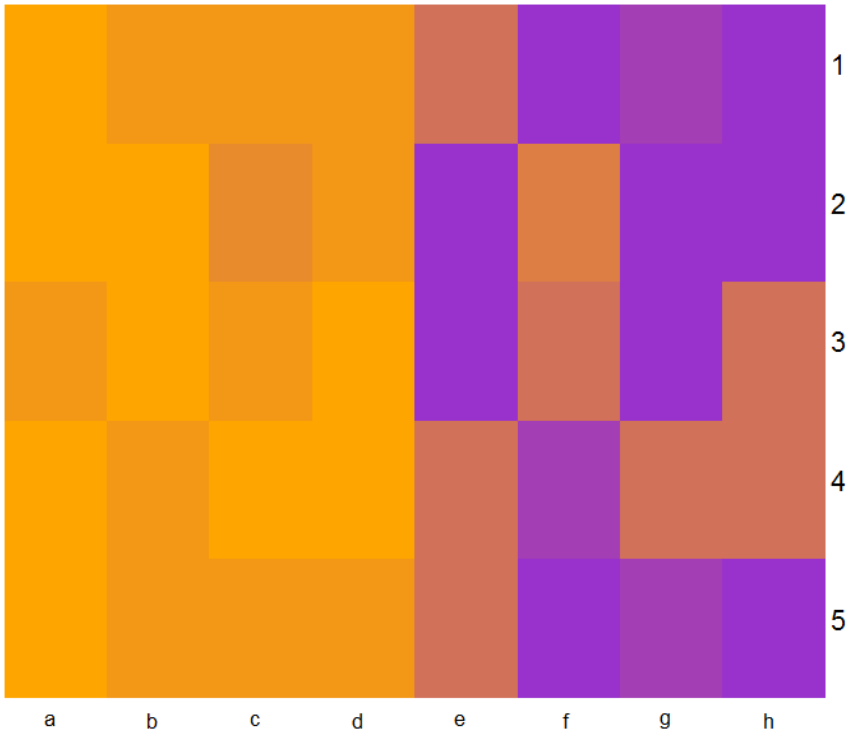
Plot types – Relationships
Heatmaps

- A heatmap is basically a table that has colors in place of numbers.



	a	b	c	d	e	f	g	h
1	3.7	10.8	8.4	10.4	19.5	40.6	39.0	40.1
2	6.9	4.7	11.7	10.7	40.8	18.7	39.9	40.4
3	9.9	6.2	9.7	4.0	43.4	19.9	39.9	20.3
4	5.6	7.8	5.2	6.0	19.8	39.2	20.5	20.0
5	3.0	8.9	9.3	8.7	20.7	41.2	38.6	39.8



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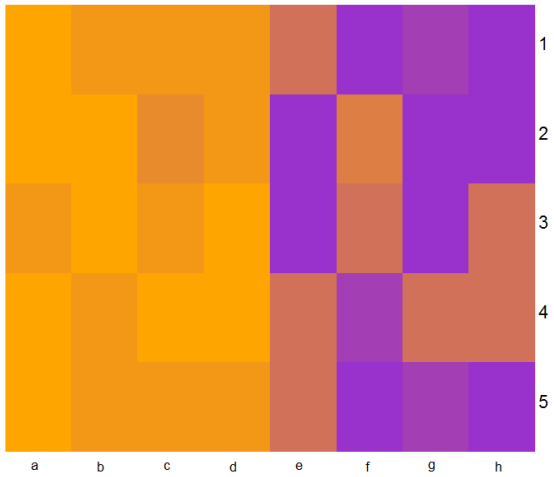
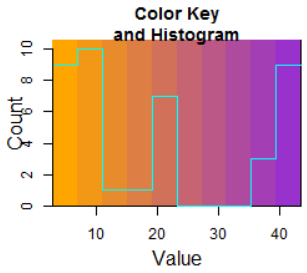
Plot types – Relationships
Heatmaps





