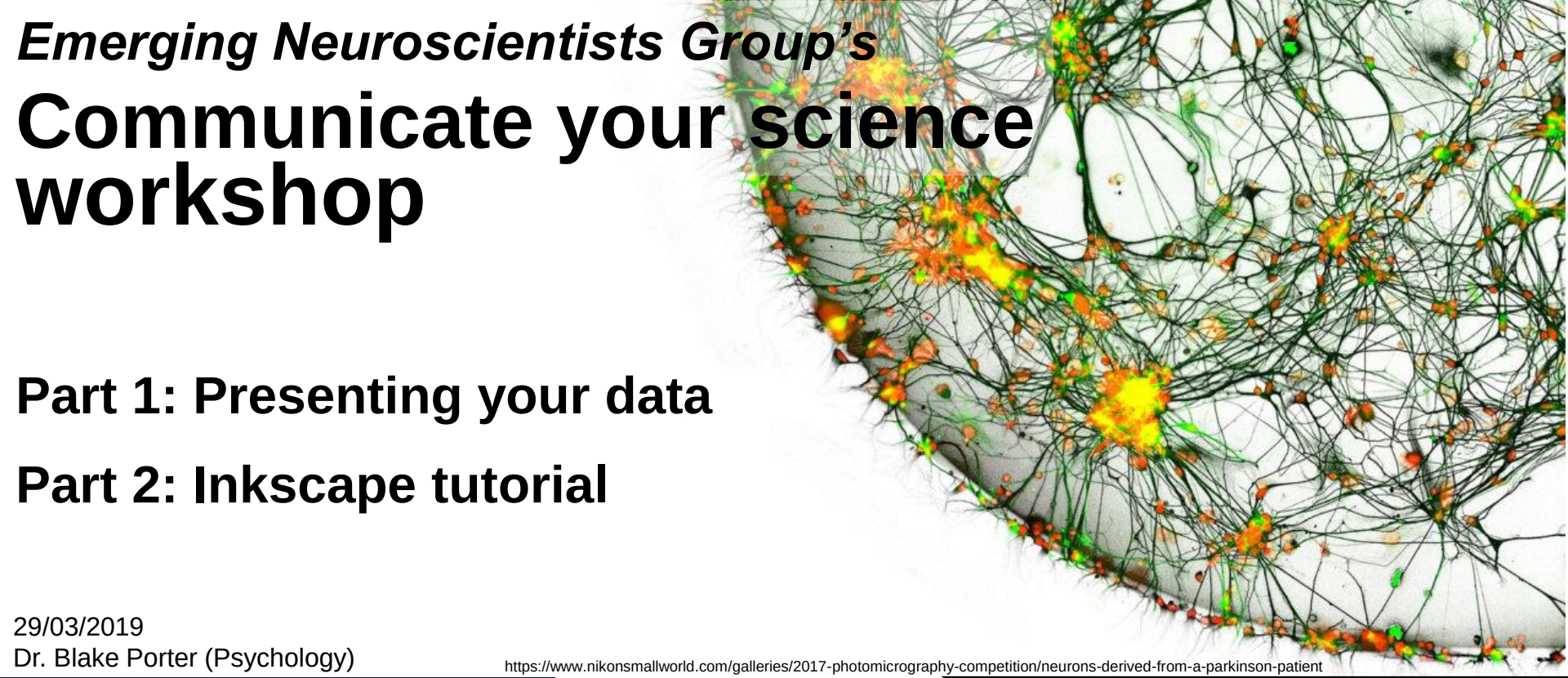
Emerging Neuroscientists Group's

Communicate your science workshop



Part 1: Presenting your data

Part 2: Inkscape tutorial

29/03/2019

Dr. Blake Porter (Psychology)

https://www.nikonsmallworld.com/galleries/2017-photomicrography-competition/neurons-derived-from-a-parkinson-patient

Brain Health Research Centre
Te Pokapū Rakahau Hauora Hinekaro

University of Otago
Te Whare Wānanga o Otāgo
New Zealand
SAPERE AUDE

Centre for Neuroendocrinology
A University of Otago Research Centre
Te Pokapū Mātai Taiāki Iaia

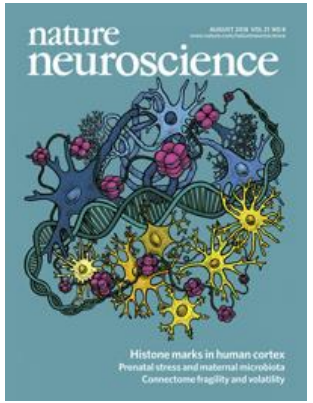
Part 1: Presenting your data

The do's, don't's, and how to's of graphing

www.gregadunn.com

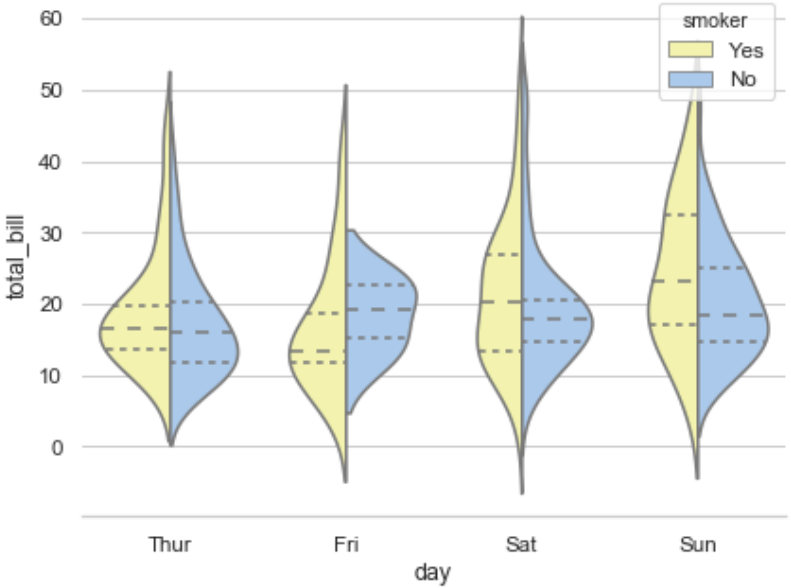
Figures are important

- Journal editors will read your cover letter and abstract then go over your **figures**
- “Figures are powerful tools to effectively and efficiently convey complex information” Rolandi, Cheng, & Perez-Kriz, 2011
- Good figures are:
  - Clear
  - Precise
  - Efficient



Software for producing **graphs** (and more)

- Programming based
  - **Python (free)**
    - MatPlotLib
    - SeaBorn

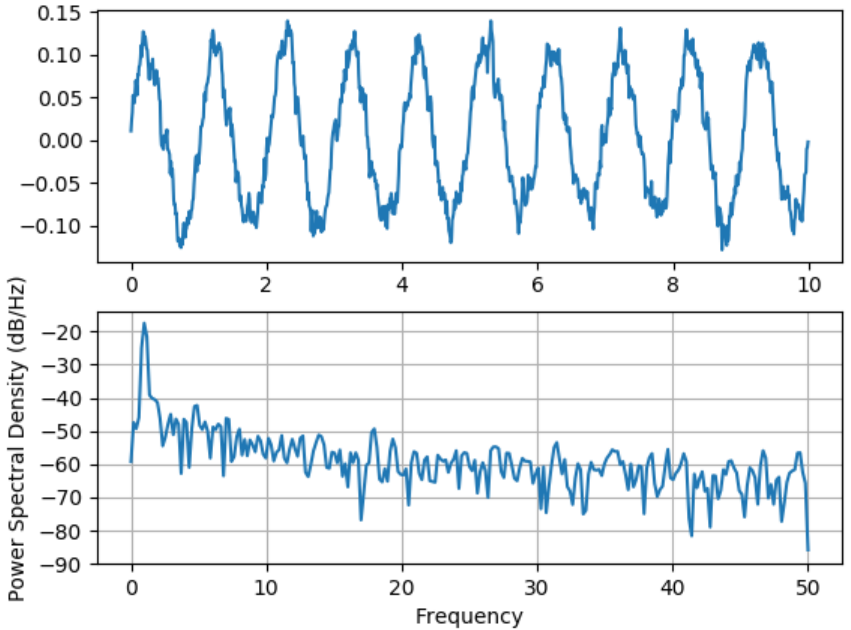


Python SeaBorn example

Quick Python Plotting – with MatPlotLib

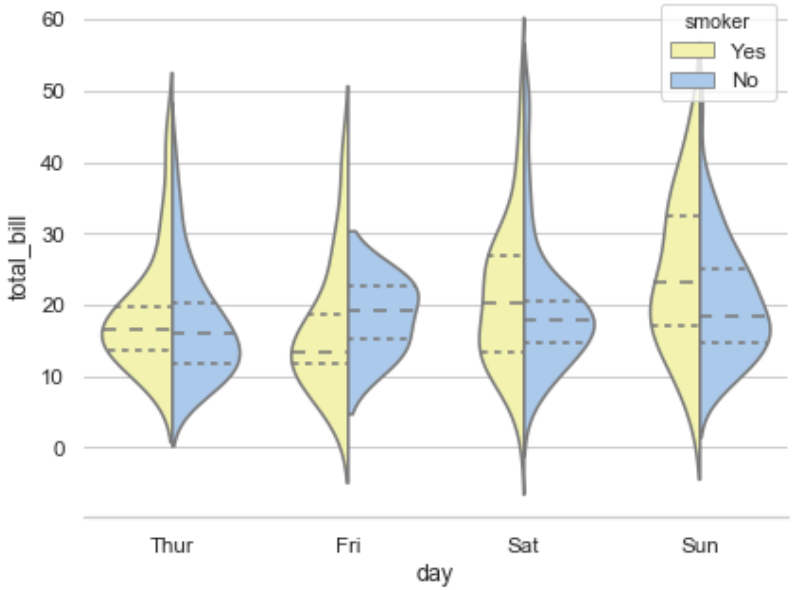
```
t = [time];
s = [signal]; # voltage
f = 5000; # sampling freq

plt.subplot(211)
plt.plot(t, s)
plt.subplot(212)
plt.psd(s, 512, 1 / f)
```



Software for producing **graphs** (and more)

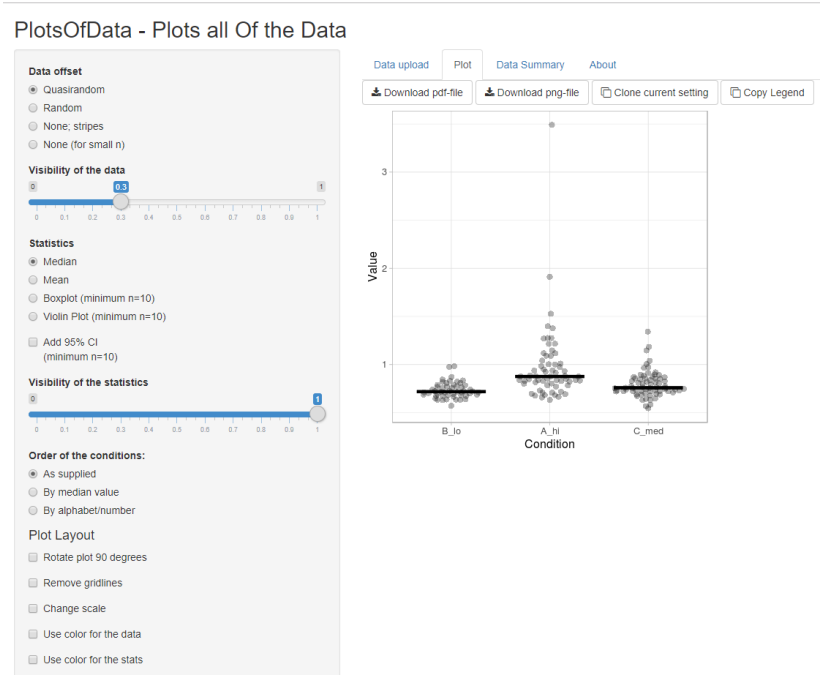
- Programming based
  - **Python (free)**
    - MatPlotLib
    - SeaBorn
  - R (free)
  - Matlab ($, but covered)
- Web-based
  - Plots of Data by UVA (free)



Python SeaBorn example

PlotsOfData - Plots all Of the Data

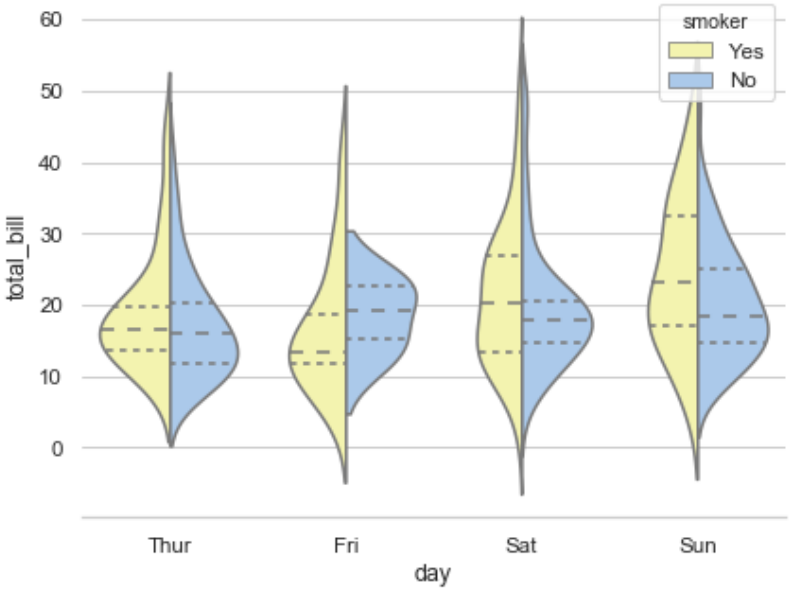
- https://huygens.science.uva.nl/PlotsOfData/
- Upload you data
  - copy+paste
  - .csv (Excel)
- Plot the data
- Data summaries



https://journals.plos.org/plosbiology/article?id=10.1371%2Fjournal.pbio.3000202

Software for producing **graphs** (and more)

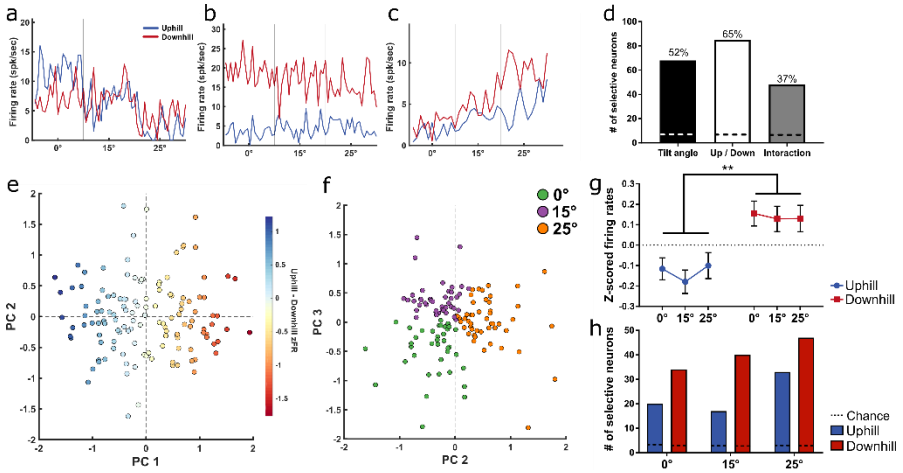
- Programming based
  - **Python (free)**
    - MatPlotLib
    - SeaBorn
  - R (free)
  - Matlab ($, but covered)
- Web-based
  - Plots of Data by UVA (free)
- Out-of-the-box
  - GraphPad ($, but covered)
  - SPSS ($, but covered)
  - Excel (~)
  - ImageJ (free)
  - Origin ($)
  - SigmaPlot ($)



Python SeaBorn example

Software for putting together **figures**

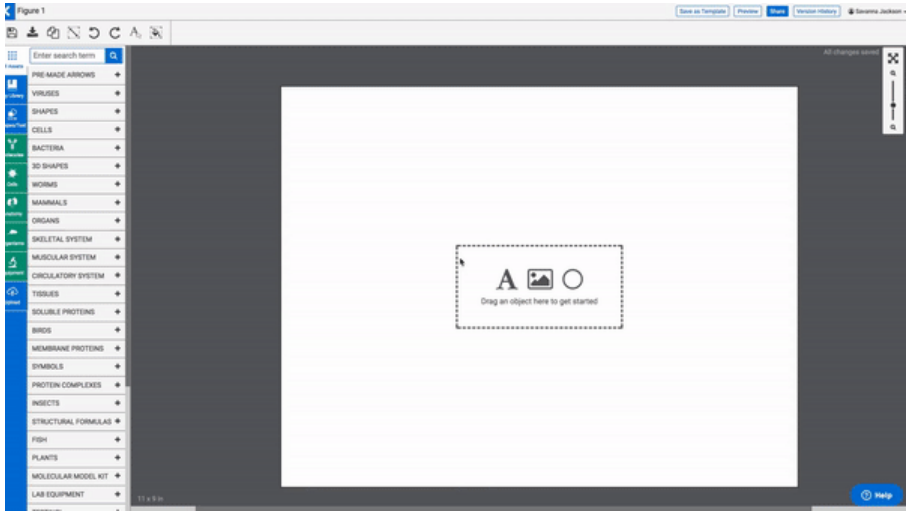
- **Inkscape (free)**
- GIMP (free)
  - Image focused
- Adobe Illustrator ($, varies)
- PowerPoint (~)
- Blender (free)
  - Specializes in 3D



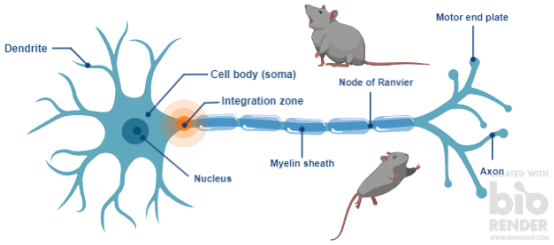
Porter, Hillman, Bilkey, 2019

Options for making **diagrams**

- DIY
  - Inkscape, Illustrator, PowerPoint
- BioRender (~)
  - $ use in journals
  - $15 per month students
- ScienceDraw by Edraw ($)

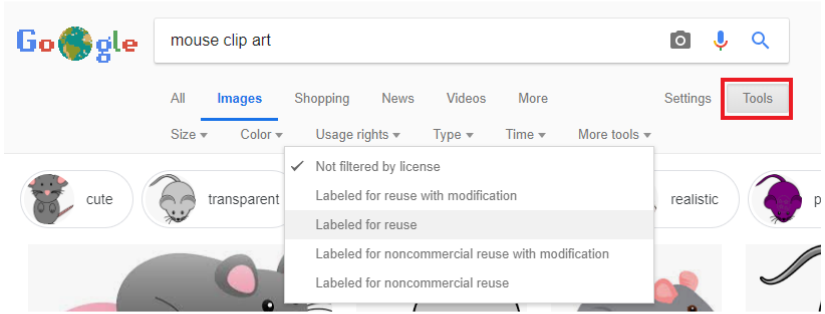


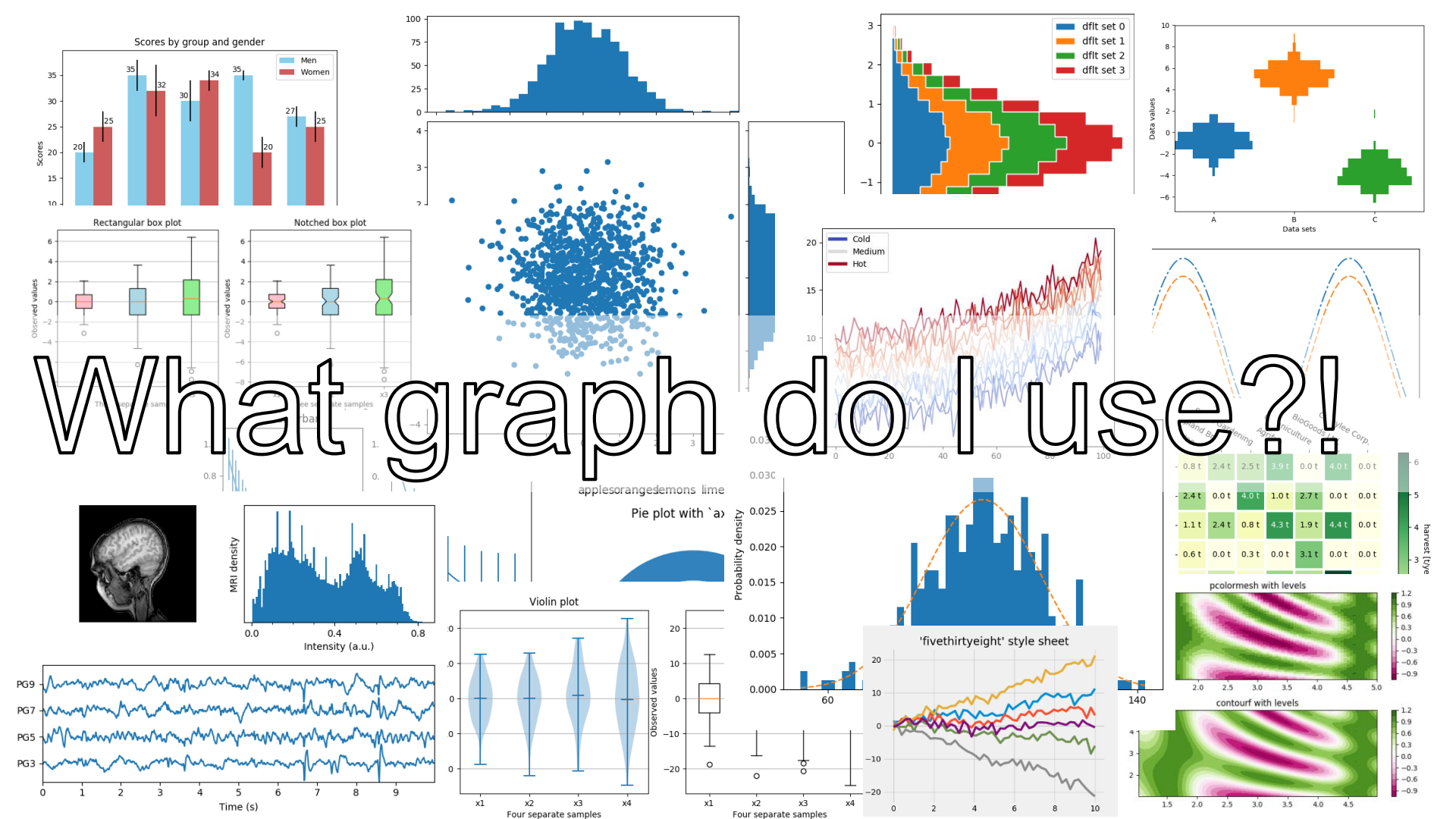
BioRender Example



Licensing of images

- Most journals constitute **commercial use**
- Wiki-commons
- CreativeCommons – ShareAlike
- “Free-use”




