

# Truth, beauty, and data

## Session 1

PMAP 8921: Data Visualization with R  
Andrew Young School of Policy Studies  
Summer 2025

# Plan for today

**Facts, truth, and beauty**

**Data, truth, and beauty**

**Beautiful visualizations**

**Class details**

# Facts, truth, and beauty

# What is truth?

Core principles of the universe?

Underlying trends in society?

Something transcendental?

Reality?

# How do we find truth?

Science!



Neil deGrasse Tyson 

@neiltyson



The good thing about Science is that it's true whether or not you believe in it.

10:41 AM · Jun 14, 2013 · [TweetDeck](#)

**14.3K** Retweets   **8.3K** Likes



# But wait!

## Beware of scientism!

**"... promotion of science as the best or only objective means by which society should determine normative and epistemological values"**

# Science is not the only way

**Art**

**Music**

**Literature**

**Religion**

**Nature**

# Nothing here is factual...

...but it all reveals truth



Cosette



King Lear



Beethoven's 9th symphony

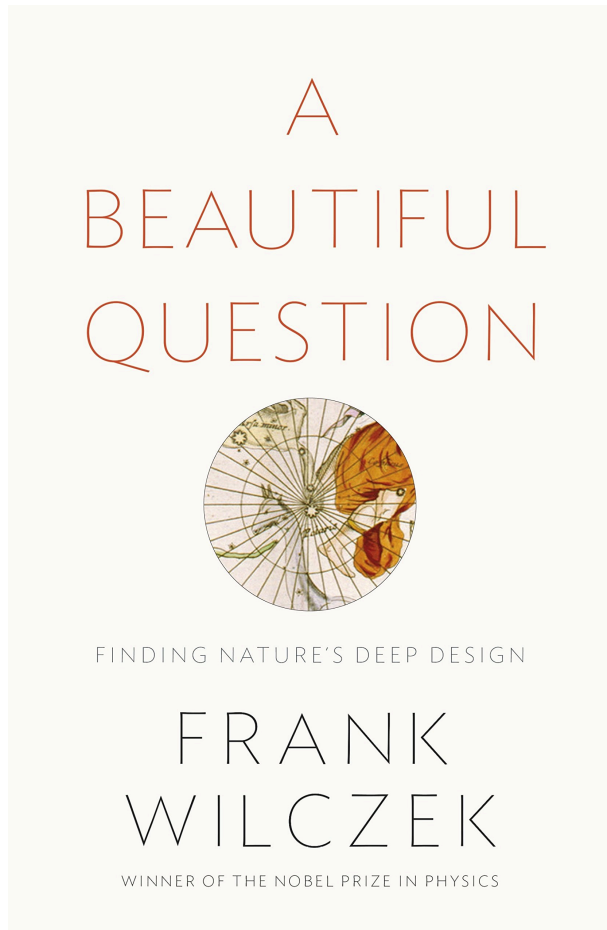


**Facts  $\neq$  truth**

**Where does truth come when  
there are no facts?**

**Beauty**

# Beauty in science



**This is also true for  
science and math  
and other more  
factual realms**

# Rhetoric and beauty

λόγος • λέξις

Logos • Lexis

Res • Verba

Essence • Structure

Content • Form

**Truth • Beauty**

# Content + form

**Art is how we translate core,  
essential content (or truth!)  
to different forms  
for specific audiences.**

# Truth is beautiful

**Truth  $\neq$  facts**

**Truth comes from aesthetic  
combination of content and form**

**Facts require beauty to be true**

# Data, truth, and beauty

# Just show me the data!

.pull-left-3.small-code[

```
head(my_data, 10)
```

```
## [38;5;246m# A tibble: 10 × 2 [39m
```

```
##           x           y
```

```
## [3m [38;5;246m<dbl> [39m [23m [3m [38;5;246m<dbl> [39m [23m
```

```
## [38;5;250m 1 [39m 55.4 97.2
```

```
## [38;5;250m 2 [39m 51.5 96.0
```

