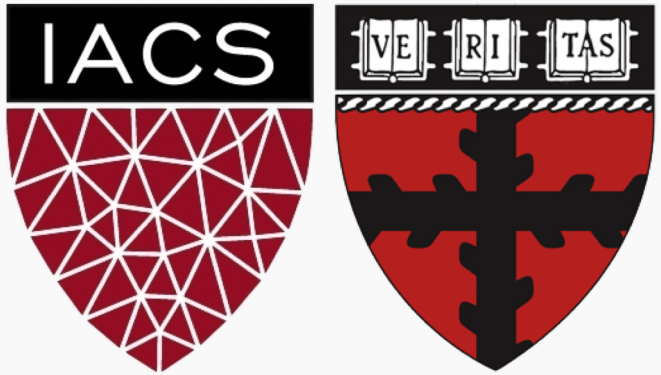
Lecture 9: Visualization for EDA and Communication

CS109A Introduction to Data Science

Pavlos Protopapas, Kevin Rader and Chris Tanner



As the matplotlib thickens …

ANNOUNCEMENTS

Projects have been posted!

- Check the website for details and read the guidelines file for due dates

Added more Office Hours!

- Check the weekly schedule on our website

Lecture Outline

- EDA Refresher
- Effective Visualization
  - Graphical Integrity
  - Scope
  - Displays
  - Sensible Design
- Communication
  - Motivation
  - Key Considerations

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EDA Refresher

Assume you know a given dataset is credible, complete with the info you want, and has no missing values. Why do further EDA?

EDA Refresher

Purposes of EDA:

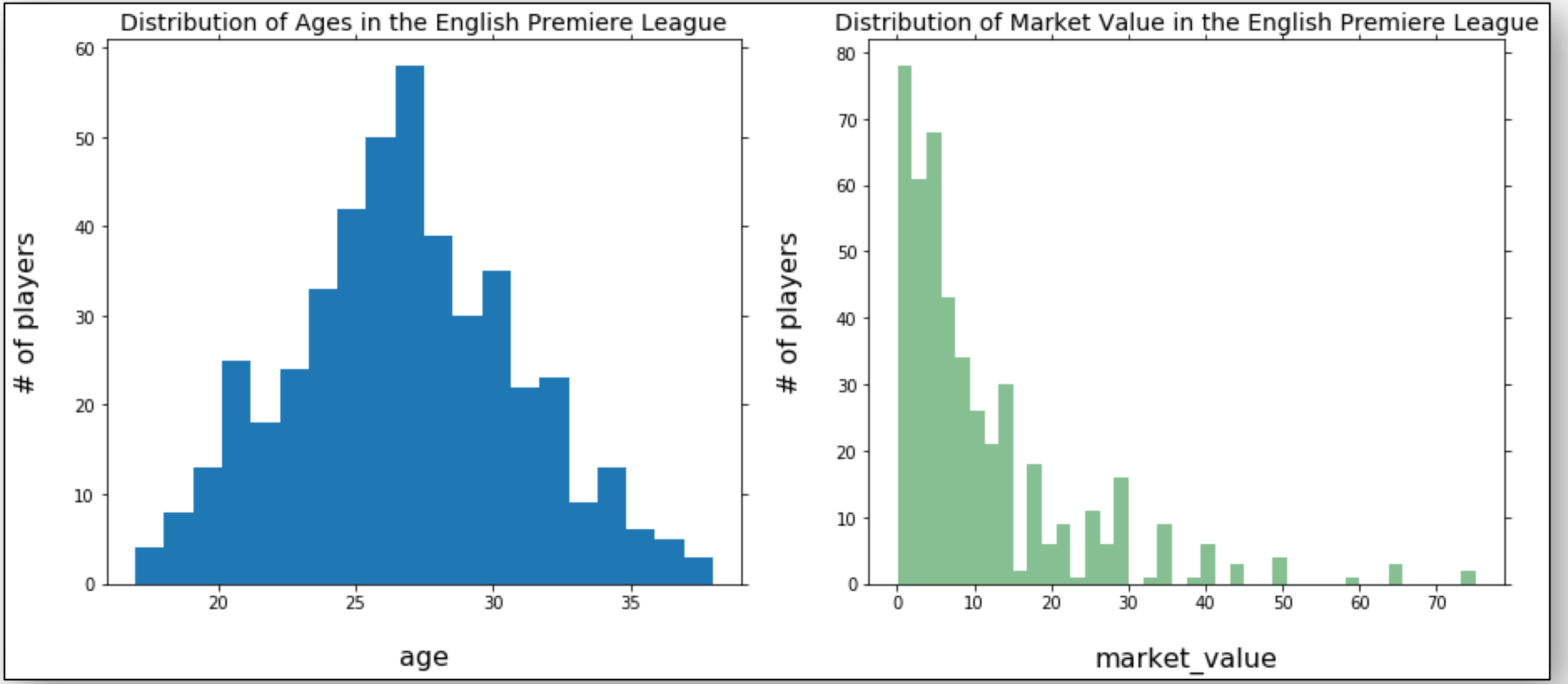
- Maximize insight into a dataset
- Uncover underlying structure
- Detect outliers
- Test underlying assumptions
- Develop parsimonious models

EDA Refresher: English Premier League

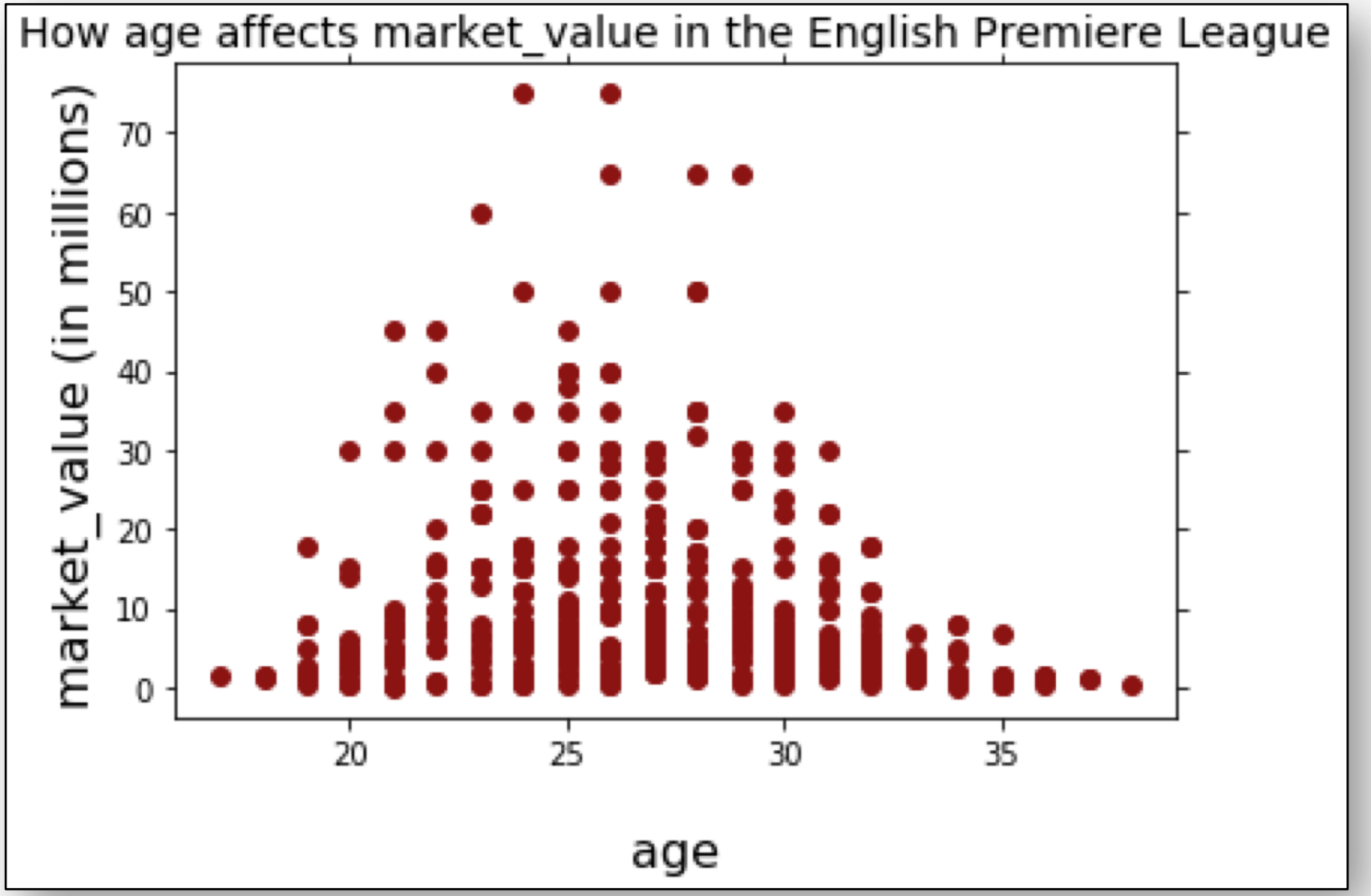
name	club	age	position	market value
Alexis Sanchez	Arsenal	28	LW	65
Mesut Ozil	Arsenal	28	AM	50
Petr Cech	Arsenal	35	GK	7
Theo Walcott	Arsenal	28	RW	20
Laurent Koscielny	Arsenal	31	CB	22