What graph do I use?!
Scores by group and gender
Men
Women
Scores
Rectangular box plot
Notched box plot
Observed values
dflt set 0
dflt set 1
dflt set 2
dflt set 3
Data values
Data sets
Cold
Medium
Hot
MRI density
Intensity (a.u.)
Violin plot
Four separate samples
Probability density
'fivethirtyeight' style sheet
pcolormesh with levels
contourf with levels
PG9
PG7
PG5
PG3
Time (s)

Bur first, Tables

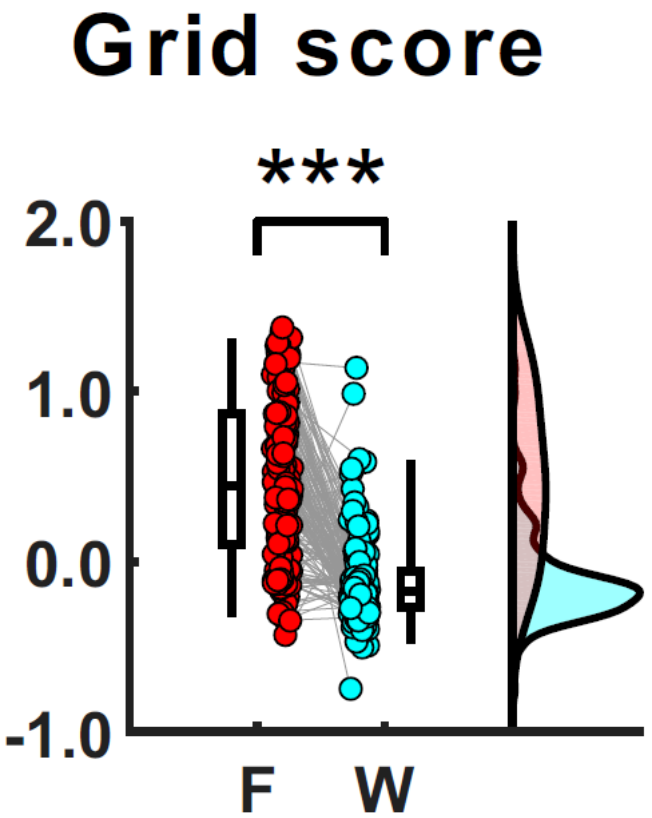
- Individual data points matter
- Compare individual points
- Precision is needed

- Quantitative information
- Multiple units of measure
- A mix of summary and detailed values

Show Me the Numbers: Designing Tables and Graphs to Enlighten – Second Edition

Back to graphs

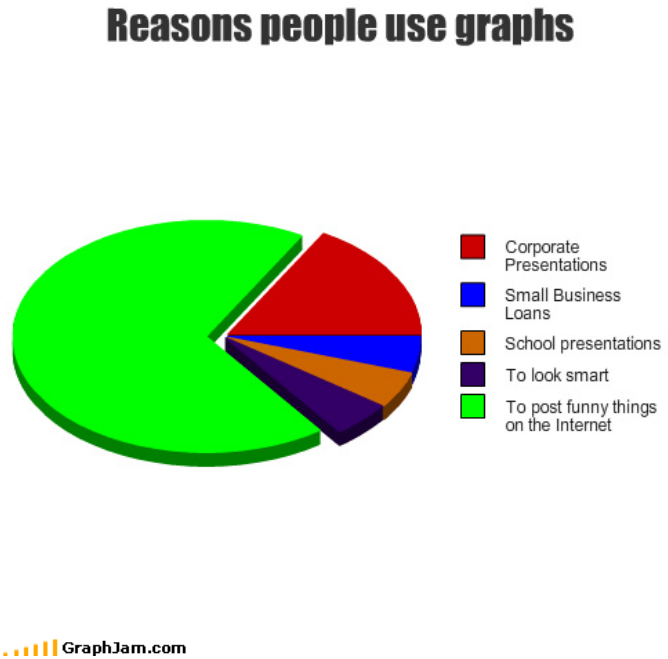
- Show the data
- Induce the viewer to think about the substance of the findings
- Avoid distorting the data
- Make large data sets coherent
- Encourage the eye to compare different pieces of data
- Reveal the data at several levels of detail, from a broad overview to the fine structure
- Integrated with the statistical and verbal descriptions of the data set



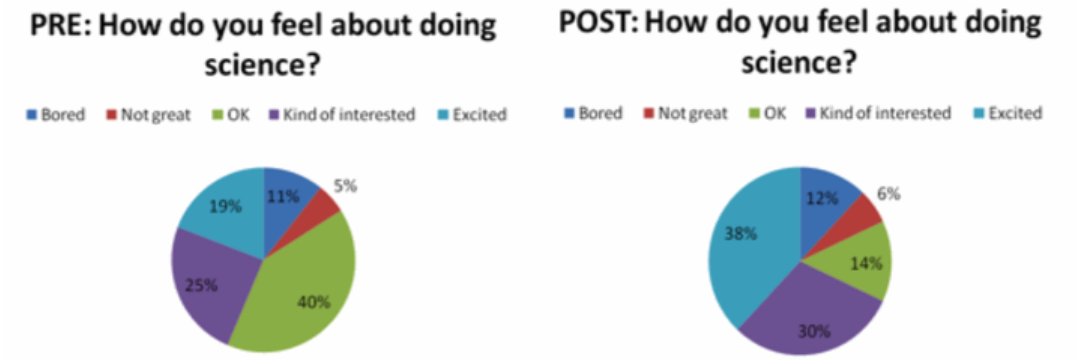
From E. R. Tufte. The Visual Display of Quantitative Information, 2nd Edition. Graphics Press, Cheshire, Connecticut, 2001 in http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/DataPresentation/DataPresentation3.html

Pie Charts

- Generally frowned upon
- Have their use
  - When proportion is important
  - When 100% is meaningful
  - Few, <= 4, nominal categories
- Alternatives
  - Line/bar chart
    - Humans are very good at line length discrimination
    - Area of pie slices not so much
- NO 3D!

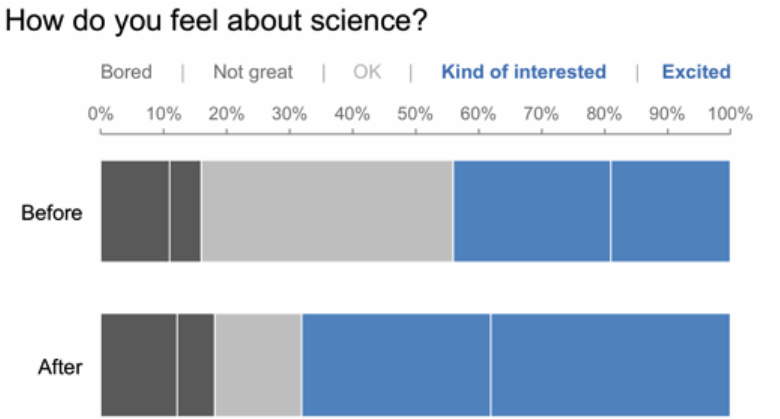


Generic Excel Pie Charts



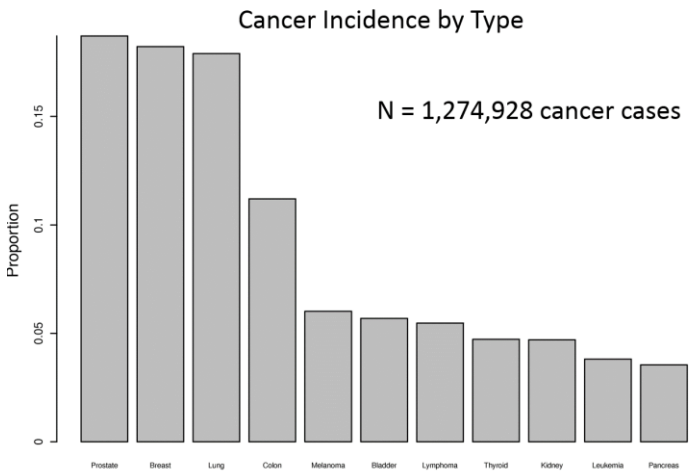
Pie Chart: *exists*
Data viz nerds:

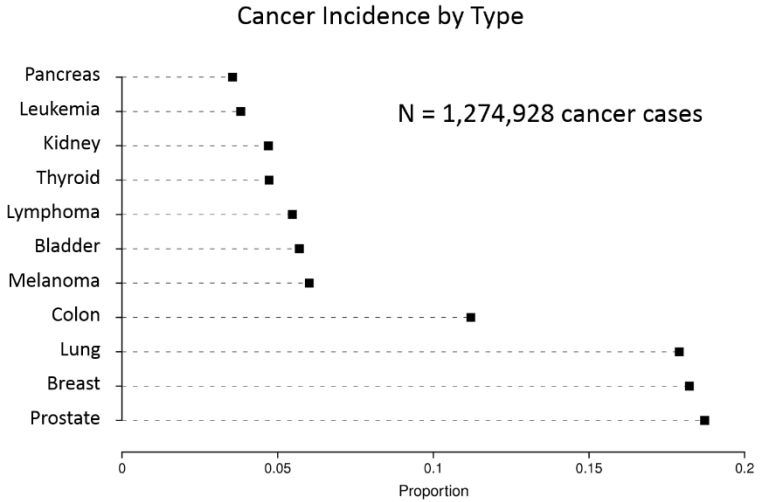
Stacked bar chart (ordinal)



http://**www.storytellingwithdata.com**/blog/2014/06/alternatives-to-pies

Bar or line?





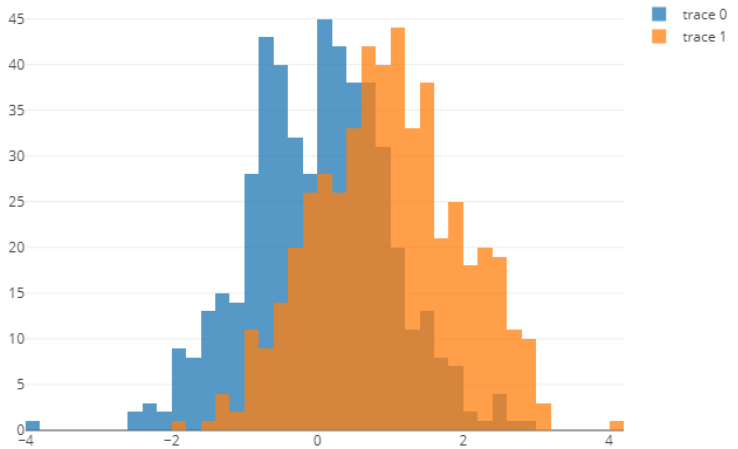
http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/DataPresentation/DataPresentation7.html

Or nothing

Of the 150 neurons we recorded, 70 (47%) were excitatory while 80 (53%) were inhibitory.

Histograms

- Shows the distribution of a data set
- Bin width is a hard problem
  - 8+ formulas
  - √# of data points (Excel)
- No spaces between bars



https://plot.ly/matlab/histograms/

https://towardsdatascience.com/histograms-and-density-plots-in-python-f6bda88f5ac0

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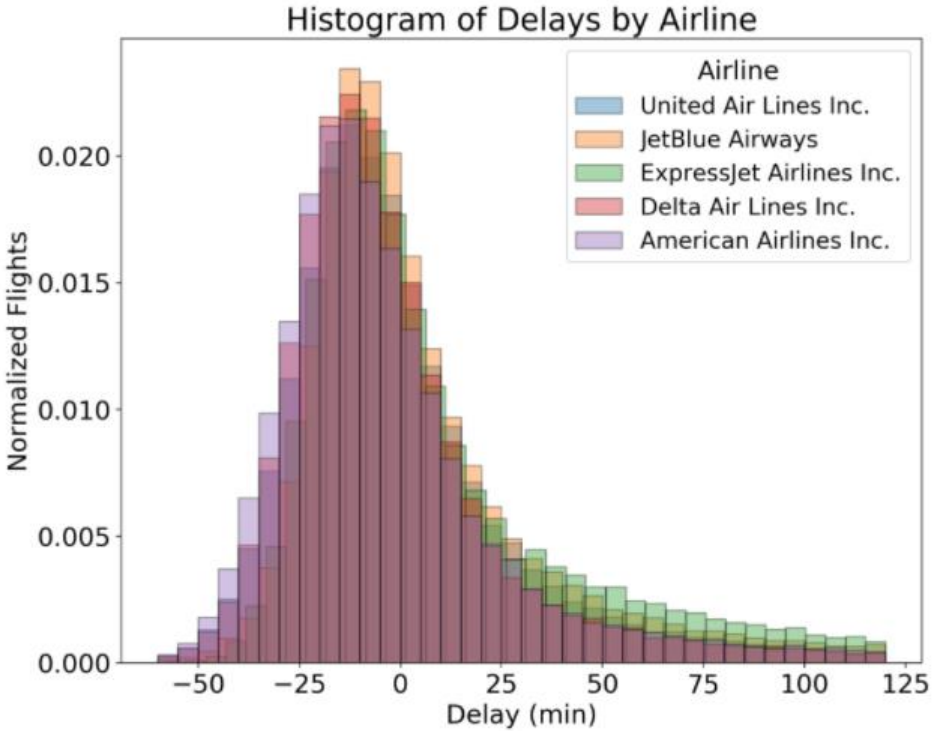
- Be careful with multiple variables
  - KDE may be better choice



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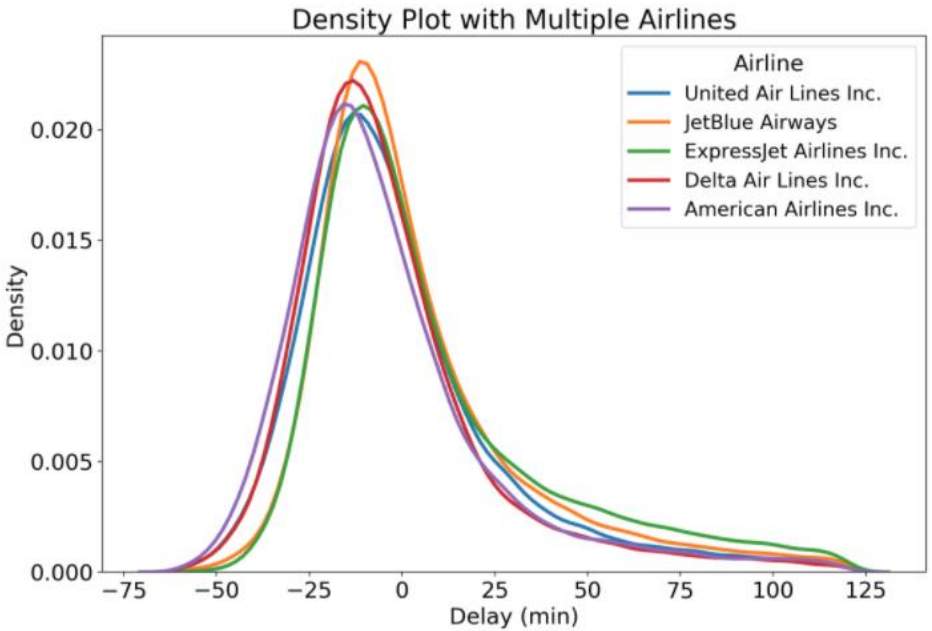


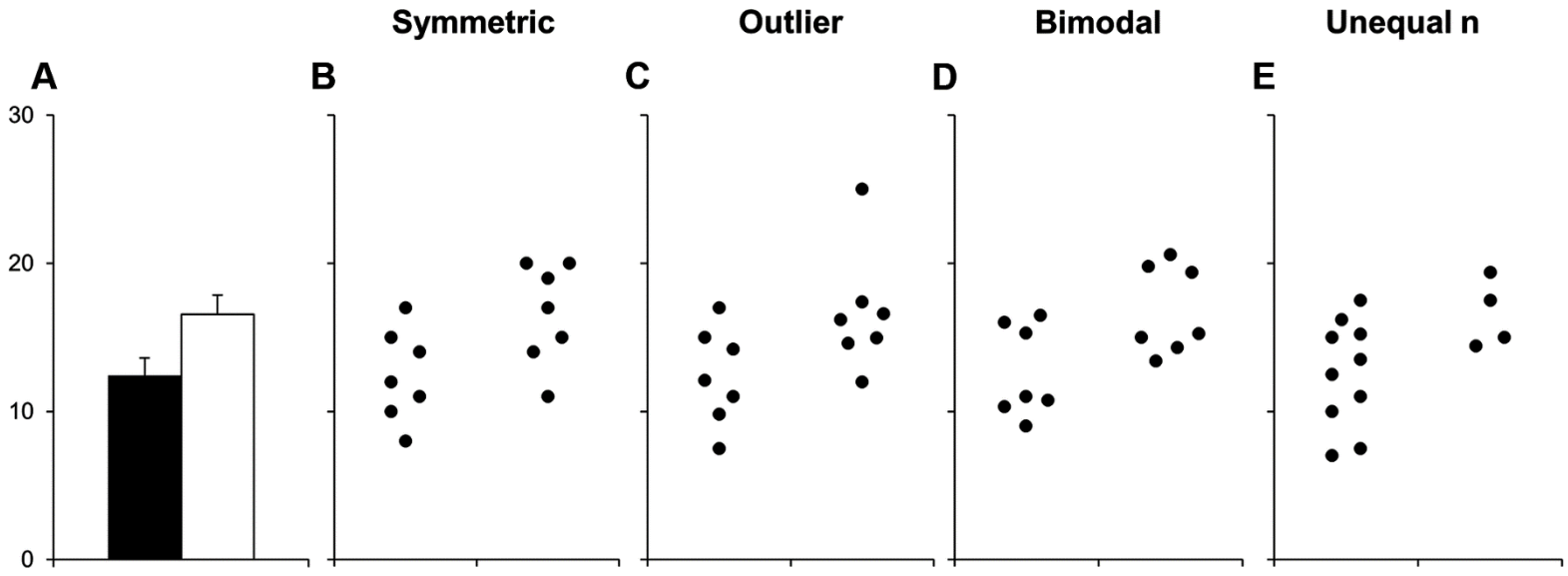
https://plot.ly/matlab/histograms/

https://towardsdatascience.com/histograms-and-density-plots-in-python-f6bda88f5ac0

Let’s end the bar graph

- ✓Beyond Bar and Line Graphs: Time for a New Data Presentation Paradigm – PLoS Biology
- Show the dots in the plots – Nature
- Leaving the bar in five steps – The Node
- Data visualization, bar naked – Journal of Biological Chemistry

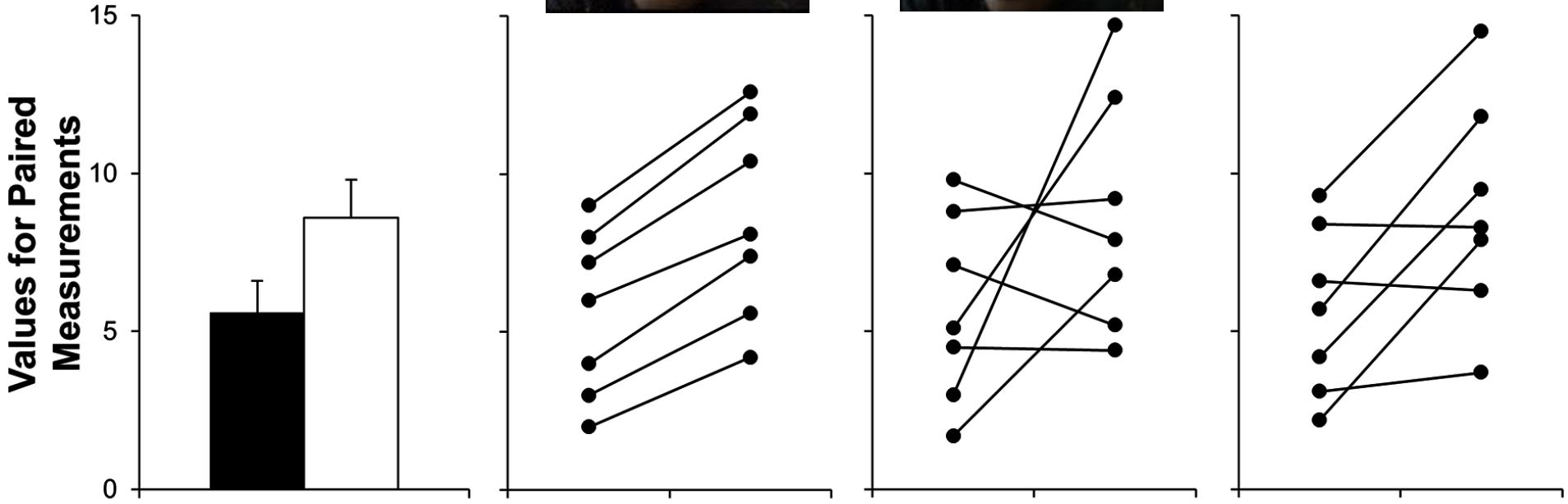
Unpaired data



Test		p value		
T-test: Equal var.	0.035	0.050	0.026	0.063
T-test: Unequal var.	0.035	0.050	0.026	0.035
Wilcoxon	0.054	0.073	0.128	0.103