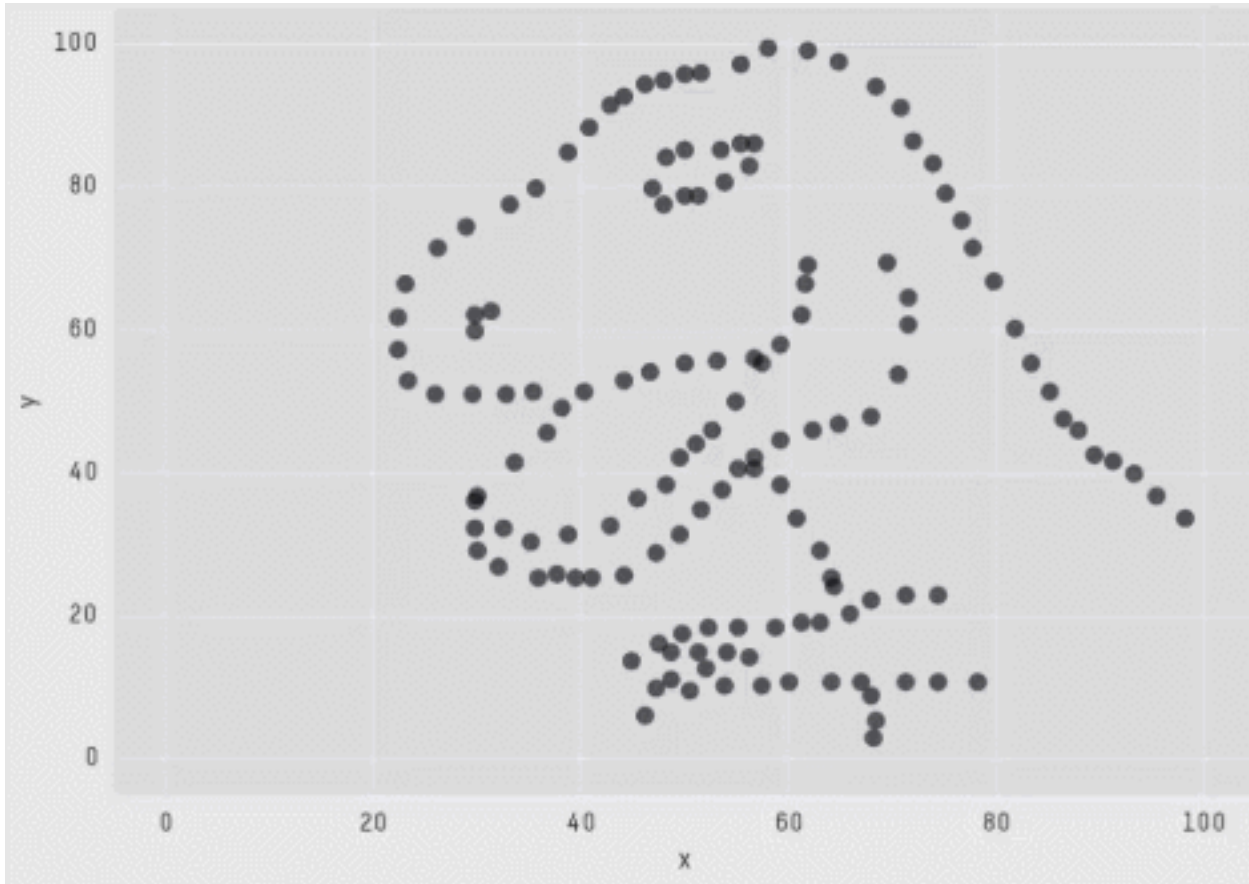
```
## [38;5;250m 3 [39m 46.2 94.5
```

```
## [38;5;250m 4 [39m 42.8 91.4
```

```
## [38;5;250m 5 [39m 40.8 88.3
```



# oh no

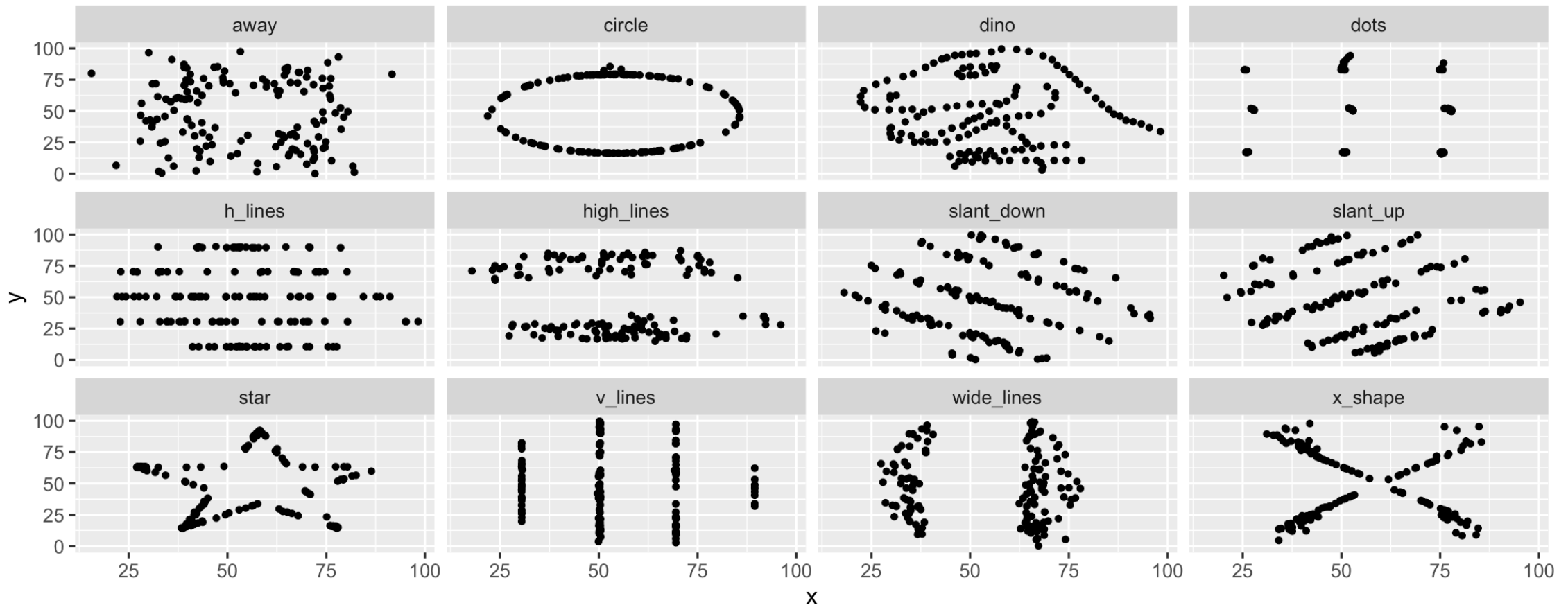


X Mean: 54.2659224  
Y Mean: 47.8313999  
X SD : 16.7649829  
Y SD : 26.9342120  
Corr. : -0.0642526