- Colour scheme for grouping.
  Clustering

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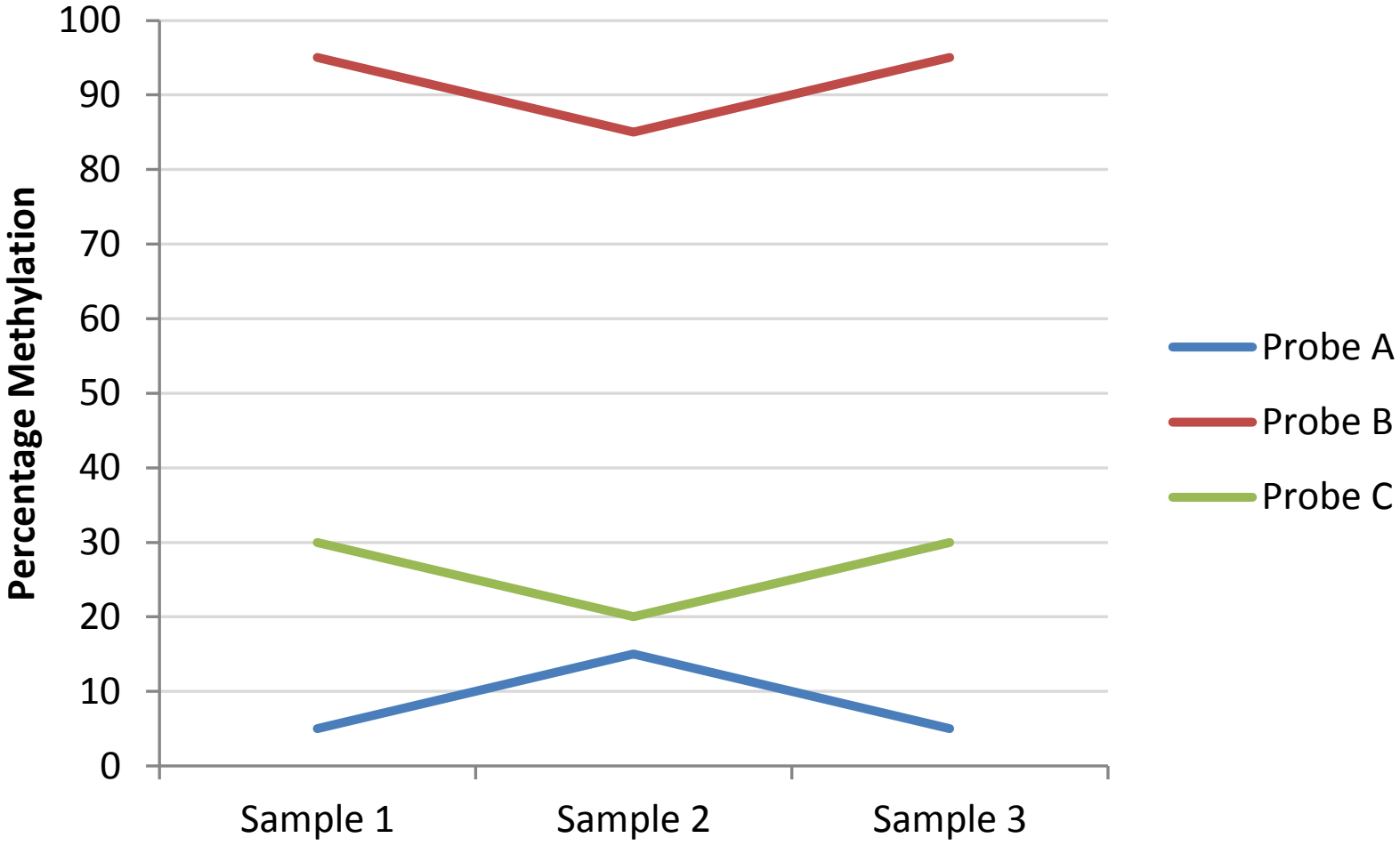
Clustering Heatmaps



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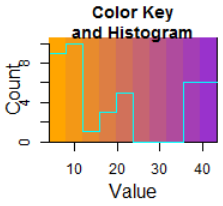
Plot types – Relationships
Heatmaps

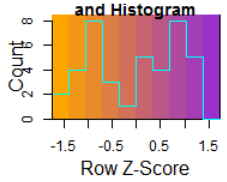
Euclidian distance: differences between values

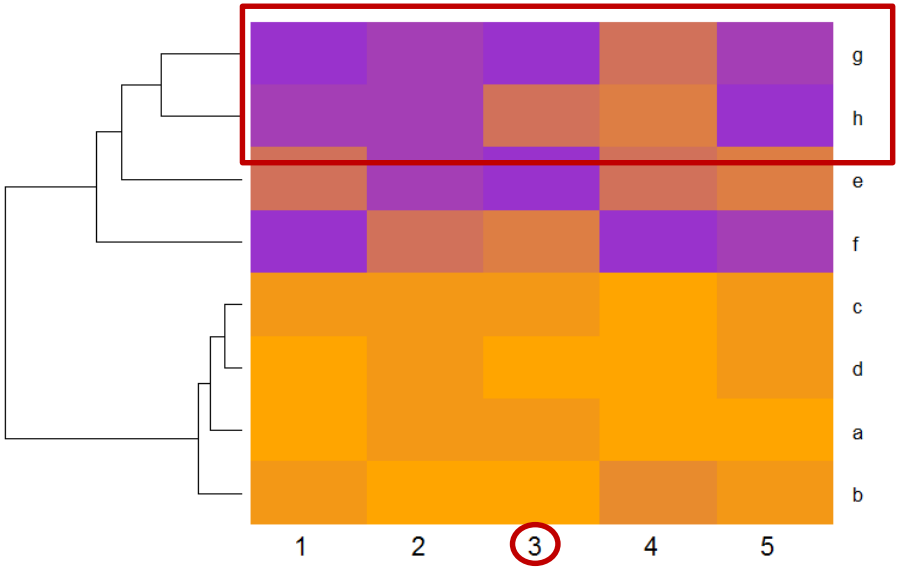
	a	b	c	d	e	f	g	h
1	3.7	10.8	8.4	10.4	19.5	40.6	39.0	40.1
2	6.9	4.7	11.7	10.7	40.8	18.7	39.9	40.4
3	9.9	6.2	9.7	4.0	43.4	19.9	39.9	20.3
4	5.6	7.8	5.2	6.0	19.8	39.2	20.5	20.0
5	3.0	8.9	9.3	8.7	20.7	41.2	38.6	39.8