Weissgerber et al, 2015

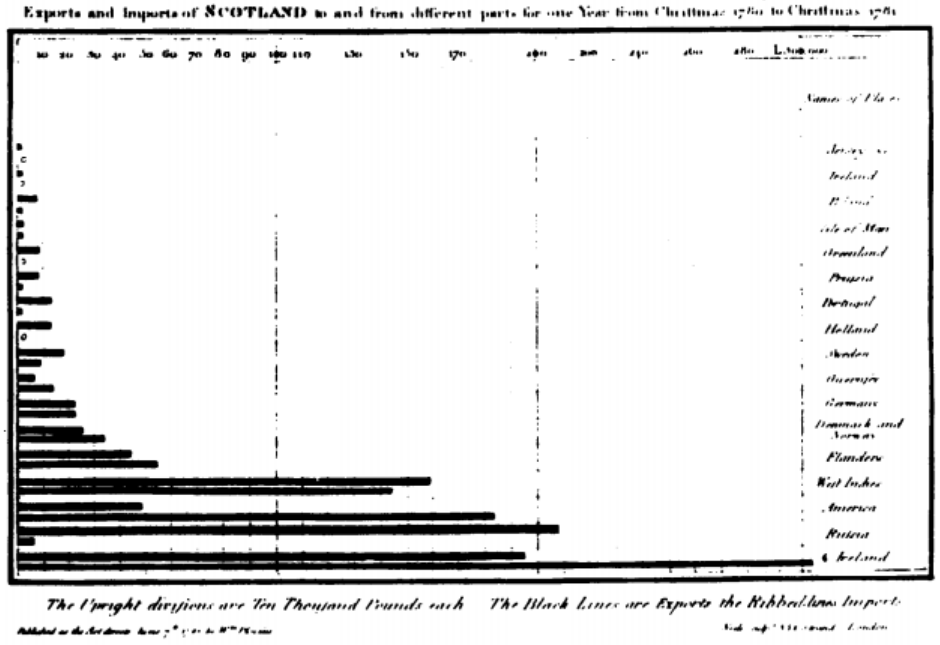
Paired data



Weissgerber et al, 2015

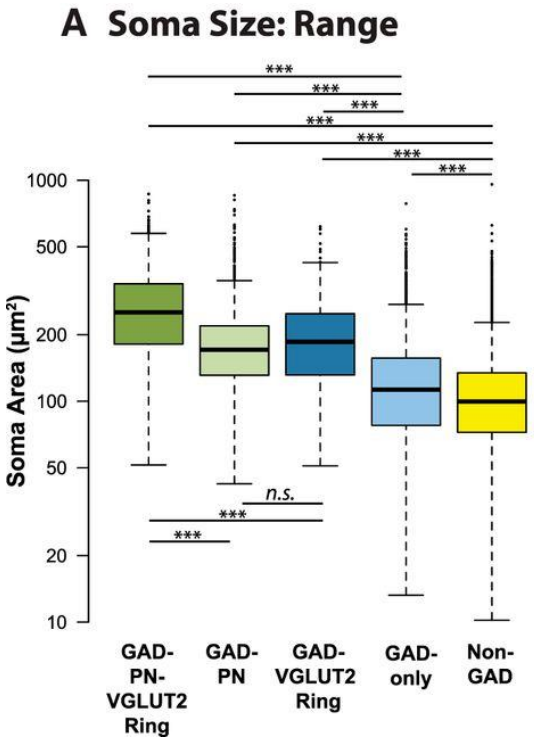
Bar graphs do have their uses

- When you have an independent, qualitative variable with nominal categories
- **Discrete data**: Dependent variable is a count or frequency
- Normal distributions
- *Misrepresenting your data*
- *Propaganda*
- *Destroying a country because Russia told you to*
  - *But see Mueller, 2019, I guess*



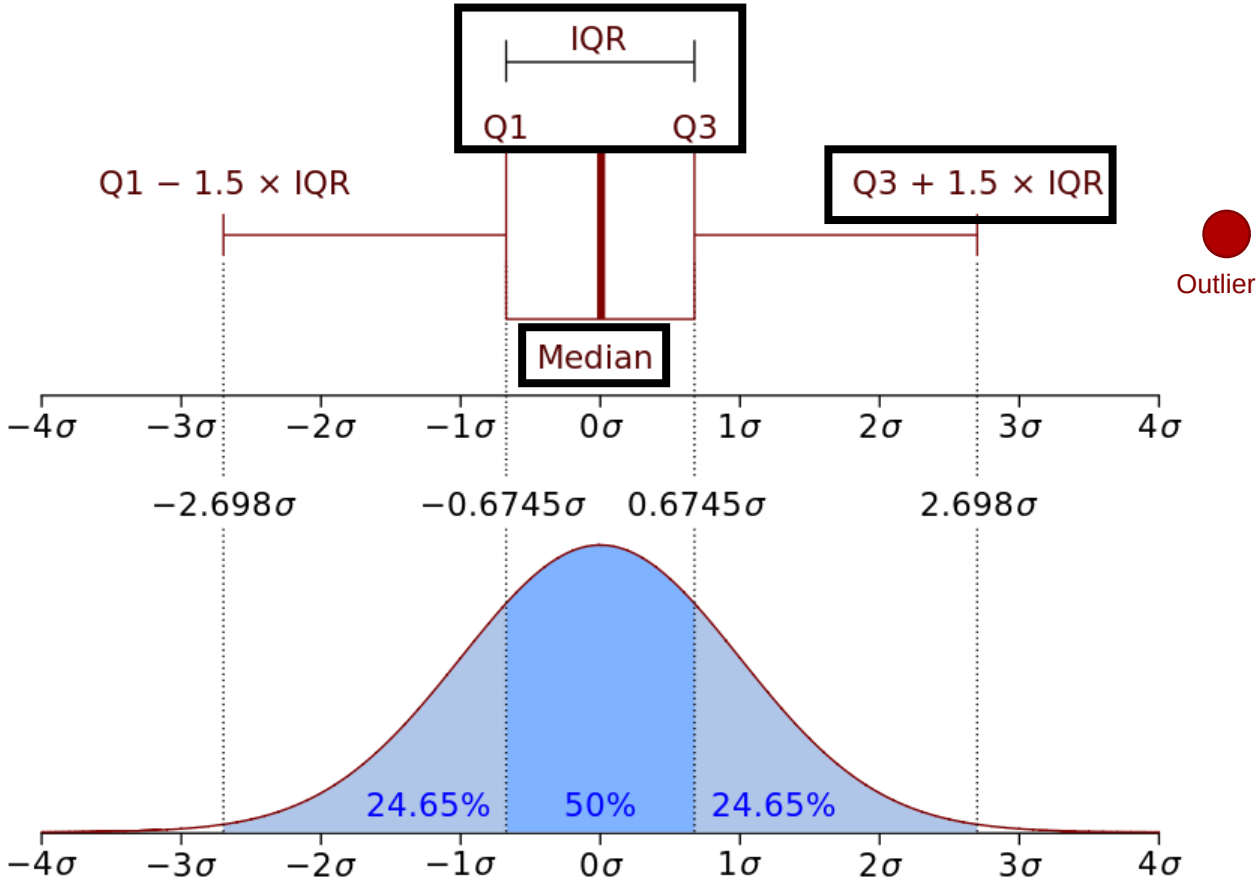
Beniger & Robyn, 1978

Bar alternatives – Box and Whisker



Beebe et al., 2016 – Using R

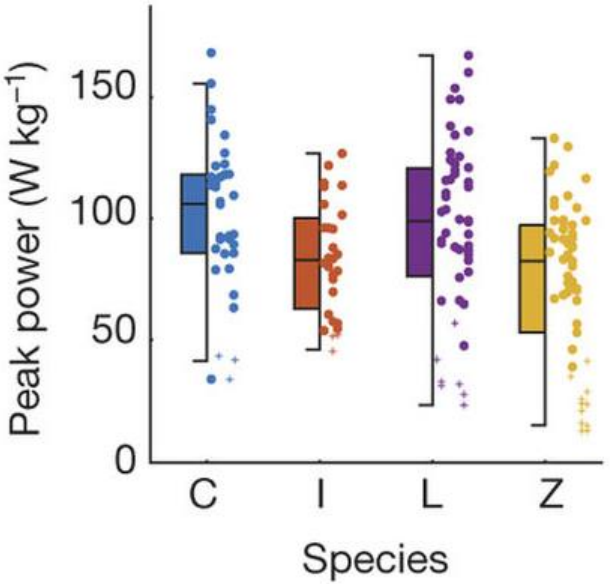
✓ Excel



https://en.wikipedia.org/wiki/Box_plot

Bonus points for showing data points*

aka pirate plot in R

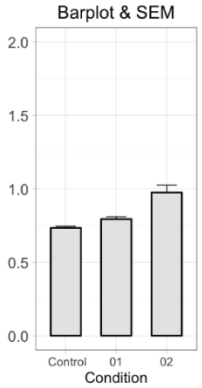


*When applicable

Made in R

https://www.reddit.com/r/rstats/comments/7z1yvg/how_can_i_recreate_this_half_boxwhisker_and_half/

Bar alternatives – Dot plot/scatter*



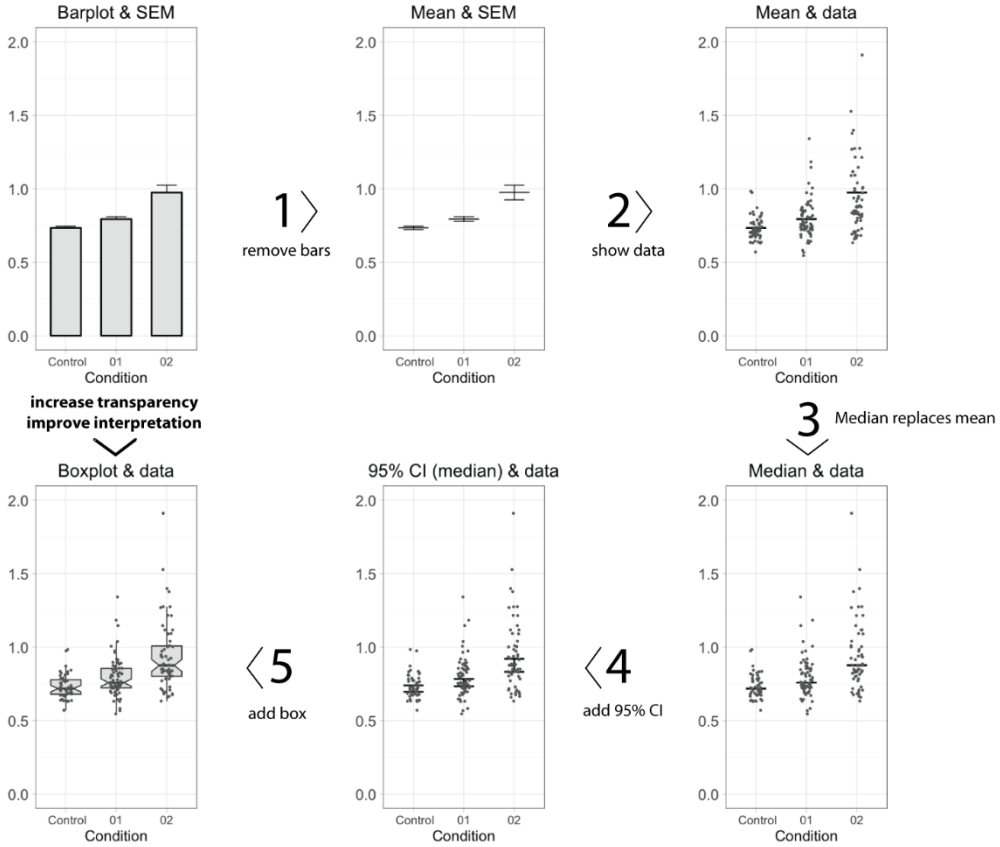
Bar graph: *Exists*
Joachim Goedhart:

@joachimGoedhart

*Not X/Y scatter plot
Made in R with ggplot2 and boxplotR – now PlotsOfData

http://thenode.biologists.com/leaving-bar-five-steps/research/

Bar alternatives – Dot plot/scatter*



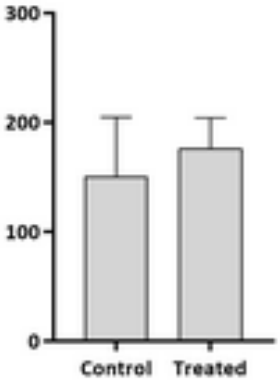
@joachimGoedhart

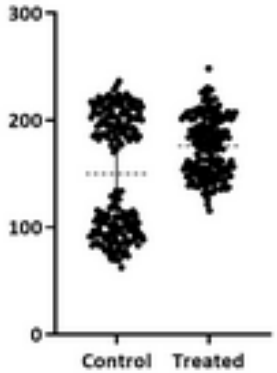
*Not X/Y scatter plot

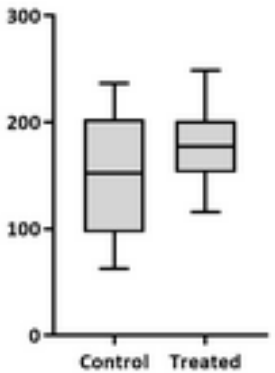
Made in R with ggplot2 and boxplotR – now PlotsOfData

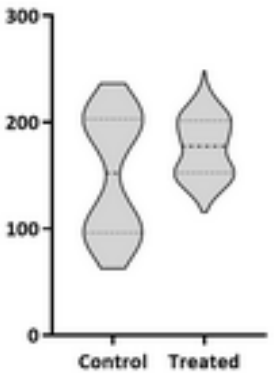
http://thenode.biologists.com/leaving-bar-five-steps/research/

Bar alternative – Violin plots



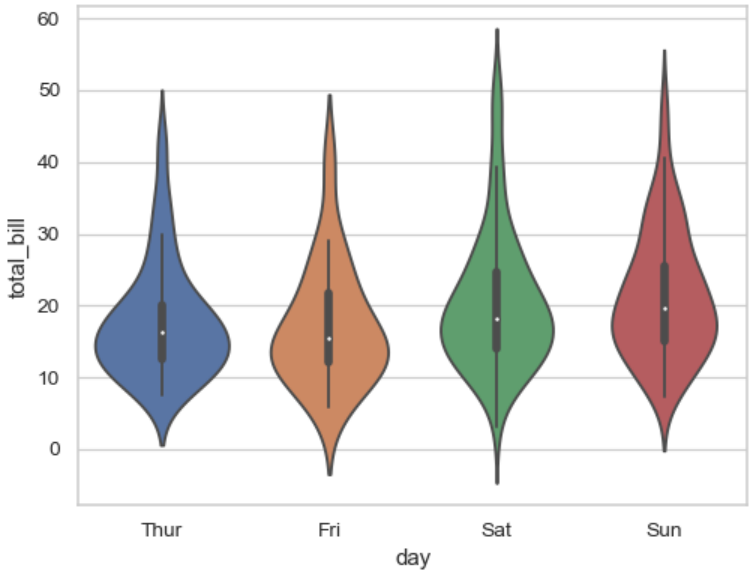






https://www.graphpad.com/guides/prism/8/user-guide/graphing-box-and-whisker-and-v.htm

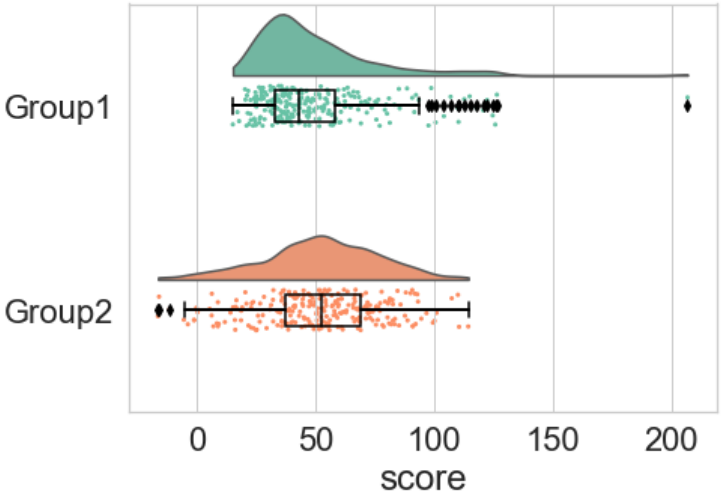
Python with Seaborn

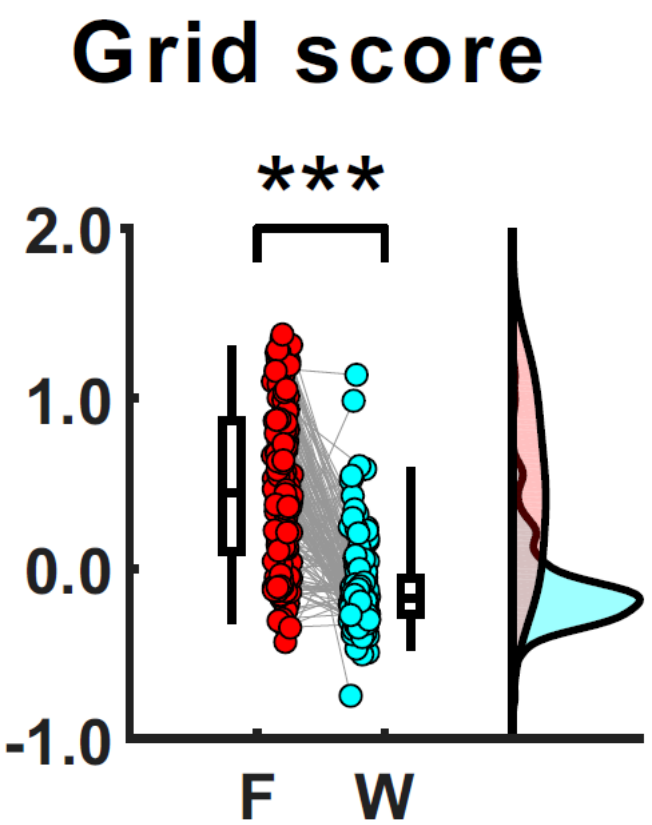



```
ax = sns.violinplot(x="day", y="total_bill", data=tips)
```

https://seaborn.pydata.org/generated/seaborn.violinplot.html

ALL THE THINGS
Raincloud plots





Made with Matlab with Raincloud by Allen et al., 2018
Available for Matlab, R, and Python

Giulio, Bush, and Jeffery, 2019

Back to graphs

- Show the data
- Induce the viewer to think about the substance of the findings
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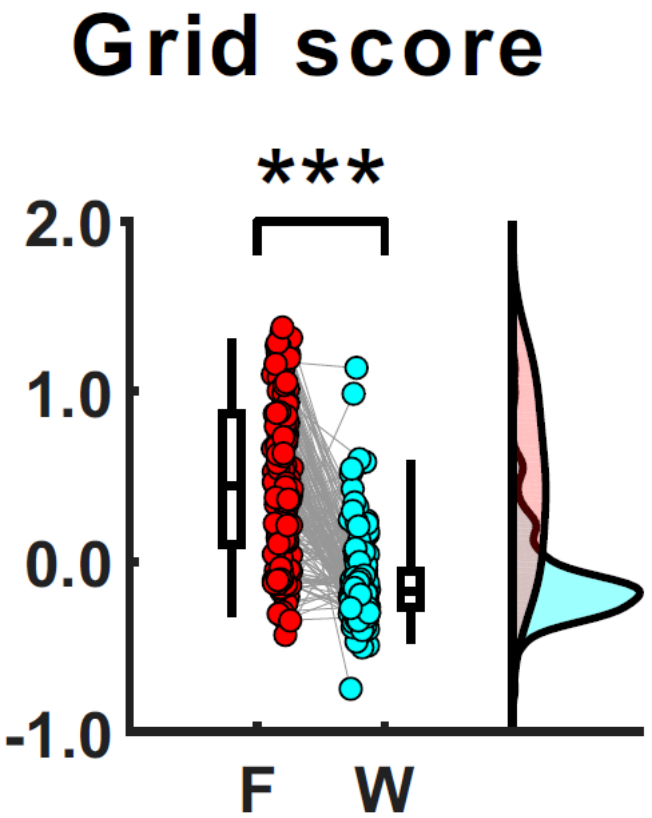
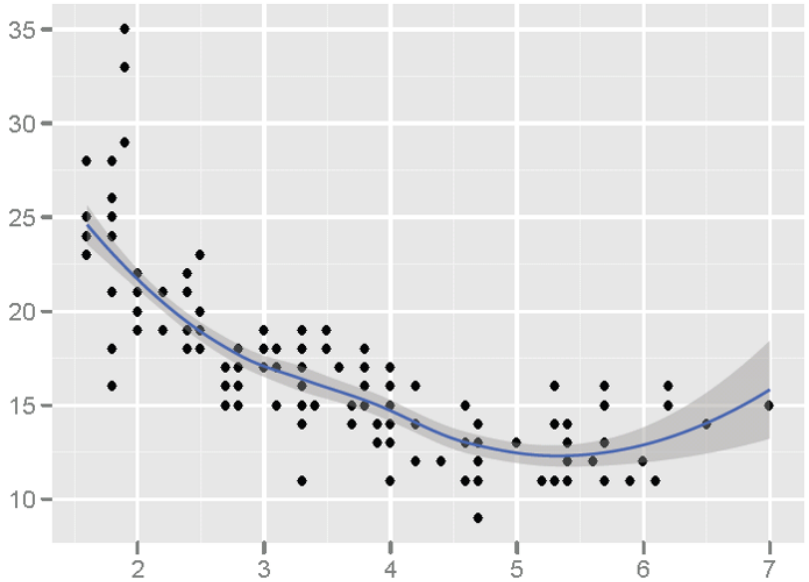