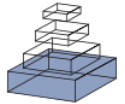
The Datasaurus Dozen

# Raw data is not enough

Each of these has the same mean, standard deviation, variance, and correlation



# Humans love patterns



## Superior pattern processing is the essence of the evolved human brain

**Mark P. Mattson**<sup>1,2\*</sup>

<sup>1</sup> Laboratory of Neurosciences, National Institute on Aging Intramural Research Program, Baltimore, MD, USA

<sup>2</sup> Department of Neuroscience, Johns Hopkins University School of Medicine, Baltimore, MD, USA

**Edited by:**

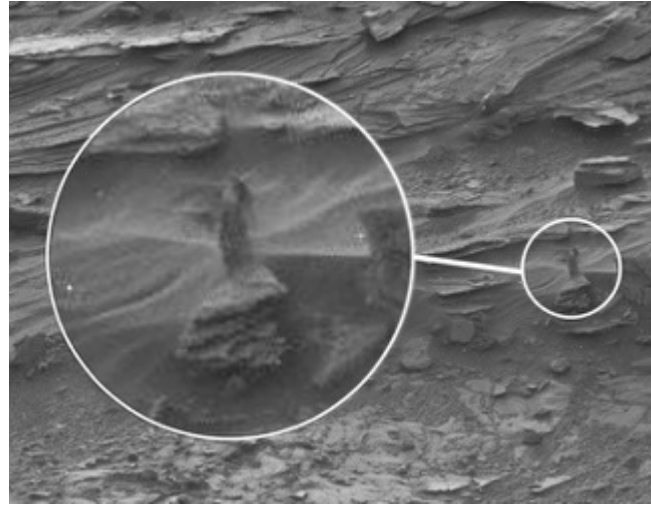
J. Michael Williams, Drexel  
University, USA

Humans have long pondered the nature of their mind/brain and, particularly why its capacities for reasoning, communication and abstract thought are far superior to other species, including closely related anthropoids. This article considers superior pattern

<https://doi.org/10.3389/fnins.2014.00265>

# (Sometimes we love them too much)

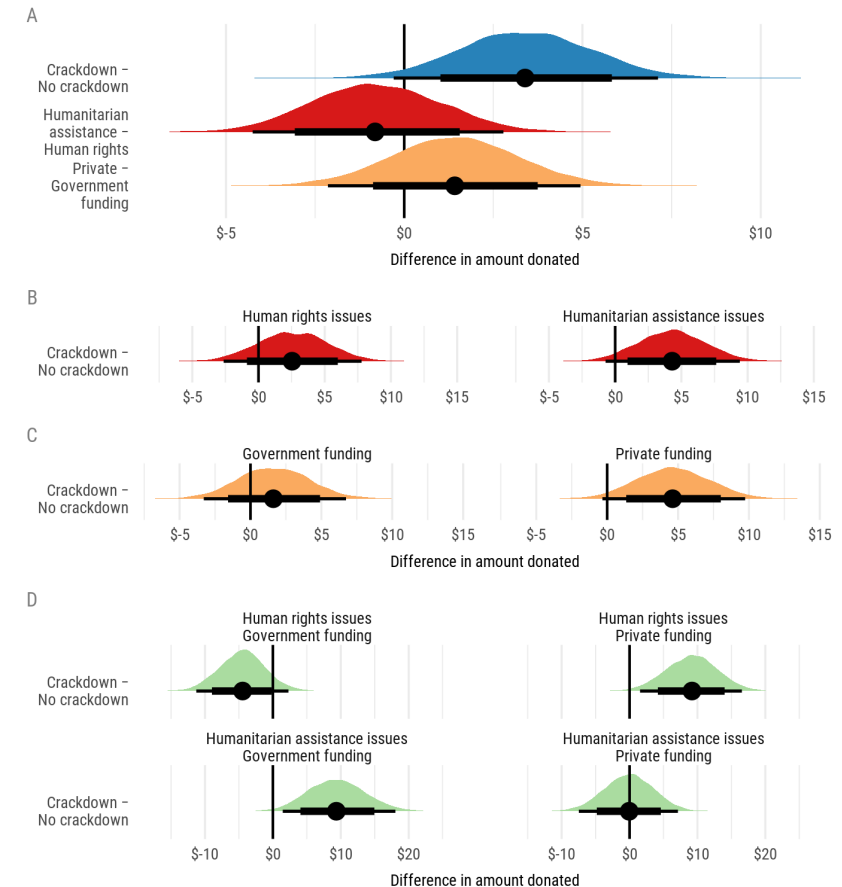
**Pareidolia: seeing patterns that aren't there.**



# Beauty is necessary to see patterns

Table 2: Mean values and differences in means for amount donated in “crackdown” (treatment) and “no crackdown” (control) conditions; values represent posterior medians