from www.transfermarkt.us

EDA Refresher: English Premier League

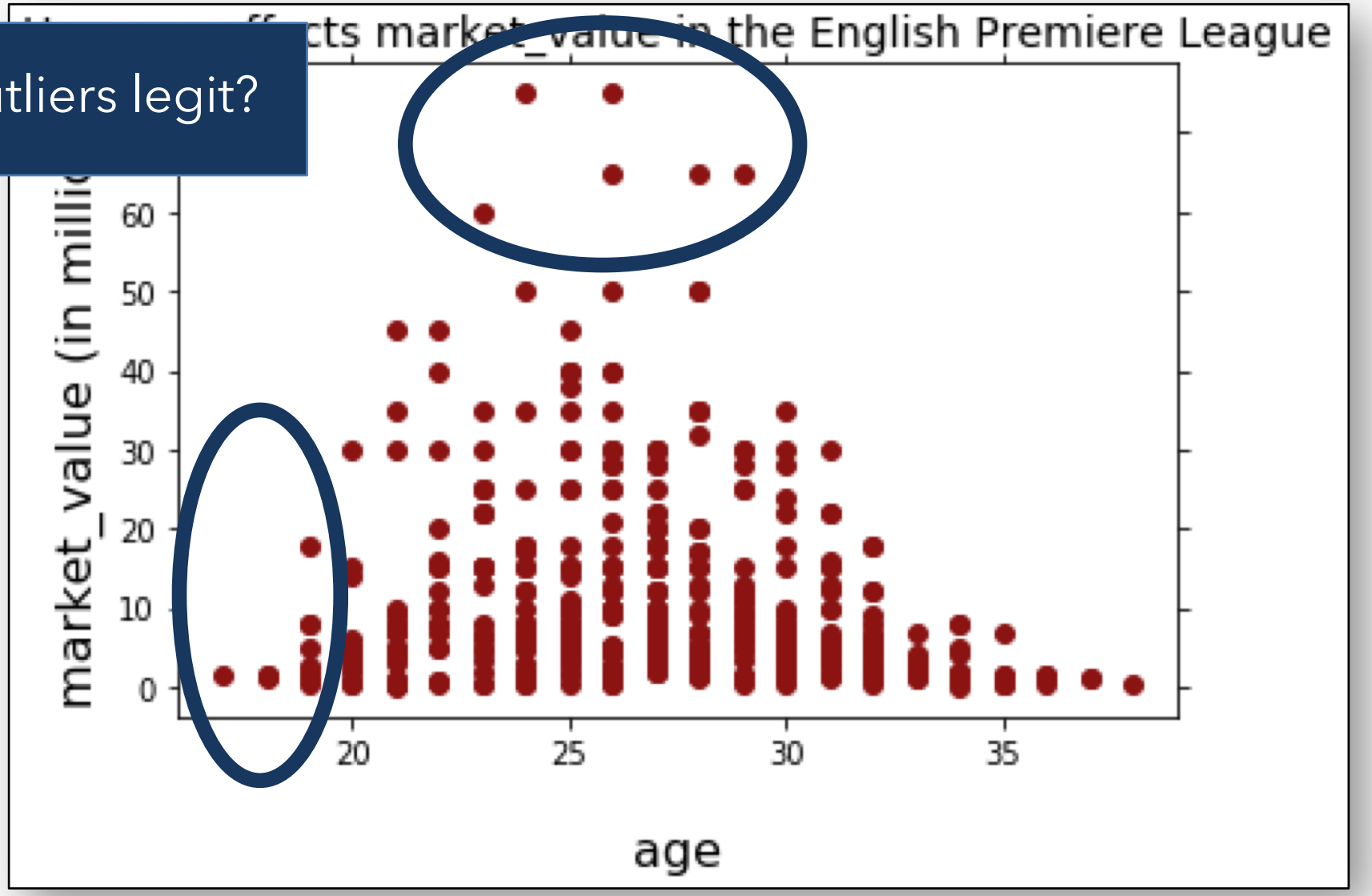


EDA Refresher: English Premier League



EDA Refresher: English Premier League

Are the outliers legit?



EDA Refresher: English Premier League

```
league_df.loc[league_df['age']<20][['name', 'club', 'age', 'position', \
    'market_value']].sort_values(by="age")
```

	name	club	age	position	market_value
233	Ben Woodburn	Liverpool	17	LW	1.50
231	Trent Alexander-Arnold	Liverpool	18	RB	1.50
350	Josh Tymon	Stoke+City	18	LB	1.00
435	Jonathan Leko	West+Brom	18	RW	1.50
147	Tom Davies	Everton	19	CM	8.00
155	Ademola Lookman	Everton	19	LW	5.00
239	Dominic Solanke	Liverpool	19	CF	2.00
270	Marcus Rashford	Manchester+United	19	CF	18.00
281	Axel Tuanzebe	Manchester+United	19	CB	1.00
282	Timothy Fosu-Mensah	Manchester+United	19	DM	2.50
375	Tammy Abraham	Swansea	19	CF	8.00
436	Sam Field	West+Brom	19	CM	0.25

EDA Refresher: English Premier League

```
league_df.loc[league_df['market_value']>=60][['name', 'club', \
    'age', 'position', 'market_value']].sort_values(by="age")
```

	name	club	age	position	market_value
377	Harry Kane	Tottenham	23	CF	60.0
263	Paul Pogba	Manchester+United	24	CM	75.0
92	Eden Hazard	Chelsea	26	LW	75.0
240	Kevin De Bruyne	Manchester+City	26	AM	65.0
0	Alexis Sanchez	Arsenal	28	LW	65.0
241	Sergio Aguero	Manchester+City	29	CF	65.0

EDA Refresher: English Premier League

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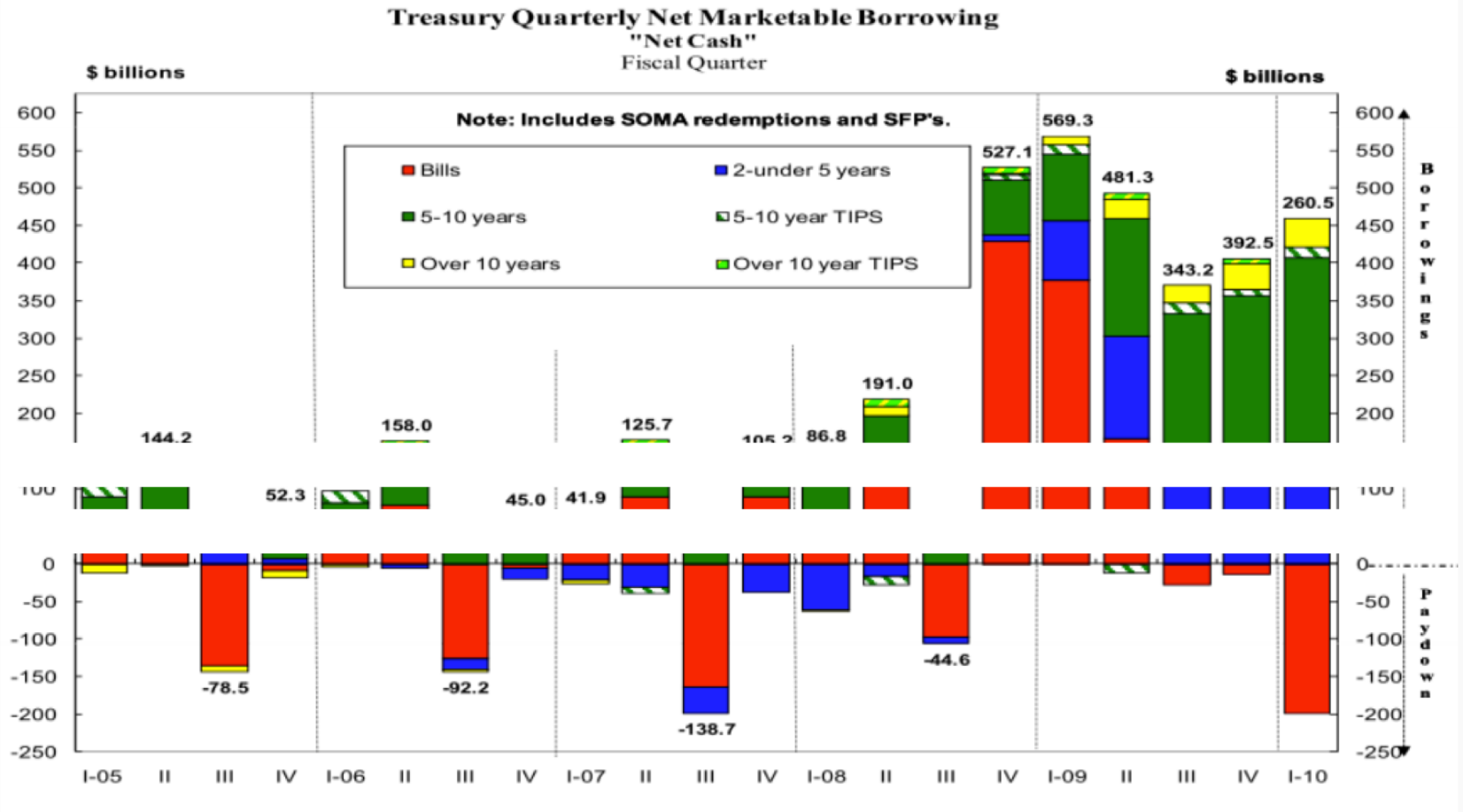
Effective Visualization

Not effective:



Effective Visualization

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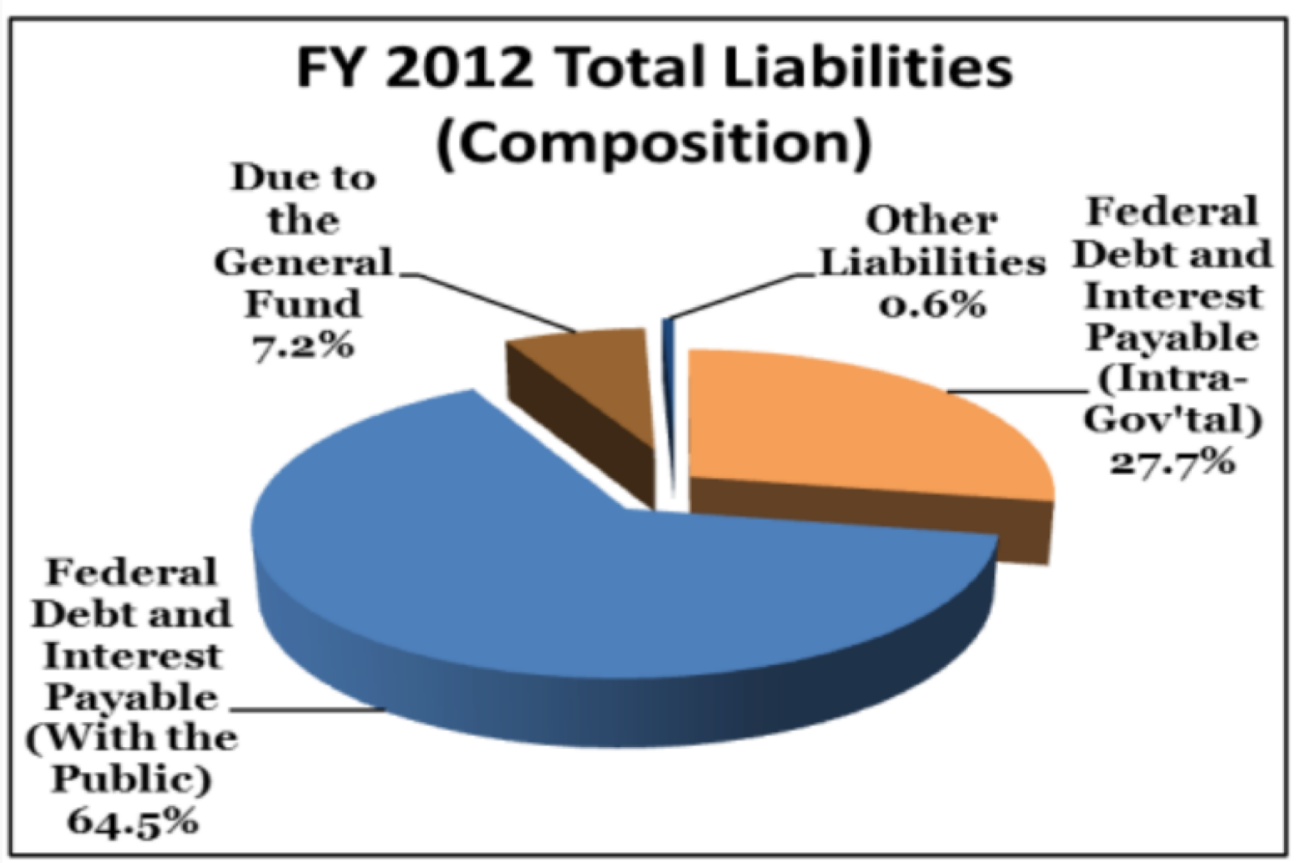
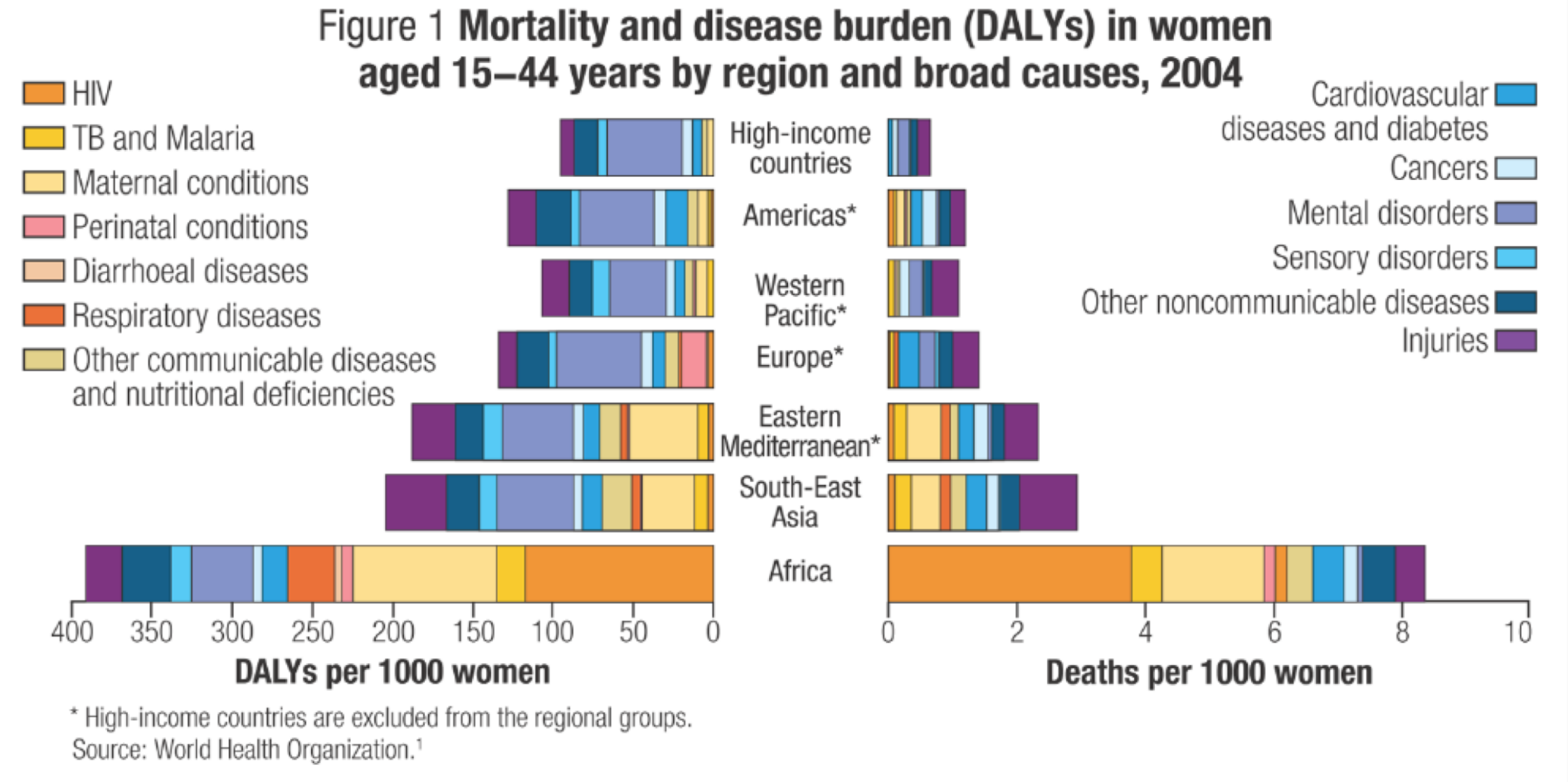


Figure 10

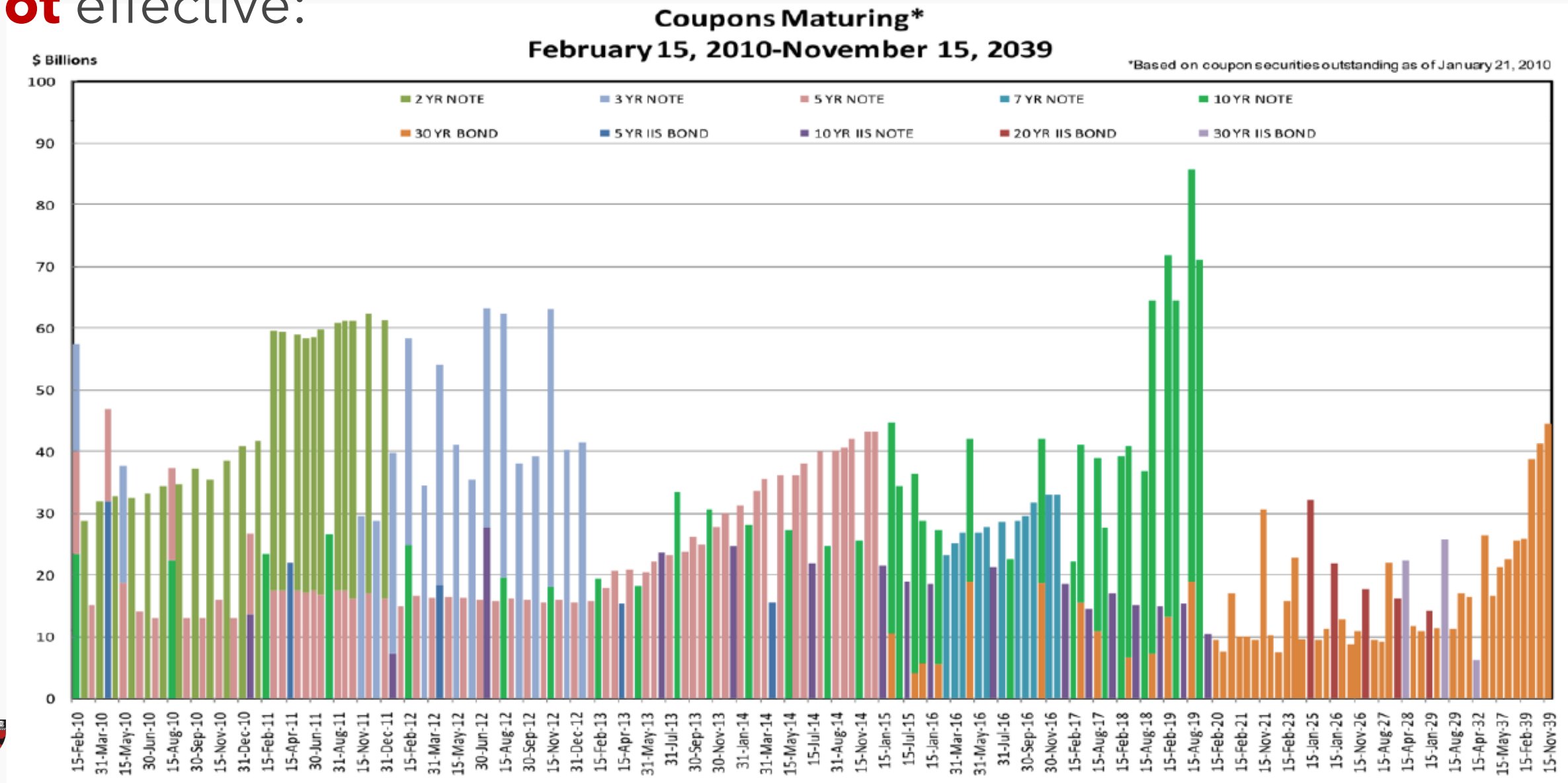
Effective Visualization

Not effective:



Effective Visualization

Not effective:



Effective Visualization

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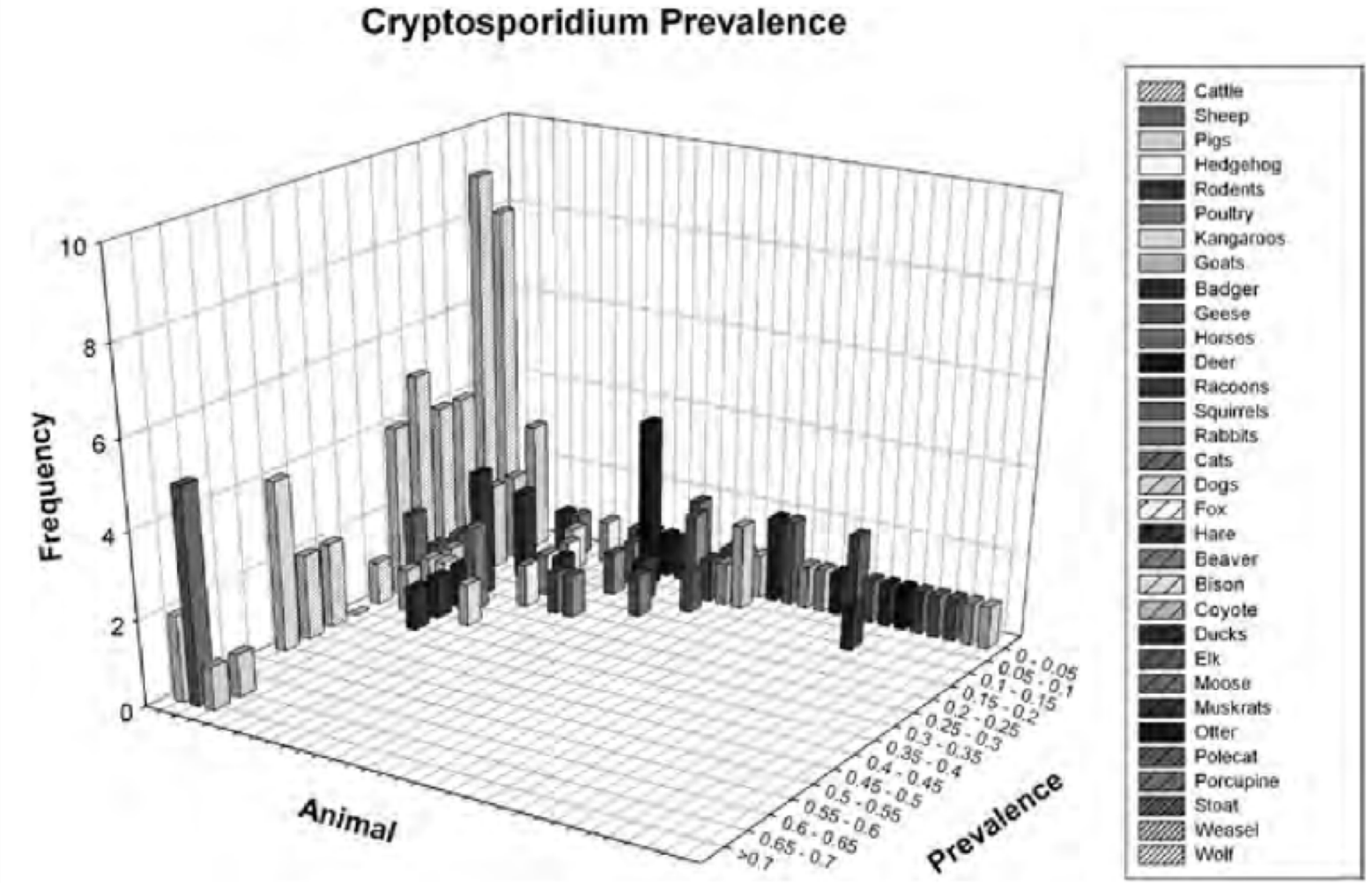

Figure 5.2 Mean prevalence rates of *Cryptosporidium* oocysts by animal species.

