Digital Research Toolkit for Linguists

Week 8: Data visualization and exporting

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May 27, 2024

Psycholinguistics and Cognitive Modeling Lab

Homework


GOOD JOB
YOU GET A GOLD STAR FOR TODAY
memegenerator.net

Main goal: Get acquainted with `ggplot2` and make different types of plots (bars, lines, points)

✖ Didn't finish the assignment (<8 plots) without explanation

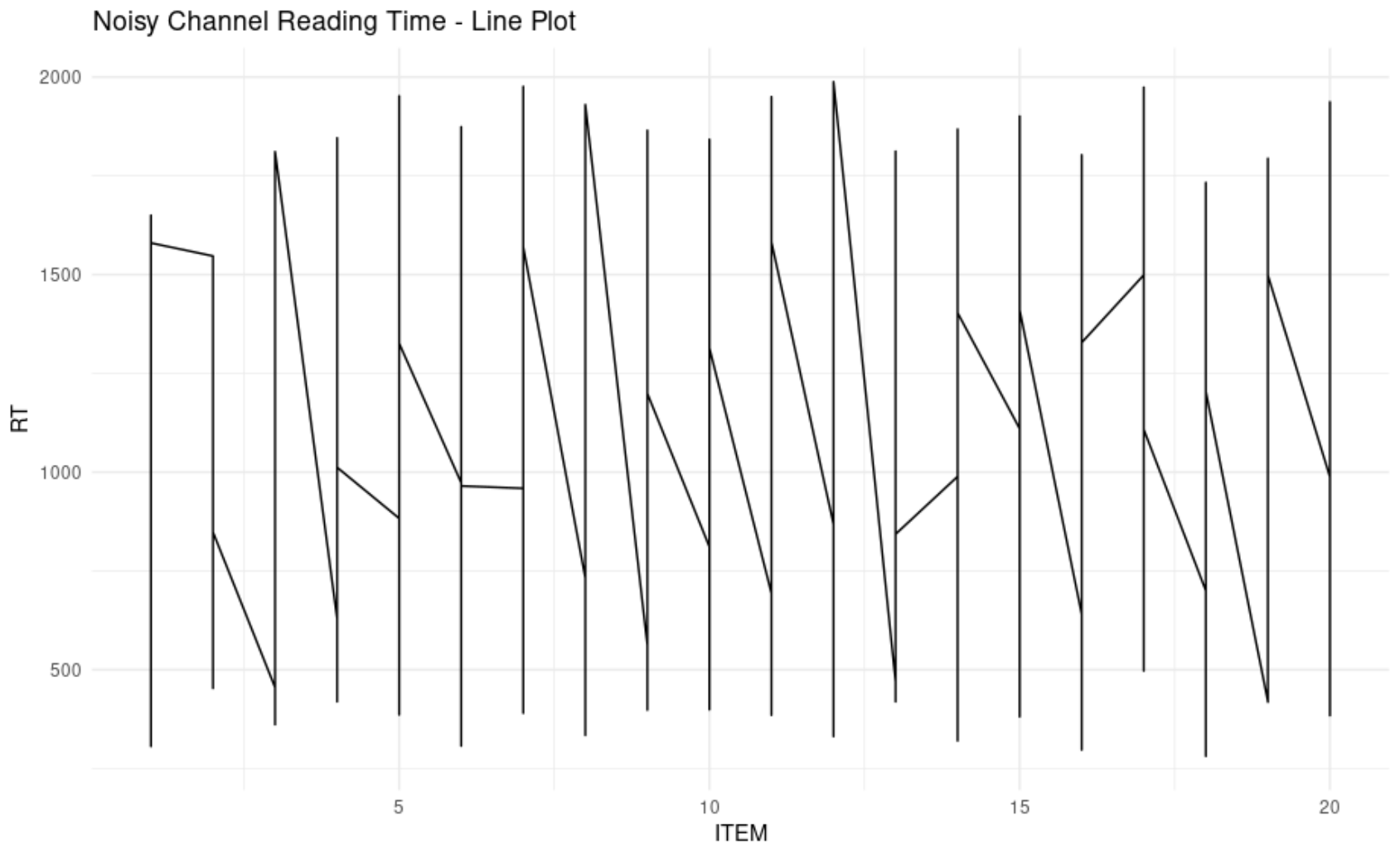
✖ Made only 1 kind of plot (e.g. all bars)

✖ Did not run your code (you can copy & paste from `esquisse`)

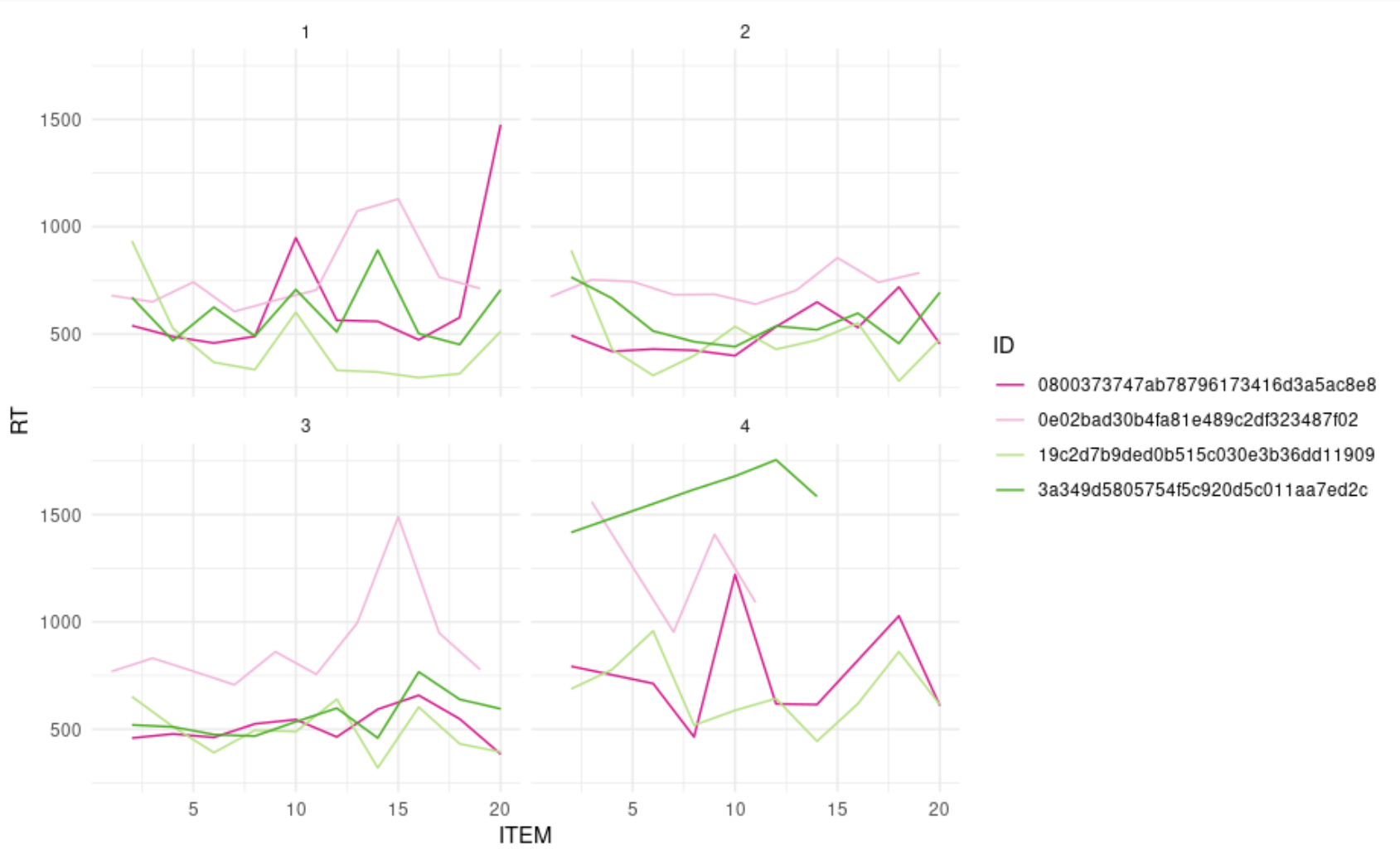
✖ Missed the essence of `ggplot2` and how layers work.

Recommended watching:
`https://www.youtube.com/watch?v=HPJn1CMvtmI`

⊘ `ggplot(noisy_rt.csv)` Assign your data to a variable.



Typically, you want **1 observation per row**.



If you have more than 1 observation per row, `ggplot2` will assume you have a good reason.

```
Error in `geom_bar()`:
! Problem while computing stat.
i Error occurred in the 1st layer.
Caused by error in `setup_params()`:
! `stat_count()` must only have an x or y
aesthetic.
```

You specified both **x** and **y** in the aesthetics.

❝ That was the whole point! ❞

The `stat` argument within `geom_bar()` determines how the data should be summarized before plotting.

`stat = "count"`
Default setting. It counts the observations, e.g. for counting occurrences for each category (this will be 1 if you have 1 observation per row).

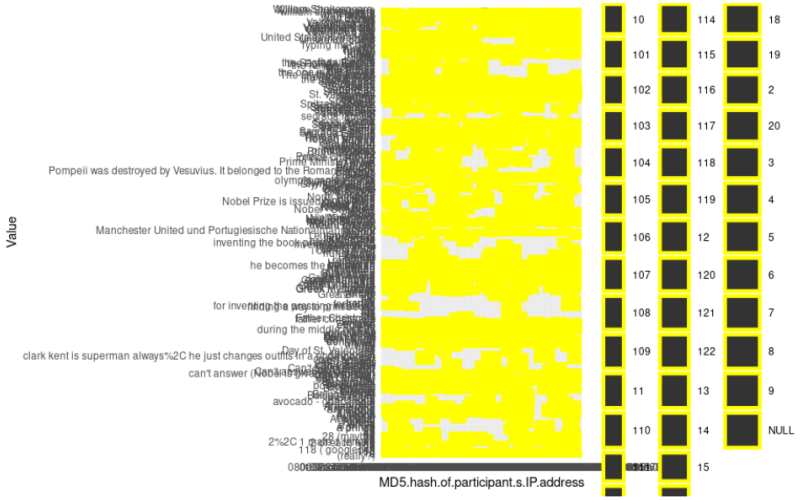
`stat = "identity"`
Uses data as is, without transformations, e.g. when you have the data in the form you want.

`stat = "summary", fun = "mean"`
Summarizes the data using a summary function `fun`, e.g. to calculate the mean.

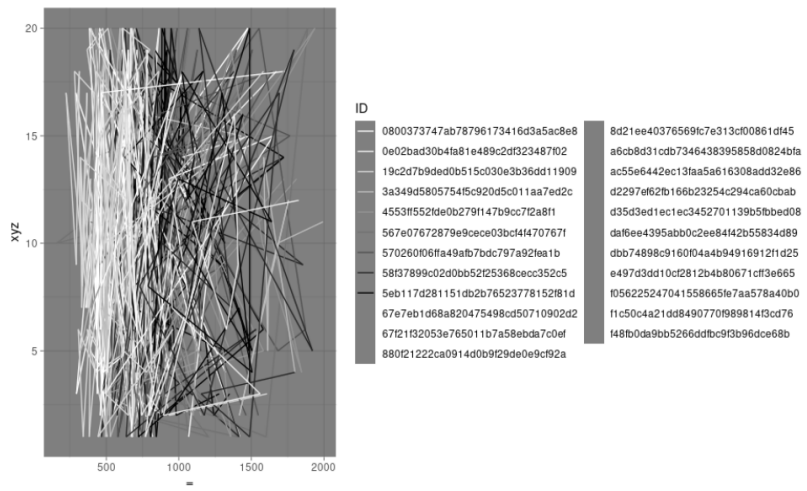
`bin`, `smooth`, `density`, ...

Ugly plots

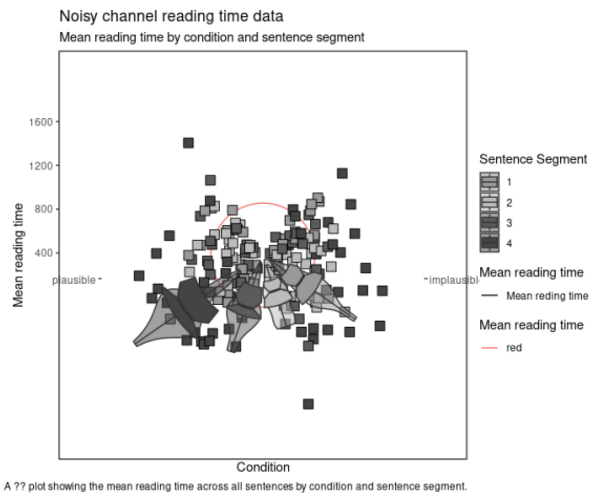
PLOT A



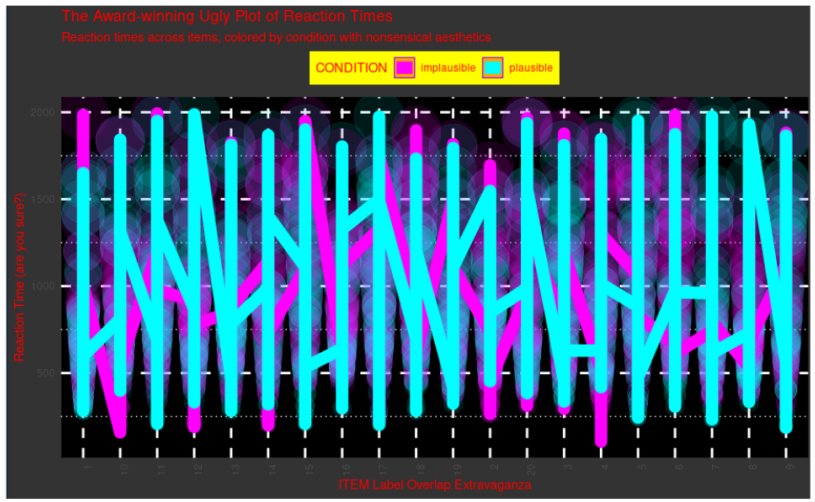
PLOT B



PLOT C



PLOT D



Questions?

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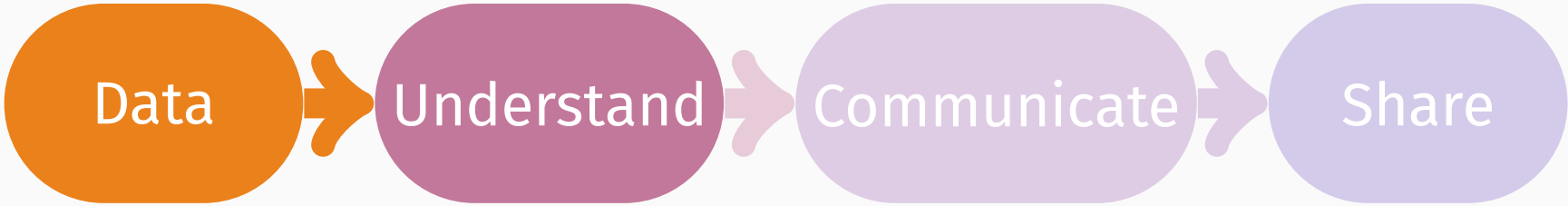
Where are we this week?



R & RStudio, packages, data types, formats, encoding

import from workspace, assign values, operations, clean, filter, arrange, select, merge, group, summarize, export, visualize

document, create clean and beautiful reports

connect, collaborate, backup

Data visualization

Data visualization

is an interdisciplinary field. It's the graphical representation of data & information in order efficiently communicate communicate complex relationships & insights in a comprehensible way.