H <sub>1b</sub>	Amount <sub>Treatment</sub>	Amount <sub>Control</sub>	$\Delta$	% $\Delta$	$p(\Delta \neq 0)$
Crackdown – No crackdown	16.34	12.93	3.39	26.3%	0.97
Humanitarian assistance – Human rights	14.06	14.85	-0.82	-5.5%	0.67
Private – Government funding	15.13	13.71	1.42	10.4%	0.79
H <sub>2b</sub> and H <sub>3b</sub>	Amount <sub>Crackdown</sub>	Amount <sub>No crackdown</sub>	$\Delta$	% $\Delta$	$p(\Delta \neq 0)$
Human rights issues	17.4	14.86	2.54	17.2%	0.83
Humanitarian assistance issues	15.91	11.68	4.3	36.9%	0.95
Government funding	13.83	12.24	1.61	13.1%	0.74
Private funding	18.95	14.23	4.62	32.4%	0.97
H <sub>2b</sub> and H <sub>3b</sub> (nested)	Amount <sub>Crackdown</sub>	Amount <sub>No crackdown</sub>	$\Delta$	% $\Delta$	$p(\Delta \neq 0)$
Human rights issues, Government funding	10.56	15.15	-4.46	-29.5%	0.91
Human rights issues, Private funding	23.76	14.5	9.19	63.8%	0.99
Humanitarian assistance issues, Government funding	21.42	11.89	9.35	77.9%	0.99
Humanitarian assistance issues, Private funding	15.69	15.72	-0.05	-0.3%	0.51



Point shows posterior median; thick black lines show 80% credible interval; thin black lines show 95% credible interval

# Beautiful visualizations

# What makes a great visualization?

**Truthful**

**Functional**

**Beautiful**

**Insightful**

**Enlightening**

Alberto Cairo, *The Truthful Art*

# What makes a great visualization?

**"Graphical excellence is the well-designed presentation of interesting data—a matter of substance, of statistics, and of design ... [It] consists of complex ideas communicated with clarity, precision, and efficiency. ... [It] is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space ... [It] is nearly always multivariate ... And graphical excellence requires telling the truth about the data."**