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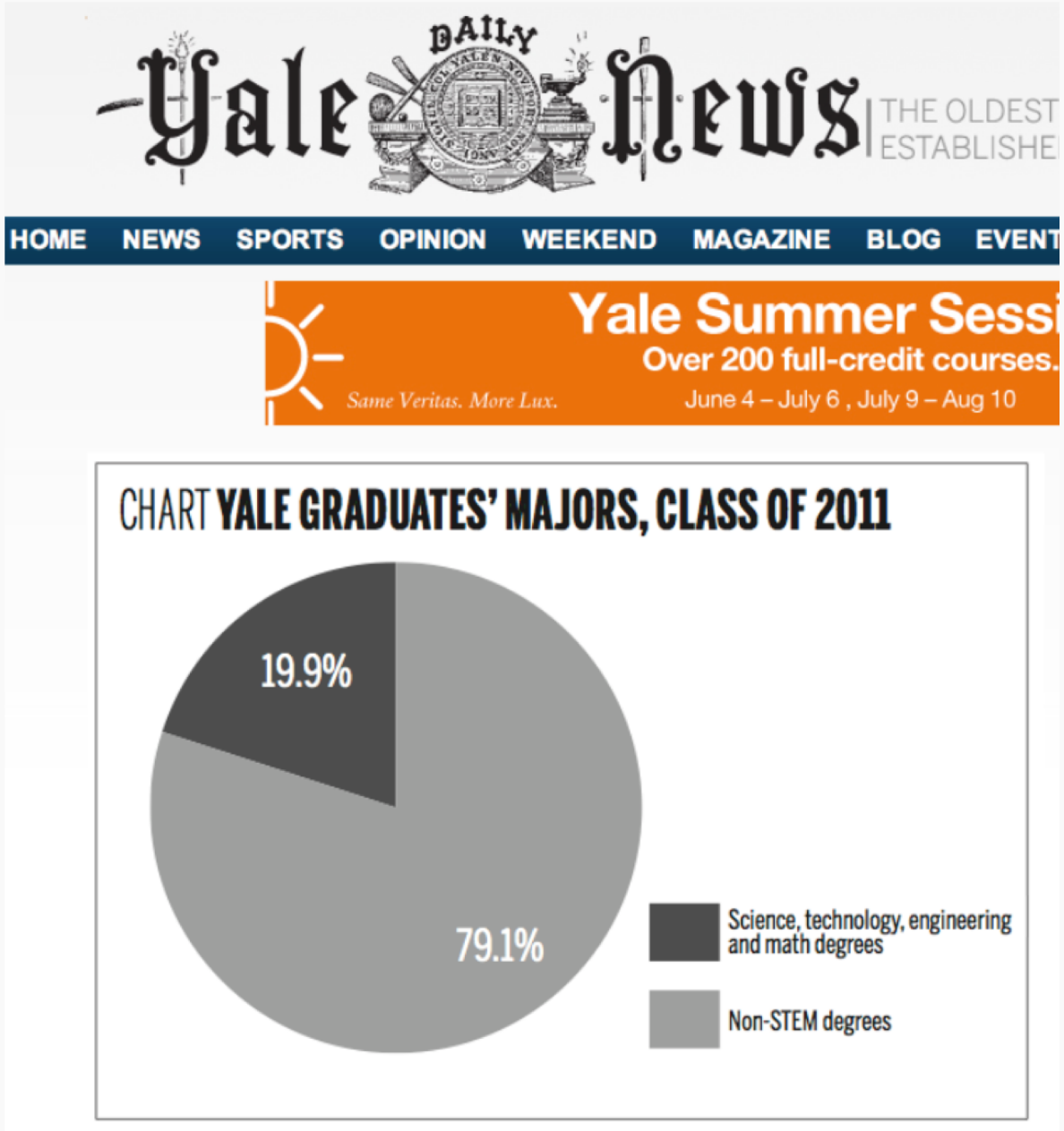
Graphical Integrity

What's wrong?



Graphical Integrity

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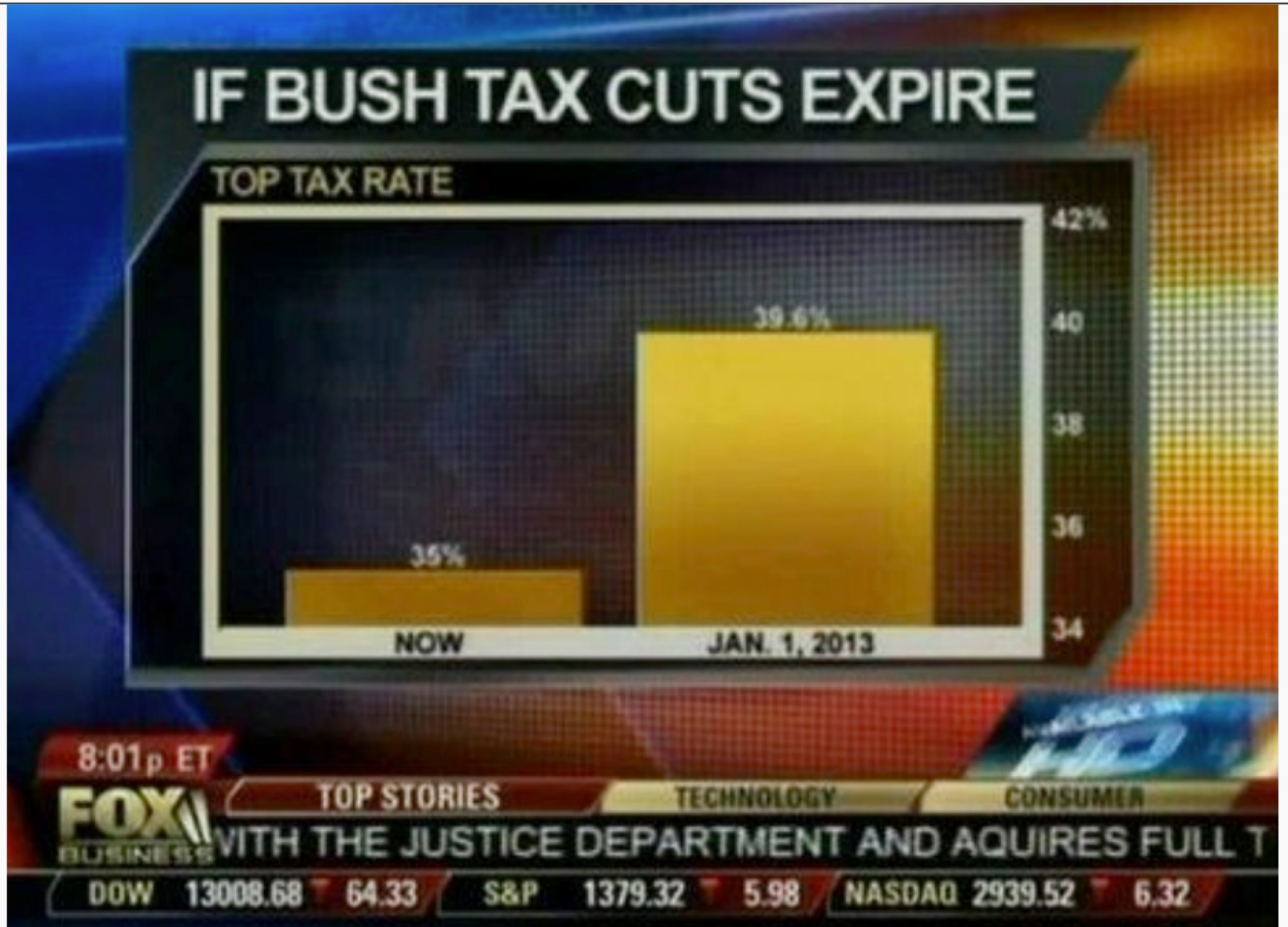
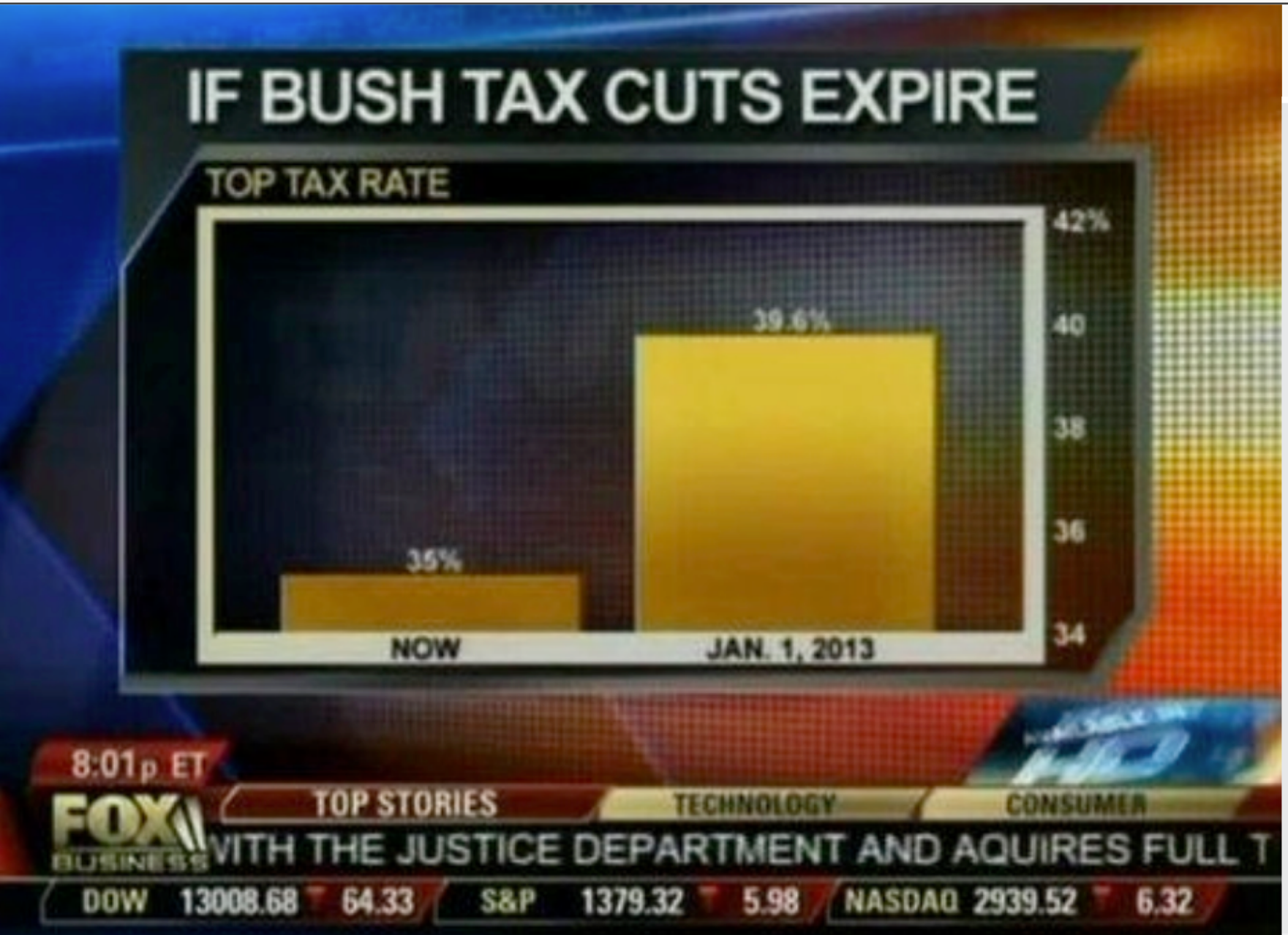
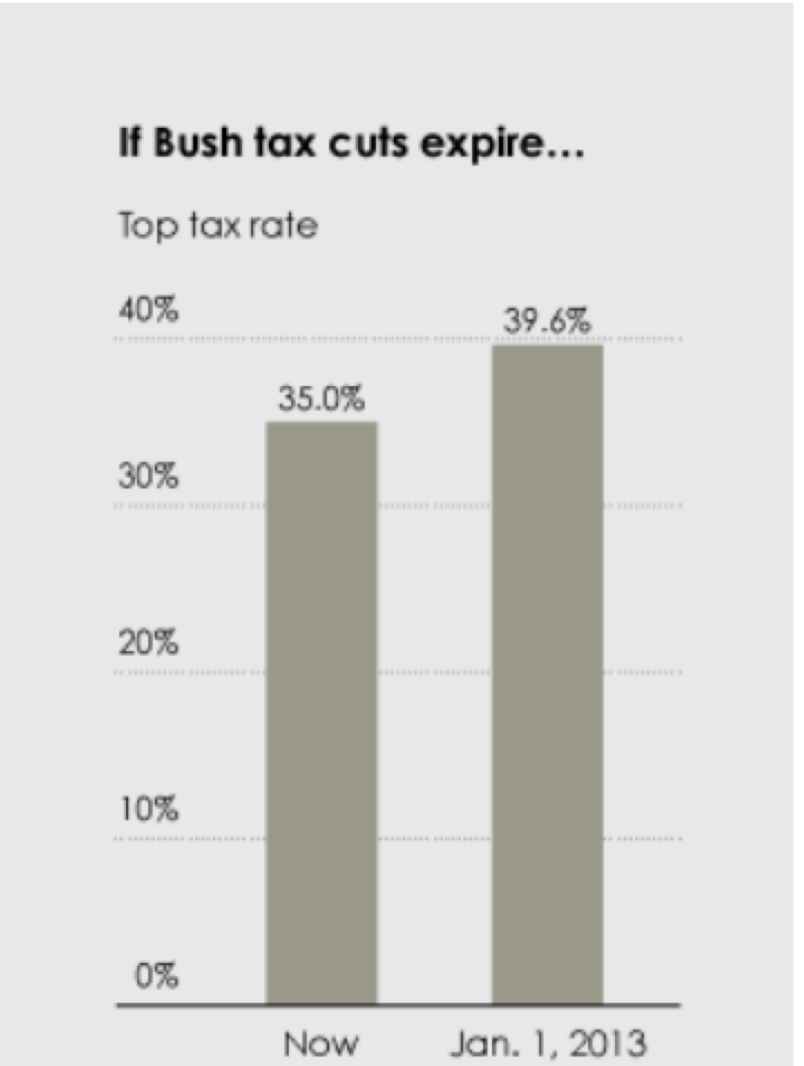