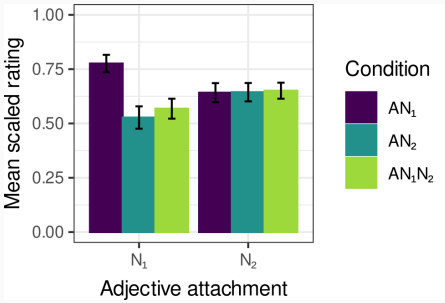
Goals

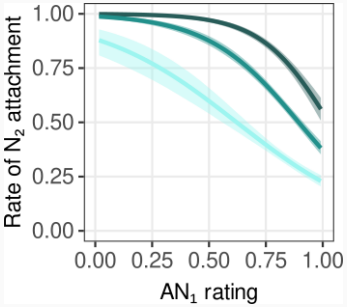
- Communication & understanding
- Analysis & exploration
- Decision making

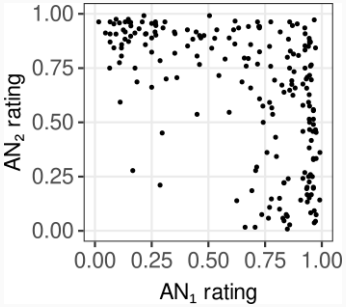
Visualization types

boil down to tables, bars, lines, and points, and a mix of all four.

item	sentence	N1	N2	unclear
3	sommerliche Arbeitskleidung	0	20	0
11	silberne Bahnhofsuhr	0	20	0
12	amtliche Baugenehmigung	0	19	1
16	hohler Bienenstock	0	20	0
19	gefüttertes Brillenetui	0	20	0
22	lackiertes Bücherregal	0	20	0
23	evangelischer Büroangestellter	0	20	0







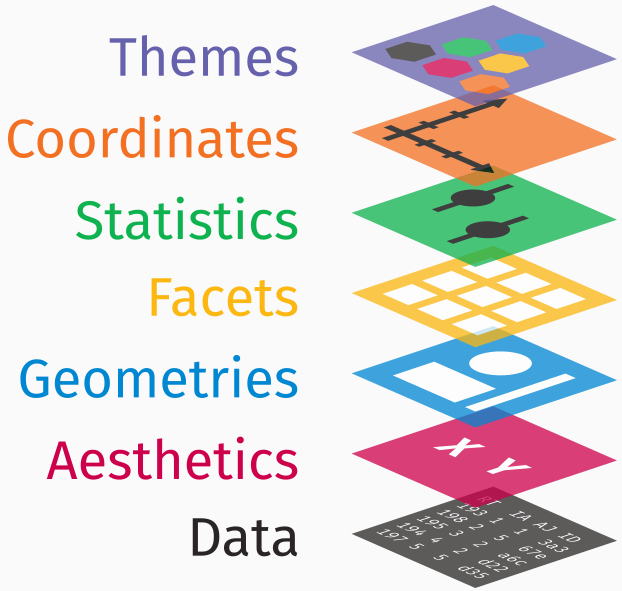
The 4 Principles of Accessibility

Web Content Accessibility Guidelines

- **P** Perceivable
- **O** Operable
- **U** Understandable
- **R** Robust

`ggplot2`

a layered grammar of graphics

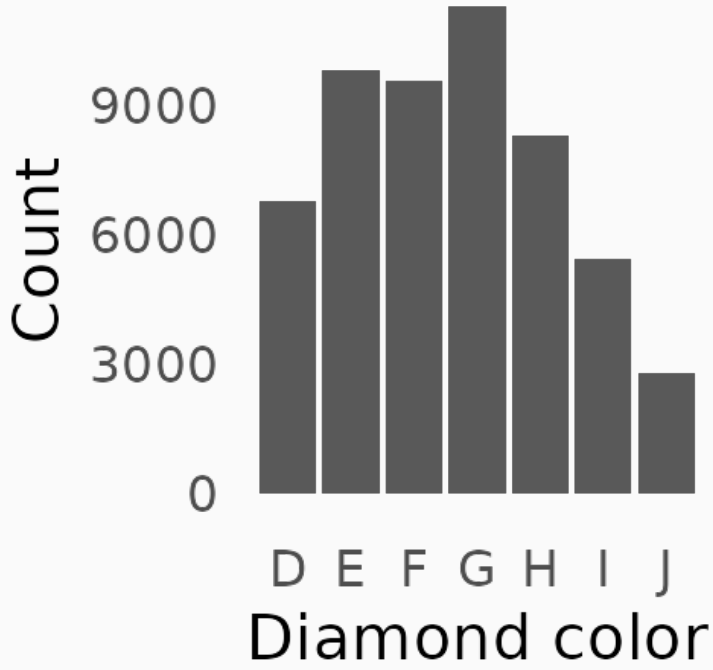


`esquisse`

GUI for exploring data based on `ggplot2`

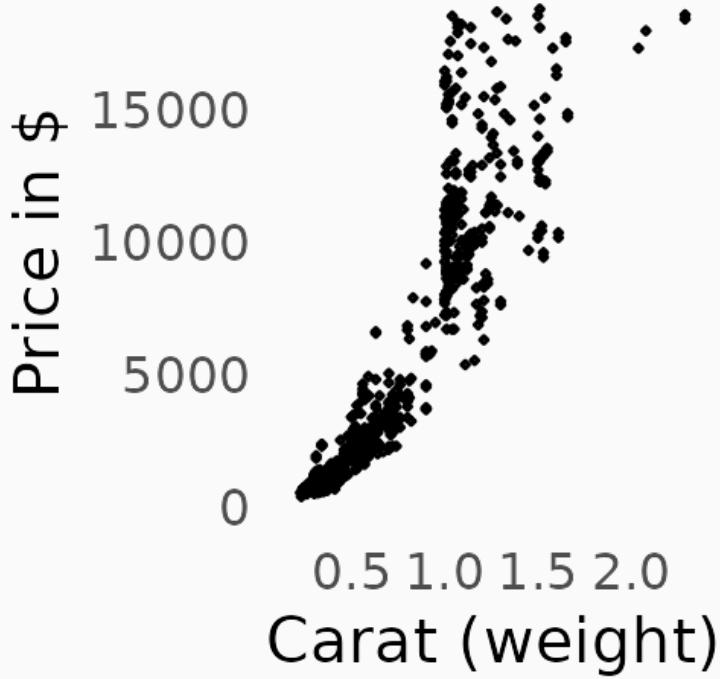
Histogram

Counts observations of categories



Scatterplot

Shows the relationship between two numeric variables



Colors

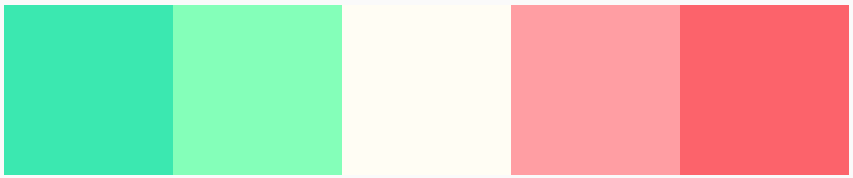
Color palette types

Discrete

Uses distinct, unrelated colors for categorical data.

Divergent

Shows data with a central midpoint, using contrasting colors to highlight deviations.



Sequential

Represents data with a gradient of colors to indicate ordered values.

DIY

Adobe color.adobe.com

Coolors coolors.co

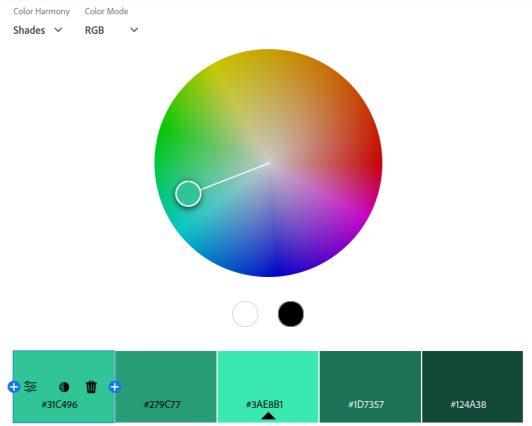
LearnUI www.learnui.design

Test the colors for accessibility and BW print:
webaim.org/resources/contrastchecker

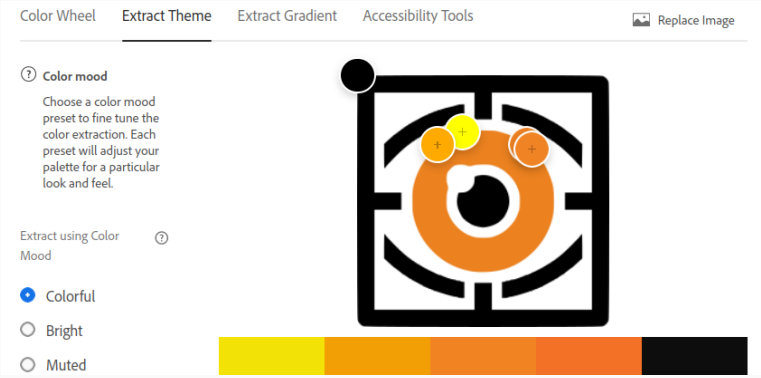
```
my.palette <- c("#8c510a","#d8b365","#f6e8c3","#f5f5f5")
plot + scale_color_manual(values = my.palette)

plot + scale_fill_manual(values =
c("#8c510a","#d8b365","#f6e8c3","#f5f5f5"))
```

Adobe color

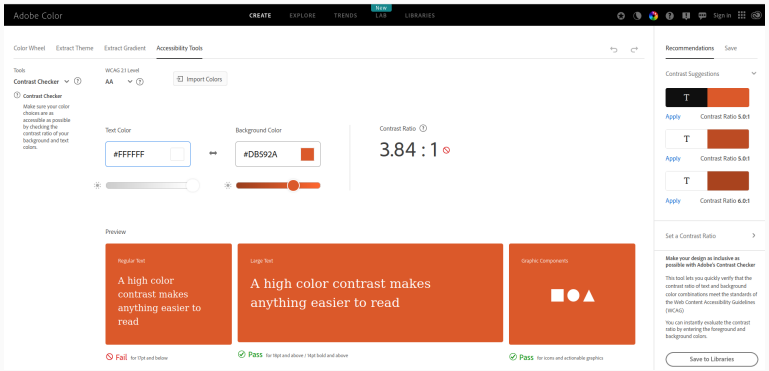
Assemble colors



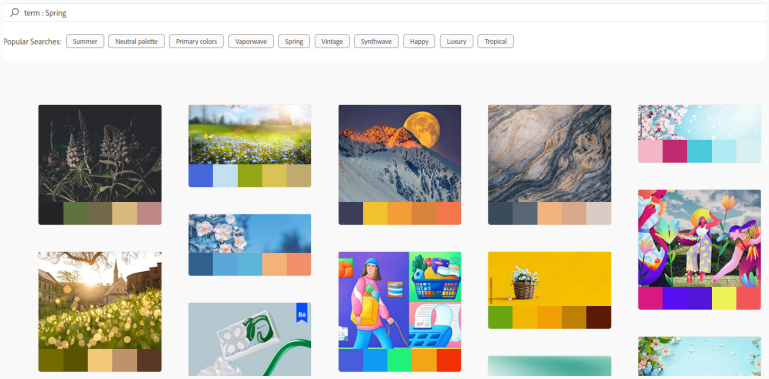
Extract from image



Check contrast

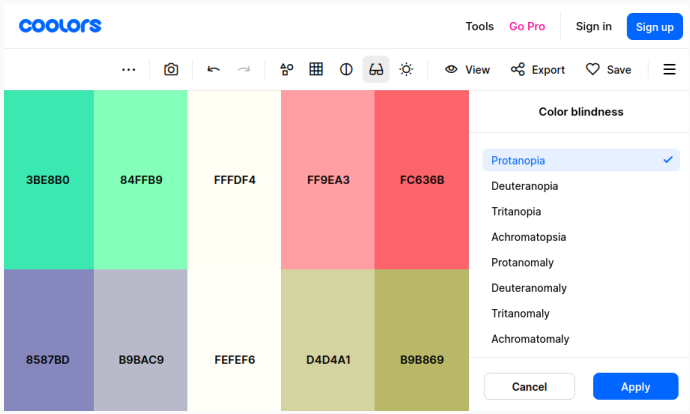


Browse trends

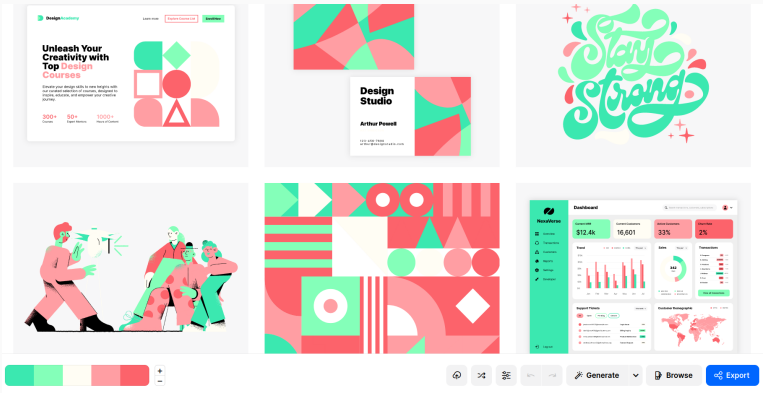


Coolors

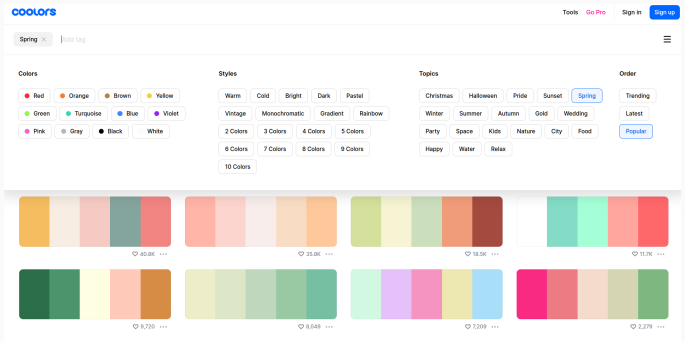
Assemble colors and check for color blindness



Visualize the palette

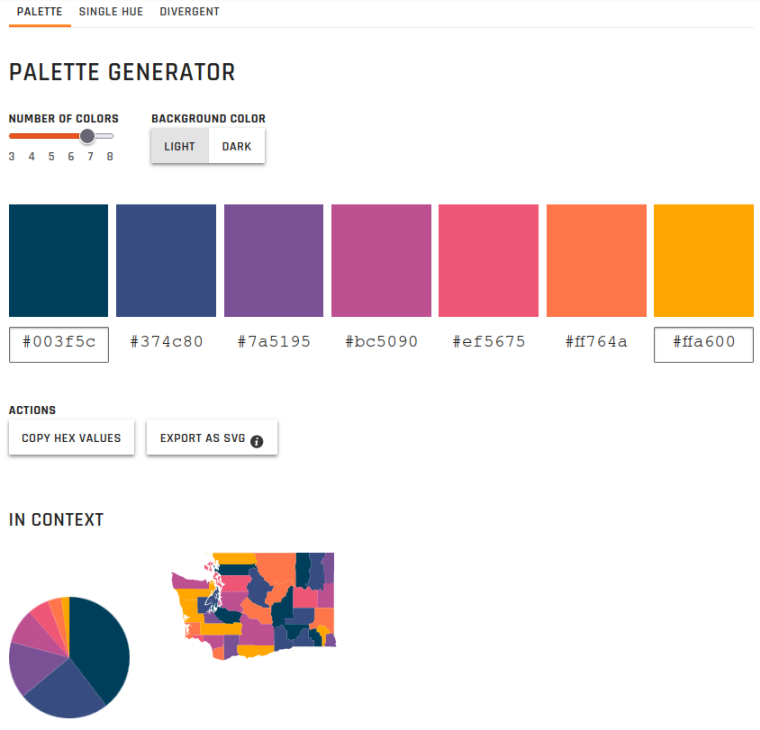


Browse trends

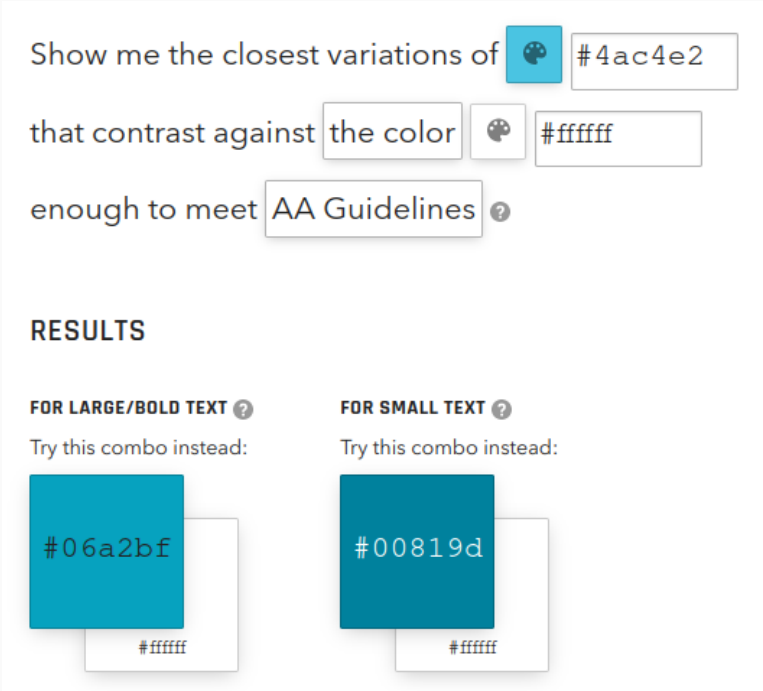


LearnUI

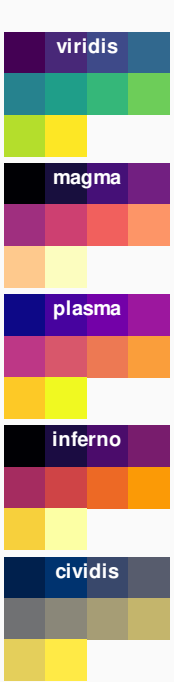
Generate color palettes

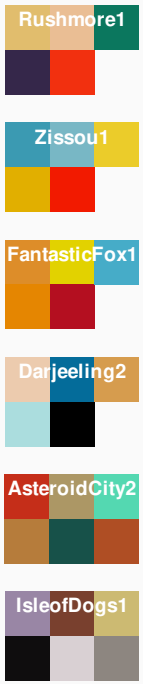


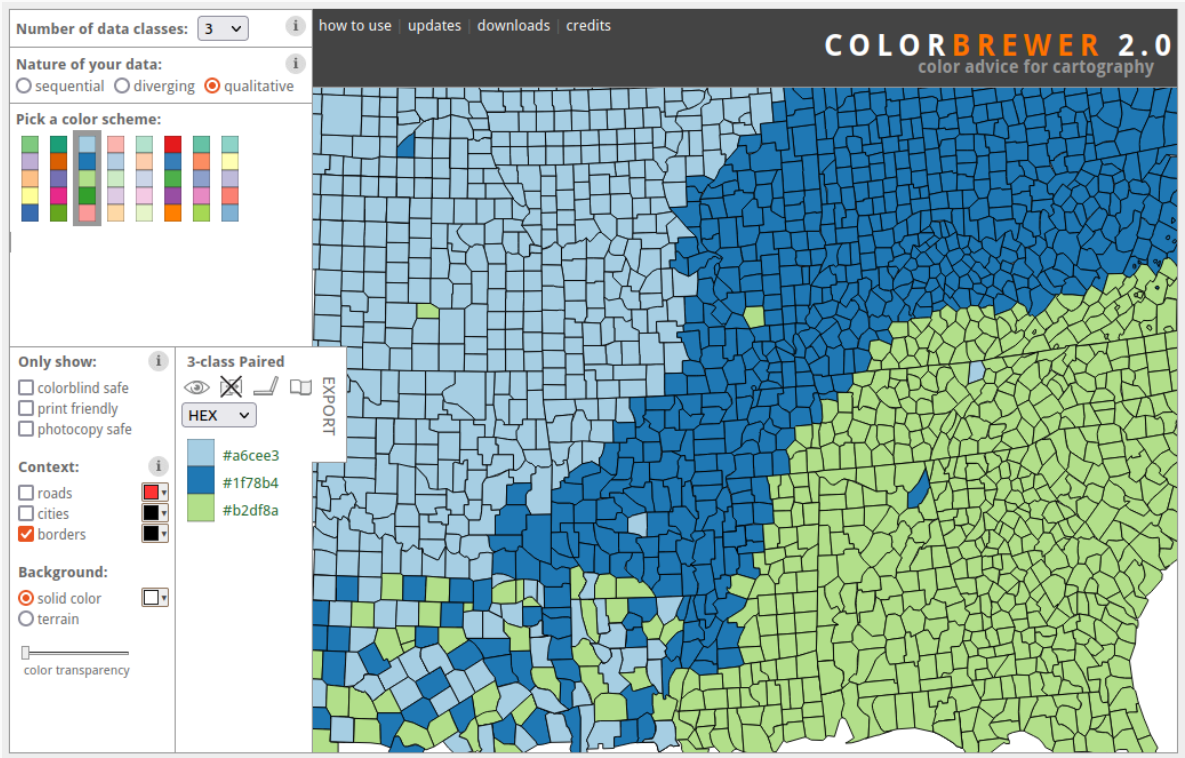
Check contrast



CBA


viridis
magma
plasma
inferno
cividis


Rushmore1
Zissou1
FantasticFox1
Darjeeling2
AsteroidCity2
IsleofDogs1


Number of data classes: 3
Nature of your data:
sequential diverging qualitative
Pick a color scheme:
Only show:
colorblind safe
print friendly
photocopy safe
Context:
roads
cities
borders
Background:
solid color
terrain
color transparency
3-class Paired
HEX
#a6cee3
#1f78b4
#b2df8a
EXPORT
how to use | updates | downloads | credits
COLORBREWER 2.0
color advice for cartography