**Edward Tufte, *The Visual Display of Quantitative Information*, p. 51**



# What makes a great visualization?

**Good aesthetics**

**No substantive issues**

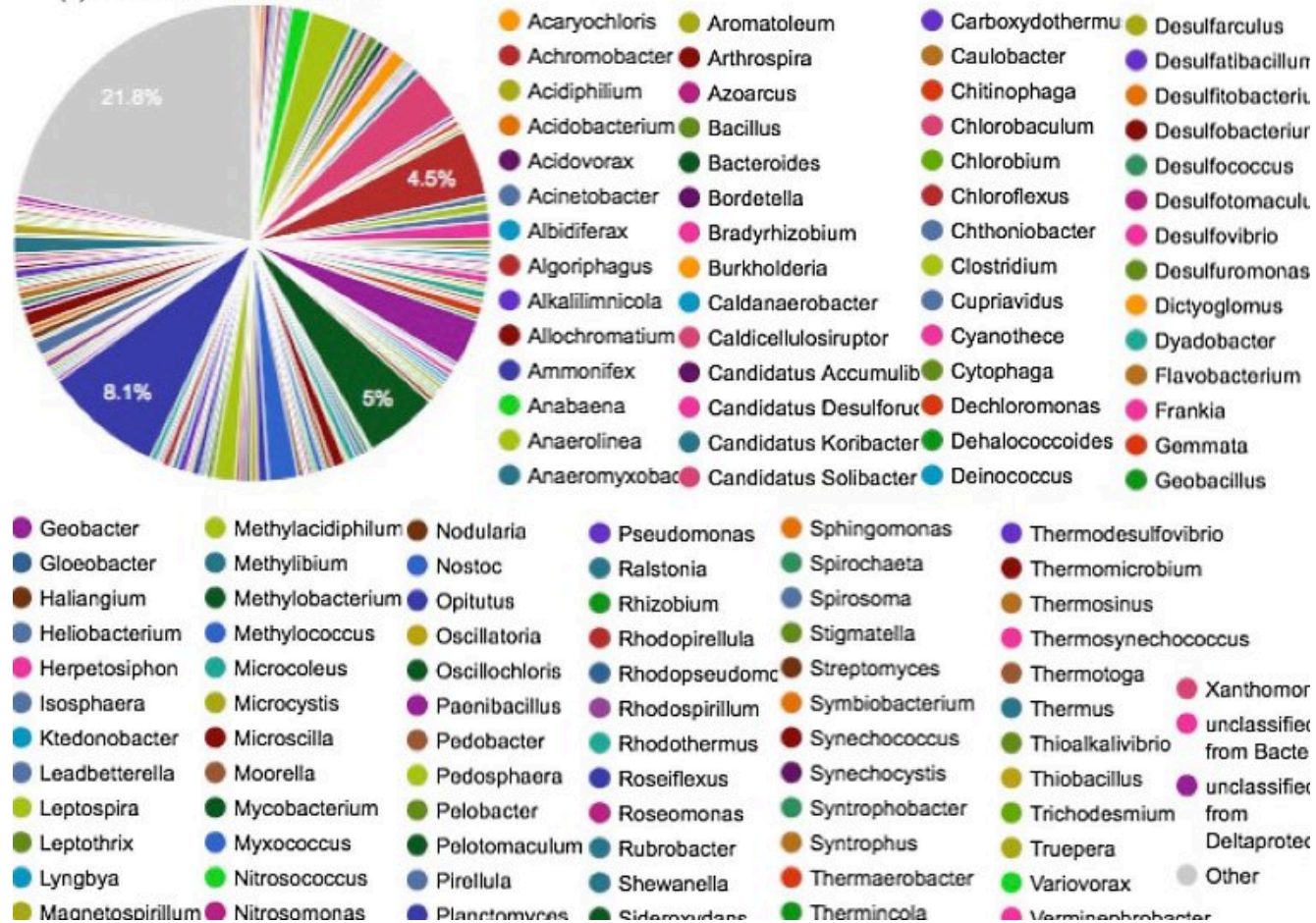
**No perceptual issues**

**Honesty + good judgment**

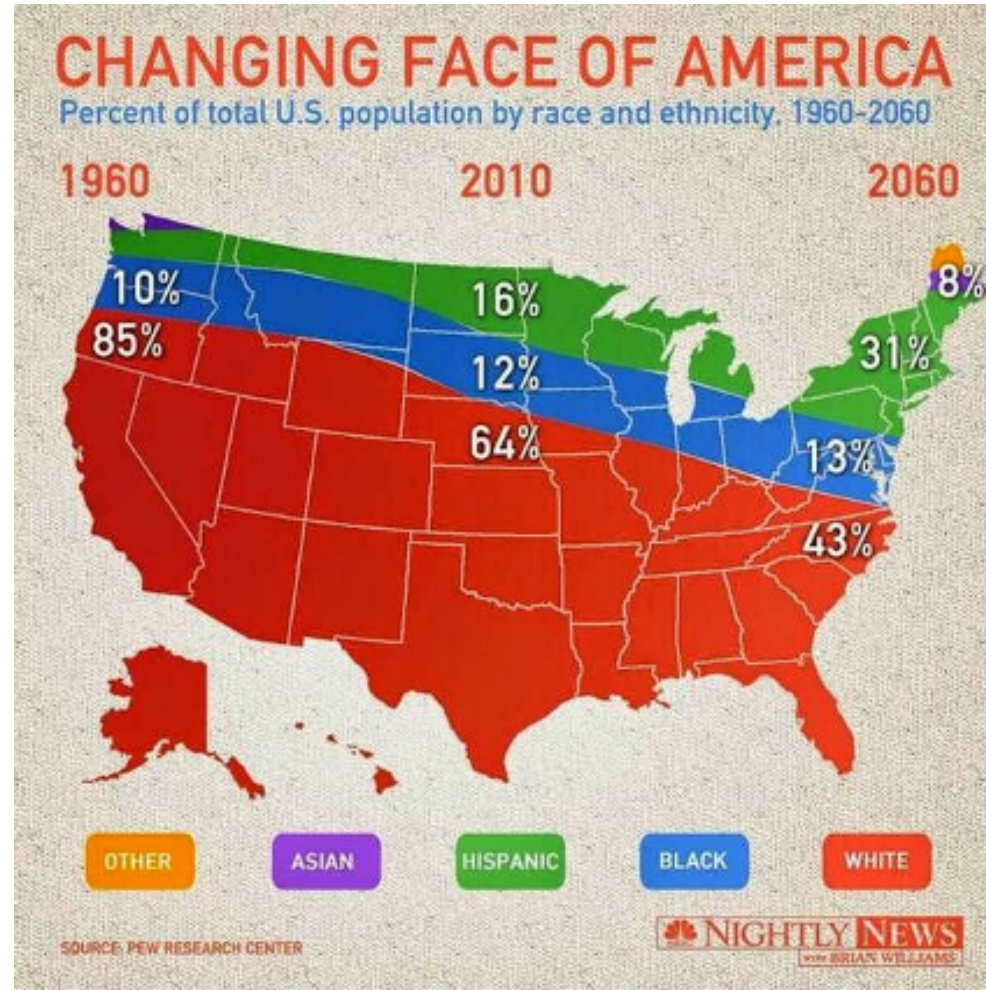
*Kieran Healy, Data Visualization: A Practical Introduction*