From E. R. Tufte. The Visual Display of Quantitative Information, 2nd Edition. Graphics Press, Cheshire, Connecticut, 2001 in http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/DataPresentation/DataPresentation3.html

Scatter plots – x/y

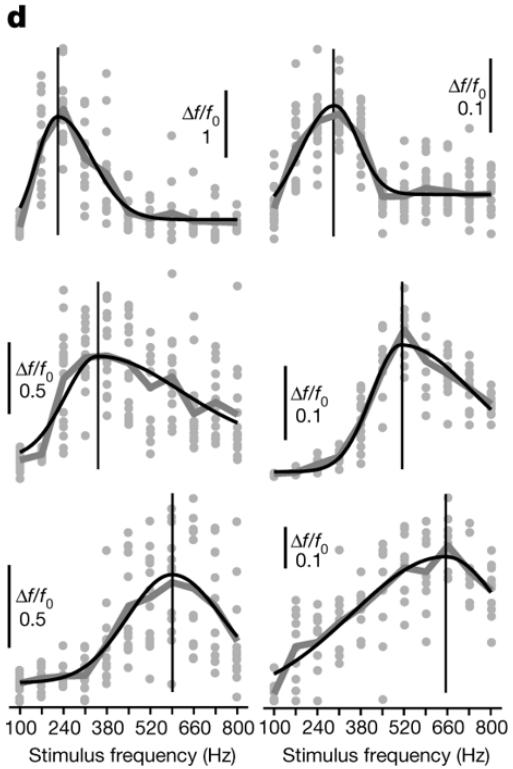
- How one variable changes due to a second variable
- If time is a variable, it should be on the X axis
- Make sure your trend line stands out

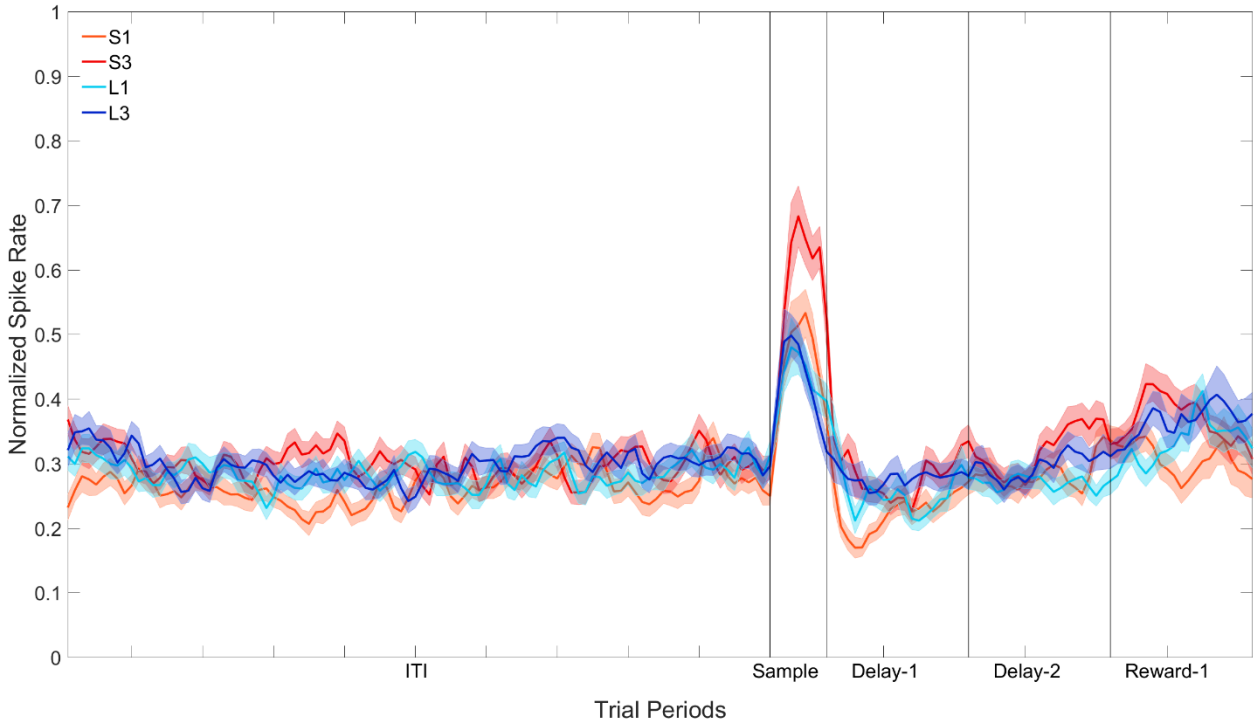


Made in R

http://biostat.mc.vanderbilt.edu/wiki/pub/Main/StatGraphCourse/graphscourse.pdf

Line graphs

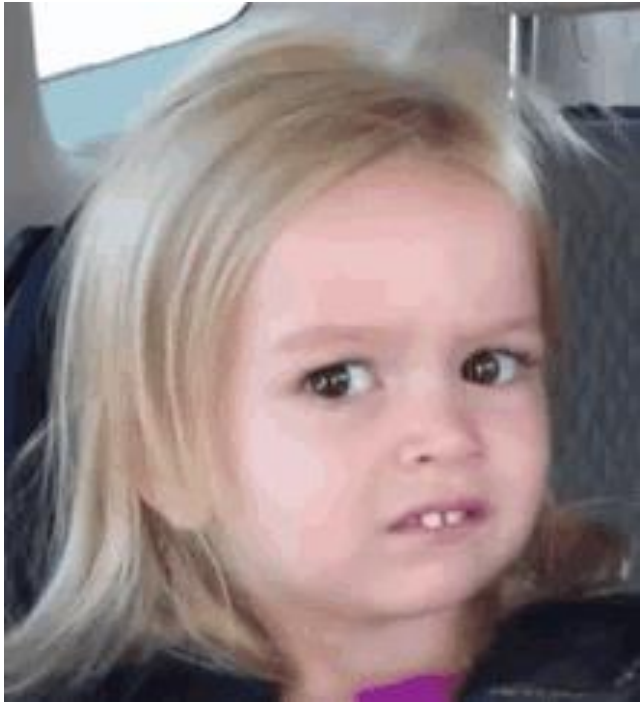


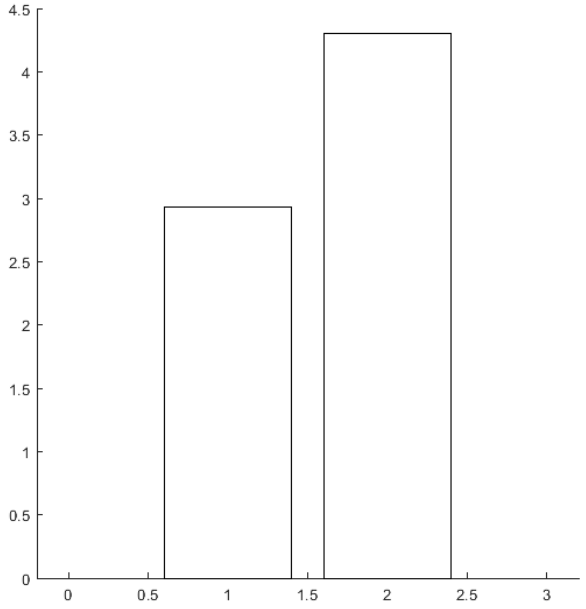


Matlab - Prsa et al., 2019

Dykes, Porter, & Colombo, 2018

Whatever you pick, error bars are necessary

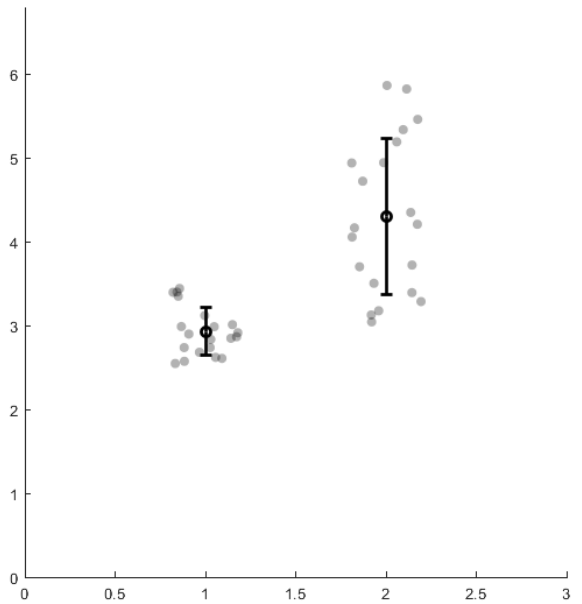




Matlab

Whatever you pick, error bars are necessary

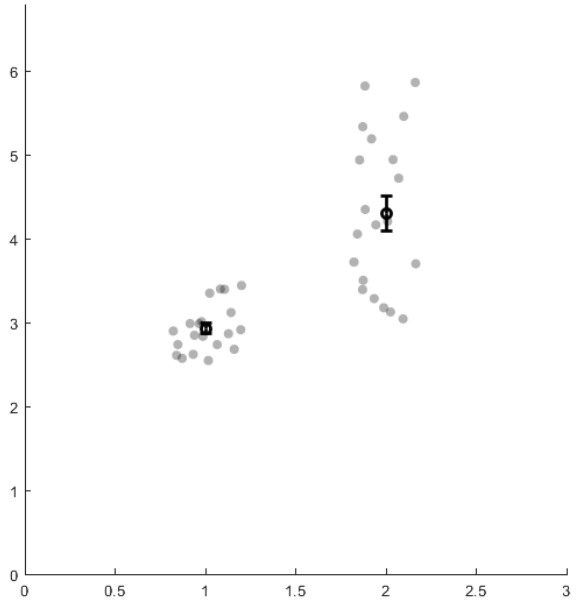
- **Standard deviation** (SD)
  - Better for comparing individual samples to the population
  - Not used when comparing multiple groups
  - Normal distribution



Matlab

Whatever you pick, error bars are necessary

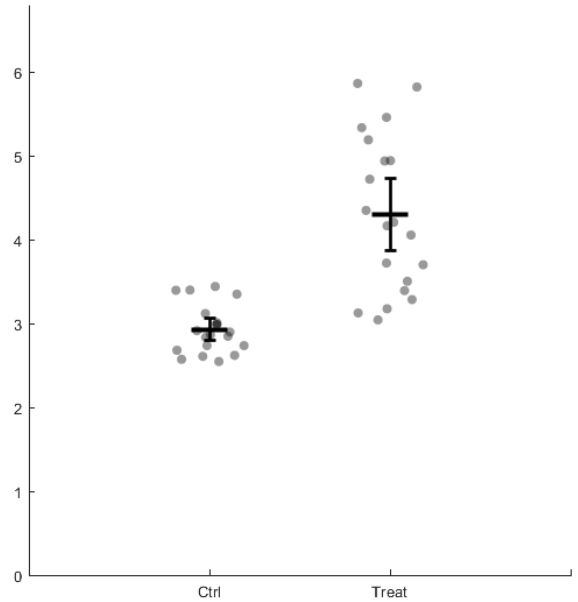
- **Standard error of the mean** (SEM)
  - Comparing observations and the accuracy of a mean
  - Normal distribution



Matlab

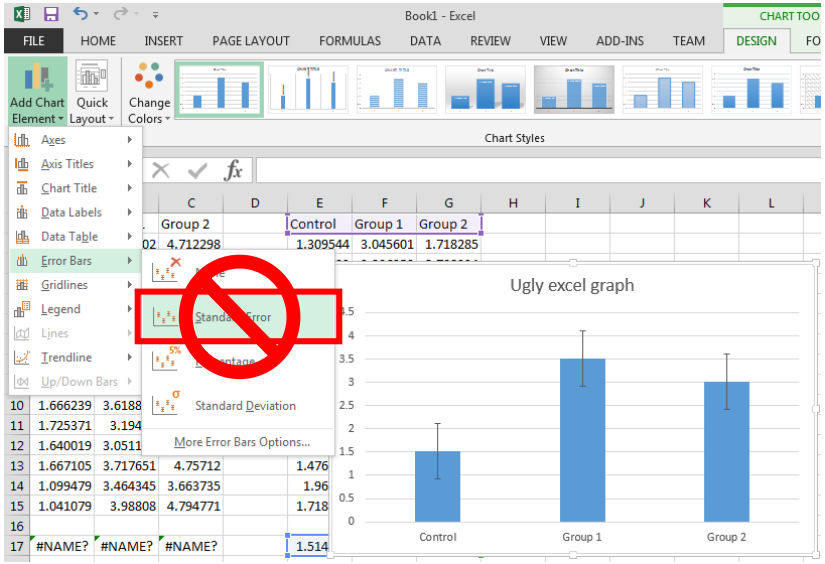
Whatever you pick, error bars are necessary

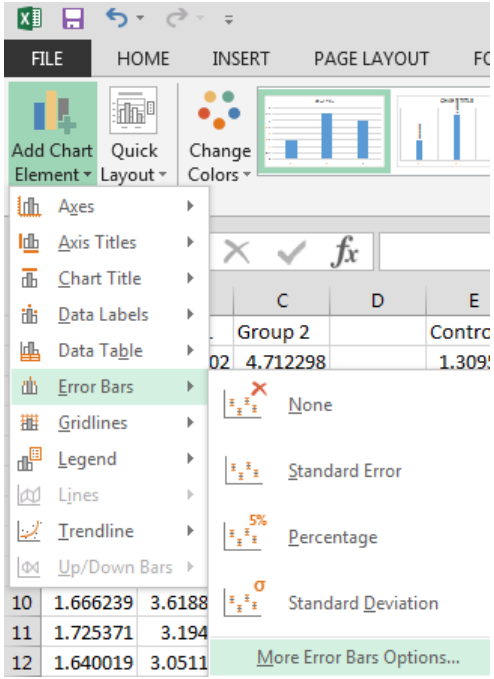
- **Confidence intervals** (CI)
  - Fewer assumptions*
  - More complicated to derive*
  - Visually show significant differences