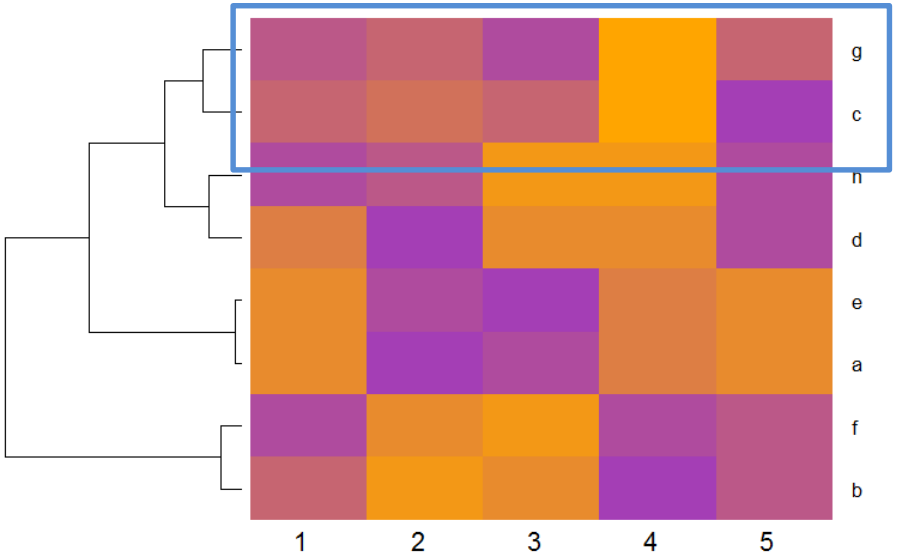
Pattern	Difference
0 0	=1.1
↑↑	=0.5
↓ -	=19.6
↓↓	=0.5
↑↑	=1.2

Correlation: consistency of pattern









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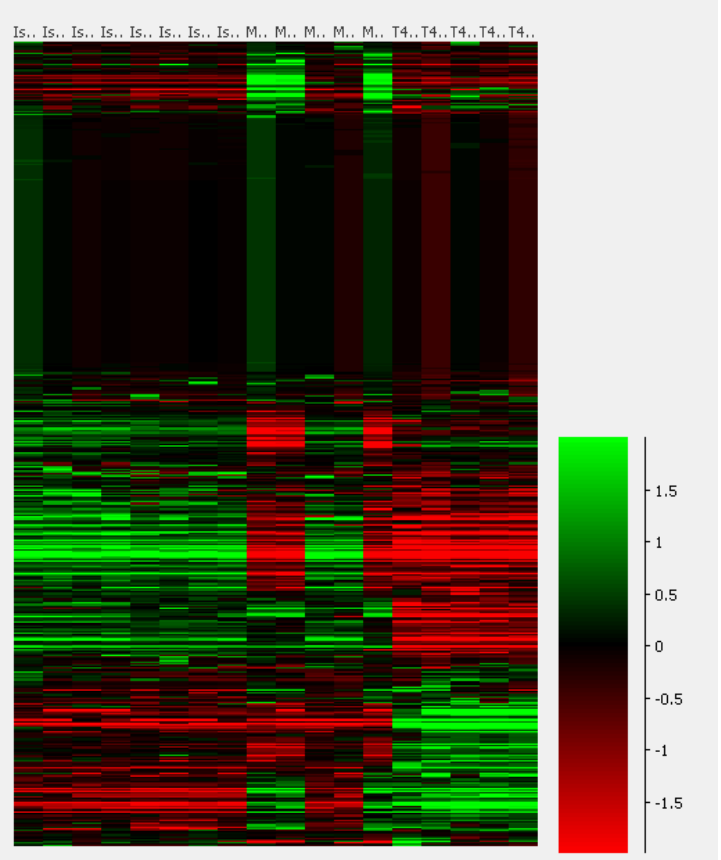
- **Heatmaps are great <u>but</u>** plot data that are changing.

Plot types – Relationships
Heatmaps

- Don’t forget to remove unchanging points to focus on differences.



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- **Heatmaps are great <u>but</u>**
  - careful with clustering
  - plot data that are changing.


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Ethics of data representation