# What's wrong?

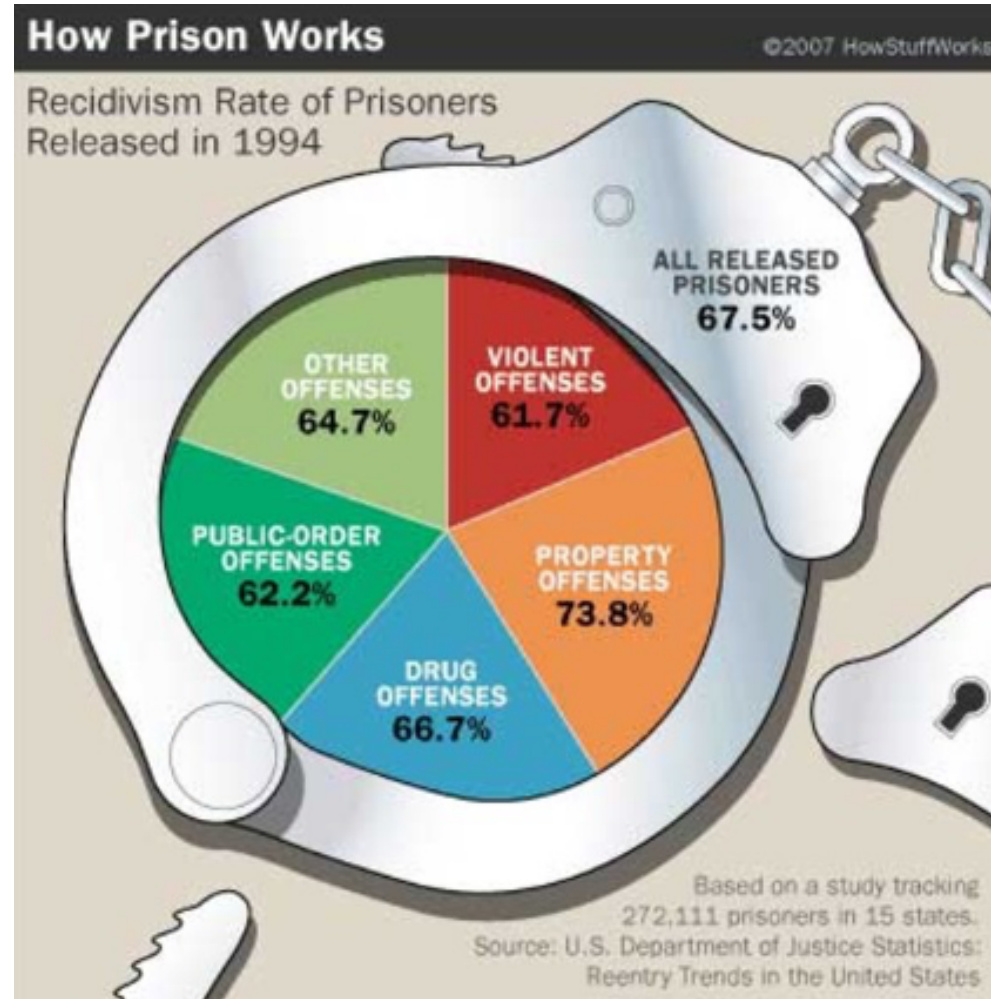
(f) Distribution of Genus



# What's wrong?



# What's wrong?

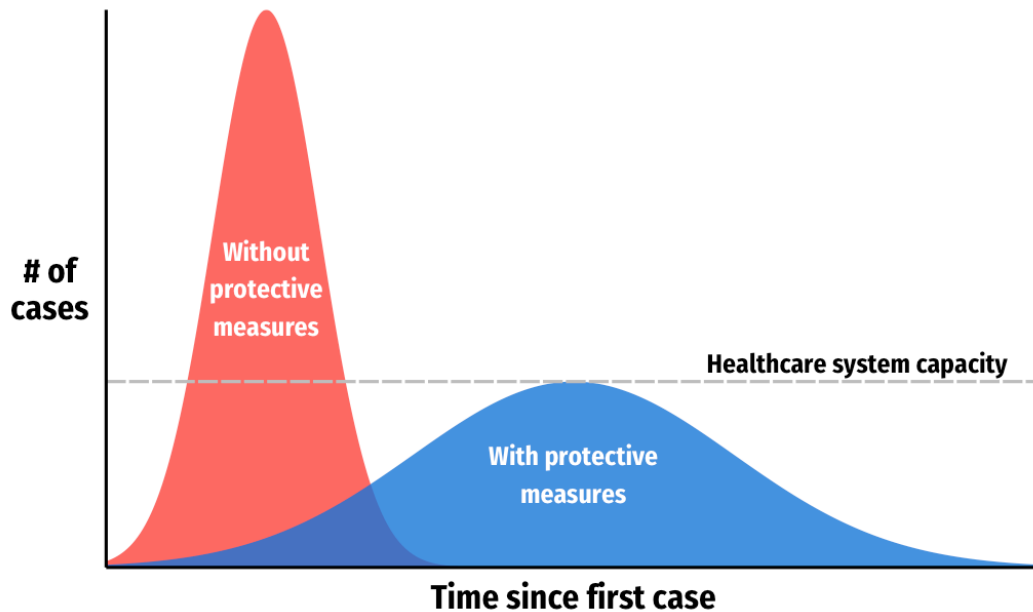




# What's right?

## Flatten the curve!

Slow down community spread by social distancing



Adapted from the CDC and The Economist  
Visit [flattenthecurve.com](http://flattenthecurve.com)

**Carl T. Bergstrom** @CT\_Bergstrom · Mar 6

3. There is a lot of complicated epidemiological modeling behind this idea, but this graphic strips all of that away, and discards irrelevant details to provide a straightforward story that people find easy to grasp at a glance.

It *\*simplifies\** and *\*highlights\** what matters.

6 198 1.8K

[Show replies](#)

**Carl T. Bergstrom** @CT\_Bergstrom · Mar 6

4. I've seldom seen a piece of sci-comm matter so much. We have an opportunity to flatten the [#COVID19](#) [#coronavirus](#) epidemic curve by aggressive social distancing and other measures.