There's a package for that

`RColorBrewer`

```
scale_fill_brewer(…, type="div", palette=1)
```

`viridis`

```
scale_colour_viridis_c(…, option="inferno")
```

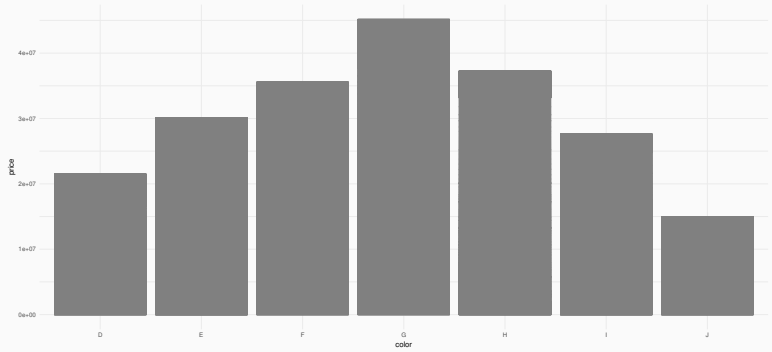
`wesanderson`

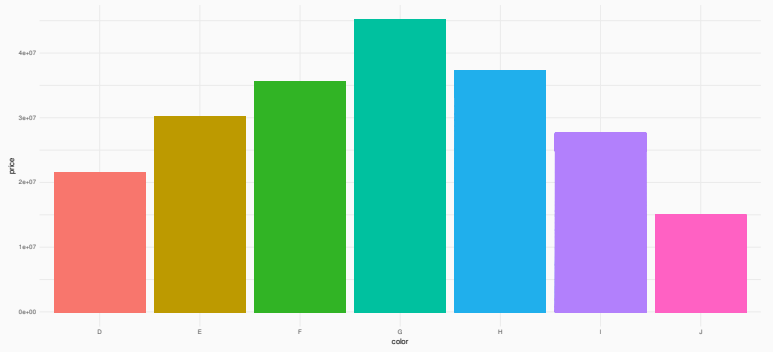
```
scale_fill_manual(values=wes_palette("BottleRocket1"))
```

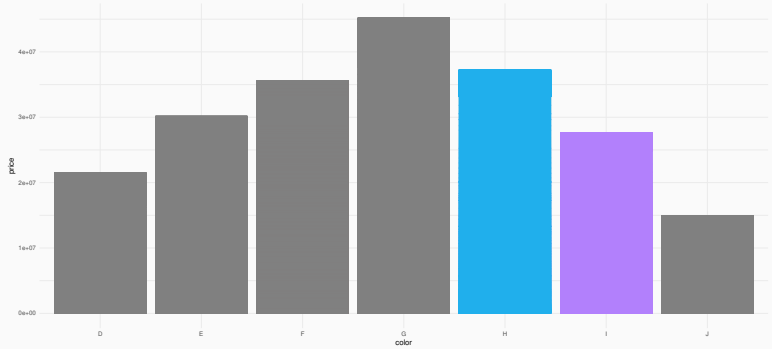
Others, e.g. `ggsci` (for journals)