v2017-06

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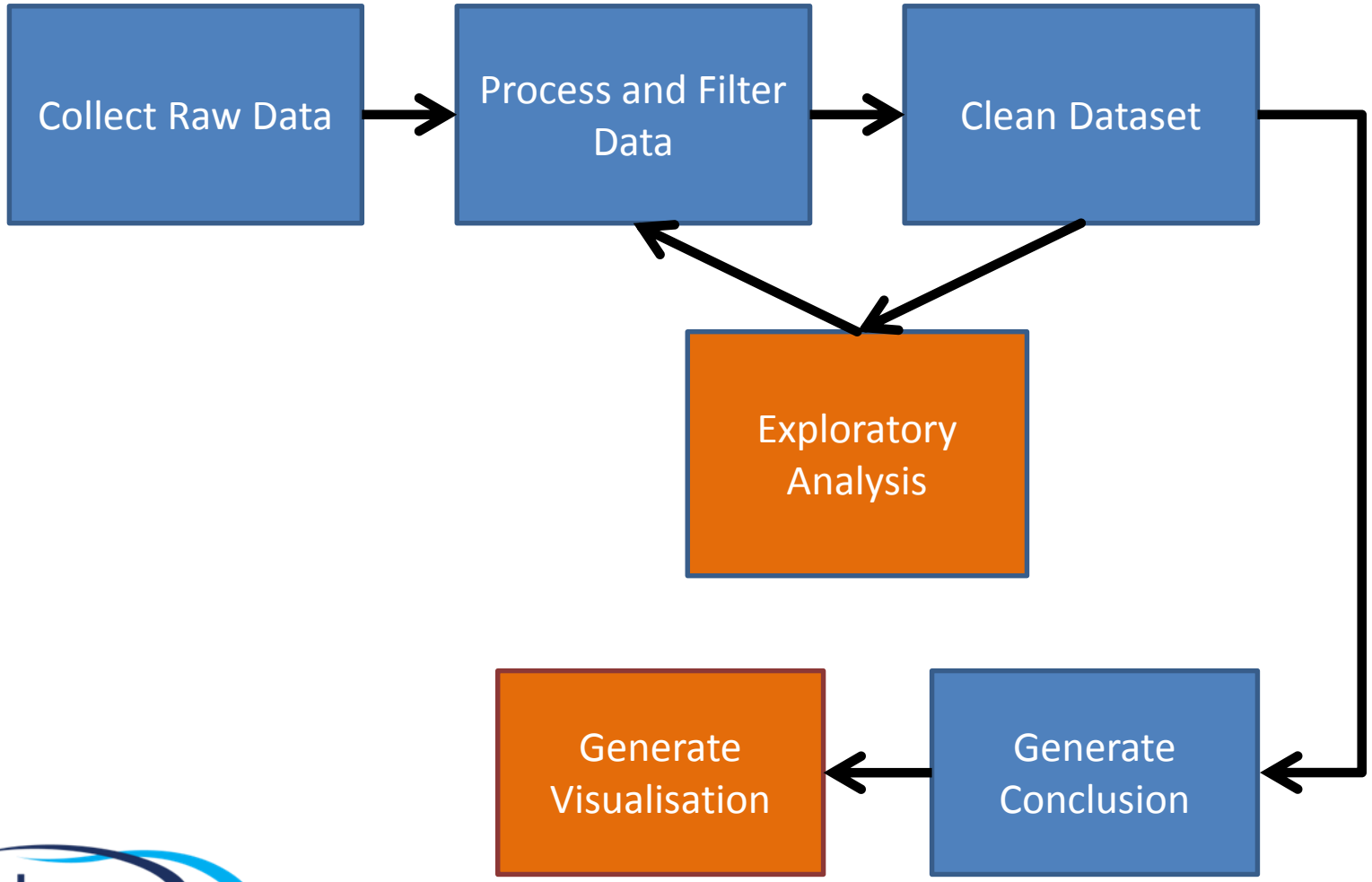
Data Visualisation Process



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What is Ethics when it comes to data visualisation?

- The figure/graph/image should show what is actually happening and not what you want to happen.
- Different ways of being unethical:
  - not exploring/getting to know the data well enough,
  - misusing your chosen graphical representation.
  - deliberately showing the data in a misleading manner,
  - choosing the 'most representative' image/experiment.

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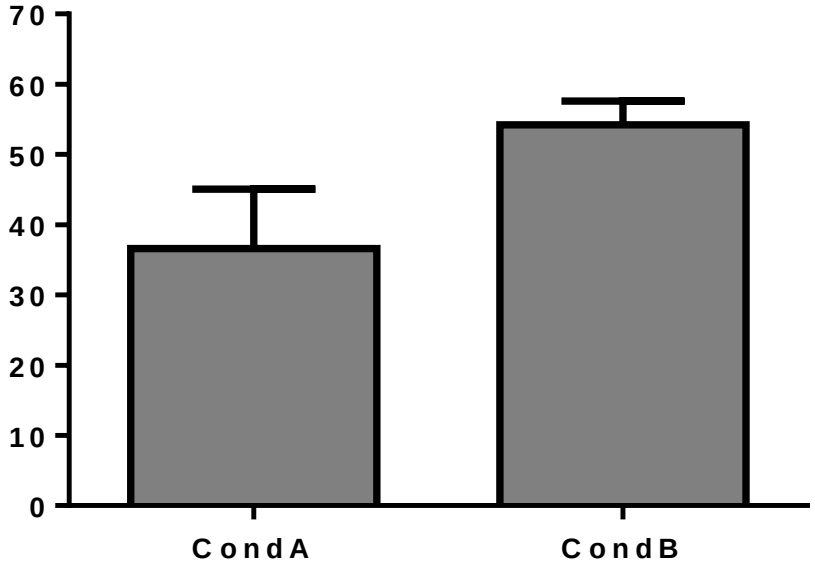
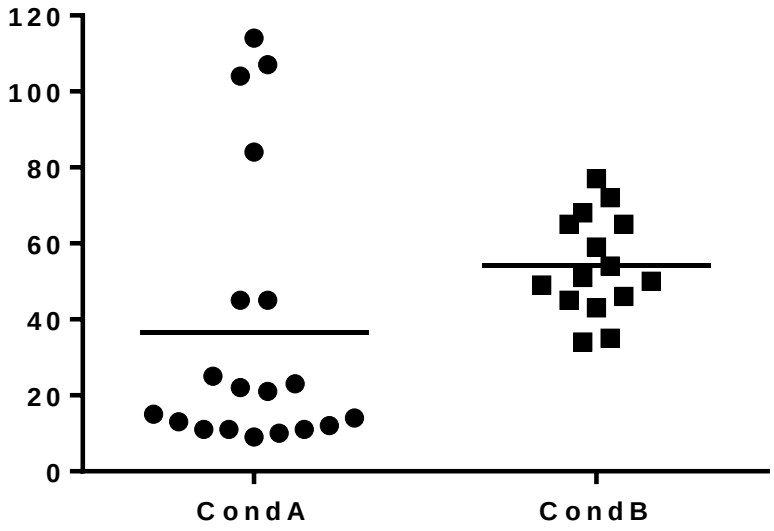
Not exploring/getting to know the data well enough
Example 1

- One experiment: change in the variable of interest between CondA to CondB.
  - ❖ Data plotted as a **bar chart**.