Graphical Integrity

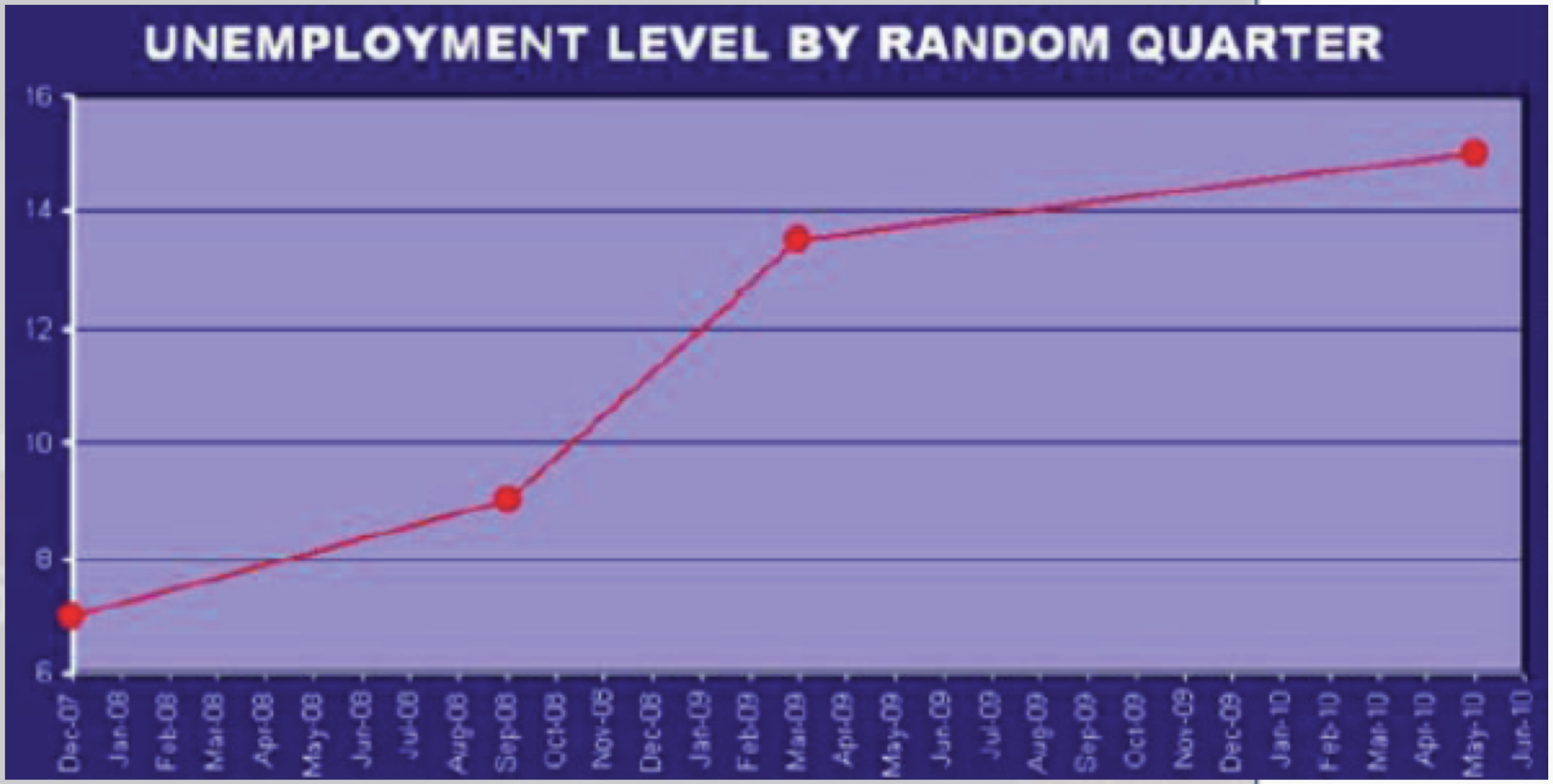




Graphical Integrity

What's wrong?