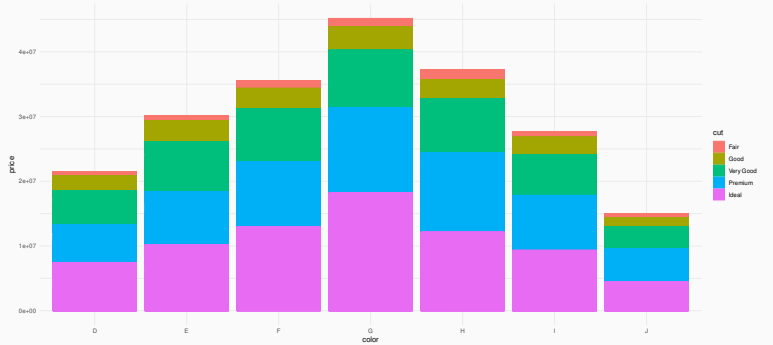
Color use guidelines

Avoid unnecessary usage of color

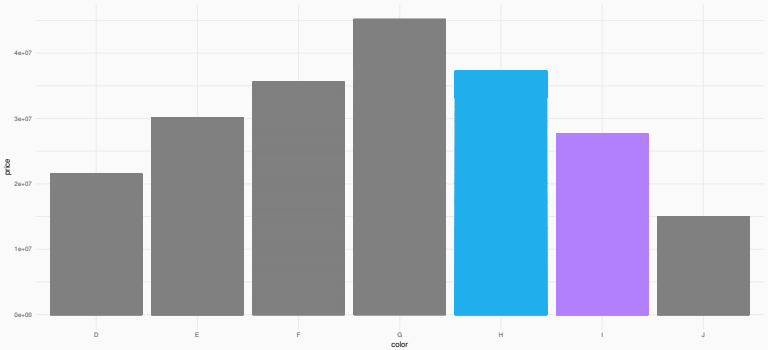


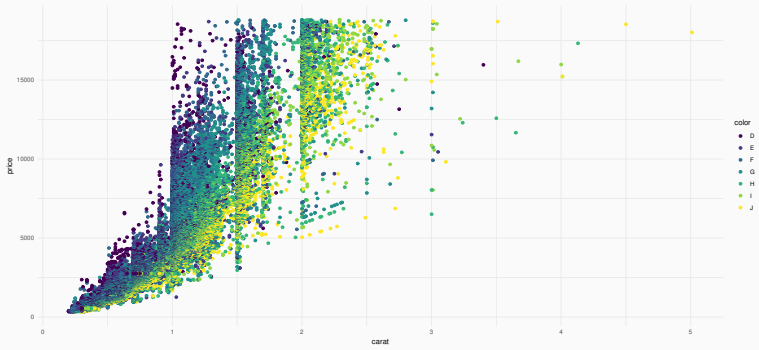


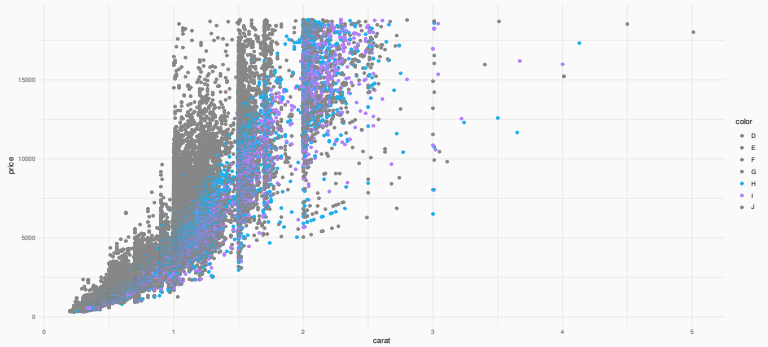


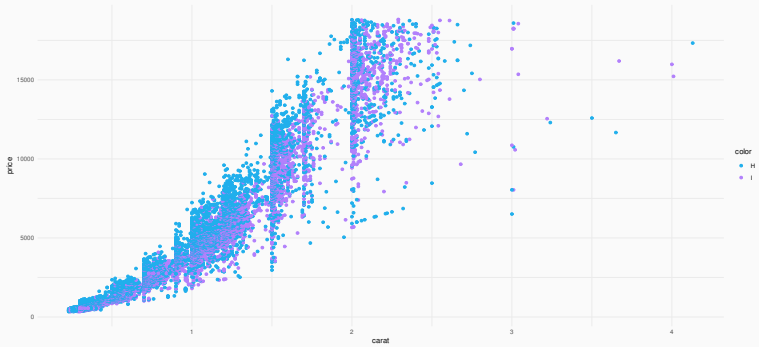


Be consistent

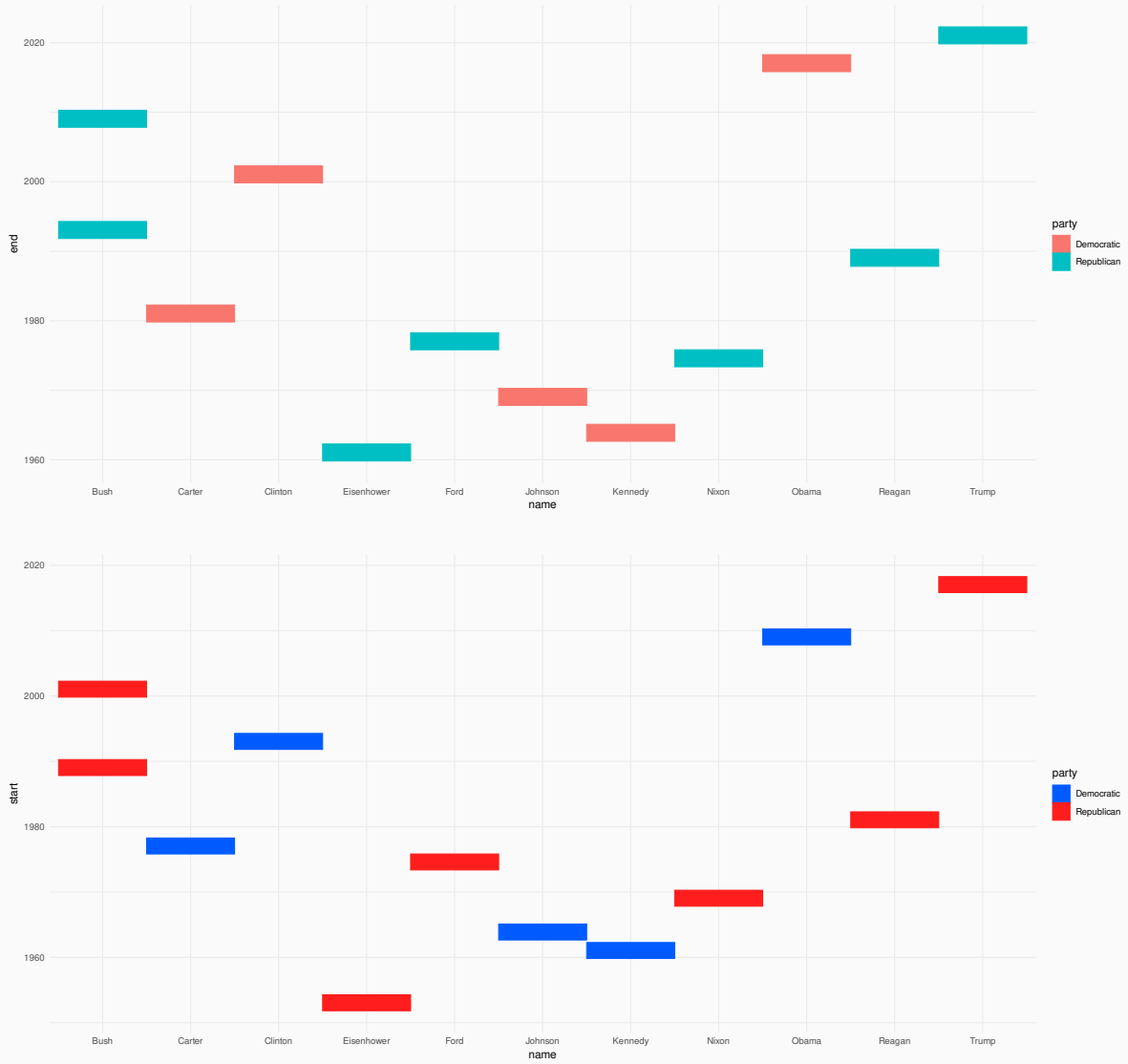




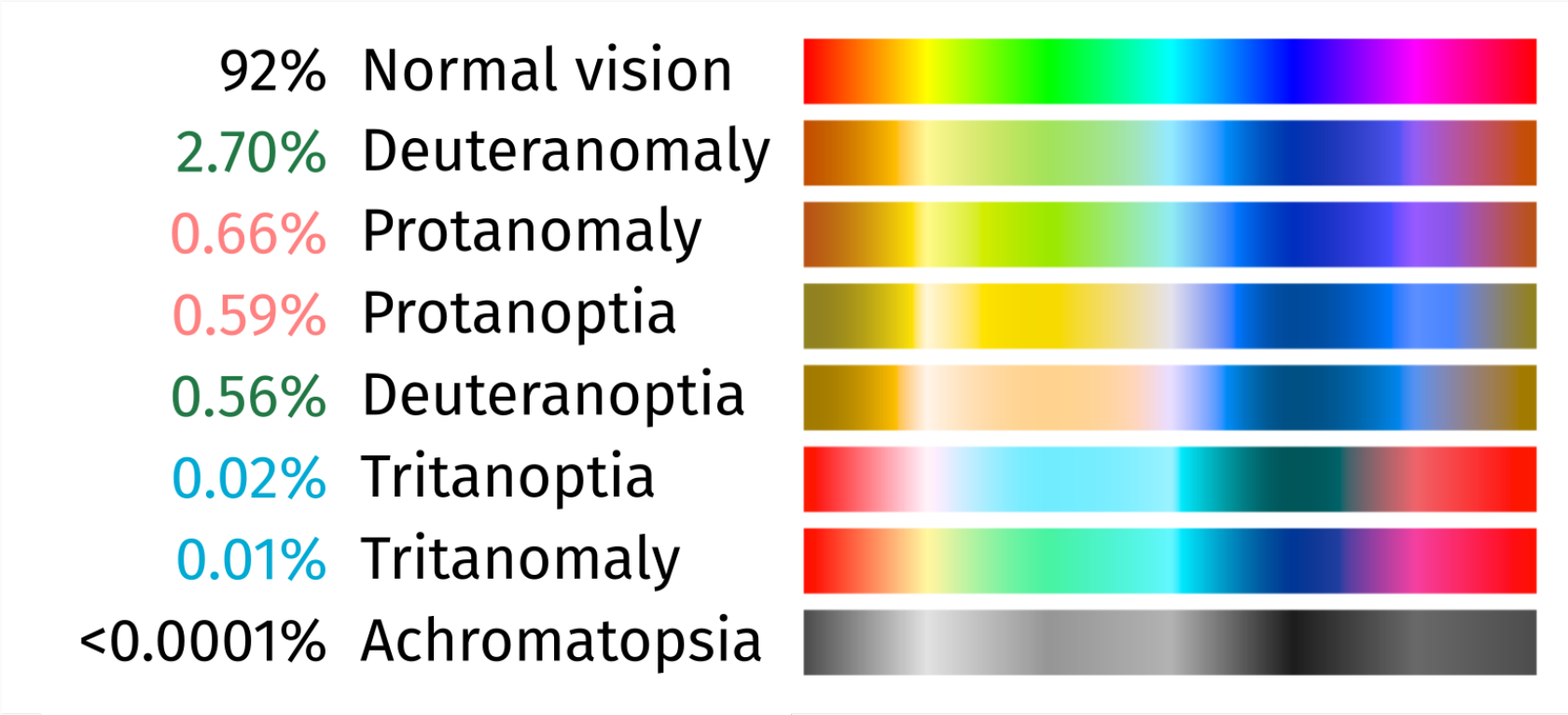




Use in a meaningful way

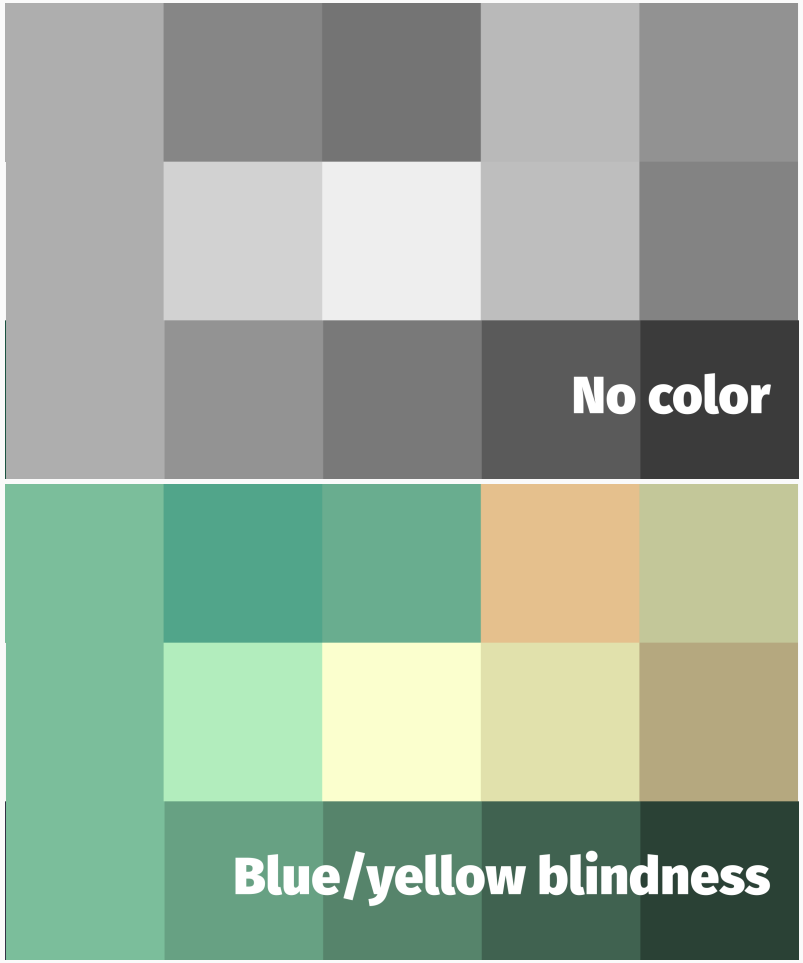


Pay attention to color blindness



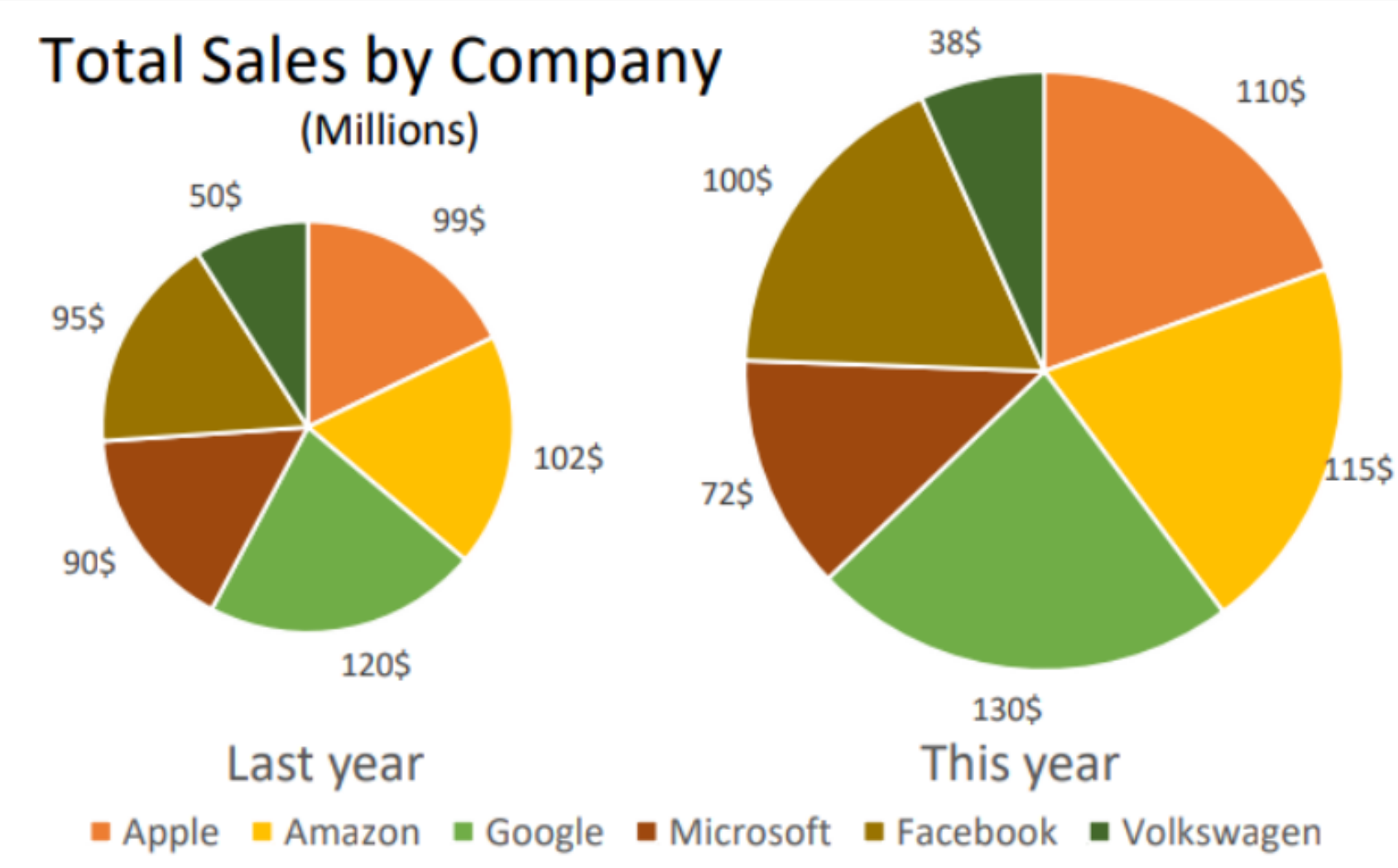
1–2 people in this class

Perceivable colors



Lying with plots

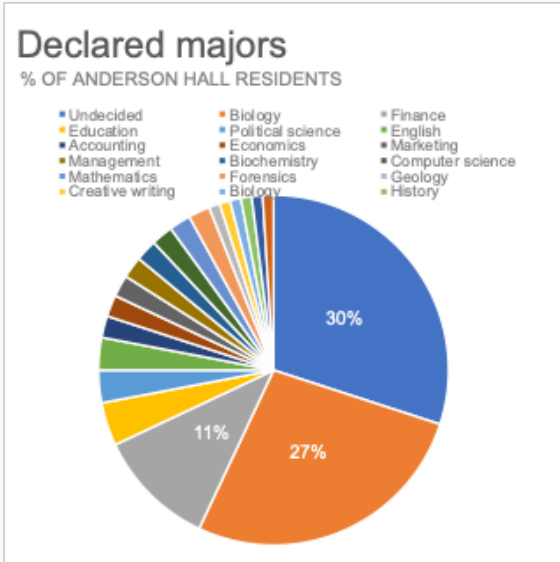
Pie plots: Manipulate the size



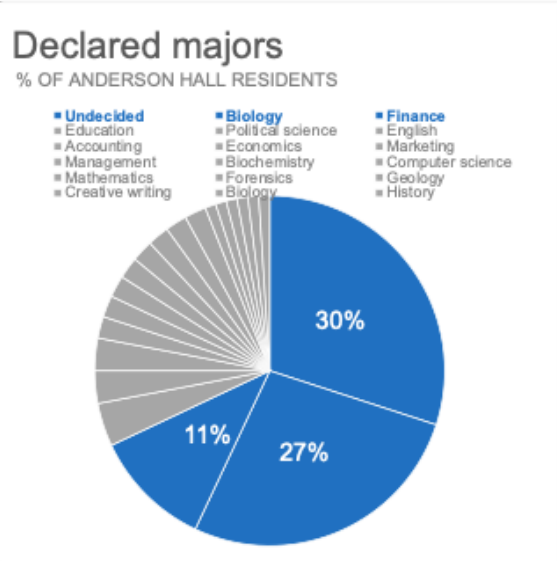
Fallenbüchel (2019)

Pie plots: Manipulate categories

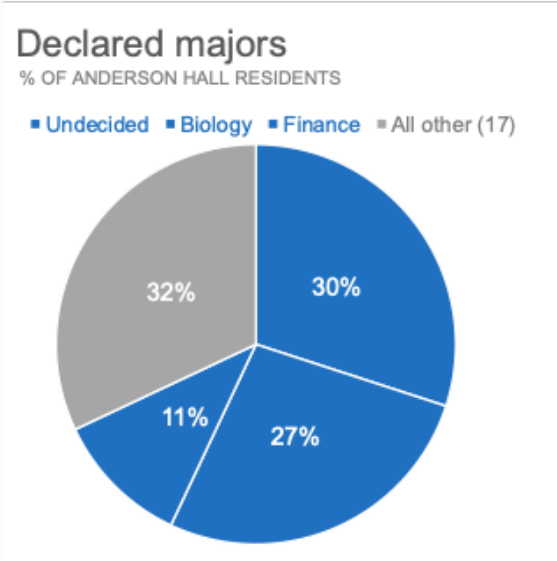
Too many slices



De-emphasize

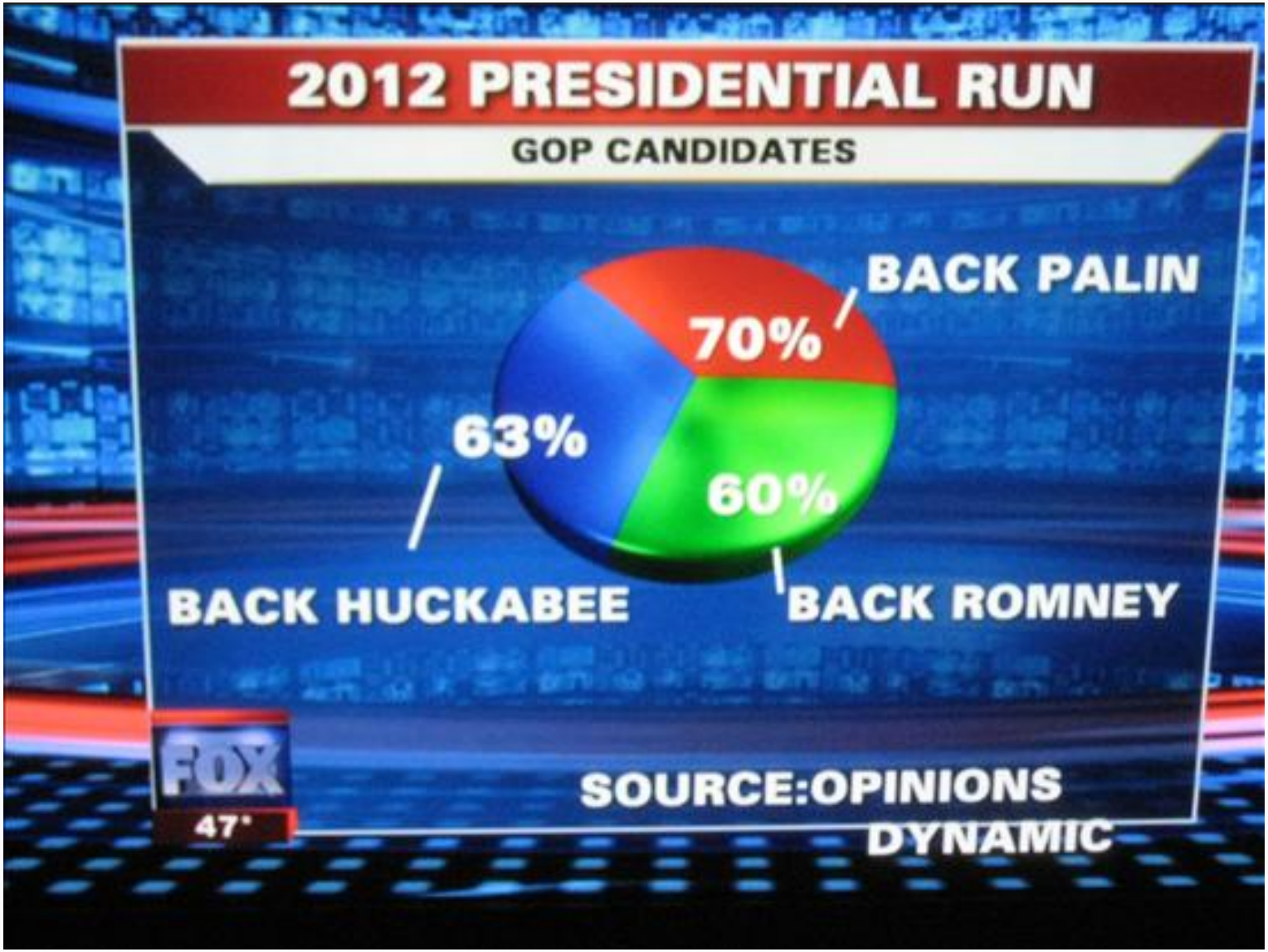


Aggregate

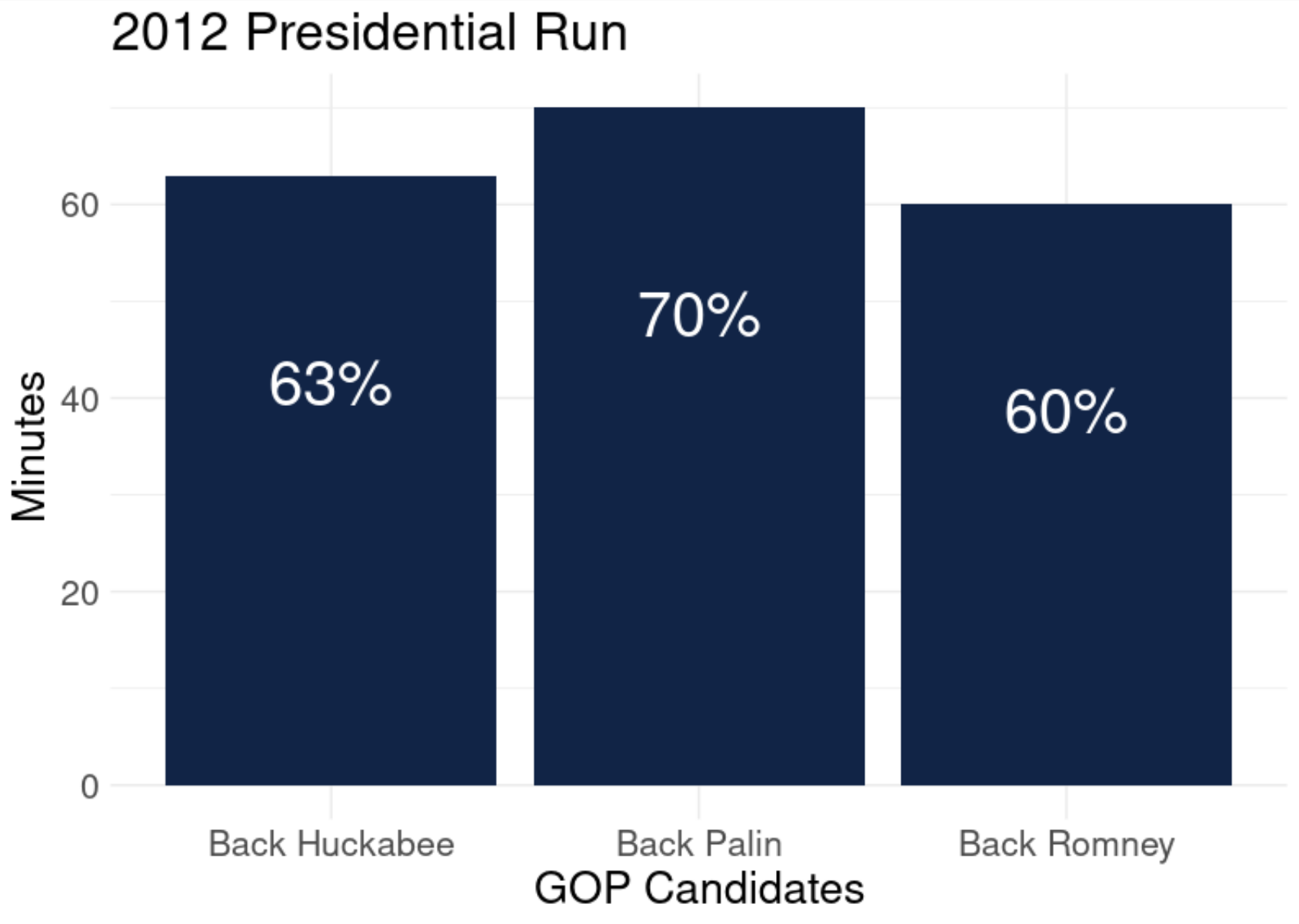


Ricks (2020)