But people don't understand what the point is, if the virus is going to circulate broadly.

8 313 2K

[Show replies](#)

**Carl T. Bergstrom** @CT\_Bergstrom · Mar 6

5. This graph provides the answer, powerfully and concisely.

And because of that, it has exploded across twitter and other media. I've used it myself a number of times. This graph is changing minds, and by changing minds, it is saving lives.

6 196 1.5K

Thread by Carl T. Bergstrom

# Class details

# Goal for the class

**Recognize and create  
beautiful and truthful  
visualizations with real  
world data**

# Plan for the class

## Foundations

Truth and beauty  
Graphic design principles  
Mapping data to graphics



## Core types of graphics

Amounts Proportions  
Uncertainty Relationships  
Comparisons Annotations

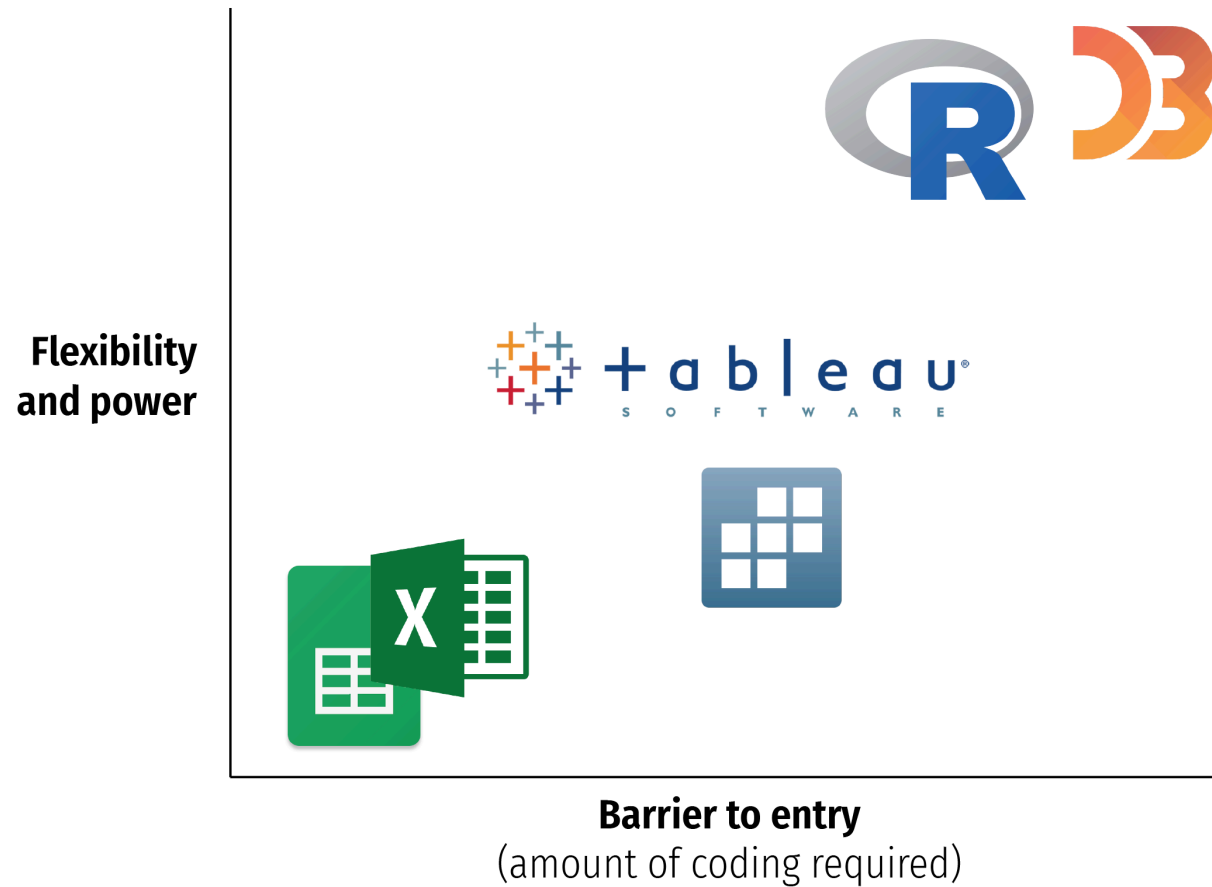


## Special applications

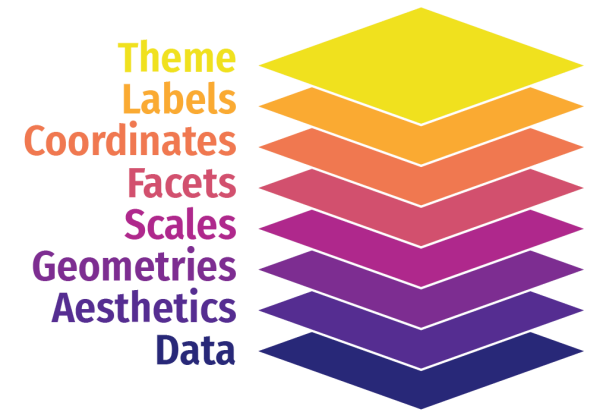
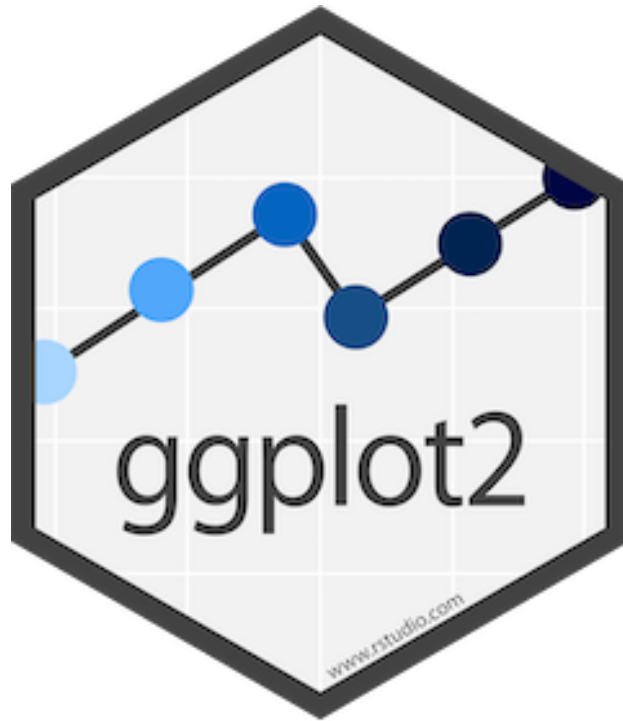
Interactivity  
Time Space Text  
Enhancing graphics



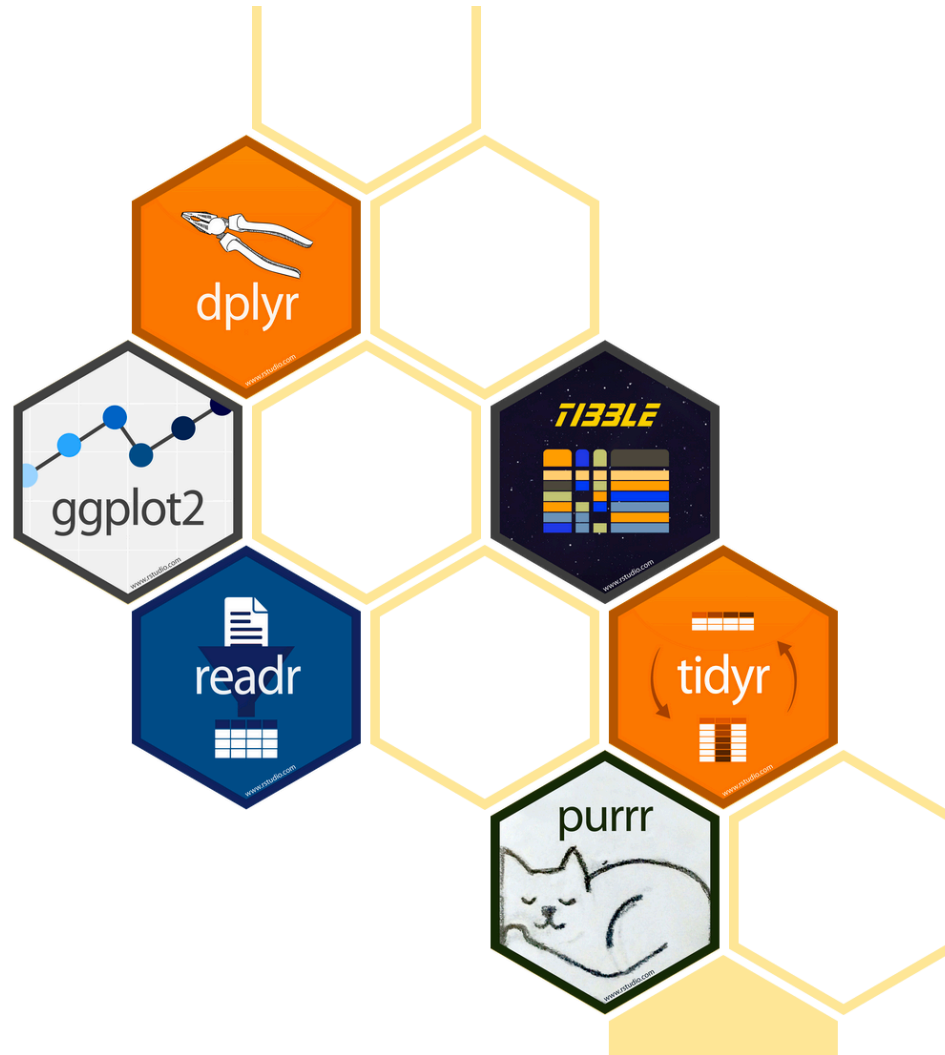
# Class technology



# Class technology



# The tidyverse



# Sucking

**“There is no way of knowing nothing about a subject to knowing something about a subject without going through a period of much frustration and suckiness.”**

**“Push through. You’ll suck less.”**

Hadley Wickham, author of `{ggplot2}`

# Sucking



The New York Times

Opinion

**SPORTING**

## (It's Great to) Suck at Something

By Karen Rinaldi

April 28, 2017



Karen Rinaldi, "(It's Great to) Suck at Something"