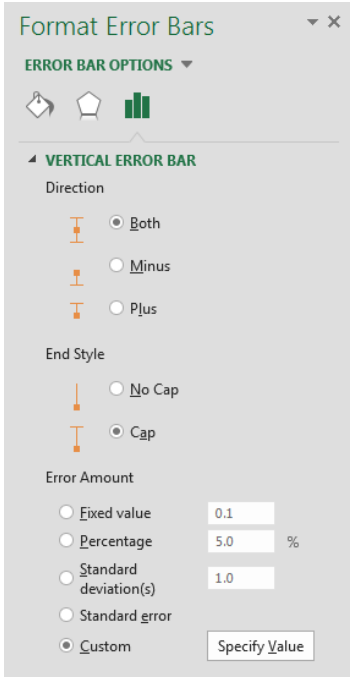


Matlab

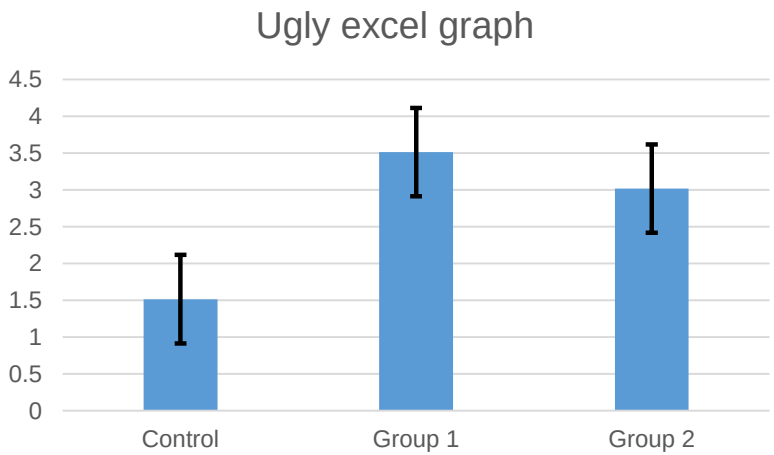
Do NOT use Excel's built in error bars

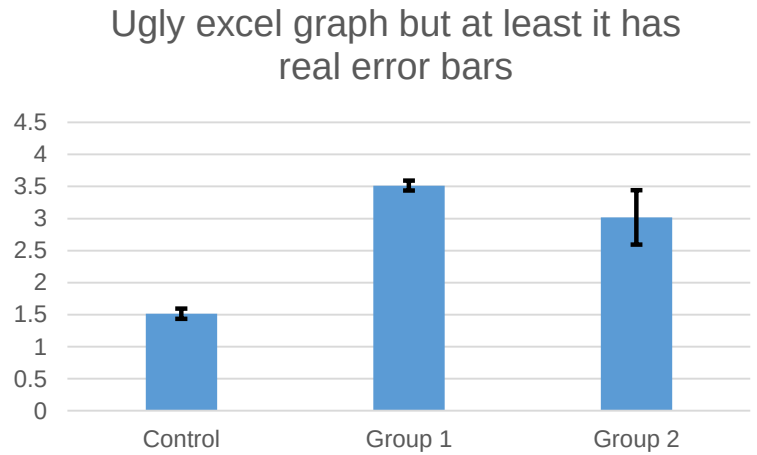




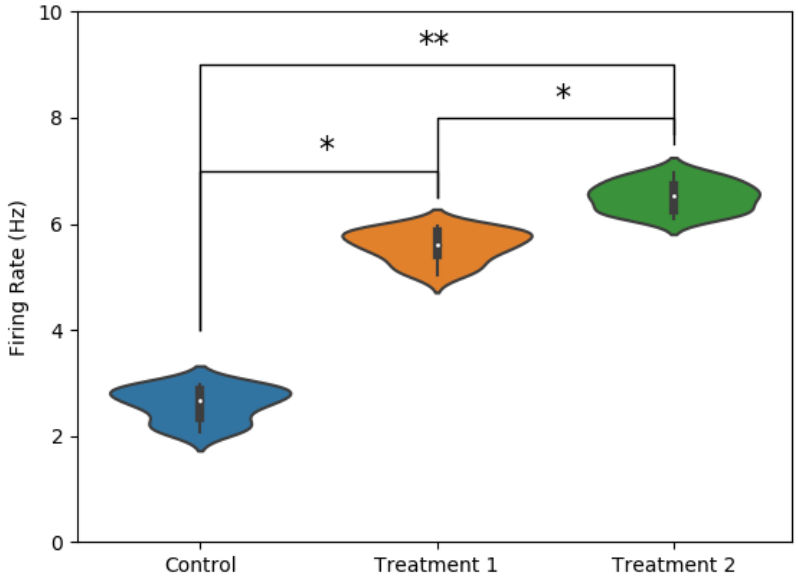


Do NOT use Excel's built in error bars

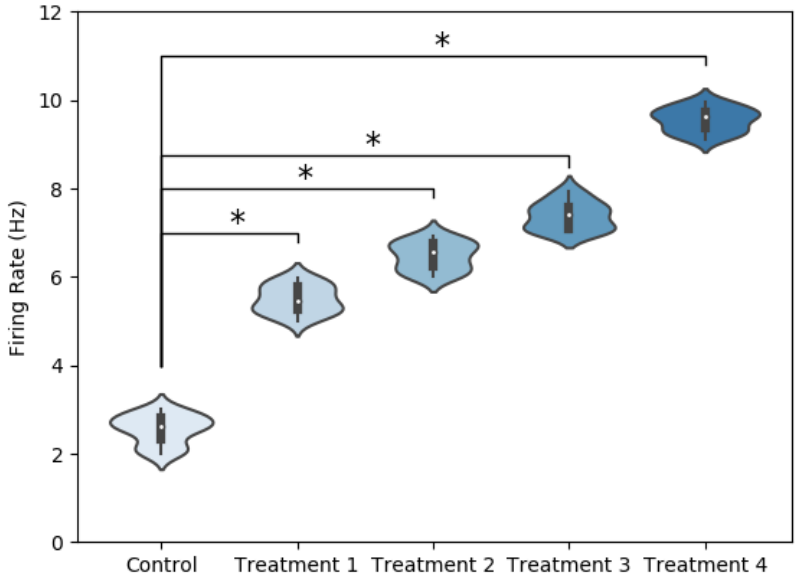




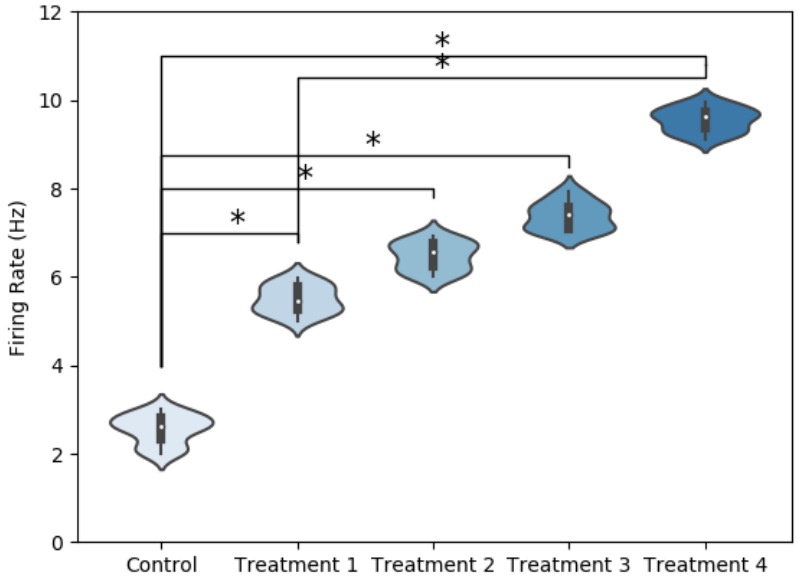
Showing Significance



Showing Significance



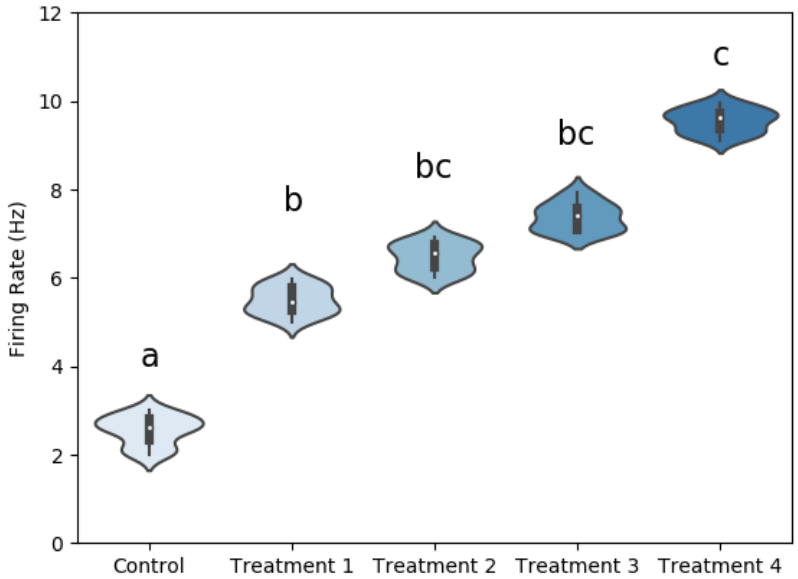
Showing Significance



Crowding solutions

Python with MatPlotLib and SeaBorn

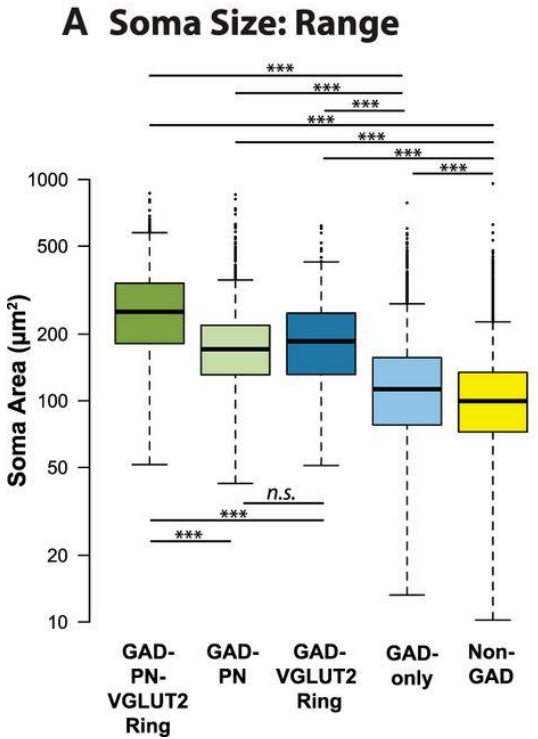
Showing Significance



Using letters

Shared letter = not different
Different letter = sig diff

Showing Significance

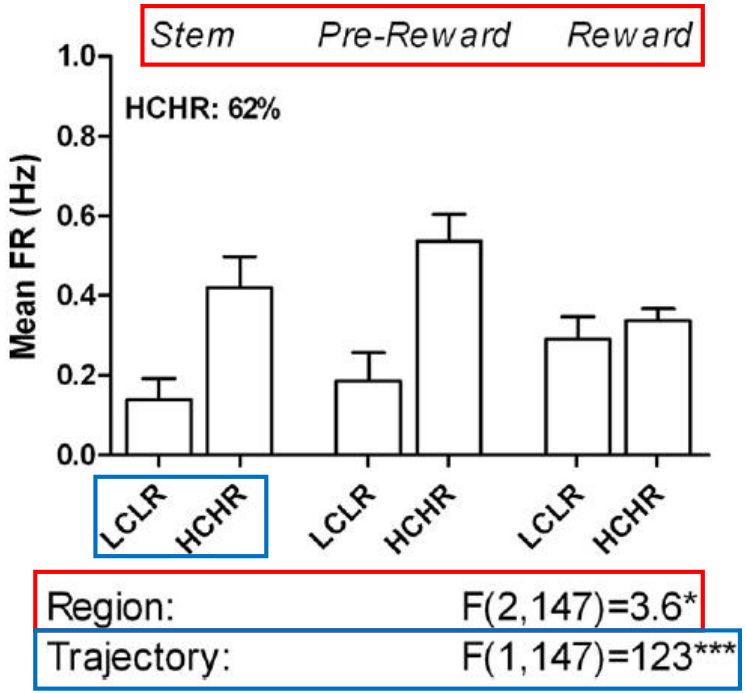


Beebe et al., 2016 – Using R

Just lines

Python with MatPlotLib and SeaBorn

Showing Significance



Show the table

Doesn't show pairwise

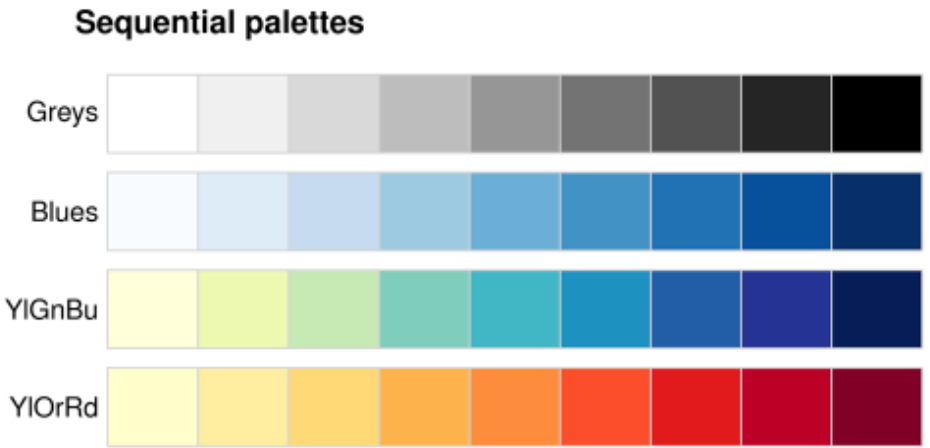
Hillman & Bilkey, 2010

Using color effectively

- “… avoiding catastrophe becomes the first principle in bringing color to information: Above all, do no harm. “ – Tufte, 1990
- Stick to greyscale when possible
- Ensure the use of color adds value to the reader
  - Can be distracting at best and confusing at worst
- Color costs $$$$

Color –Sequential data

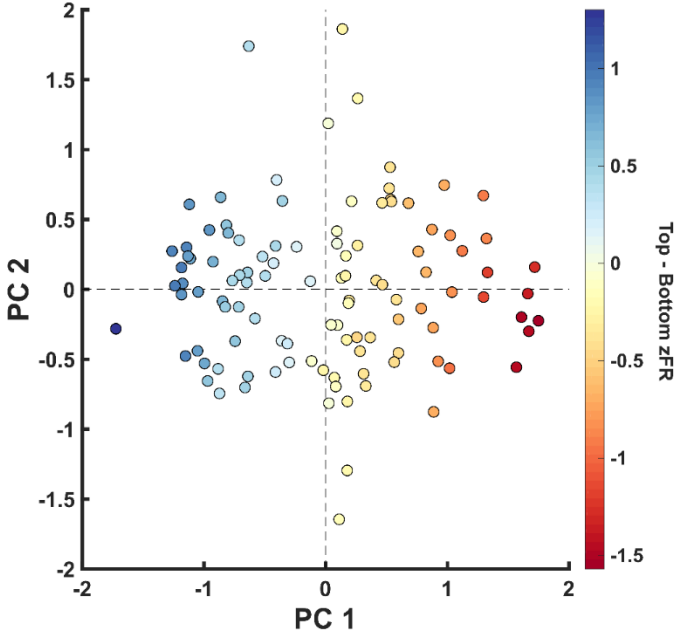
- **Variables**: Ordinal
  - e.g. dose response
- **Data**: Using a minimum baseline
- Lighter = less/min/zero
- Darker = more/max



https://betterfigures.org/2015/06/23/picking-a-colour-scale-for-scientific-graphics/

Color – Diverging data

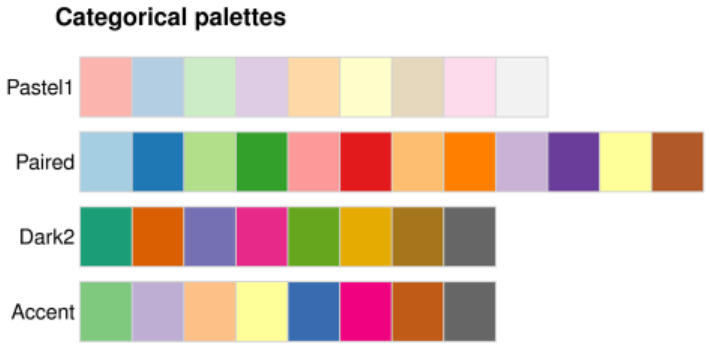
- **Variables:** Ordinal
  - e.g. Likert scale
- **Data:** centers around some value (0, mean/median)
  - Shown as white
  - e.g. Z-scores
- Contrasting colors



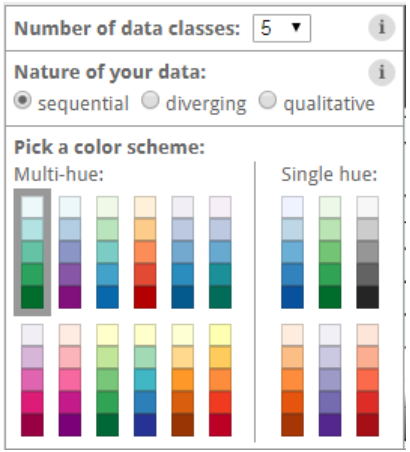
Porter, Hillman, & Bilkey, 2019

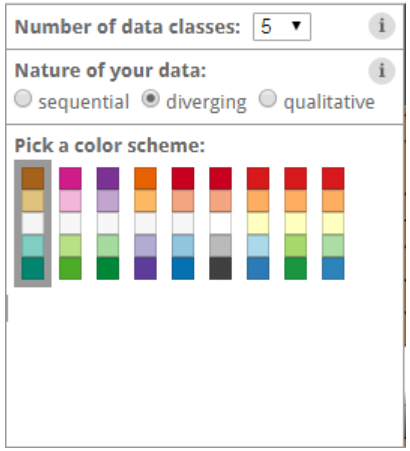
Color – Qualitative data

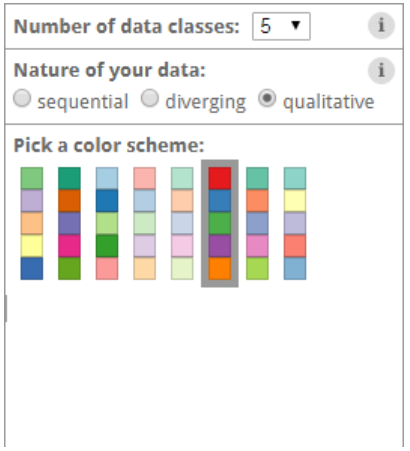
- **Variables:** Nominal
- Keep brightness the same
  - Unless using paired data



Beautiful palettes from ColorBrewer2.org

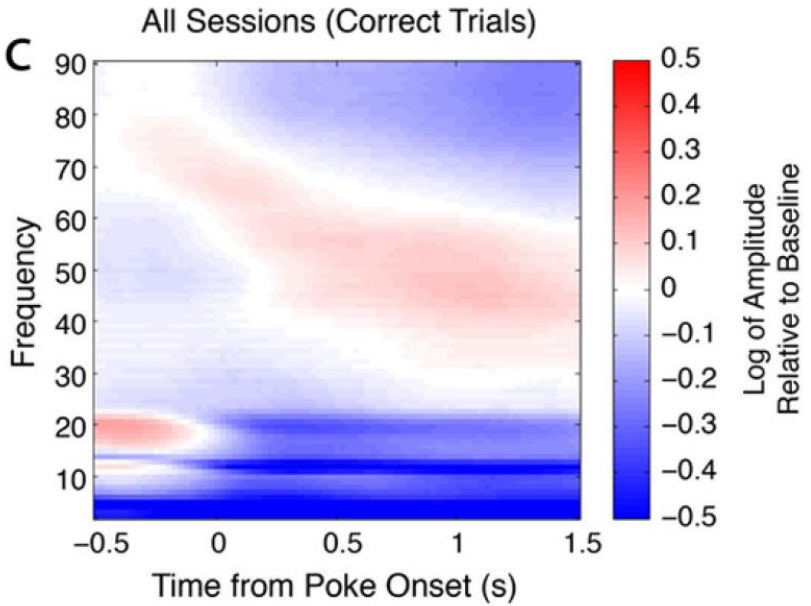






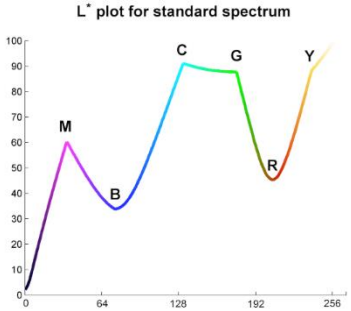
Color as a 3rd dimension

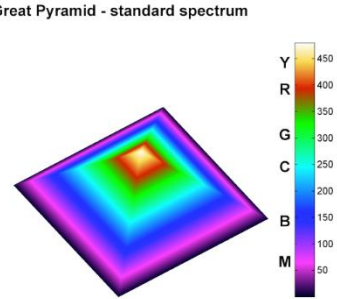
- Great way to plot another dimension of data
- Color choice is very important
  - As numerical values will not be directly seen

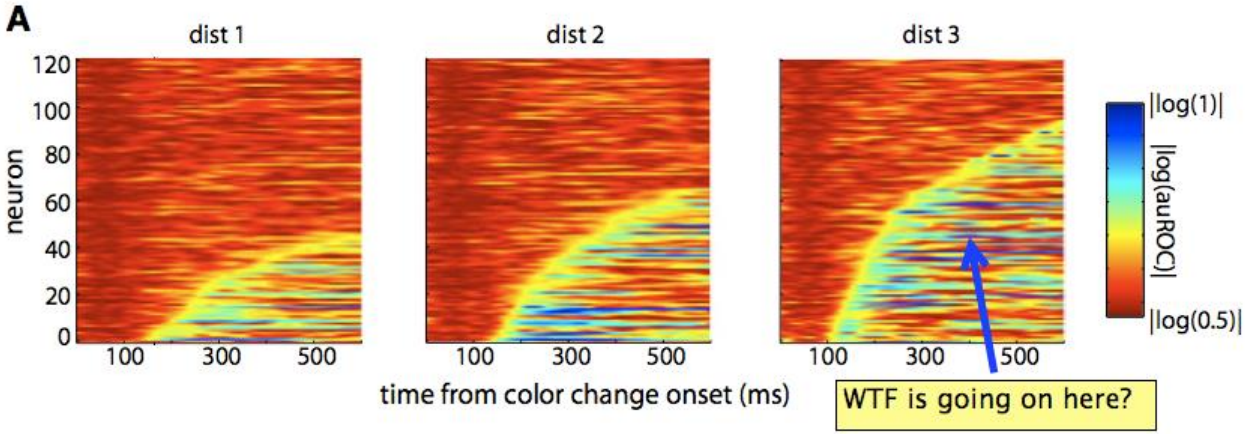


Rangel et al., 2015

NO RAINBOWS



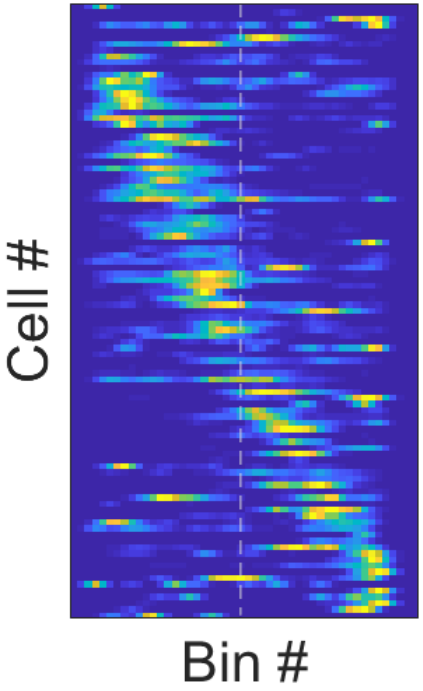


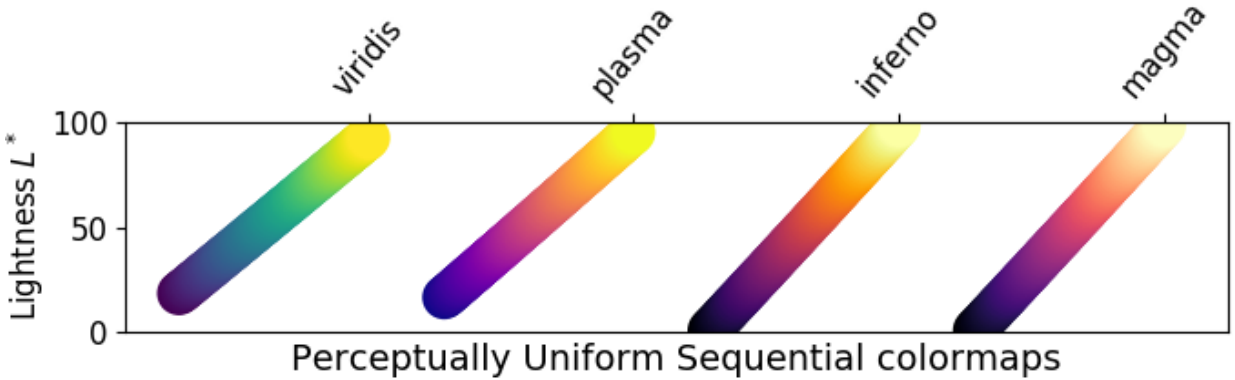


https://mycarta.wordpress.com/2013/02/21/perceptual-rainbow-palette-the-method/

https://eagereyes.org/basics/rainbow-color-map

Many alternatives (with cooler names)



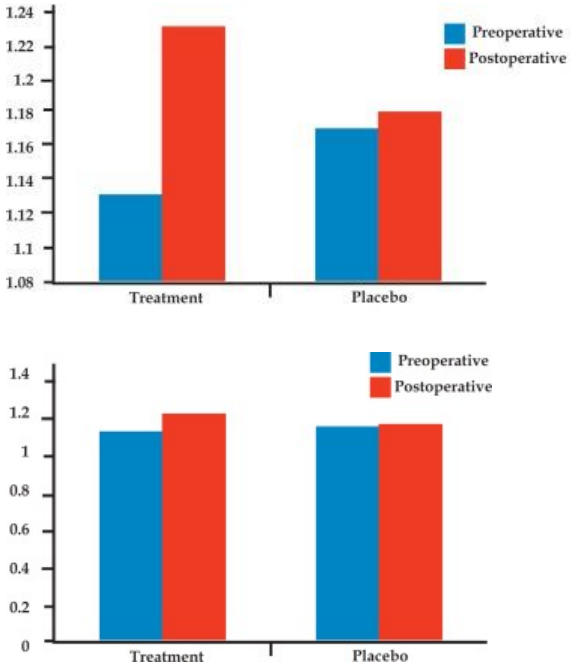


Matlab's "Parula"

https://matplotlib.org/users/colormaps.html

Y zero?