Pie plots: Wrong plot type

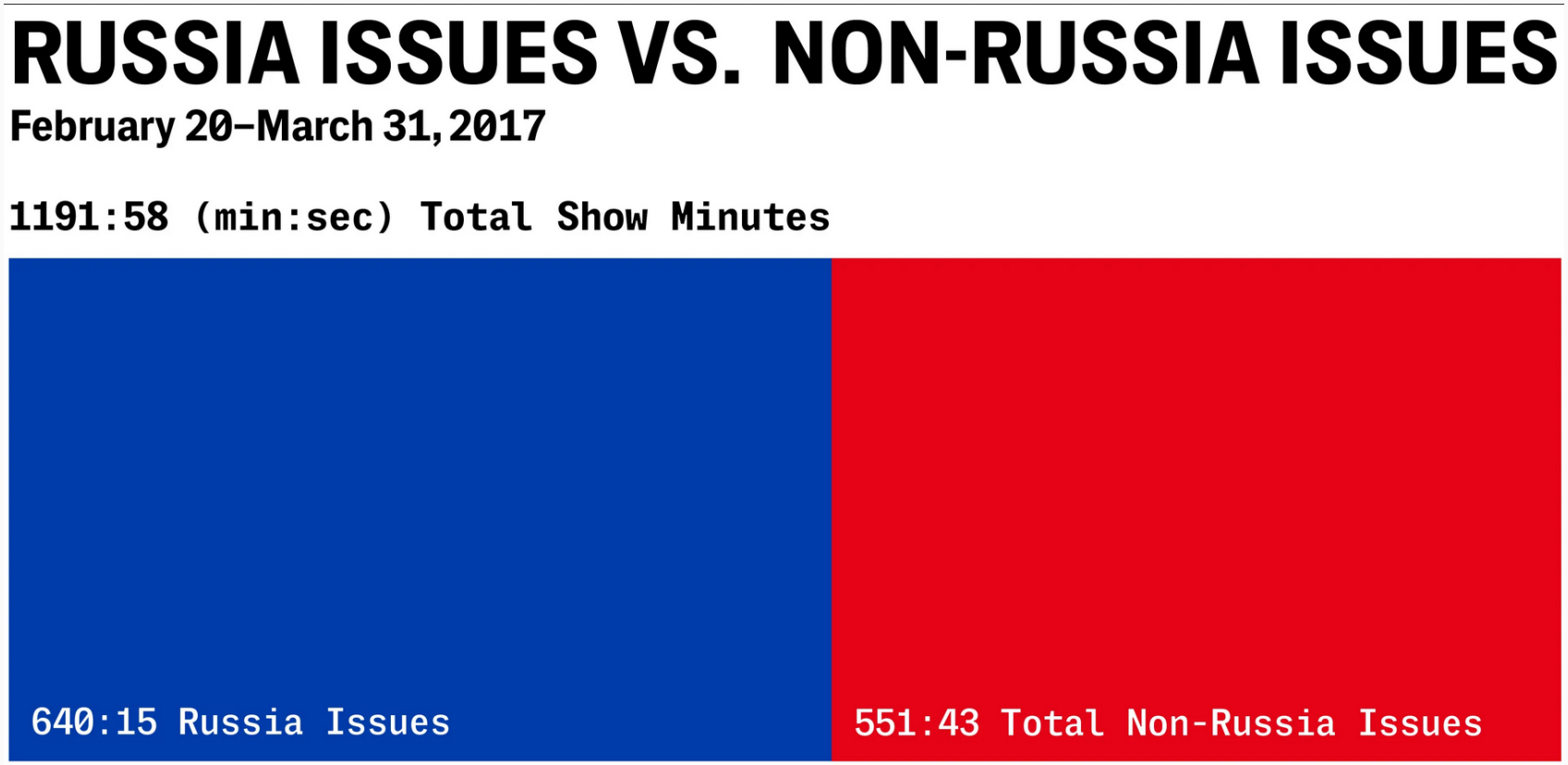


Pie plots: Wrong plot type



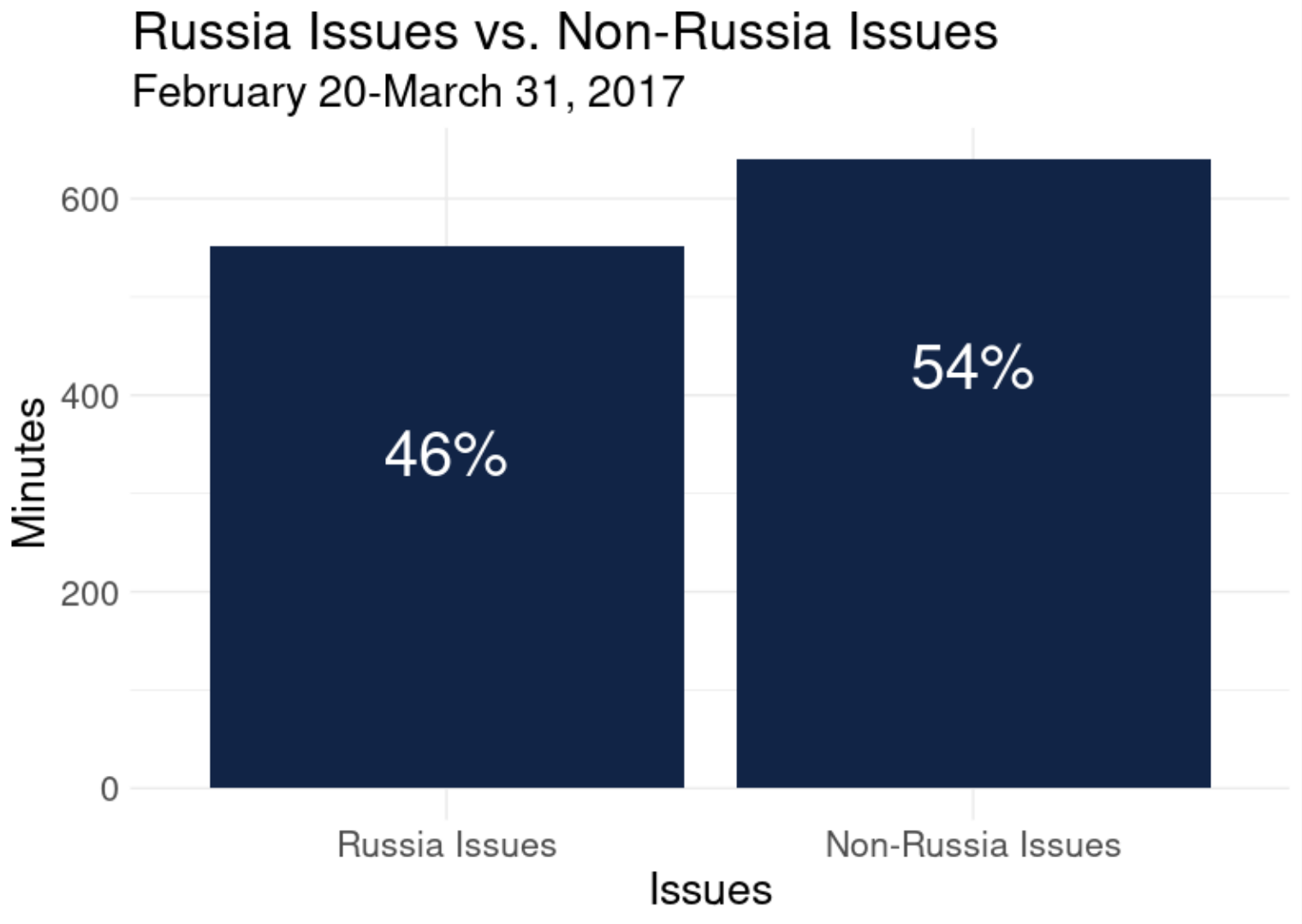
McCready (2020)

Bar plots: Stack (+ color)

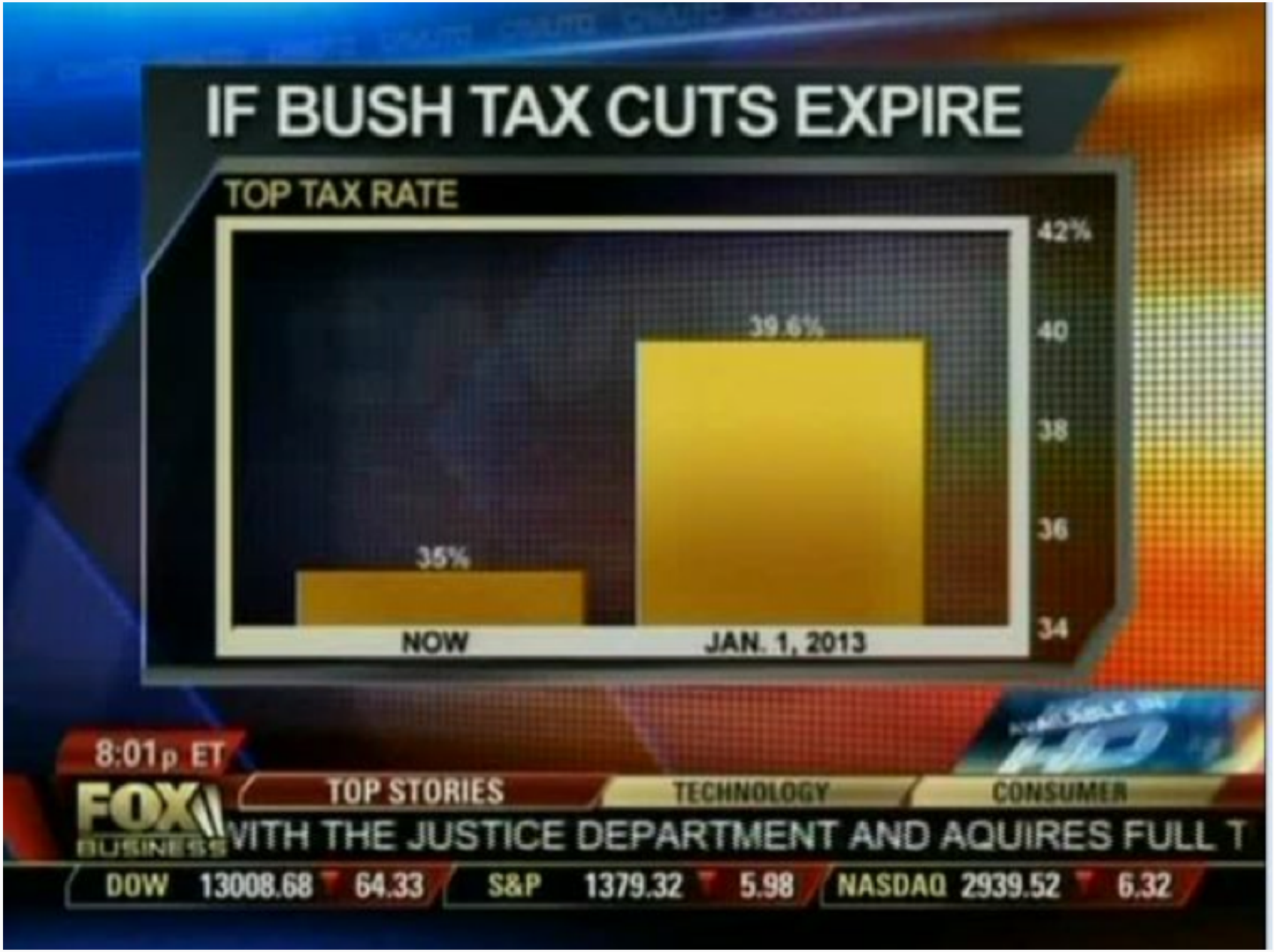


Maté (2017)

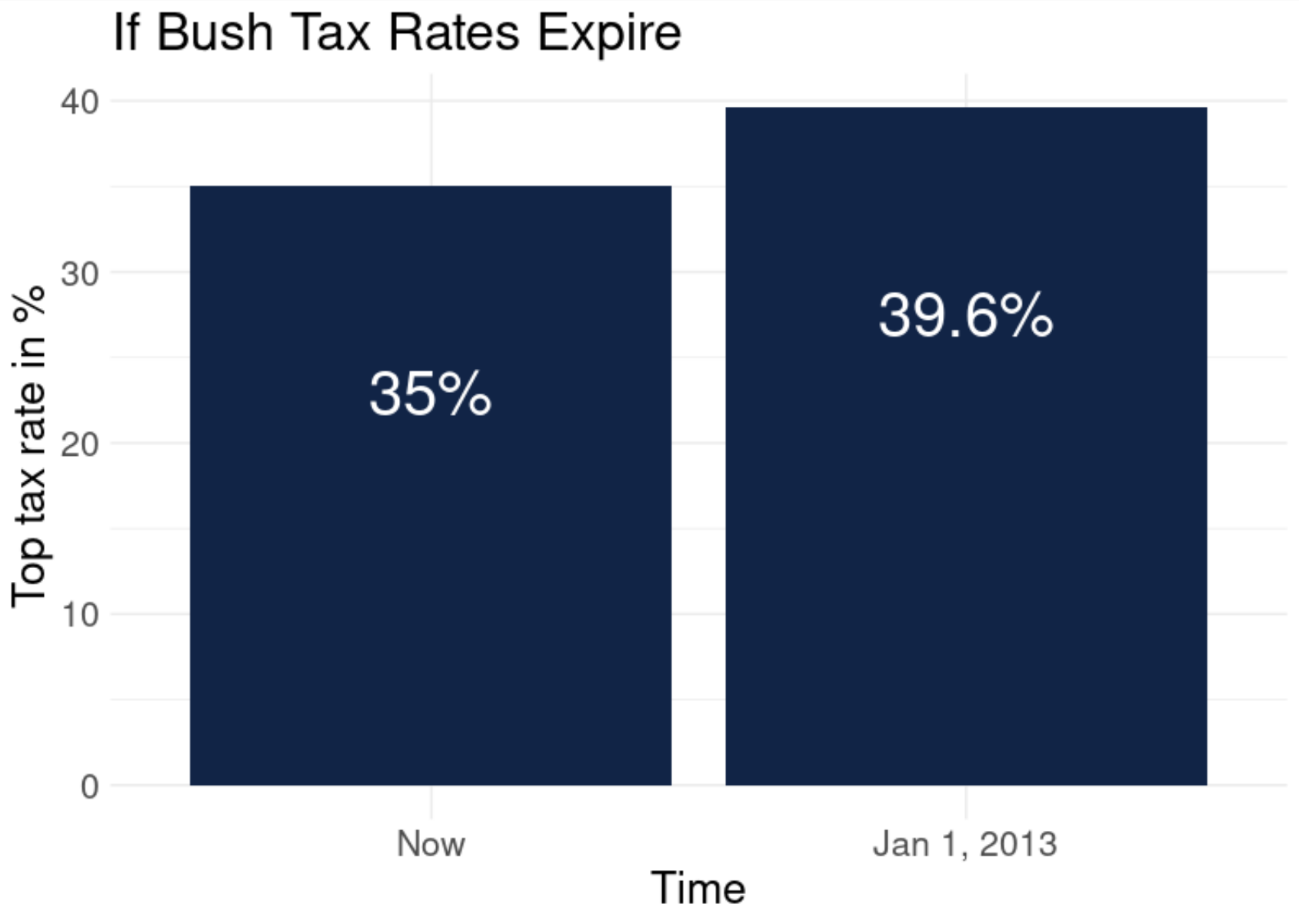
Bar plots: Stack (+ color)