Graphical Integrity



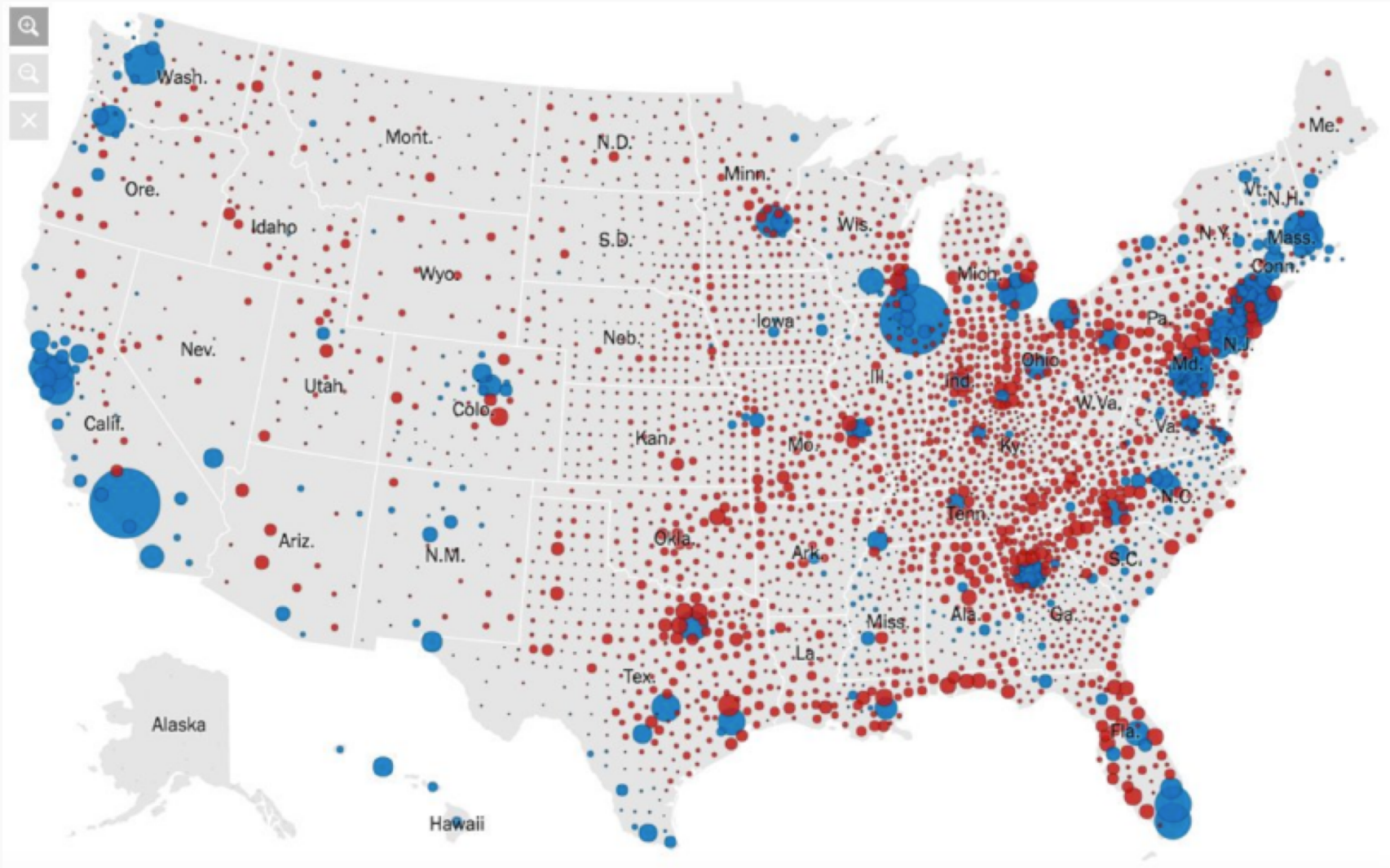
Graphical Integrity

What's wrong?

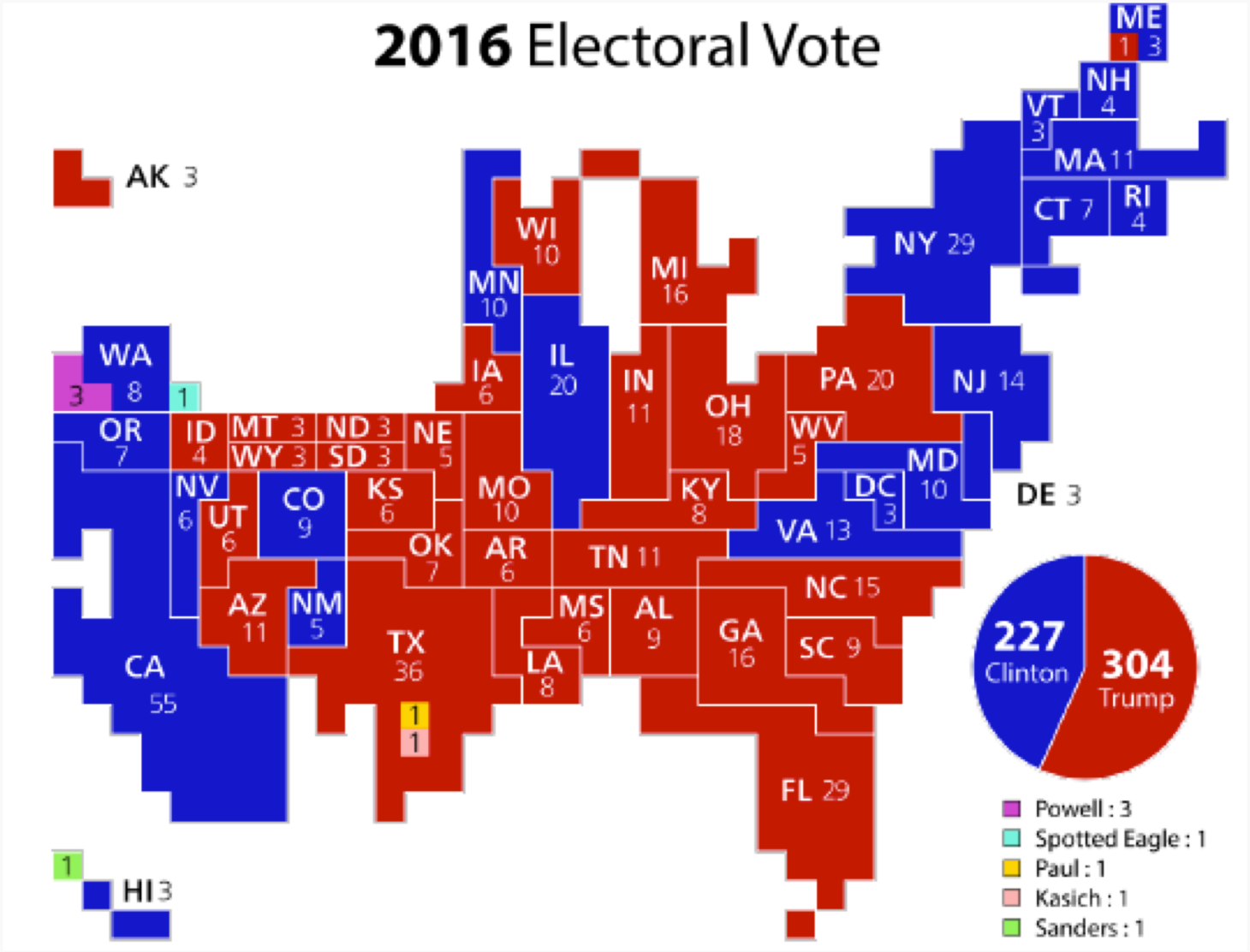
October 1, 2019

Graphical Integrity

Graphical Integrity



Graphical Integrity

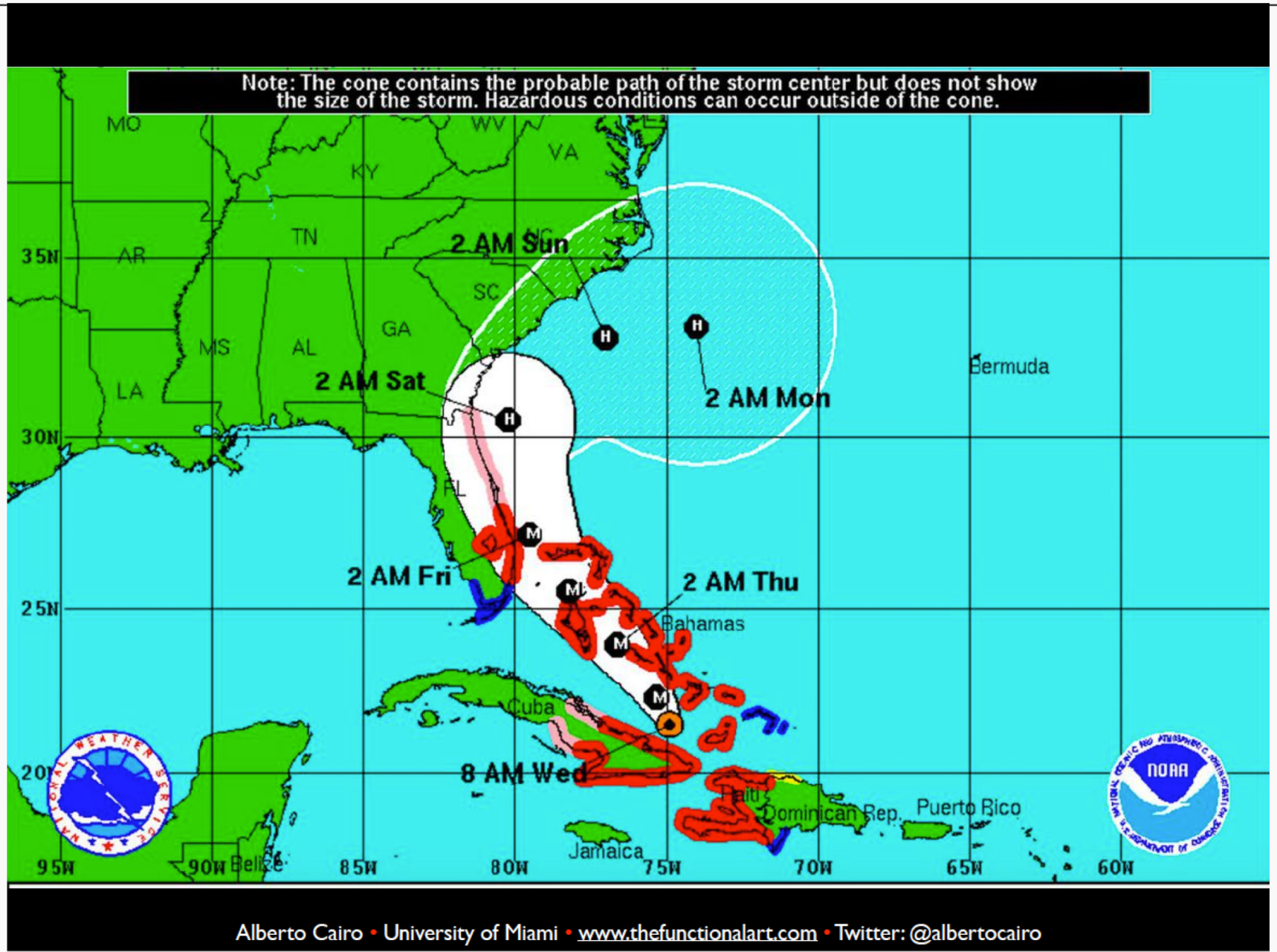


Graphical Integrity

Lesson: be proportional

Graphical Integrity

What's wrong?