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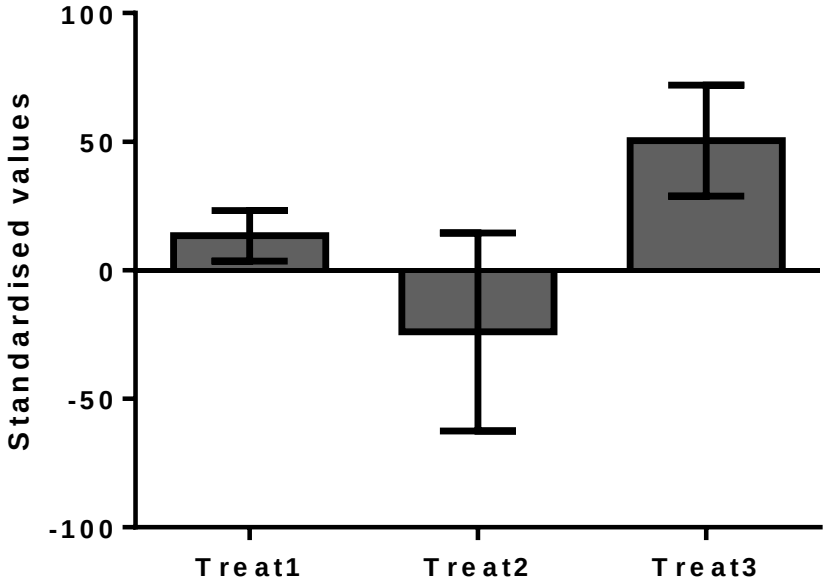
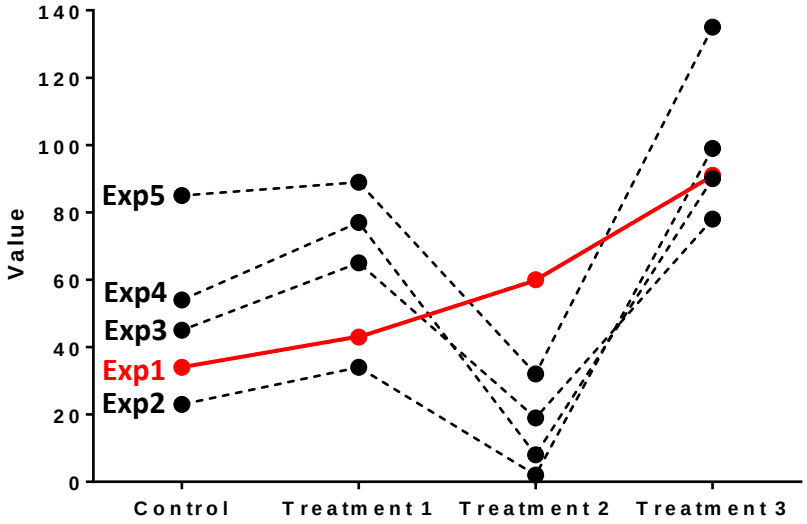
Not exploring/getting to know the data well enough
Example 2

- Five experiments: change in the variable of interest between 3 treatments and a control.
  - ❖ Data plotted as a **bar chart**.





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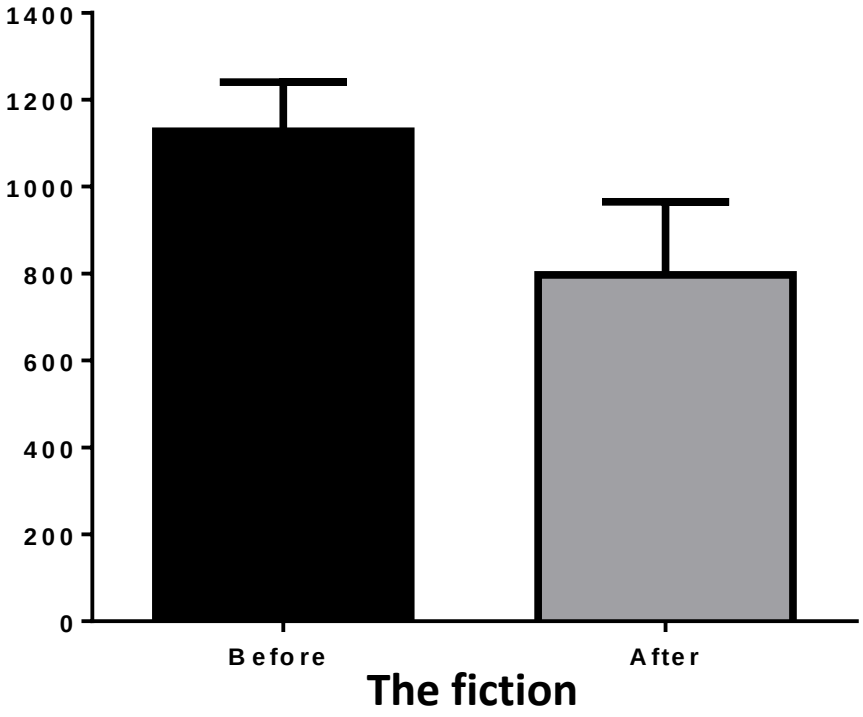
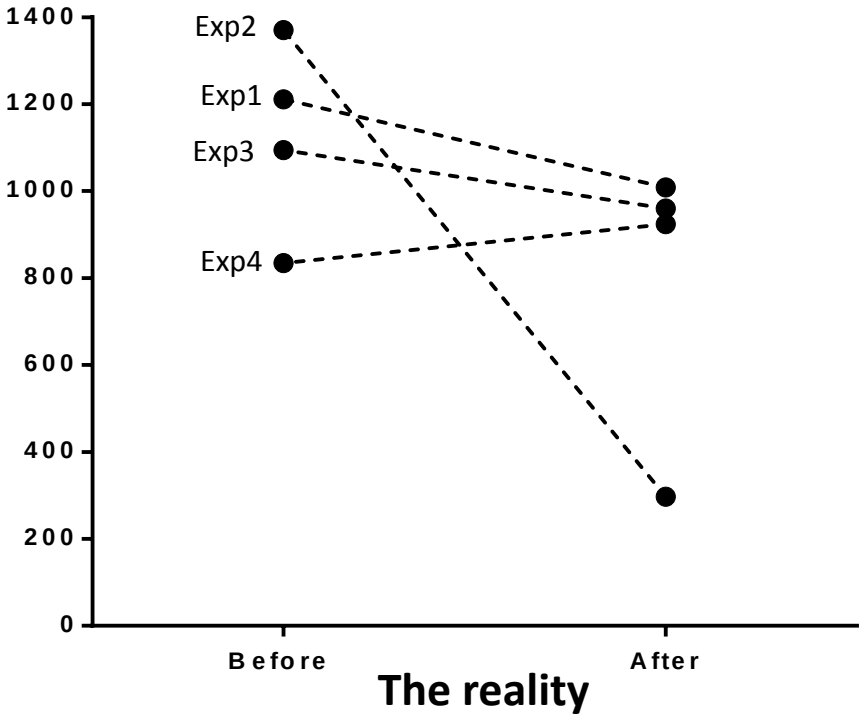
Choosing the wrong graph to present the data