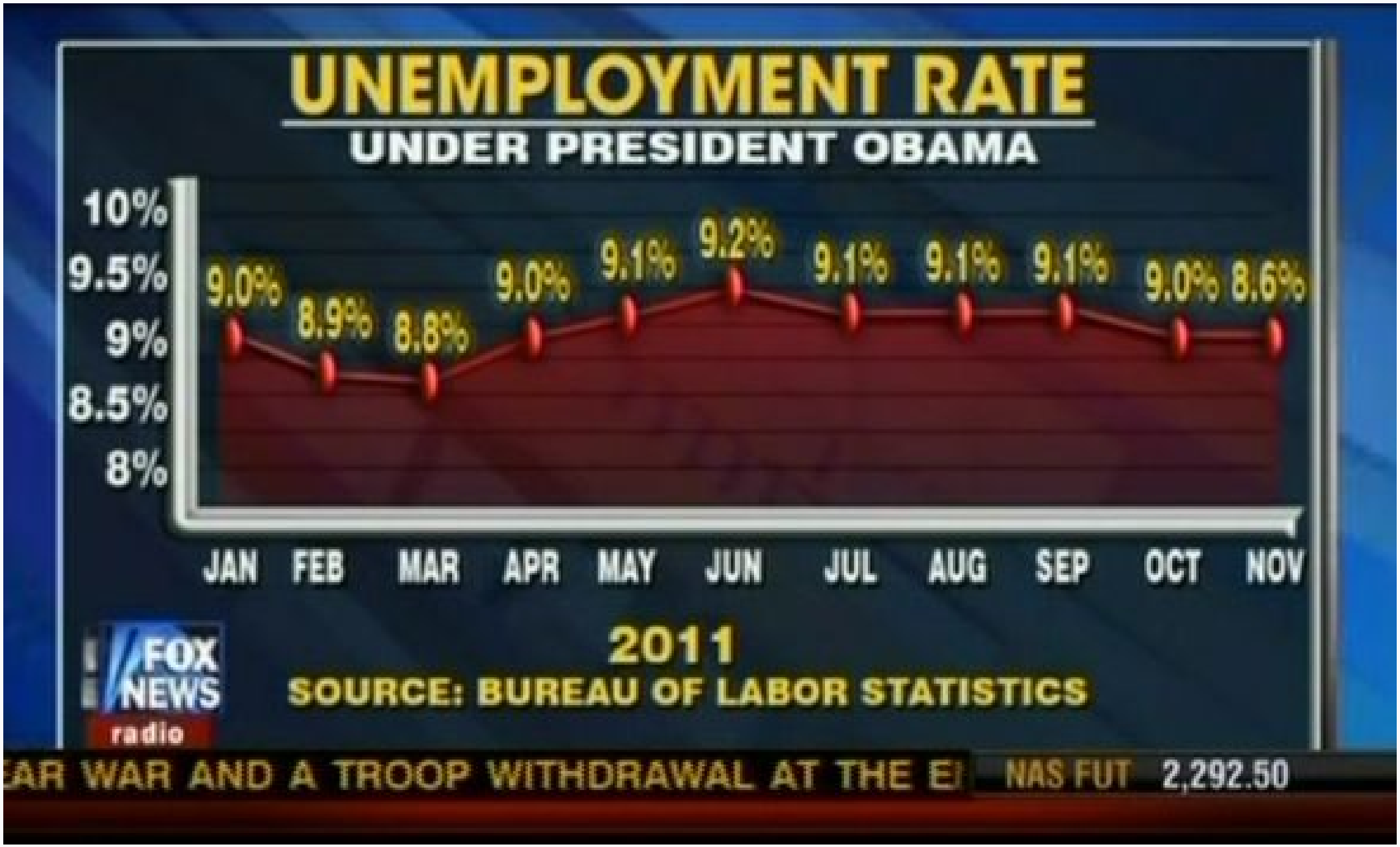
X/Y plots: Omit the baseline



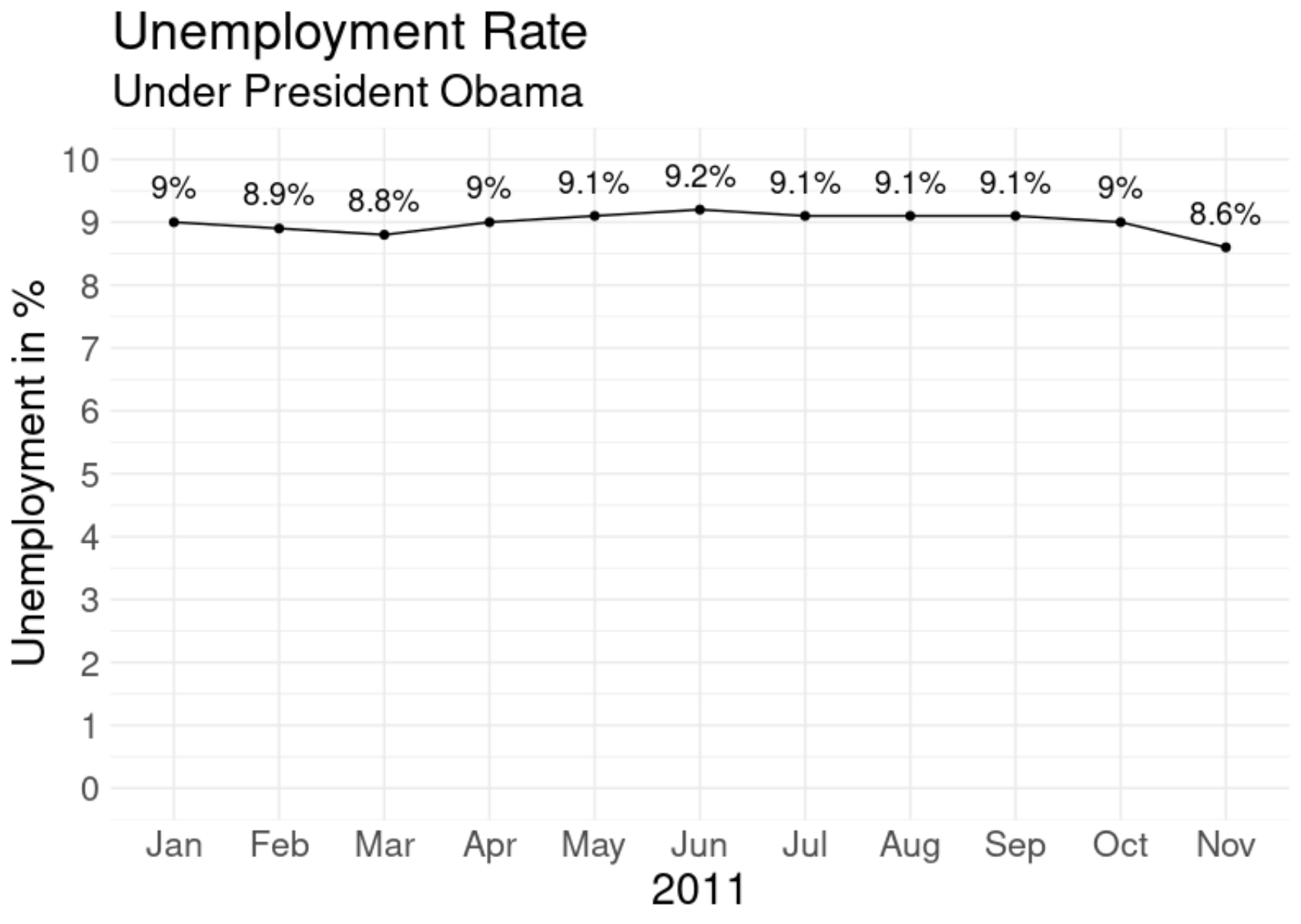
X/Y plots: Omit the baseline



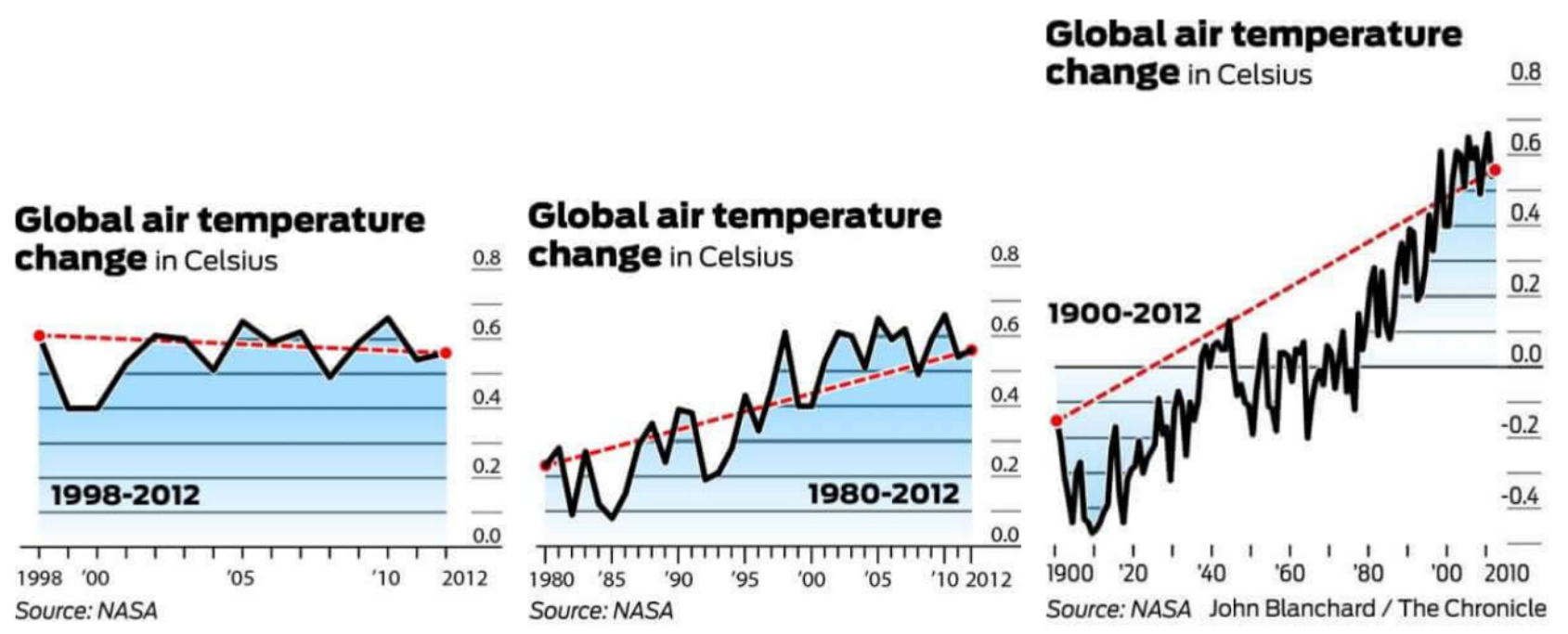
X/Y plots: Manipulate the Y-axis



X/Y plots: Manipulate the Y-axis

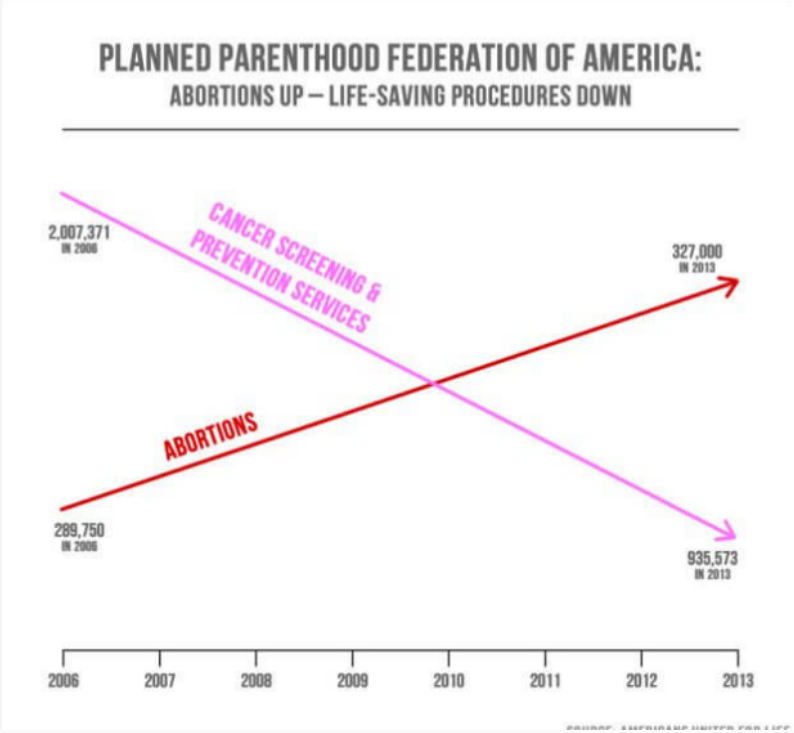


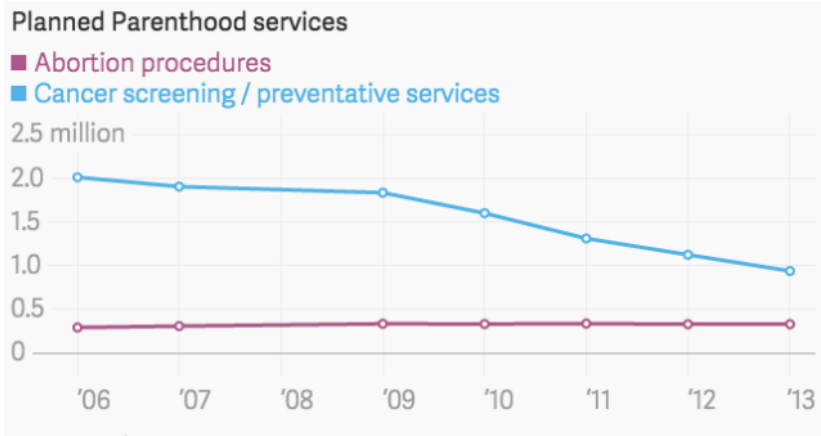
X/Y plots: Pick the range



Fallenbüchel (2019)

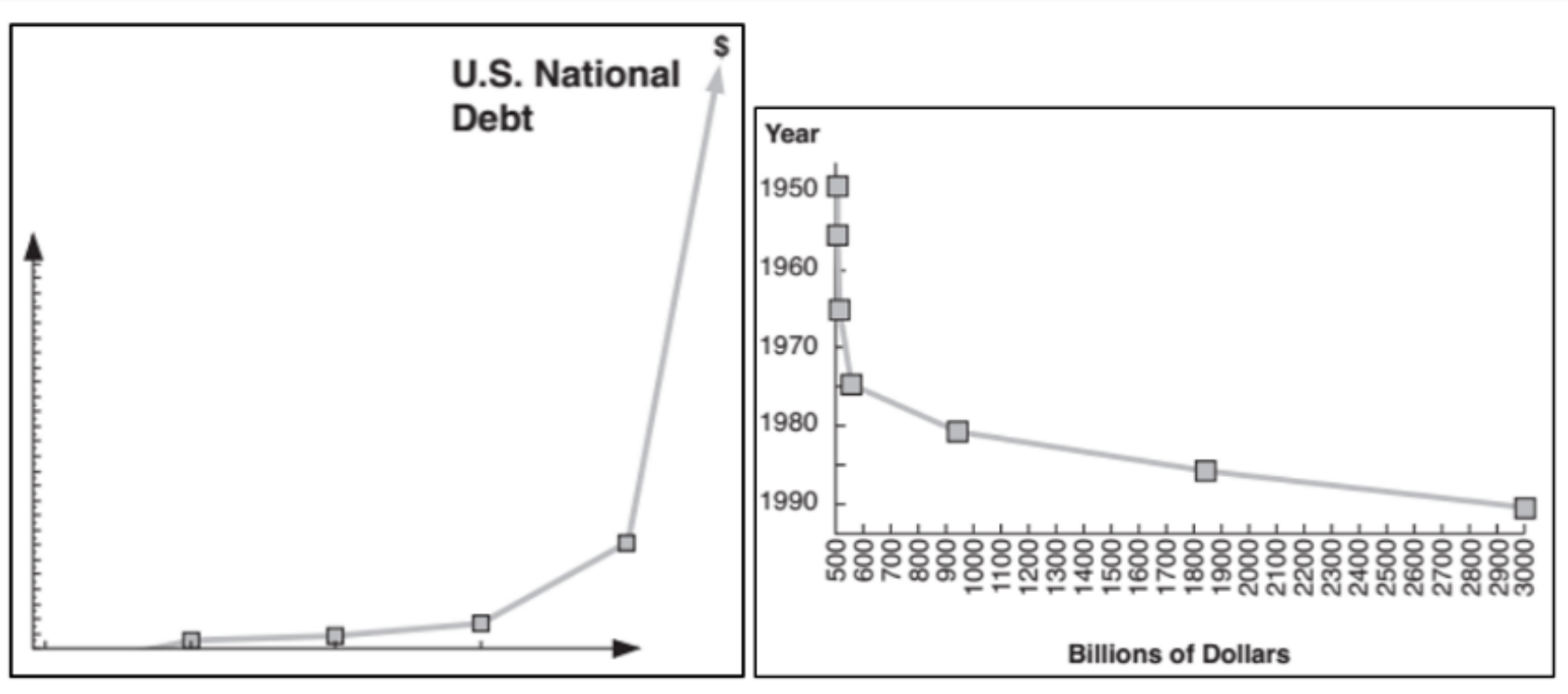
X/Y plots: Fuck the y-axis entirely





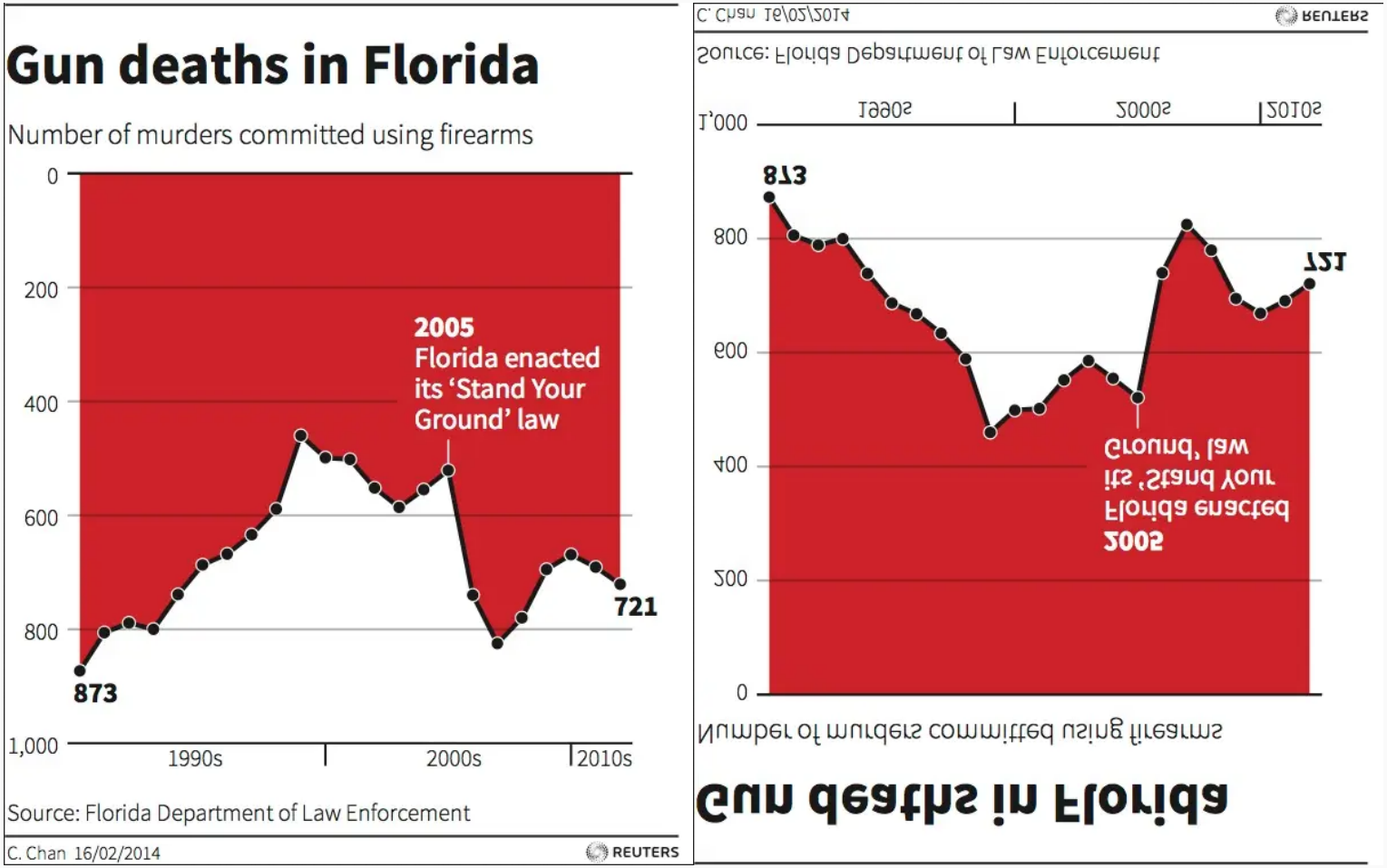
Fallenbüchel (2019)