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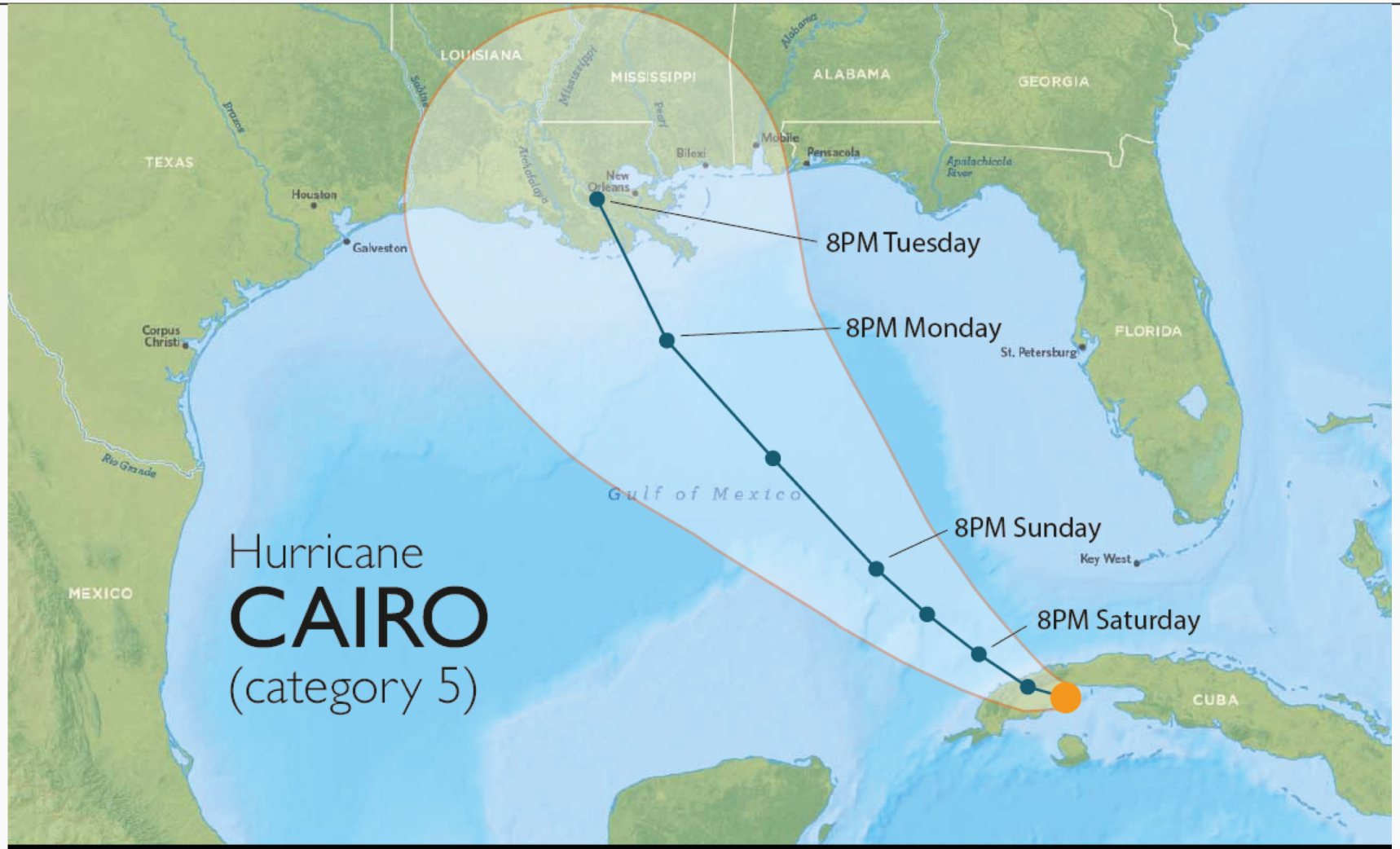

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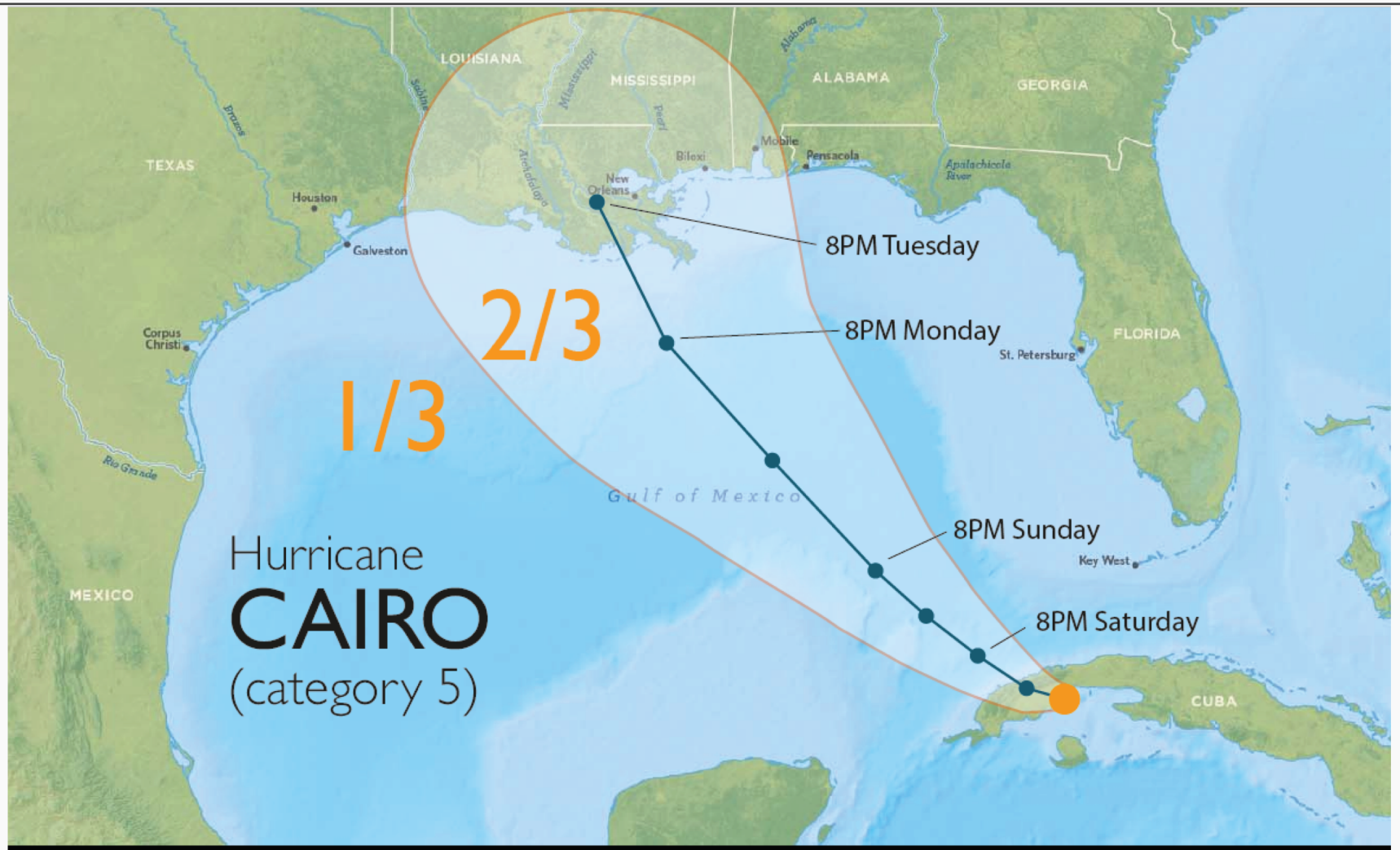


Graphical Integrity

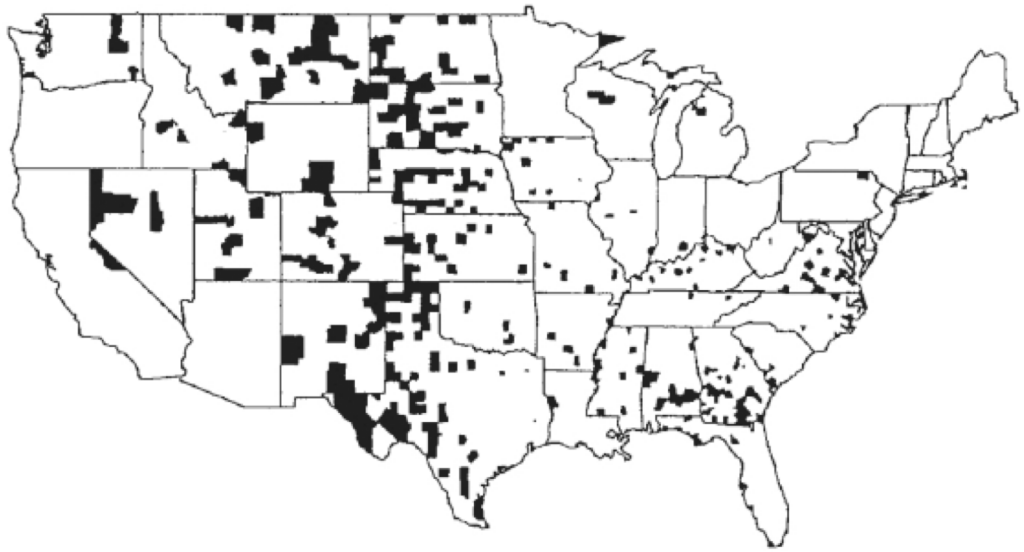
What's wrong?

Graphical Integrity

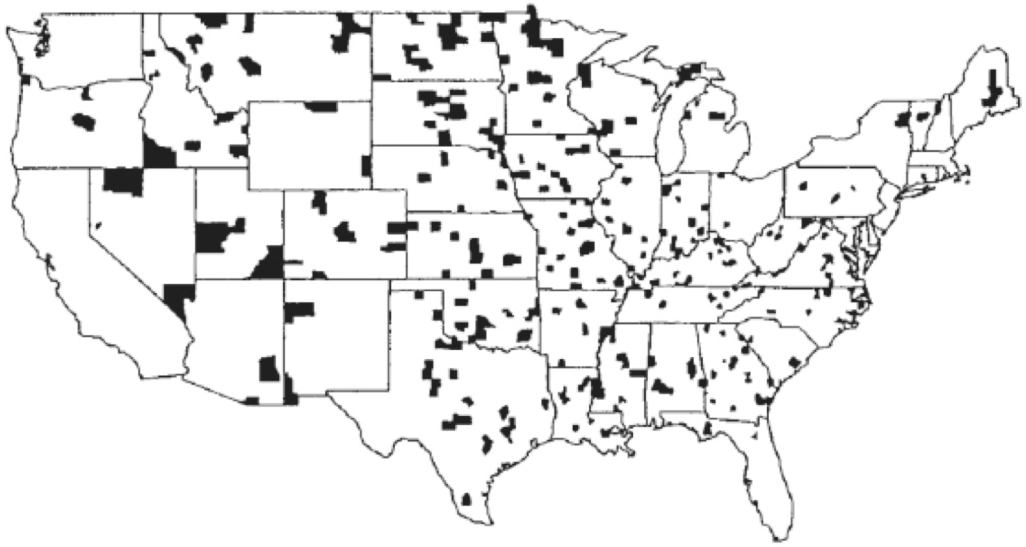
Lesson: include uncertainty

Graphical Integrity

What's wrong?