- Four experiments: Before-After treatment effect on a variable of interest.
- Hypothesis: Applying a treatment will decrease the levels of the variable of interest.
  - ❖ Data plotted as a **bar chart**.



The fiction



The reality

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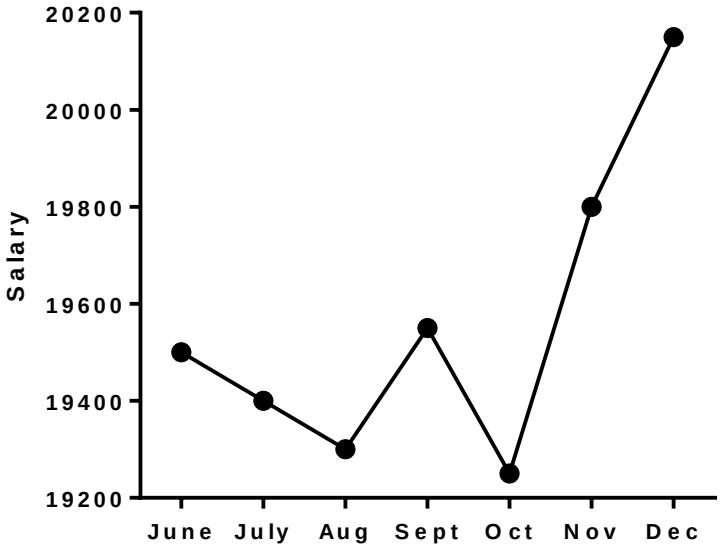
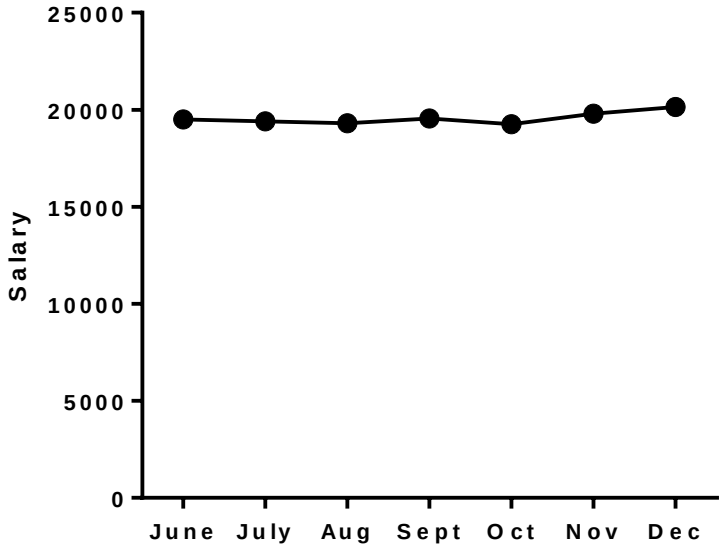
Choosing the wrong axis/scale

- Example: increase in salary in the last term.