X/Y plots: Flip plot

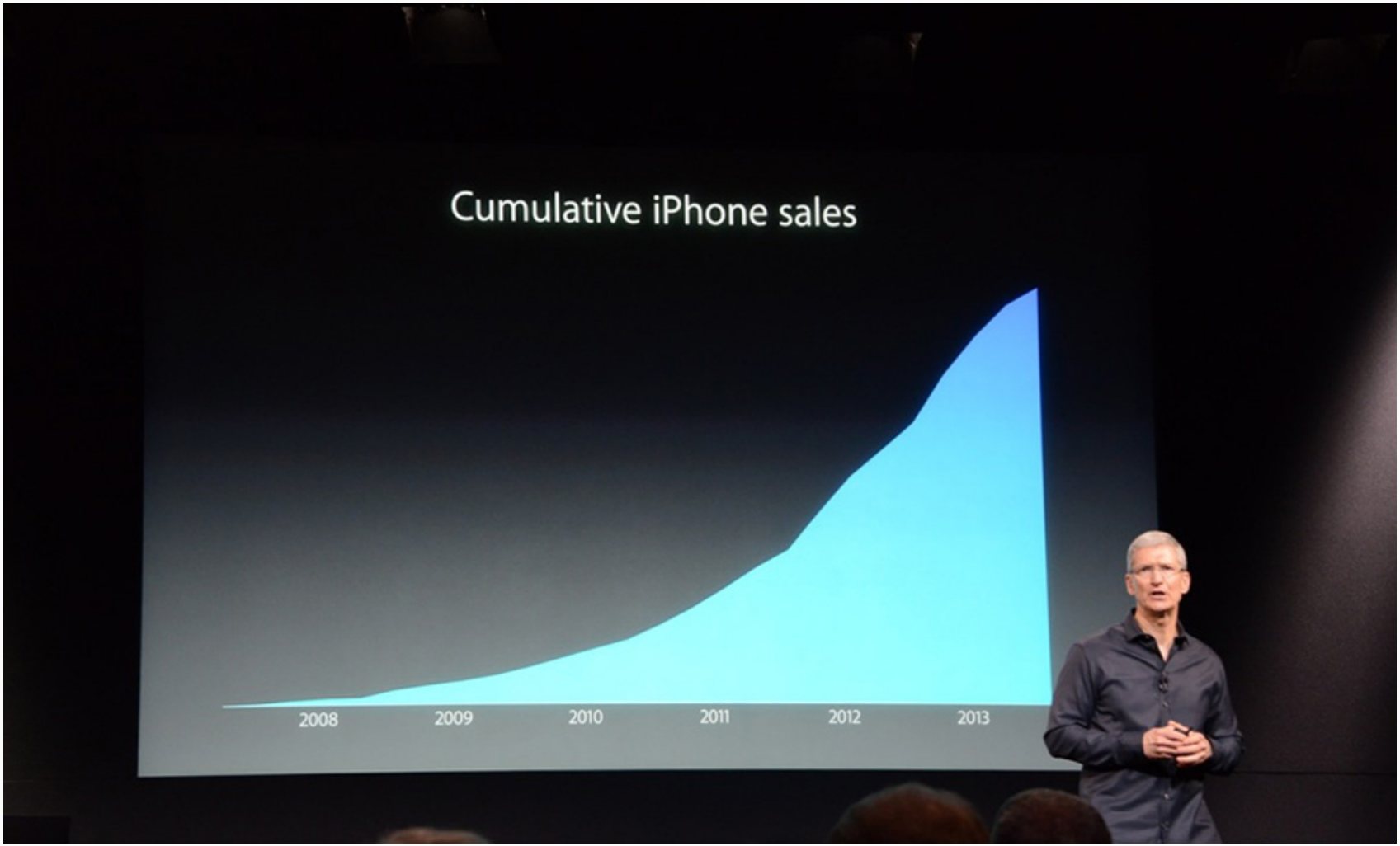


Fallenbüchel (2019)

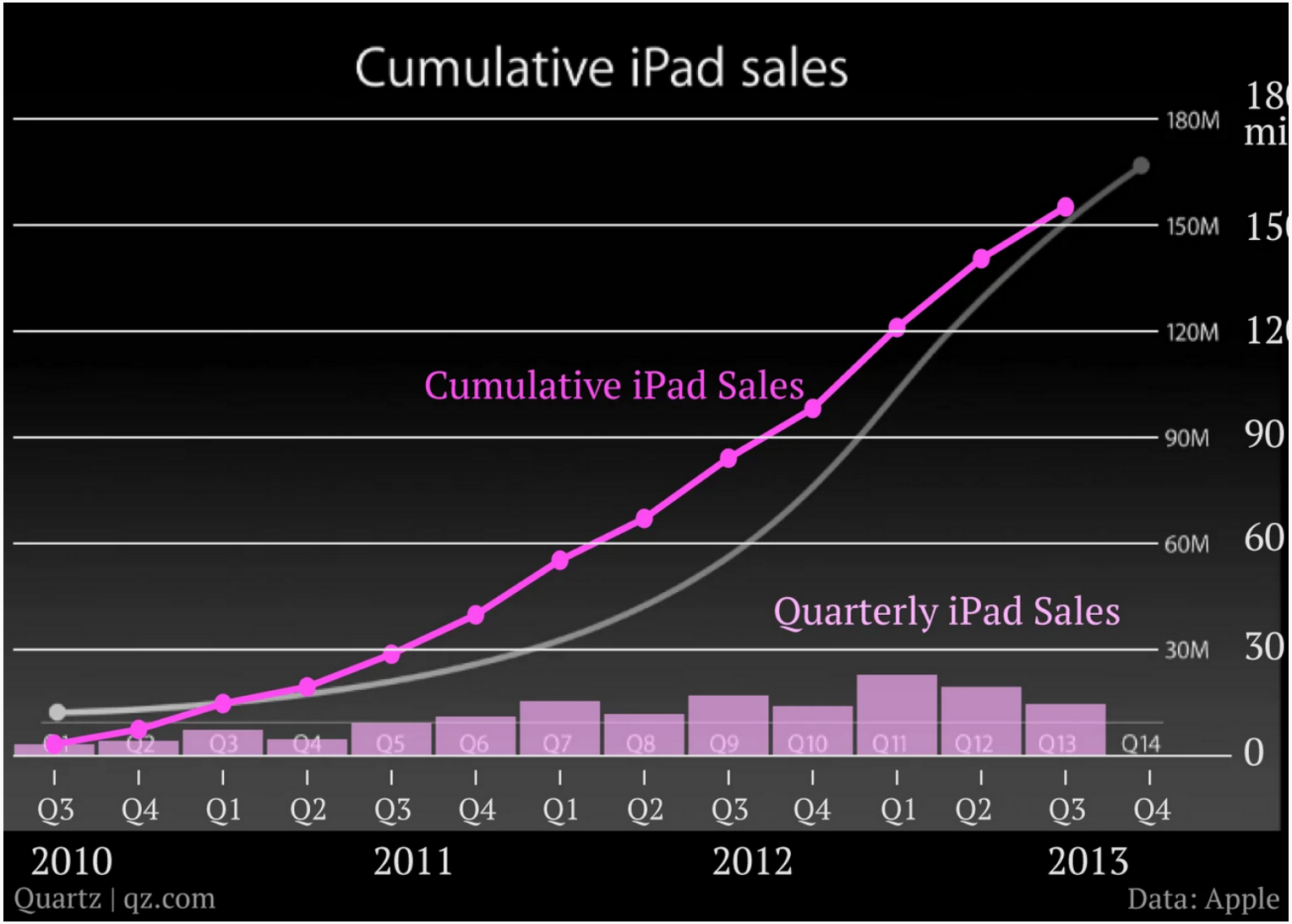
X/Y plots: Flip plot



X/Y plots: Cumulative growth



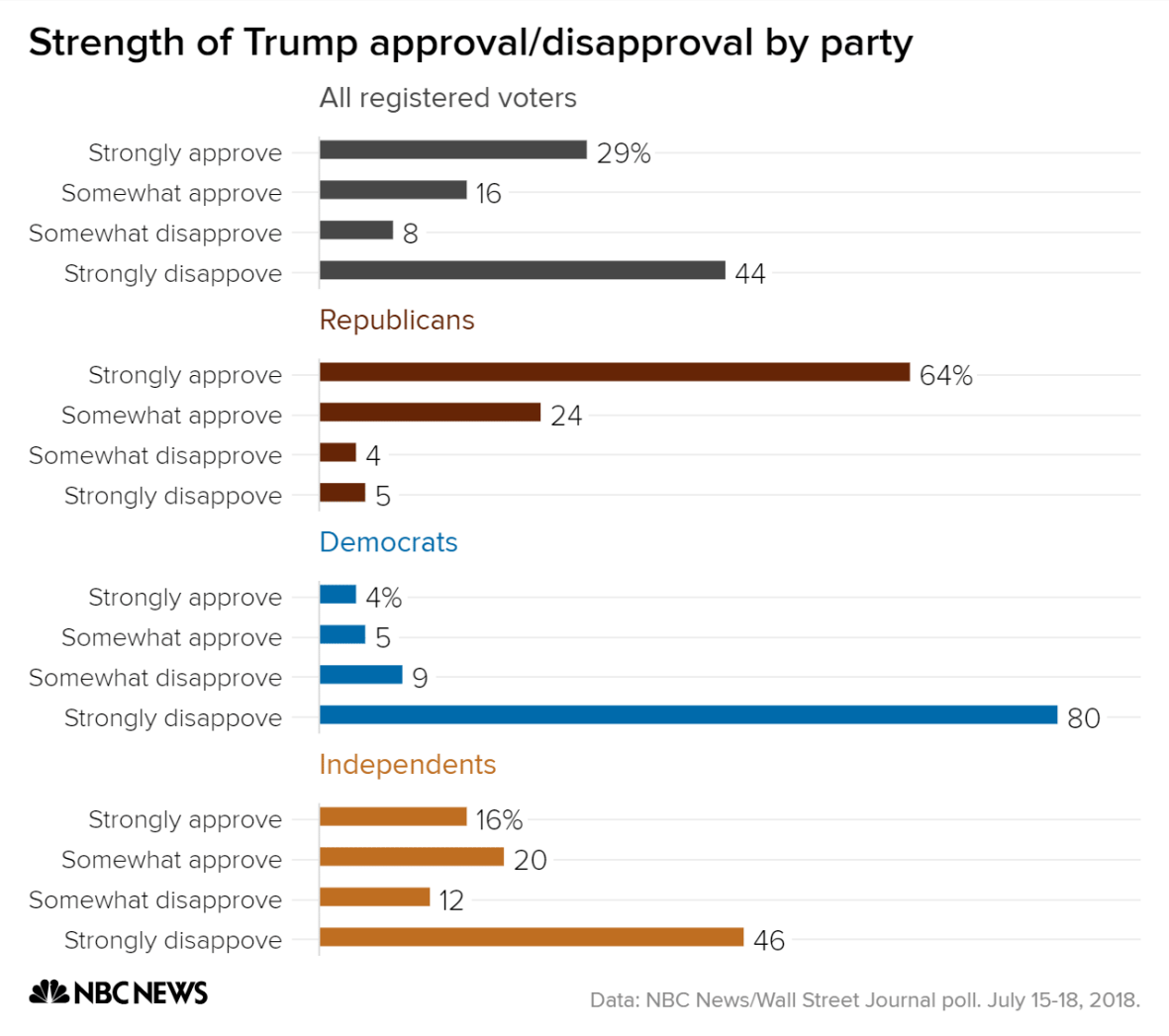
X/Y plots: Cumulative growth



Yanofsky (2013)