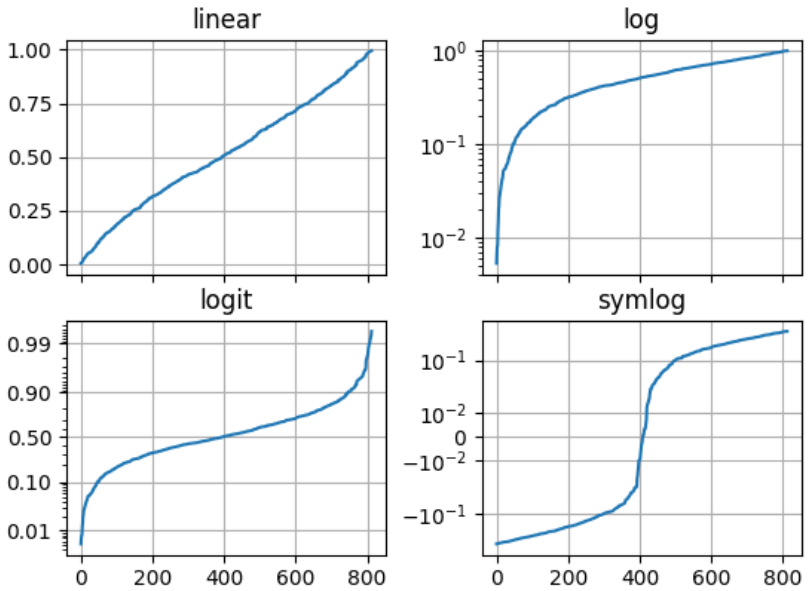
- Starting at zero is *generally* a good idea
  - When zero is a possible data point
  - Using bar charts
- If not using zero
  - Start y-axis at your minimum data point
  - A statistically reasonable range
    - ± 3 SD
  - Data points are shown
- Data should fill the space



Duquia et al., 2014

Logarithmic scales

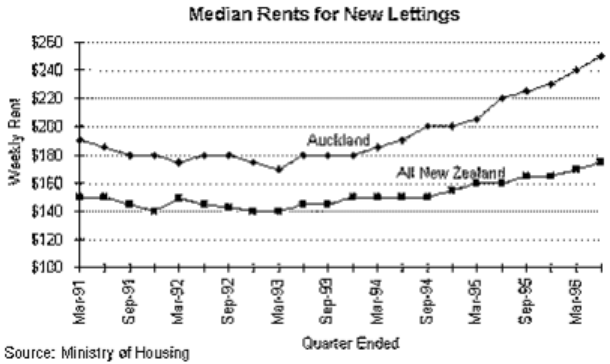
- Percent change
  - Weber-Fechner law
- Multiplicative factors
  - Dendrite spin size
  - Numerosity encoding
- Skewed data
  - Neuron firing rates
  - 1/f power rule for EEG/LFP



https://matplotlib.org/examples/scales/scales.html

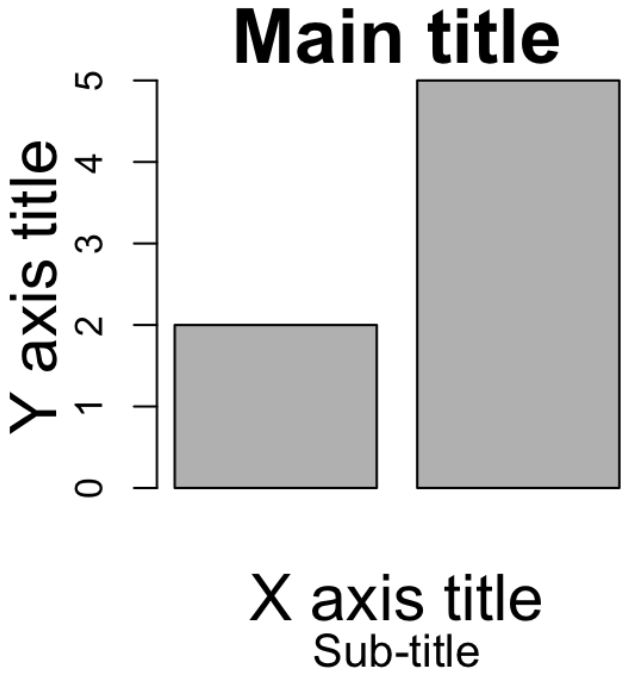
Tick marks and guidelines

- Careful not to overcrowd
  - You don’t need to label every tick
- Use guidelines to subtly draw attention
  - Make sure they don’t distract from data (esp line graphs, trend)
  - Err on less, or none



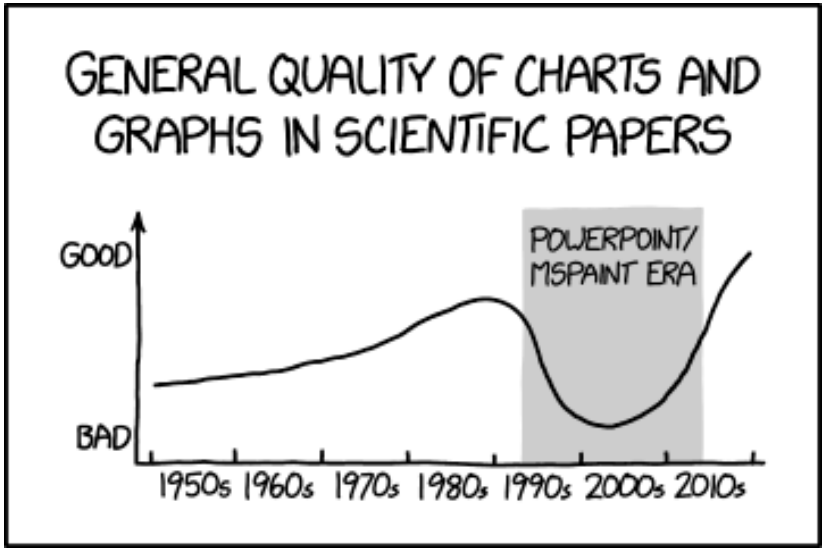
Using text effectively

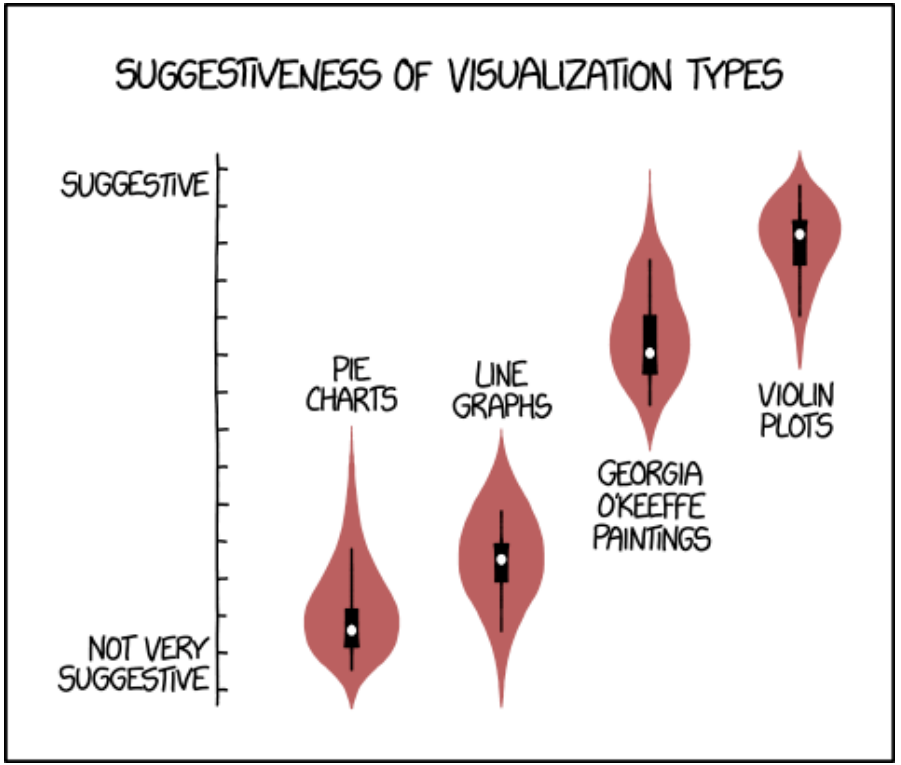
- Font size should go from larger to smaller as you go outside in
- Make sure values aren't too small
  - Make fewer ticks for larger fonts



R - http://www.sthda.com/english/wiki/print.php?id=145

Questions?





https://xkcd.com/1945/

https://xkcd.com/1967/

Inkscape

Vector graphics editor

https://inkscape.org/

Babraham Institute

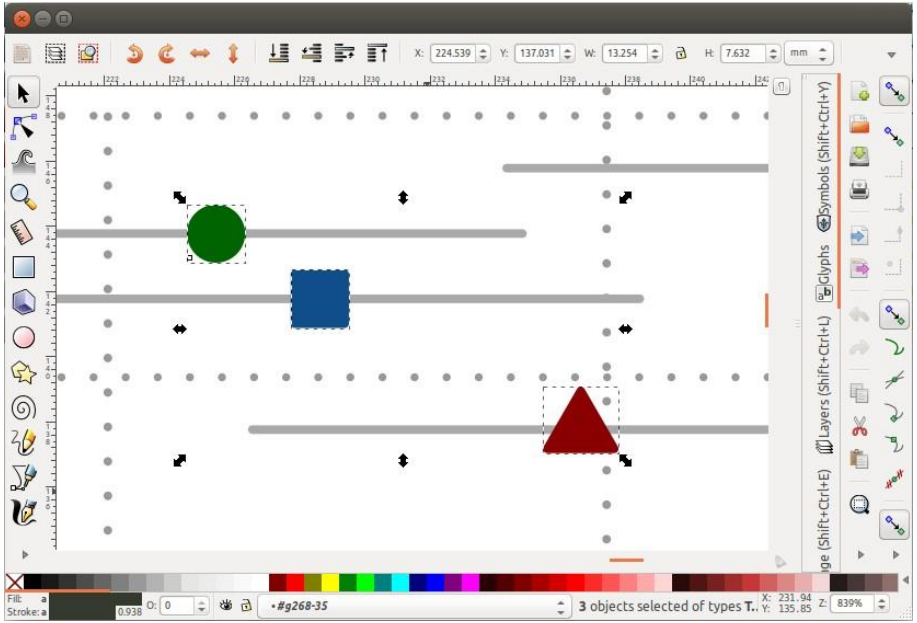
This PowerPoint on Inkscape was created by Aiora Zabala, Simon Andrews, and Boo Virk

https://bioinformatics-core-shared-training.github.io/
https://slideplayer.com/slide/3838119/

Aiora Zabala http://aiorazabala.net/
Simon Andrews http://proteo.me.uk/about/
Boo Virk @bv208

What is Inkscape?

- Vector graphics editor
- Free, open source
- Cross platform
- Easy-ish to use
- Good for:
  - Composing figures
  - Drawing
- Weak:
  - Editing images

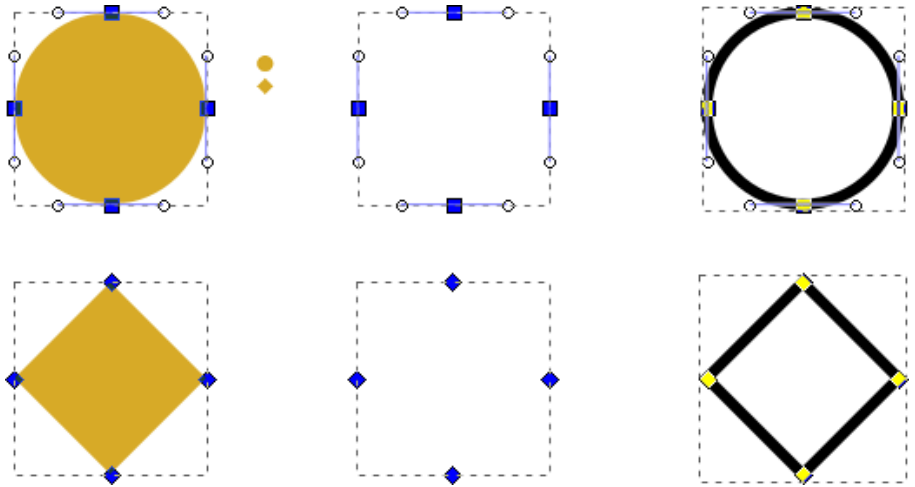


Bitmaps

Images are made of pixels and a color value

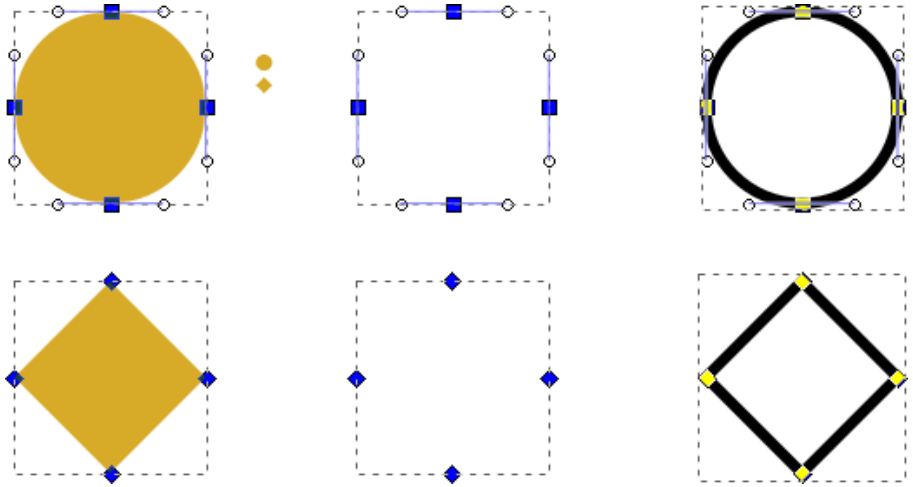
Vector Graphics

Images are made by points and their connections. Connections can be straight or smooth



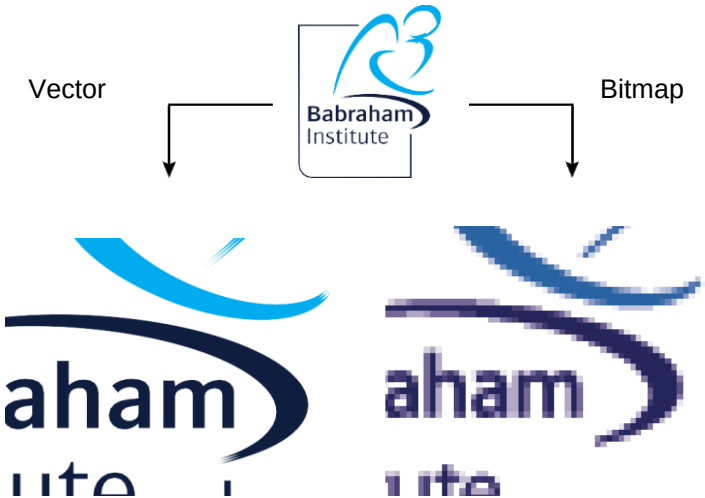
Vector graphics

- No resolution
- Fully editable

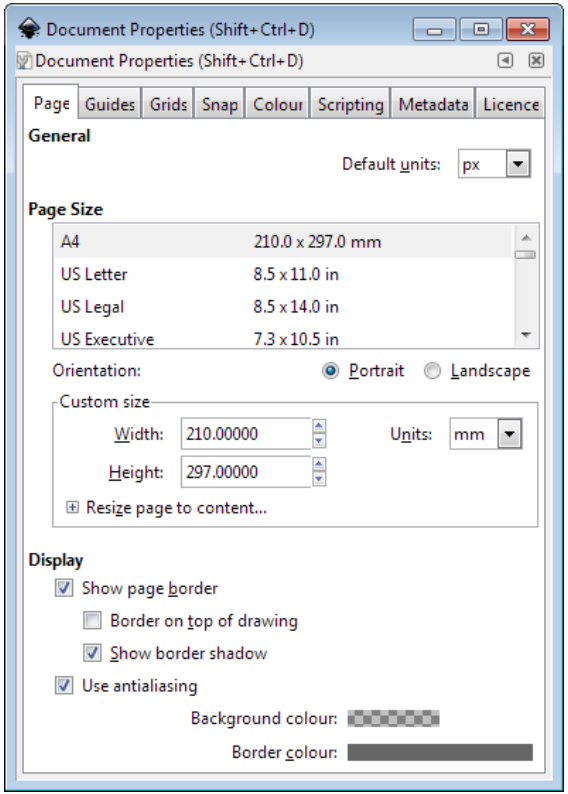


Scaling figures

- Vector images can be scaled freely without loss of quality
- Bitmap images can be scaled down, but not up



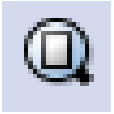
Exercise 1: Setup a Canvas



- File > Document Properties
  - Shows page in view
  - Doesn't restrict drawing
  - Useful as a guide
- Change background color to white
- Change to landscape

Moving around

- Panning
  - Scroll bars on bottom / right
  - Scroll up/down, Shift+scroll for left/right
- Zooming in / out
  - Click to zoom in, shift+click to zoom out 
  - Control + Scroll Up/Down to zoom in/out to cursor
- Shortcuts
  - Fit page, drawing, selection in window



The main toolbar

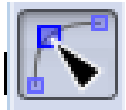
Selection tool, F1
Edit nodes tool, F2
Sculpt tool
Zoom tool, F3
Measurement tool
Make rectangles, F4
Make 3D boxes
Make ellipses / arcs, F5
Make polygons / stars
Make spirals, F9

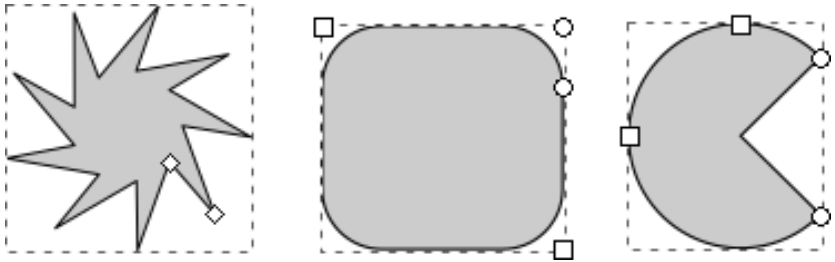
Draw freehand lines, F6
Draw straight lines / curves
Calligraphy tool
Add text, F8
Sculpt with spray
Erase
Fill
Edit gradients
Select color
Create diagram connectors

Create basic shapes

- Select a tool from toolbar
- **Click and drag on canvas**
  - Box selects the bounds of the new shape
  - Colors are remembered from the last shape
- Basic options appear in **top toolbar**
  - Number of spokes on stars
  - Rounded corners on rectangles
  - Circle vs segment vs arc

Control nodes

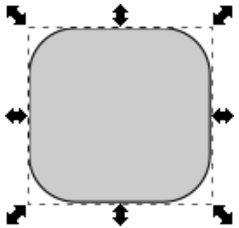
- Use the Edit Nodes tool 
- Two types of control points, squares and circles
  - Squares generally change the size of the shape
  - Circles change the appearance



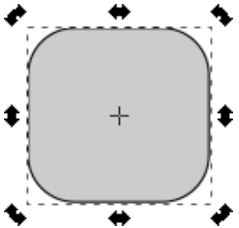
General transformations

- Select the Selection tool 
- Moving – Click and drag an object
- Duplicating – Select object and press Ctrl+D
- Resizing / Rotating
  - Click on object
  - **Click again** to change control arrow type
  - Click and drag arrows to resize / rotate

Resize / Rotate



resize

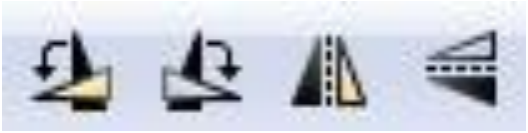


rotate

- Can use shift/control keyboard modifiers as before
- For rotation you can move the crosshair to change the center of rotation

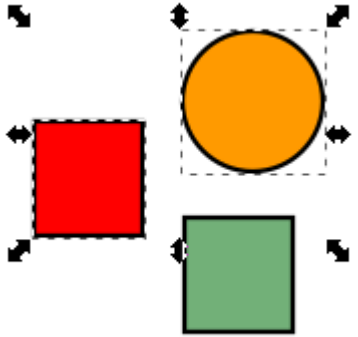
Transform Shortcuts

- Rotate 90 degrees anticlockwise
- Rotate 90 degrees clockwise
- Mirror object around the vertical axis
- Mirror object around the horizontal axis



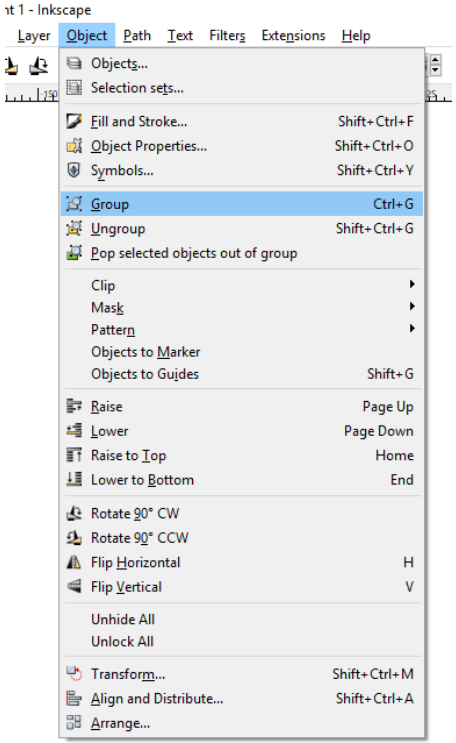
Selecting

- Selecting multiple objects, either:
  - Drag a box to cover multiple objects
  - Shift+click:
    - to add an object to a selection
    - on a selected object to remove it from the selection