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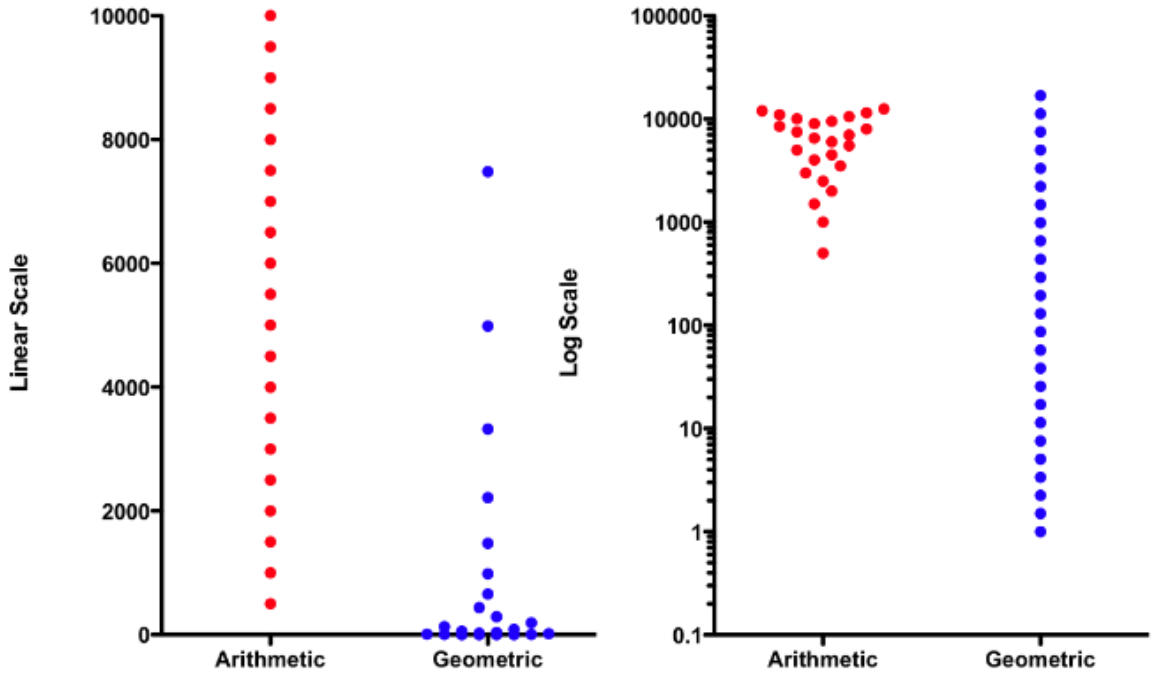
Choosing the y-axis/scale

- Be careful with Linear vs. logarithmic scale.



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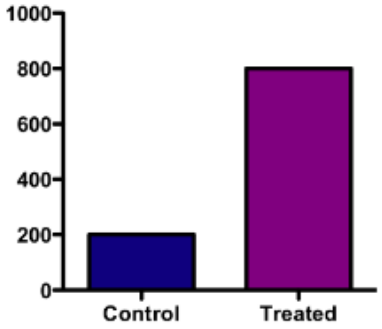
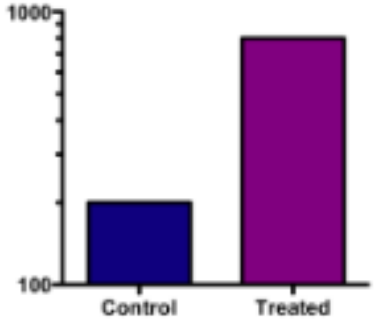
Choosing the y-axis/scale

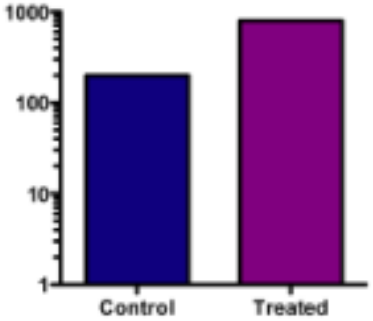
- For **cheating**, a bar graph using a **log axis is a great tool**, as it lets you either exaggerate differences between groups or minimize them.

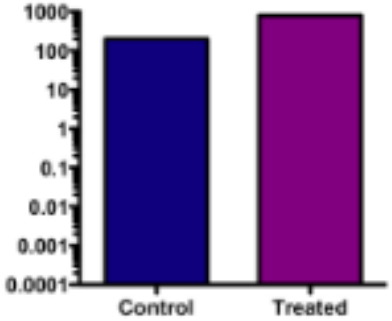
Linear scale



Logarithmic scale







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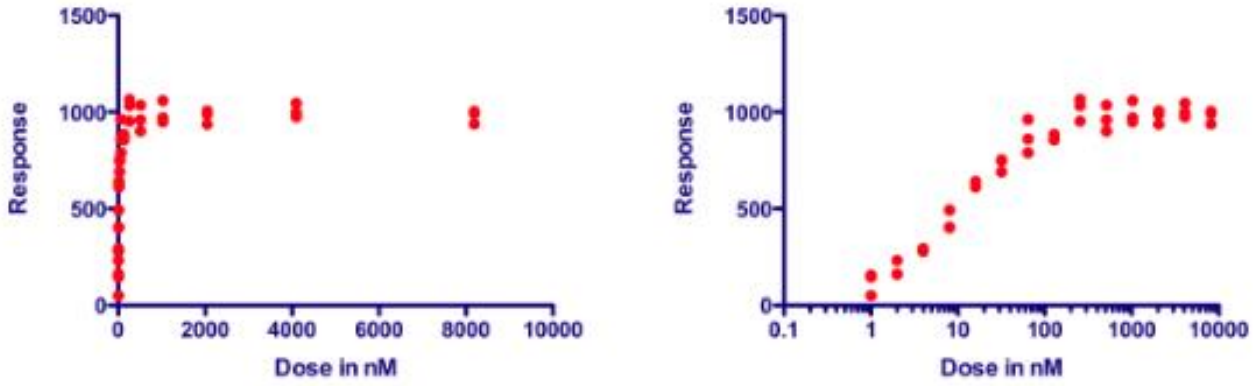
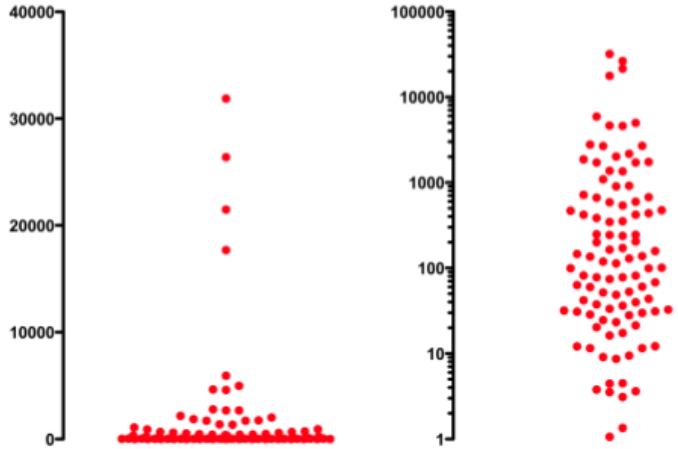
Choosing the y-axis/scale