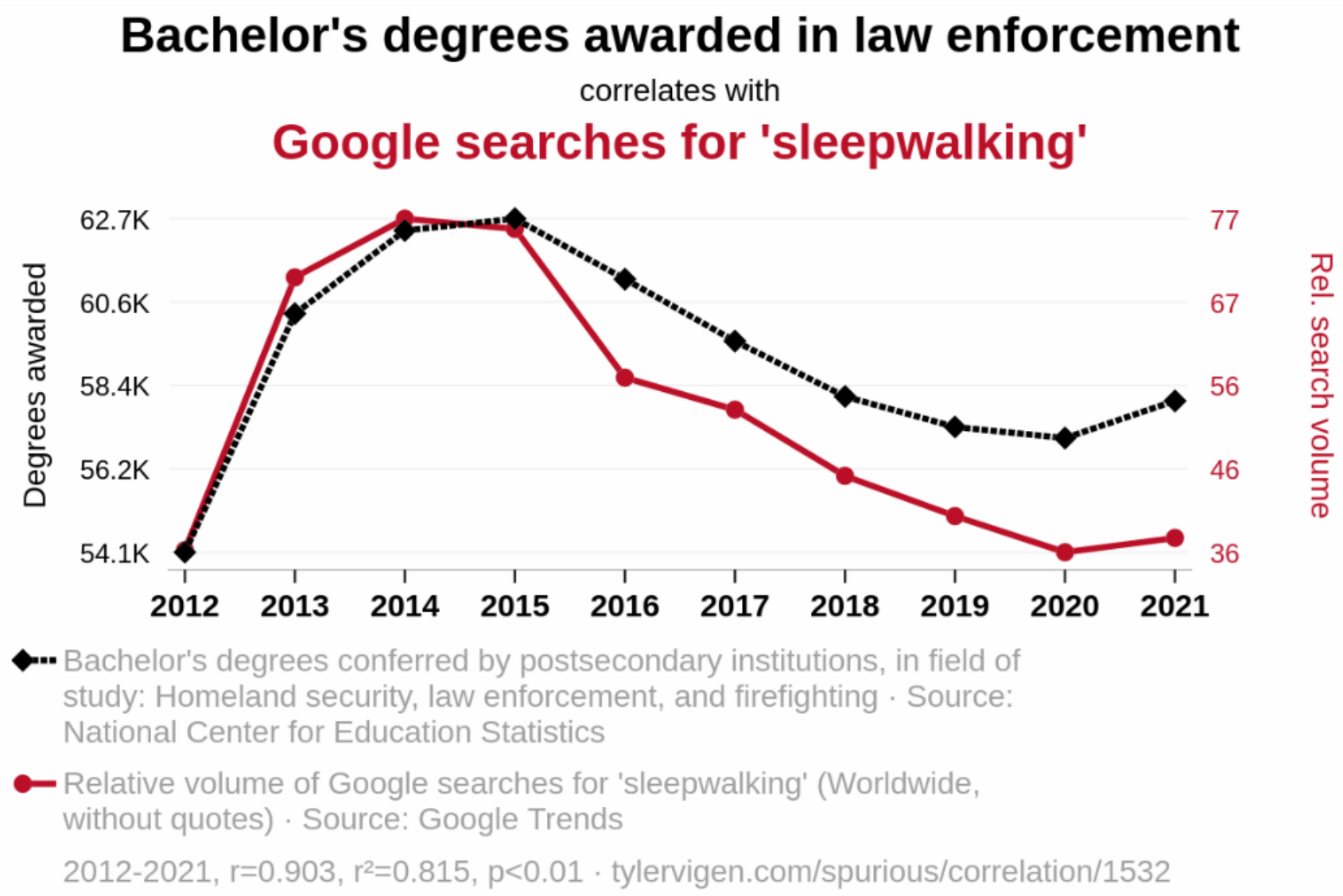
X/Y plots: Cherrypick data

X/Y plots: Cherrypick data



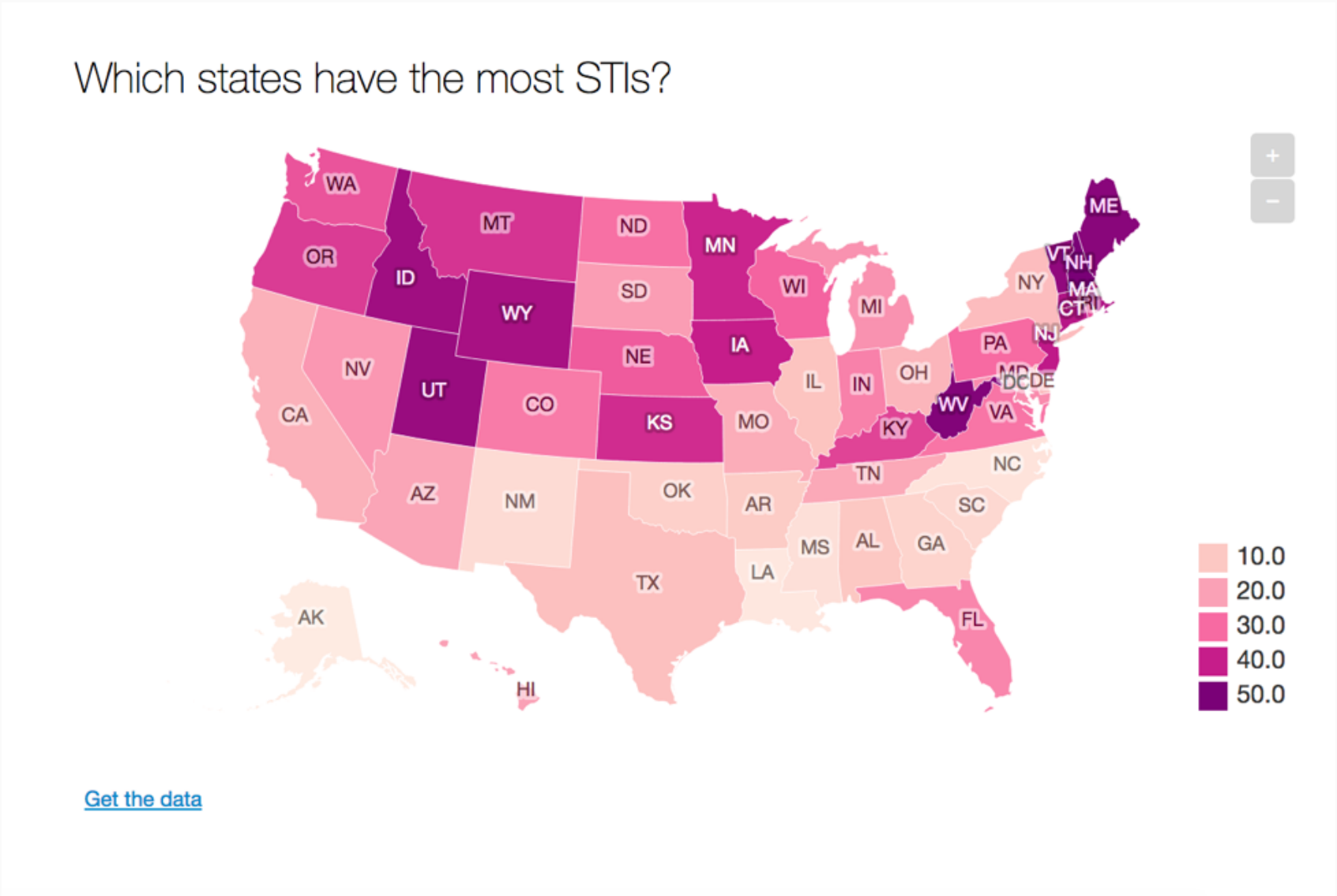
Murray (2018)

X/Y plots: Correlate axes



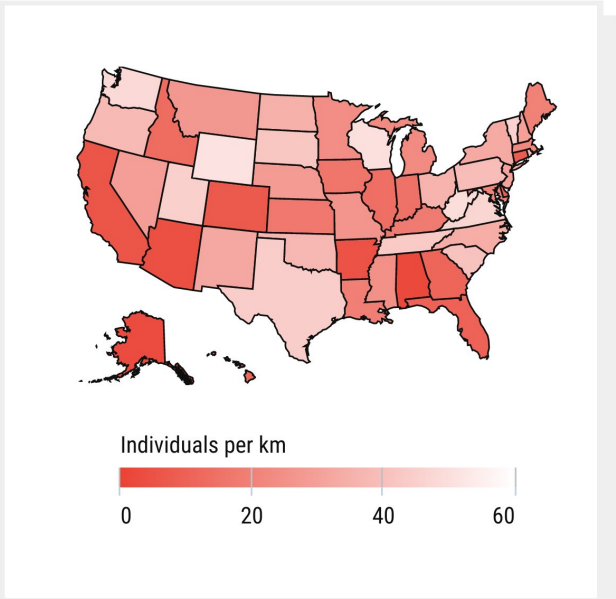
Vigen (2024)

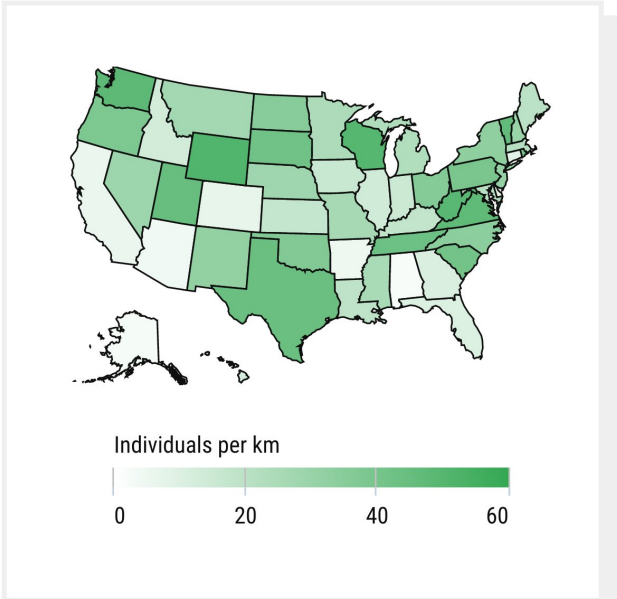
Colors: go against convention



McCready (2020)

Colors: go against convention

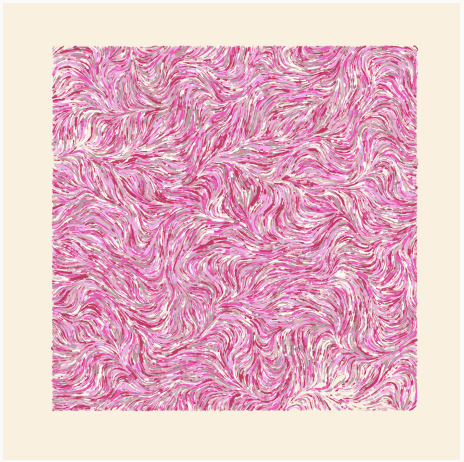


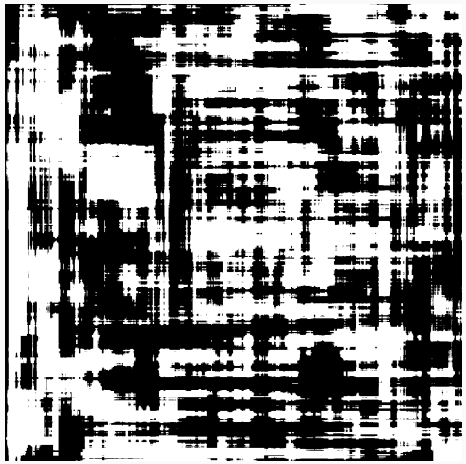
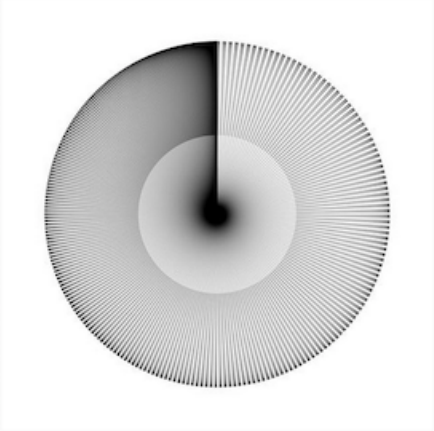
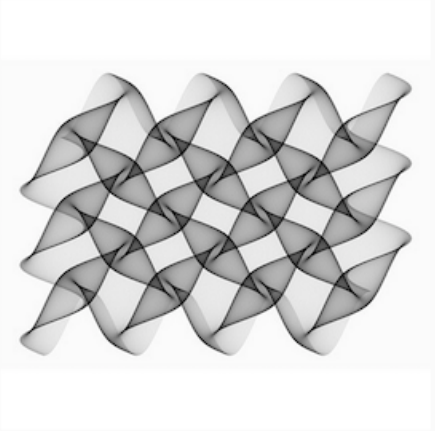
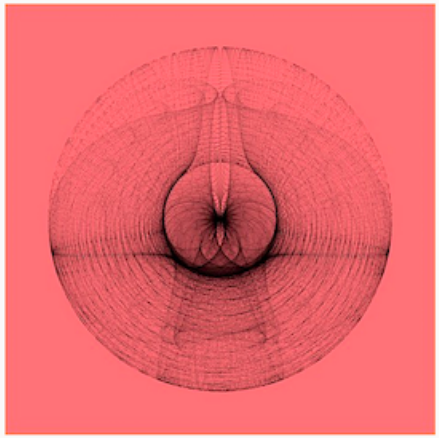


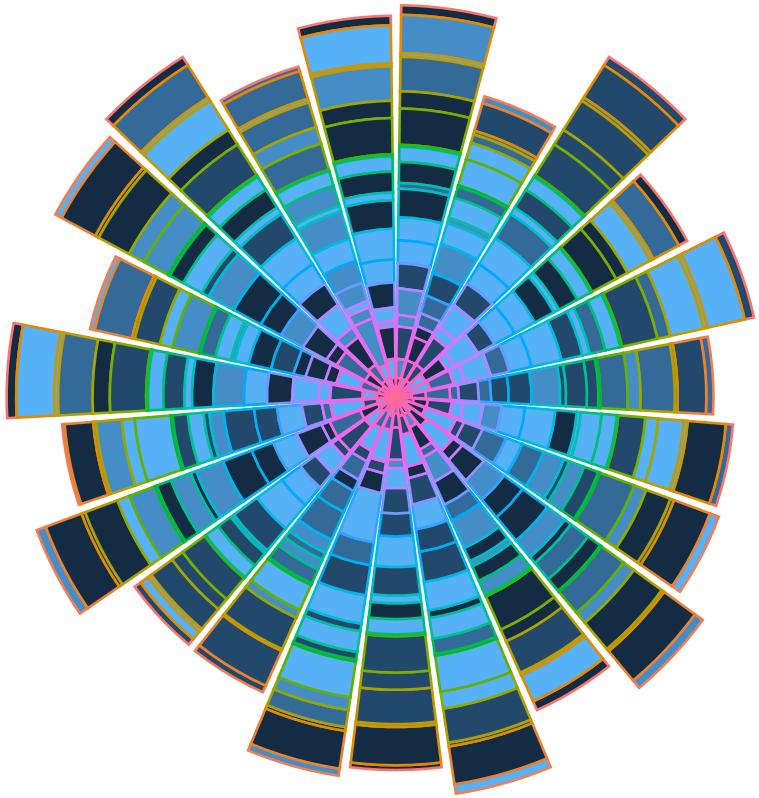
McCready (2020)

Generative art

Start out with `aRtsy` and `generativeart`, but also a mix of `ggplot2, ggforce, rayshader, ggpattern, gridExtra`



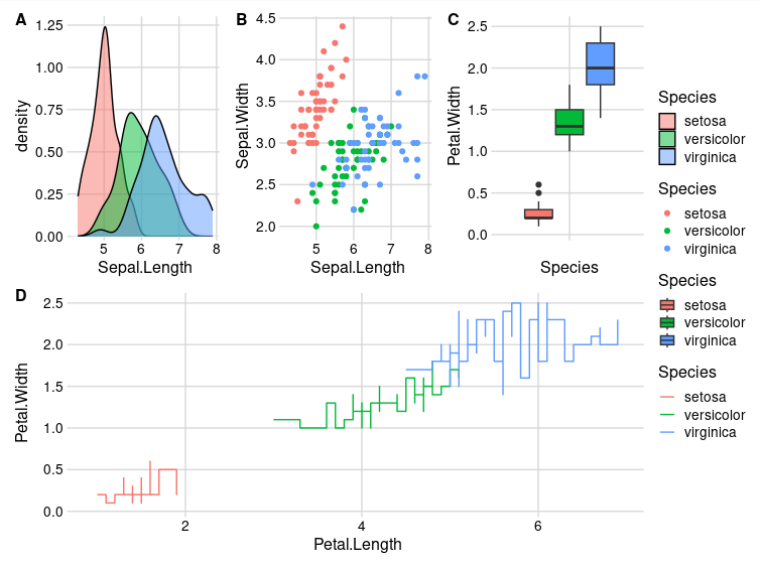


Moving on from R

Arranging plots

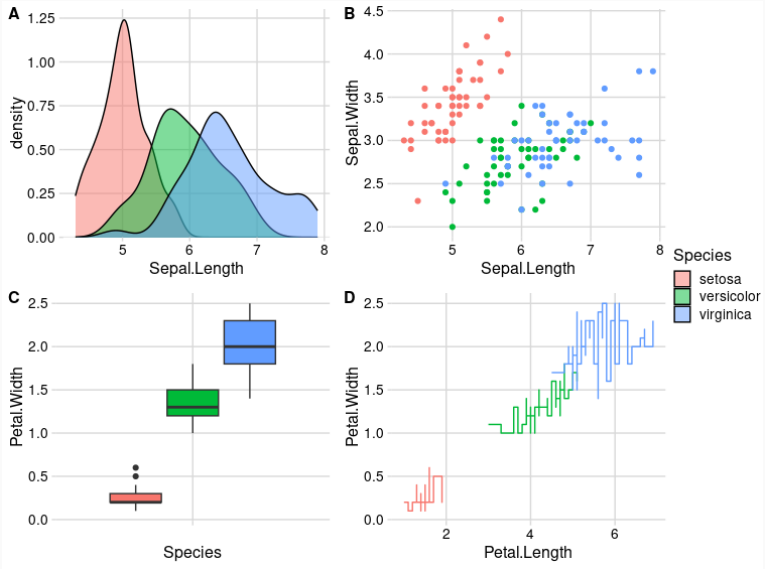
`patchwork`

makes it ridiculously simple to combine separate ggplots into the same graphic.



`cowplot`

provides various features to make plots beautiful, including aligning and arranging plots.



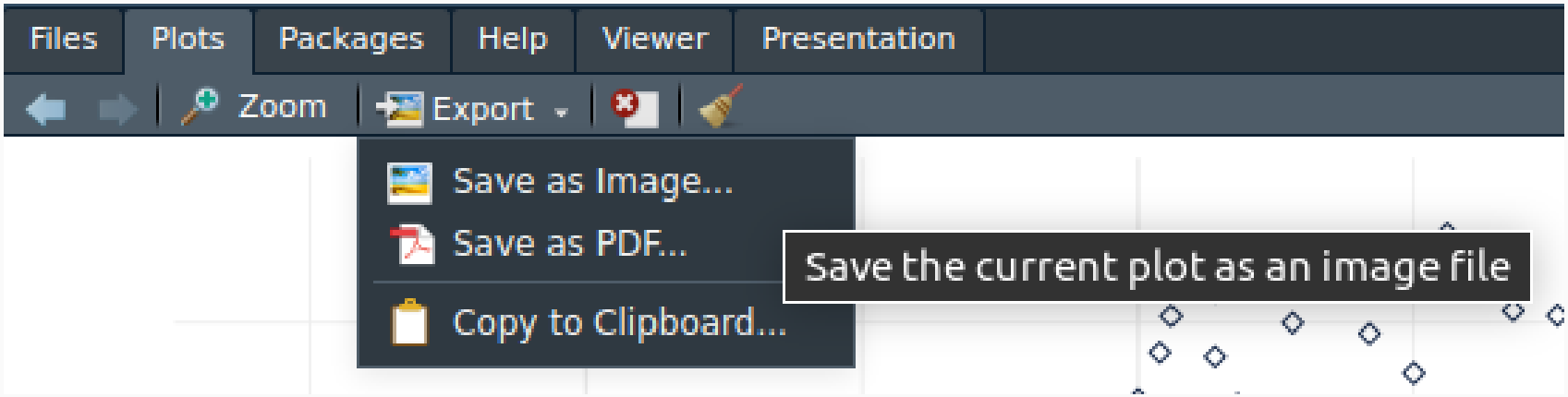
Exporting plots

`ggsave("FILENAME", width=NR, height=NR, dpi =300)`

Saves the last plot by default, but you can specify `plot = my.plot`

A common standard for high-quality prints is 300 DPI (dots per inch)

Choose PDF or PNG file extension for printing, SVG for more editing.



Exporting dataframes

Save a data frame to the **current working directory**.

```
write_csv(WHAT, "PATH TO WHERE", row.names=FALSE)   comma
write_tsv()                                          tab
write_excel_csv()                                    CSV for Excel
write_delim()                                        specify how to separate
```

```
write_csv(moses_accuracy, "Moses accuracy.csv",
          row.names = FALSE)

write_delim(moses_accuracy, "Moses accuracy.txt",
            row.names = FALSE, delim = ":")
```

Questions?

Wrap-up

Summary

- ✔ R programming basics and RStudio IDE
- ✔ write scripts
- ✔ file encoding, variable naming, and tidy code with pipes
- ✔ install and load packages
- ✔ import/export data from/to the working directory
- ✔ save and remove objects in the environment
- ✔ preprocess raw data (filtering, renaming, arranging, mutating, selecting, if else)
- ✔ make sense of data (merging, grouping, summarizing)
- ✔ print and visualize the results
- ✔ find help

Homework assignment due May 31st 15:30

- Complete assignment 6 ($\rightarrow$ ILIAS)
- Vote for the ugliest plot.
- Install Quarto: `https://quarto.org/docs/get-started/`
- Watch the Quarto introductory video: `https://youtu.be/_f3latmOhew?si=xxovQvYkUosC_4uB`

Next time: Reporting on data

References

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