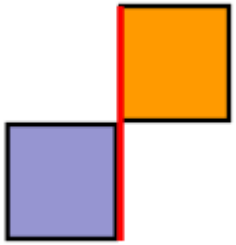
Grouping

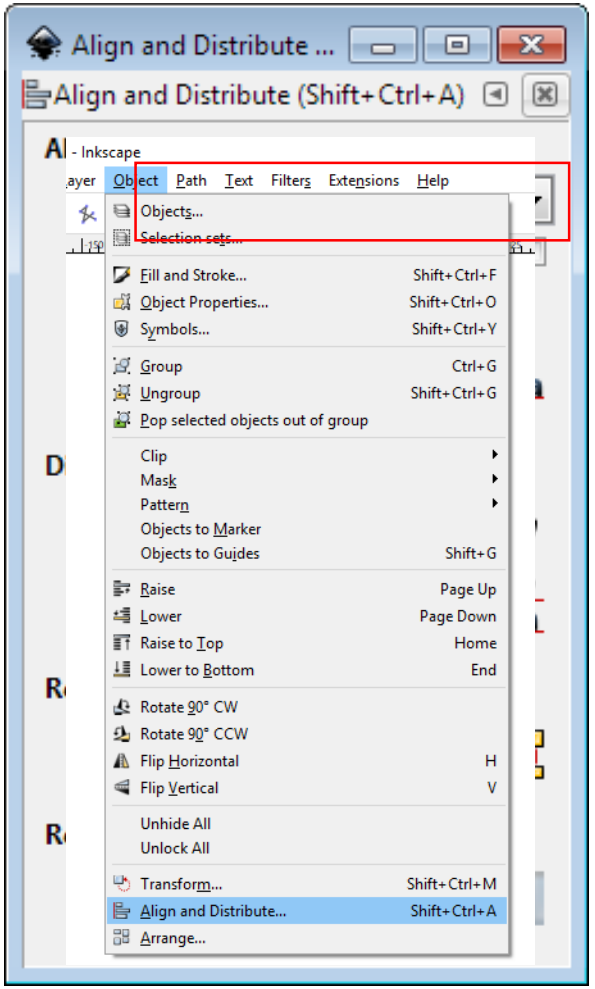
- Grouping (right click > Group or Ctrl +G)
  - Combine multiple objects into a single object
  - Reversible: Ungroup (Control+Shift+G)



Aligning and distributing

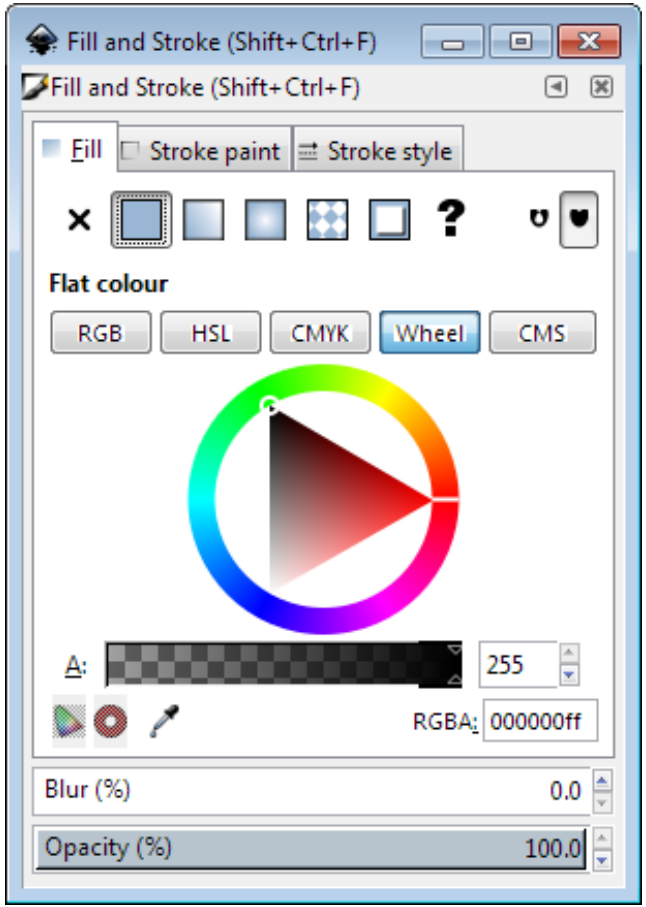
- Object >Align and Distribute
  - Align = Give objects the same center/edge position
  - Distribute = Space objects evenly
- Align relative to
  - First/Last selected object in group
  - Largest/Smallest object in group
  - Page
  - Drawing
- Never align anything by eye!





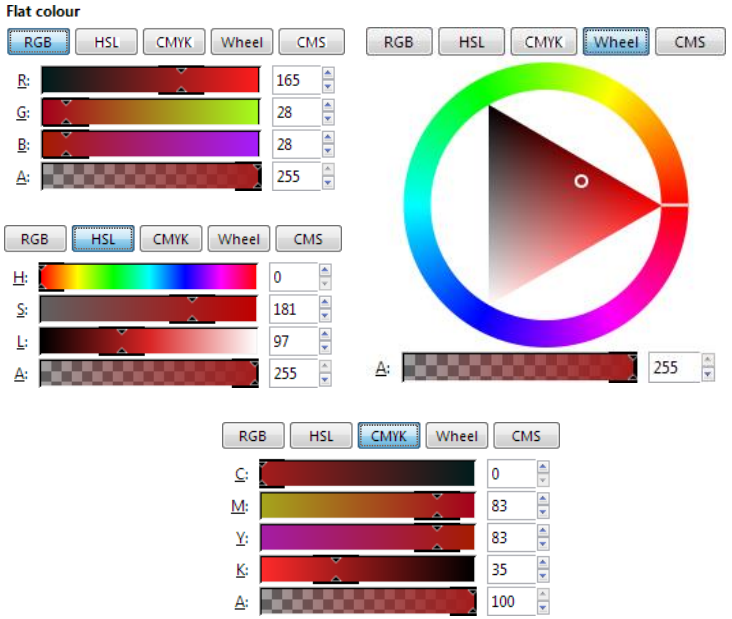
Fill and Stroke (Outline)

- Fill = Color/ Gradient/ Pattern within a shape
- Stroke = The line around a shape
- Object > Fill and Stroke (Shift+Ctrl+F)
- Edit
  - Colors
  - Opacity
  - Blur



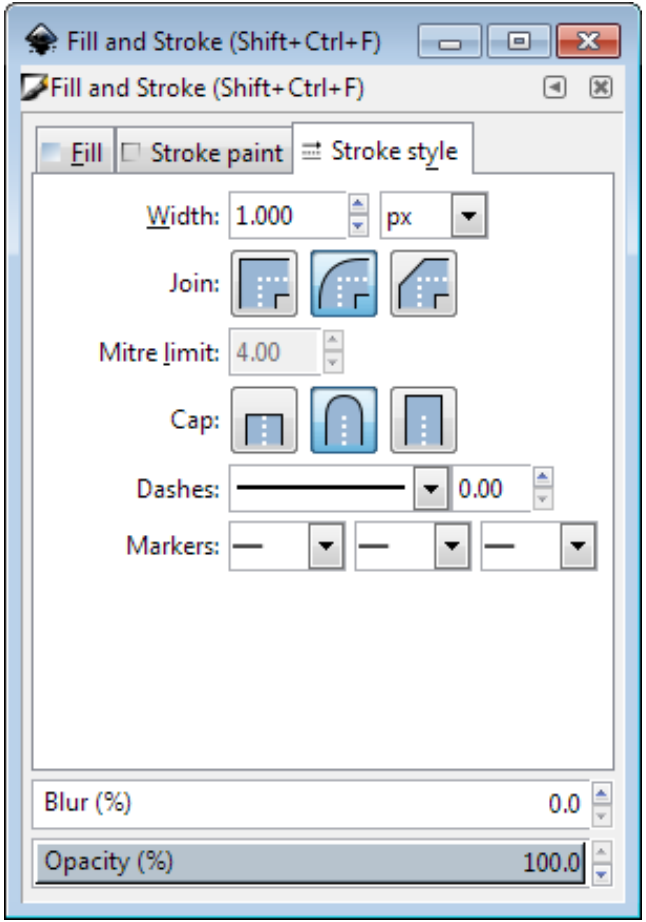
Fill and Stoke

- Fill types
  - Flat color
  - Linear gradient
  - Circular gradient
  - Specify color and alpha (opacity)



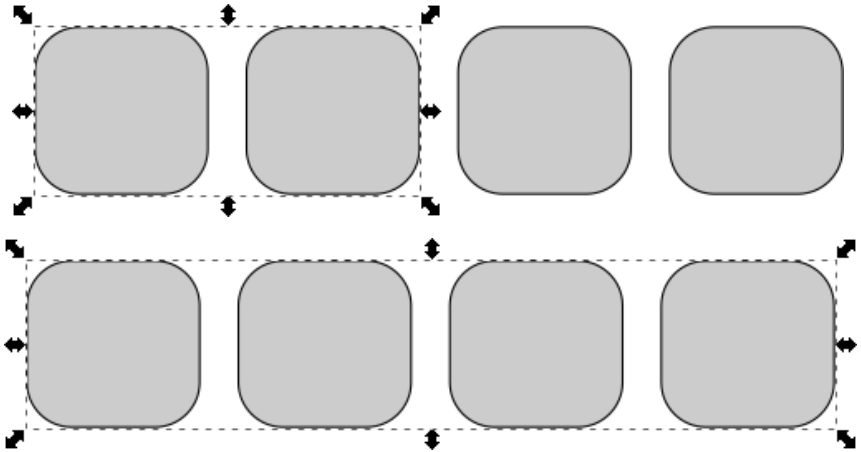
Stroke Options

- Width of line
- Shape of corners
- Shape of line ends
- Dashes
- Markers/Arrowheads



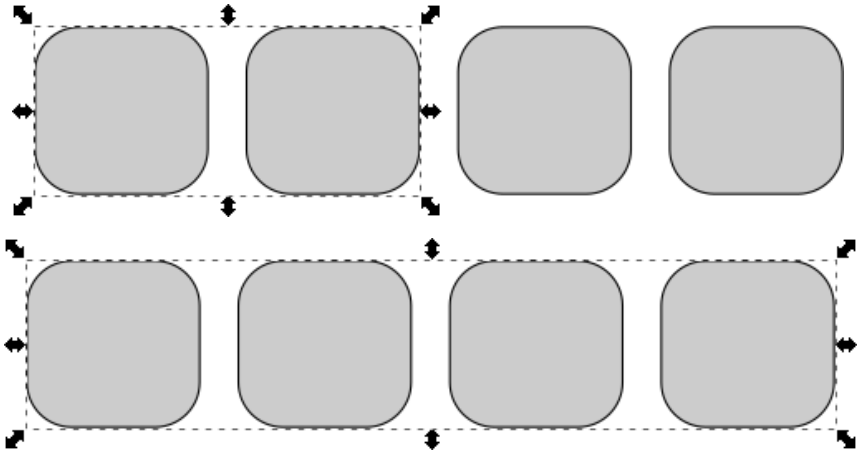
Exercise 2: Create and align shapes

Create this 2x4 grid:



Draw a rectangle with curved corners, duplicate it as necessary, align the figures

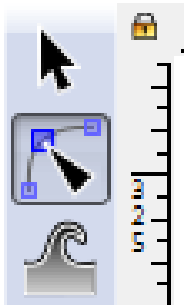
Exercise 2: Create and align shapes



Tools/ attributes to do this: **rectangle, corner radius, fill and stroke, select (and group if necessary)** and **alignment**

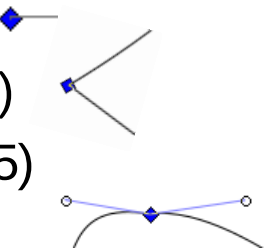
Creating and Editing Paths

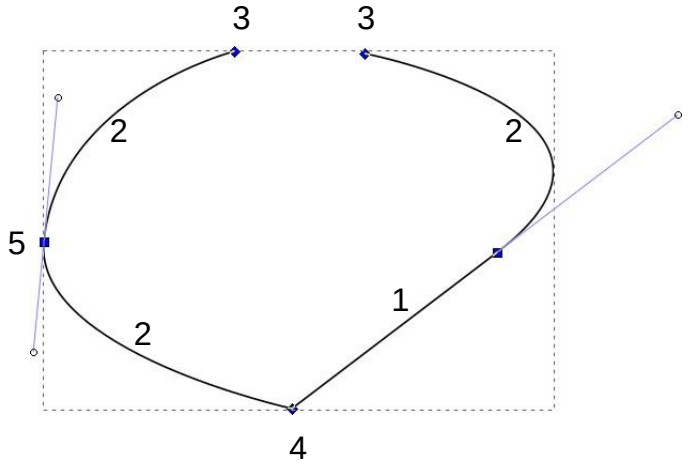
- Created using freehand or line tool
- Can convert other objects to become a path
- Paths are composed of nodes and segments
- There are different types of node and segment



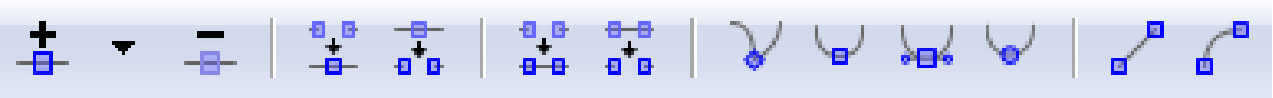
Nodes and Segments

- Segment types
  - Lines (1)
  - Curves (2)
- Node types
  - End (3)
  - Corner (4)
  - Smooth (5)
    - Normal
    - Symmetric
    - Auto

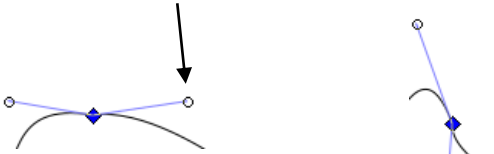




Editing nodes

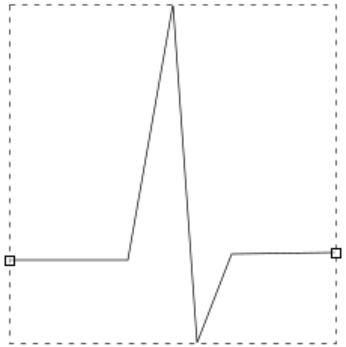


- Use nodes toolbar to add, remove or convert nodes or segments
- Select nodes or segments to make their handles visible
- Drag handles to change the arc of curves

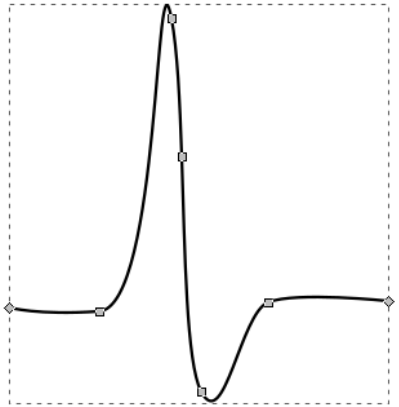


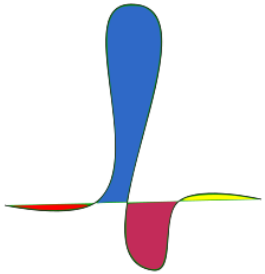
Exercise 3: Drawing an action potential

- Use the Bezier tool 
- Plot out an AP



- Use the Edit nodes tool 
- Smooth your AP
  - So it doesn't look like electrical noise

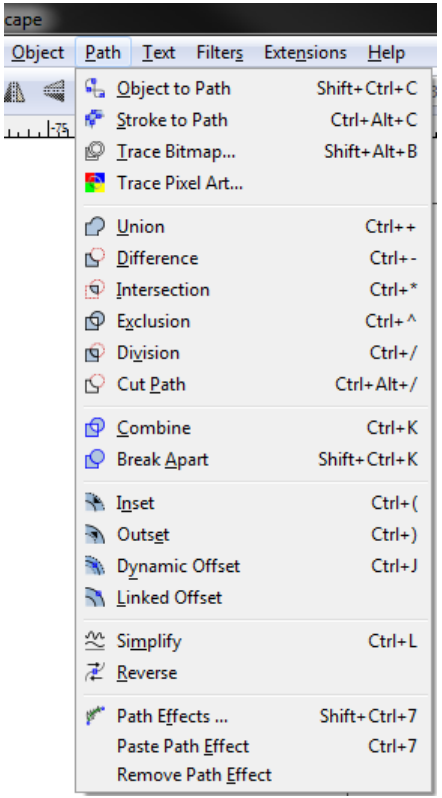




Or Picasso AP?

Combining paths

- You may want to add or subtract objects from each other
- Use Paths (***Path > Object to Path***)
- Lots of options for joining paths together

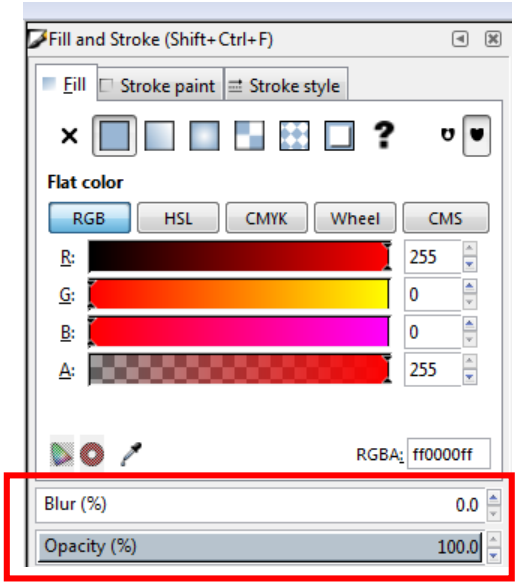


Exercise 4: path combinations

- Create two overlapping shapes
- Change their fills 
- Copy & paste them six times
- Apply path combinations to each pair of shapes

Opacity / Blur

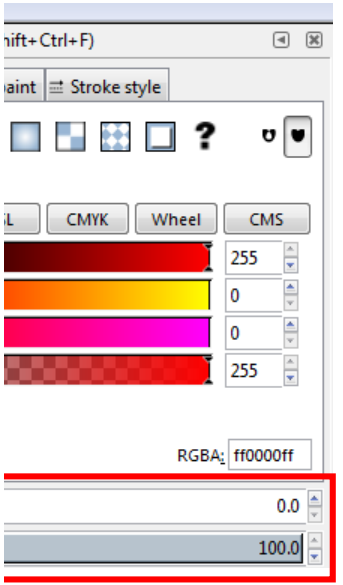
- Applies to whole object
- Separate from alpha in colors
- Works on all Objects



Opacity / E

- Applies to whc
- Separate from
- Works on all C

when you realize you could blur any image and people will think it's funny

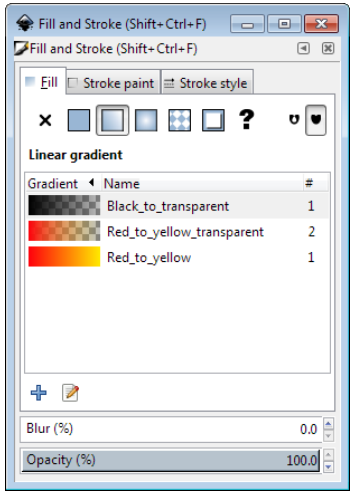


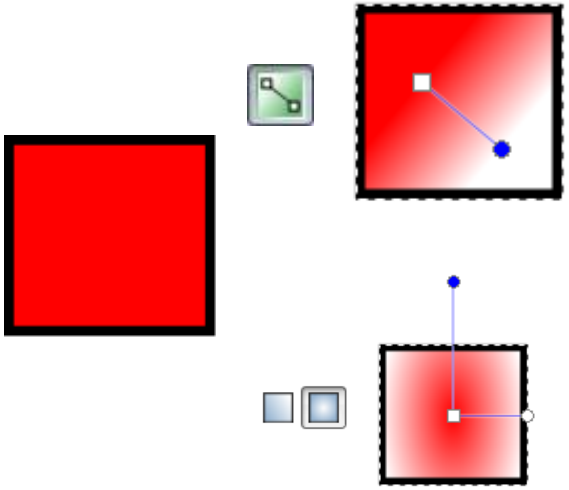
Op

r
r
r

Gradients

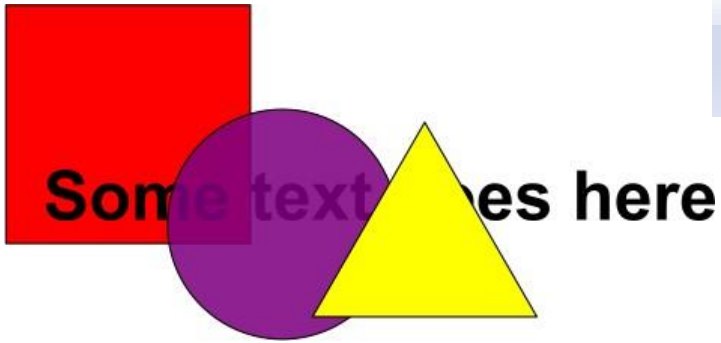
- Standard color option
- Set multiple colors / opacities to go through
- Set the direction and extent of the gradient

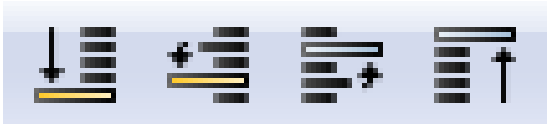




Ordering / Forward-Backward

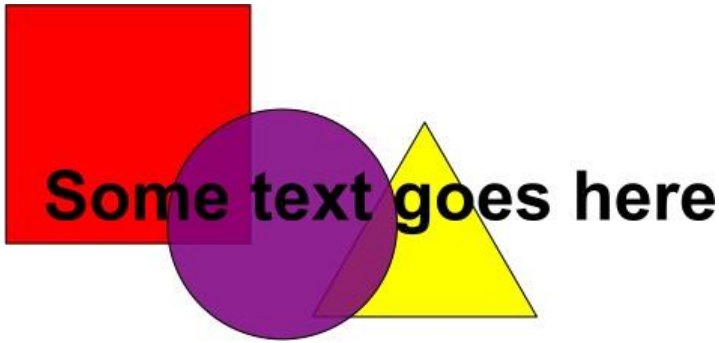
- New objects sit over the top of old objects
- Objects obscure those underneath them (exceptfor transparency)





Z-axis ordering / stacking / layers

- Send object to bottom of z-stack
- Lower object one level
- Raise object one level
- Bring object to top



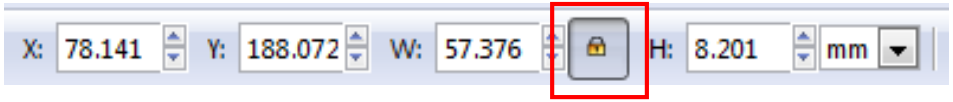
Working with bitmaps (images/photos)

- Inkscape can include bitmaps in images
- Appear as objects alongside vector objects
- Can't edit the images
- Can't increase the resolution of the image
- Transparency (eg PNG) is preserved

- ***File > Import***
- Formats: PNG, JPEG, SVG, PDF etc.