- **Logarithmic axis** should be used for:



Logarithmically spaced values



Lognormal data

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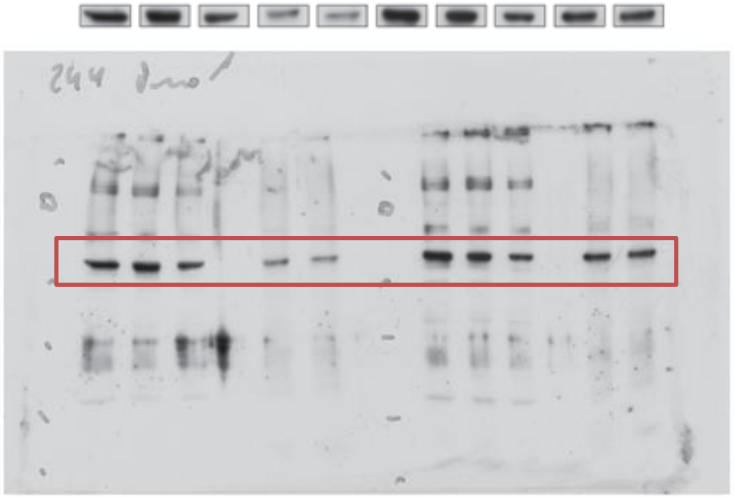
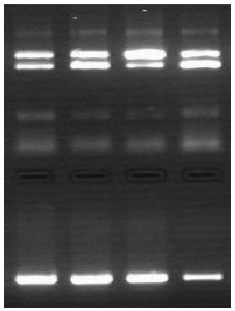
Simply Cheating:

Manipulating images: Western blot

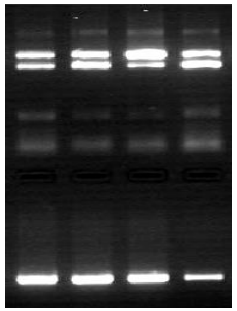
- Presenting bands out of context



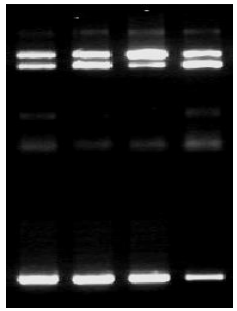
- 'Playing' too much with contrast



Original

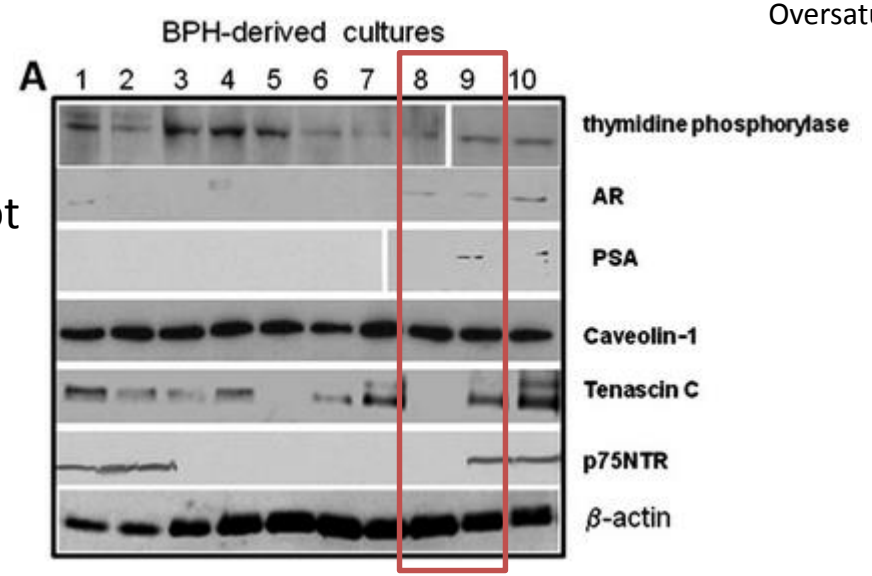


Brightness and Contrast Adjusted



Brightness and Contrast Adjusted Too Much: Oversaturation

- 'Rebuilding' a Western blot from several cuts



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Is my plot ethical?

Would a reader come to a different conclusion if they could see the details of the data which were omitted from the plot?

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