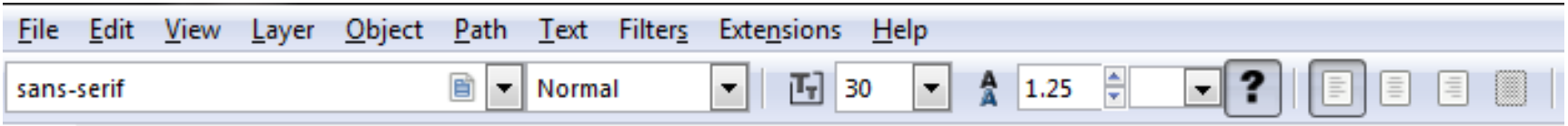
Exercise 5: Add text

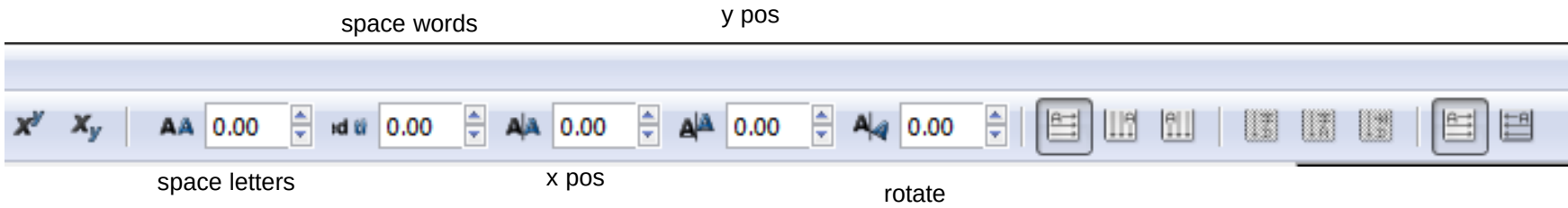
- Use the text tool to add text. 
- Click and type to generate text
- Text can be scaled or rotated as any other object 
  - **Always hold Ctrl** when scaling otherwise the aspect ratio will be messed up



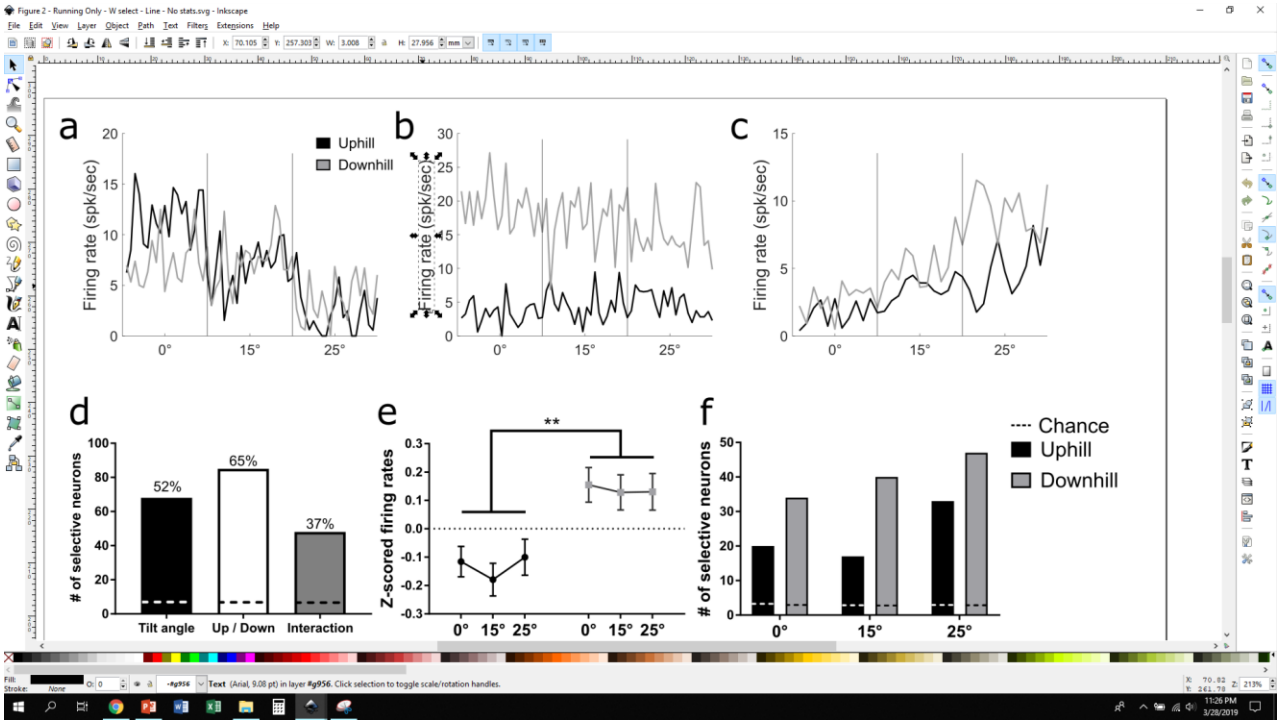
Text options

Text toolbar





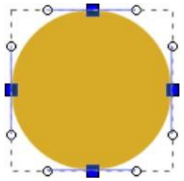
Making figures



File formats

- **Vectors**: for anything that has been generated by a computer: graphs, illustrations, and text.

- **File types:**
  - .svg
  - .eps
  - **.pdf**
  - .ai



- **Bitmaps**: for figure components generated by a camera (e.g. microscopy or blot photos).

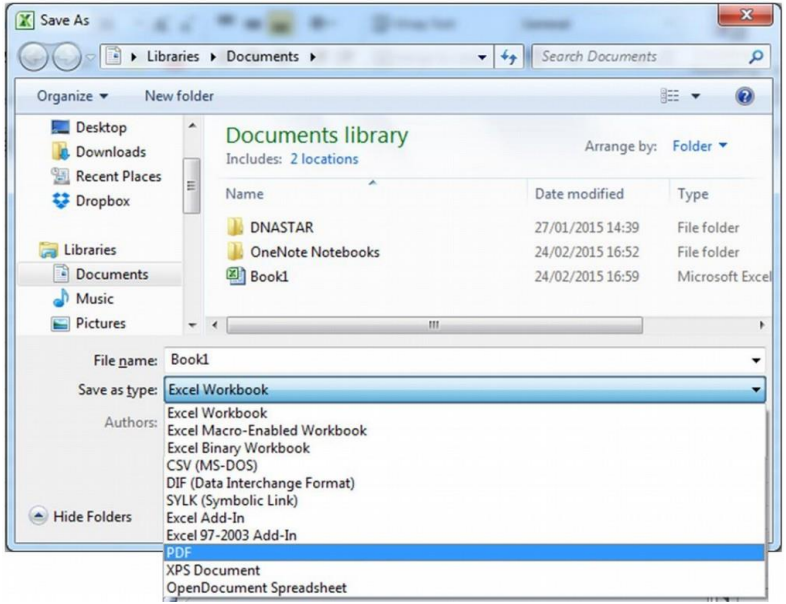
- **File types:**
  - .png
  - .jpg/jpeg
  - .gif
  - .bmp
  - .tif/.tiff

File formats

- Bitmap images can be embedded within a vector image
- Ideally, **publication figures** should be **vector** graphics for assembly and annotation of figure panels, with **bitmap images embedded** within
- This ensures that no resolution will be lost, no weird blurring, text shifting, weird overlapping
  - Though not all journals accept vector formats

Export from Excel

- Select your graph
- File > Save as… > Select PDF



Export from Python with MatPlotLib

```
# code for plot
plt.savefig('awesomeData.svg')
```

- Supports all the file types
- Many options for saving
  - size, resolution, page size, background color/transparent

Export from R

In PDF:

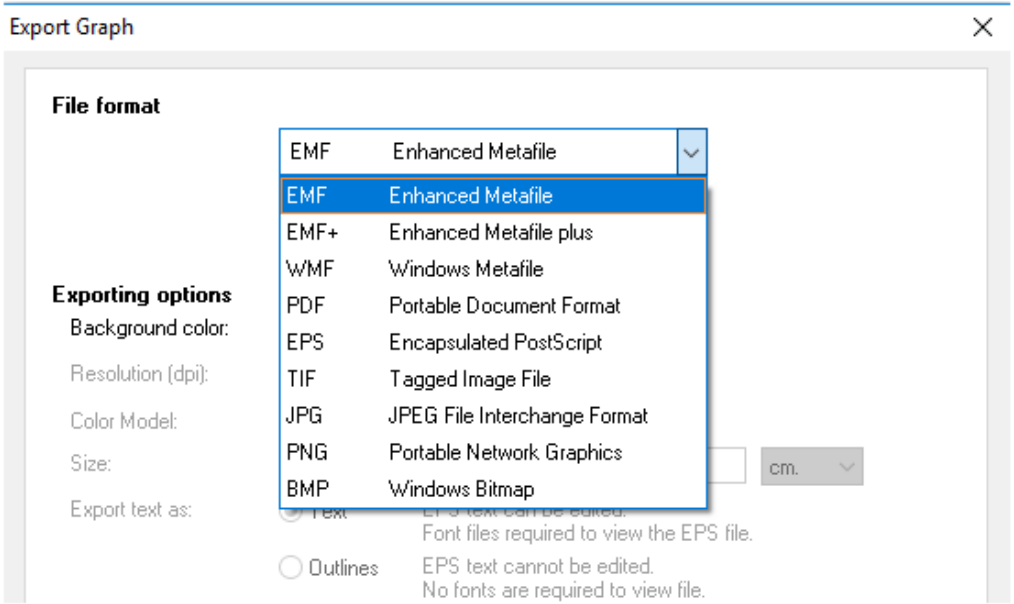
```
pdf(file="myplot.pdf")
# … code of plot here
dev.off()
```

Other formats:

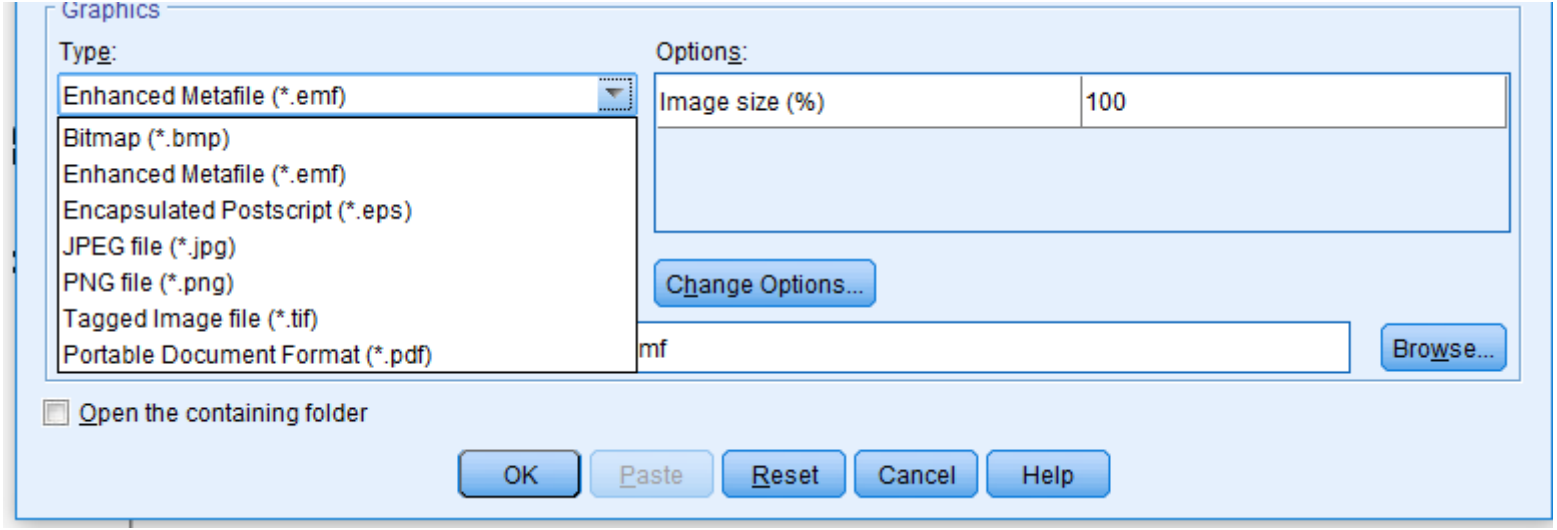
- png()
- jpeg()
- bmp()
- tiff()
- svg()
- postscript()

They all have arguments to set dimensions, resolution, etc. although the syntax can vary slightly.

Export from GraphPad

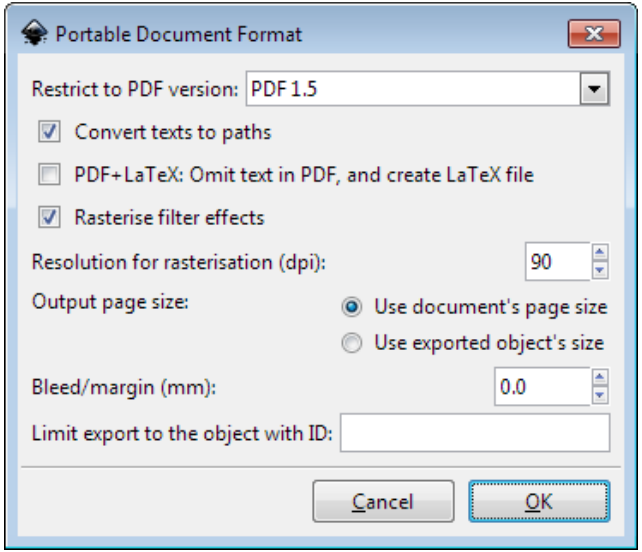


Export from SPSS



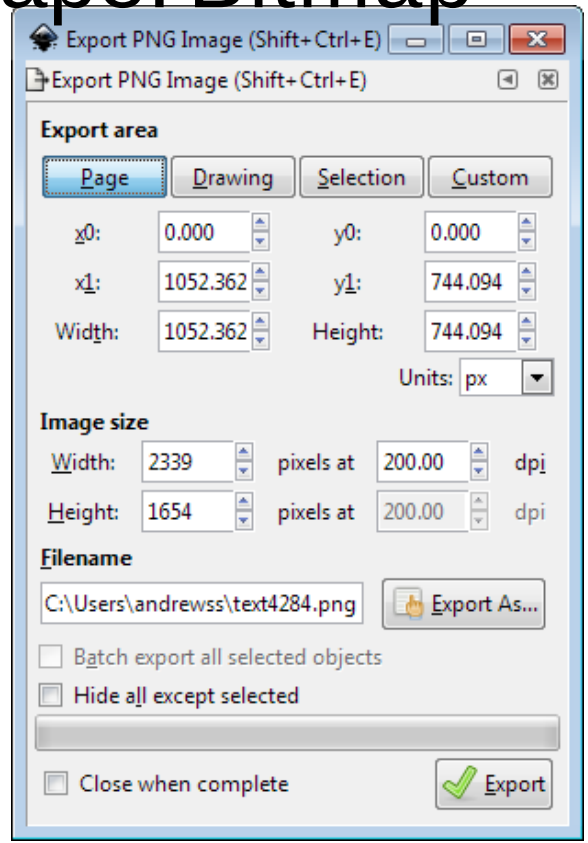
Exporting files from Inkscape: Vector

- Some journals accept PDF figures
  - Inkscape makes sizing your figures easy
- Many other vector file types
  - .svg, .eps, .emf, .tex
- ***File > Save (As)***, select PDF



Exporting files from Inkscape: Bitmap

- If journals make you
- If you have very complex figures with many points/dots
  - Bitmaps smaller in size, faster to load
- File > Export PNG Image
- PNG only
  - https://convertio.co/png-tiff/
  - https://www.irfanview.com/



Saving vs Exporting

- In Inkscape (and any other vector software) distinguish between *working or editable* files (e.g. SVG), which are best seen with the software that created them, and files for *sharing or publication* (e.g. PDF or TIFF), which do not keep full editing features
- **Save** the file frequently while working on it
- **Export** the file once it's ready to share

Basic Steps in Preparation

- Determine the final size of the figure (journal guidelines)
- Heights of text, thickness of lines
- Figure in color, grayscale or black and white (journal guidelines)
- Resolution (journal guidelines)
- Acceptable File format: choose the best one, vector if possible
- Colorspace: CMYK or RGB (journal guidelines)

Questions?

Twitter: @Obhrc or @BlakeP_Neuro
Email: blakeporterneuro@gmail.com
Website: www.blakeporterneuro.com

Python resources

Learning Python

- learnPython.org – Basics
- ✓ **Python by DataCamp – Interactive learning (4 free courses)**
- Python2 by CodeAcademy – Interactive learning (mix free and $)
- Python for Neuroscience – Workshop from University of Chicago
  - Some experience assumed
- www.blakeporterneuro.com

Python tools

- Spyder Environment for Python – makes work easier
- Matplotlib – for making graphs
- Seaborn – for nice graphs

Inkscape resources

- Inkscape – website for download and learning
- Designing effective scientific figures Introduction to Inkscape to finalise figures
- Youtube
  - Eg https://youtu.be/zUIOEXssTSE
- https://bioinformatics-core-shared-training.github.io/effective-figure-design/DesigningEffectiveScientificFigures_Practical_INKSCAPE_Zabala_v00.pdf
- https://slideplayer.com/slide/3838119/

A literal (up-to-date) book on graph making

- http://biostat.mc.vanderbilt.edu/wiki/pub/Main/StatGraphCourse/graphscourse.pdf

General figure making guides

- How to Create Publication-Quality Figures
- Ten Simple Rules for Better Figures
- A brief guide to designing effective figures for the scientific paper
- Designing science graphs for data analysis and presentation
- What graph do i pick?
- Presenting data in tables and charts
-

Data visualization

- http://www.storytellingwithdata.com/
- https://www.tableau.com/learn/articles/best-data-visualization-blogs
- https://www.tableau.com/learn/articles/data-science-blogs
- https://guides.library.duke.edu/datavis/topten
- http://thenode.biologists.com/author/joachimg/

Color

- http://seaborn.pydata.org/tutorial/color_palettes.html
- https://matplotlib.org/users/colormaps.html
- https://betterfigures.org/2015/06/23/picking-a-colour-scale-for-scientific-graphics/
- **http://colorbrewer2.org**

Resources I used/read to make this presentation in no order whatsoever

- https://www.prismnet.com/~hcexres/textbook/tables.html
- https://matplotlib.org/gallery/index.html
- https://hackerspace.kinja.com/5-rules-for-making-graphs-1605706367
- https://www3.nd.edu/~pkamat/pdf/graphs.pdf
- http://personal.psu.edu/dys100/GraphingBackgroundRules.pdf
- http://berkeleysciencereview.com/errorbars-anyway/
- https://www.biologyforlife.com/interpreting-error-bars.html
- https://www.biologyforlife.com/graphing-with-excel.html
- http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/DataPresentation.html
- https://blog.datawrapper.de/pie-charts/
- https://depictdatastudio.com/when-pie-charts-are-okay-seriously-guidelines-for-using-pie-and-donut-charts/

Resources I used/read to make this presentation in no order whatsoever

- https://www.biologyforlife.com/interpreting-error-bars.html
- http://berkeleysciencereview.com/errorbars-anyway/
- https://www.cruk.cam.ac.uk/core-facilities/bioinformatics-core/training
- https://bioinformatics-core-shared-training.github.io/effective-figure-design/DesigningEffectiveScientificFigures_Zabala_morning_v00.pdf