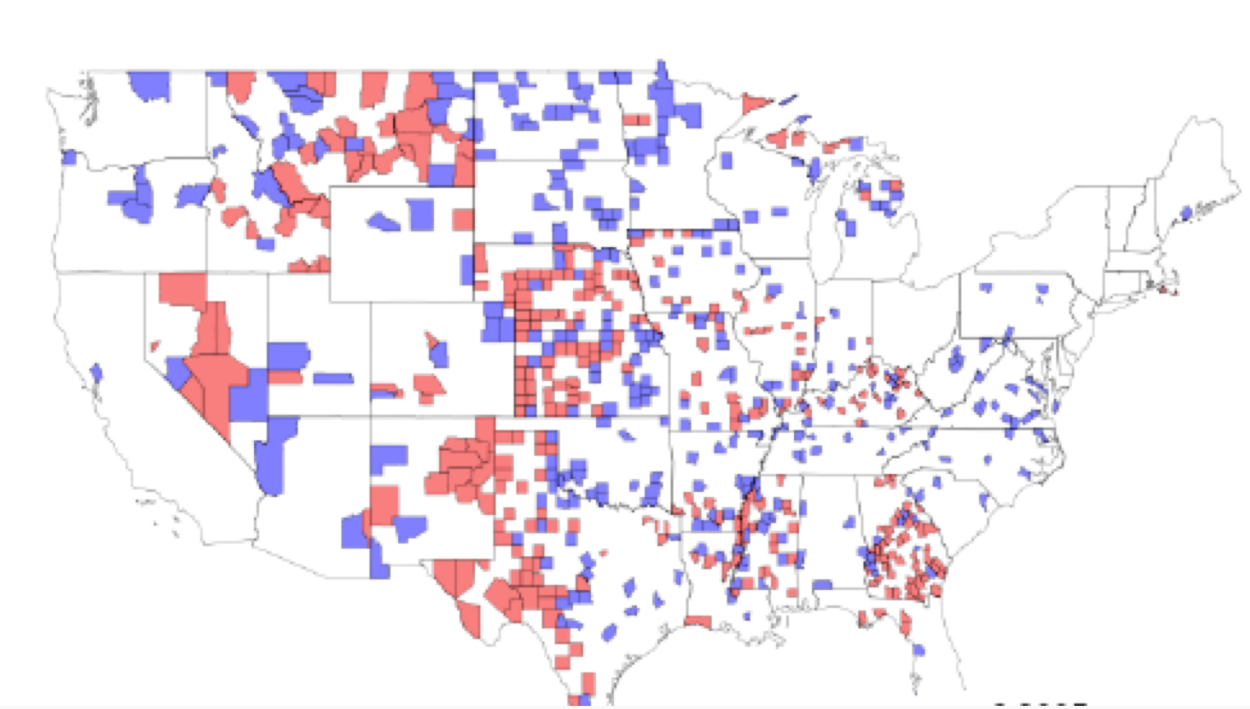


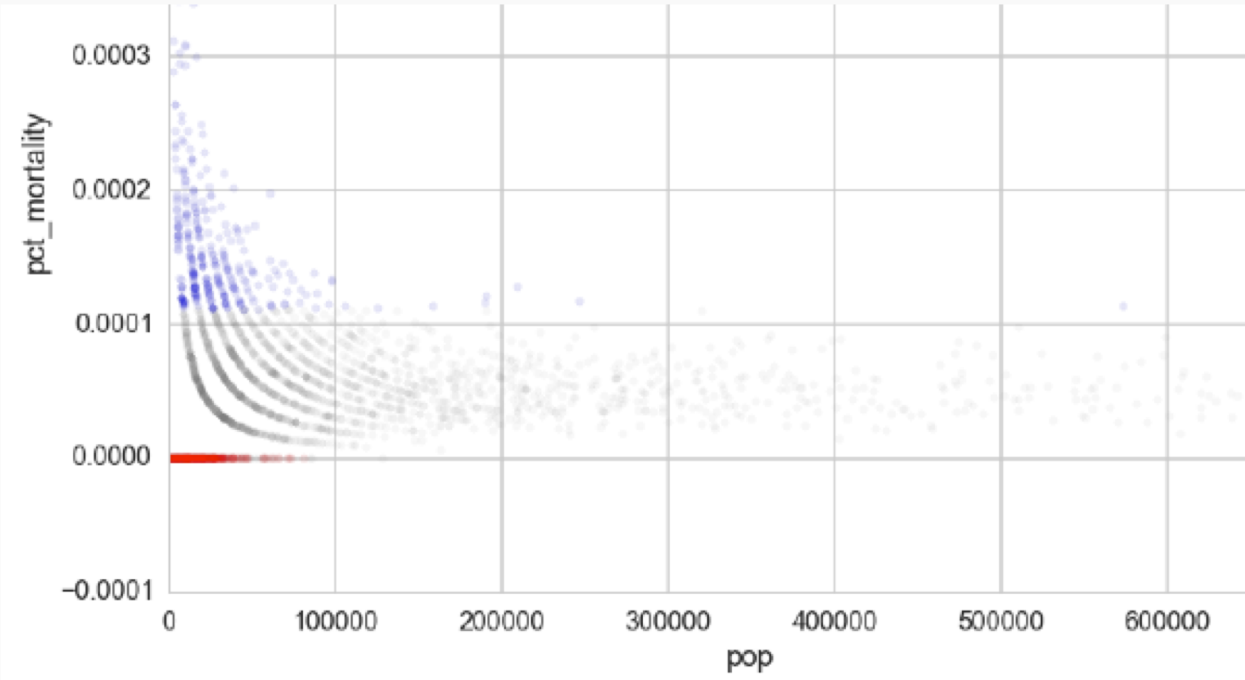
Counties with the LOWEST kidney cancer death rates (1980-1989)



Counties with the HIGHEST kidney cancer death rates (1980-1989)

Graphical Integrity





Graphical Integrity

Lesson: plot all the data

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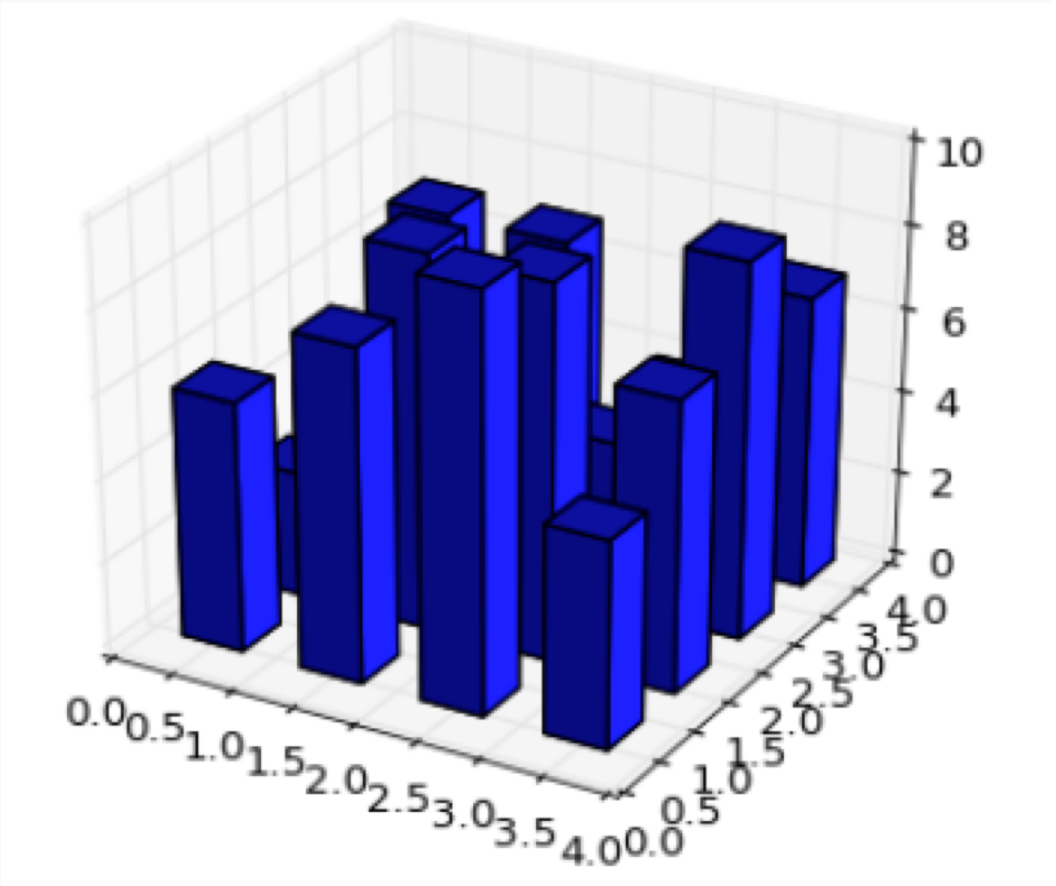
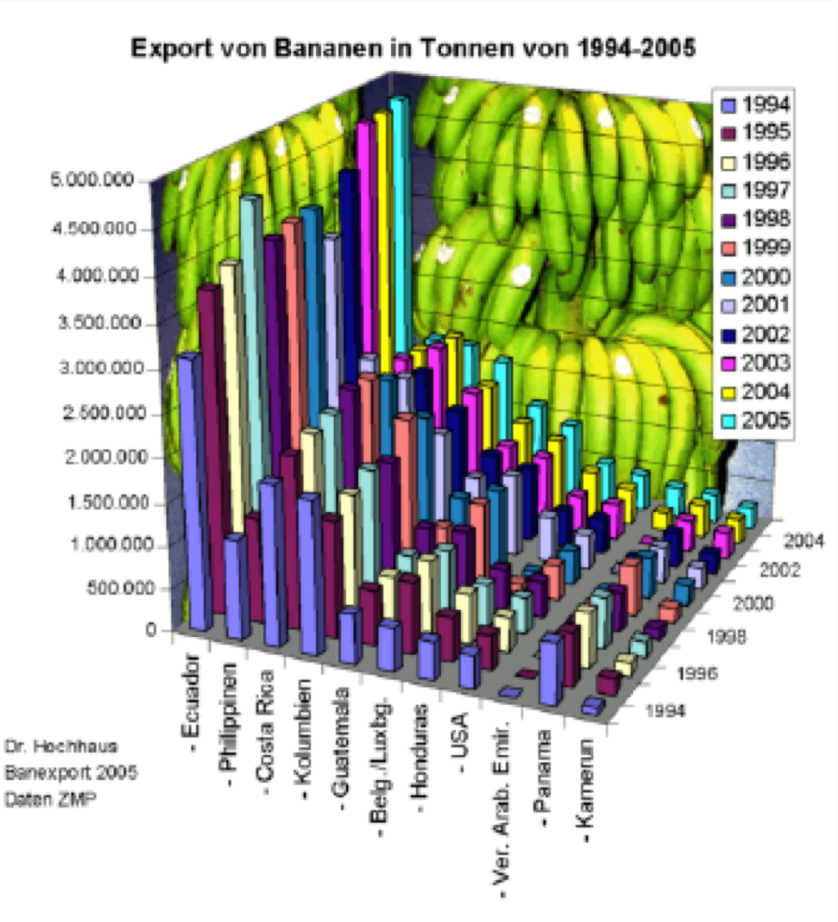
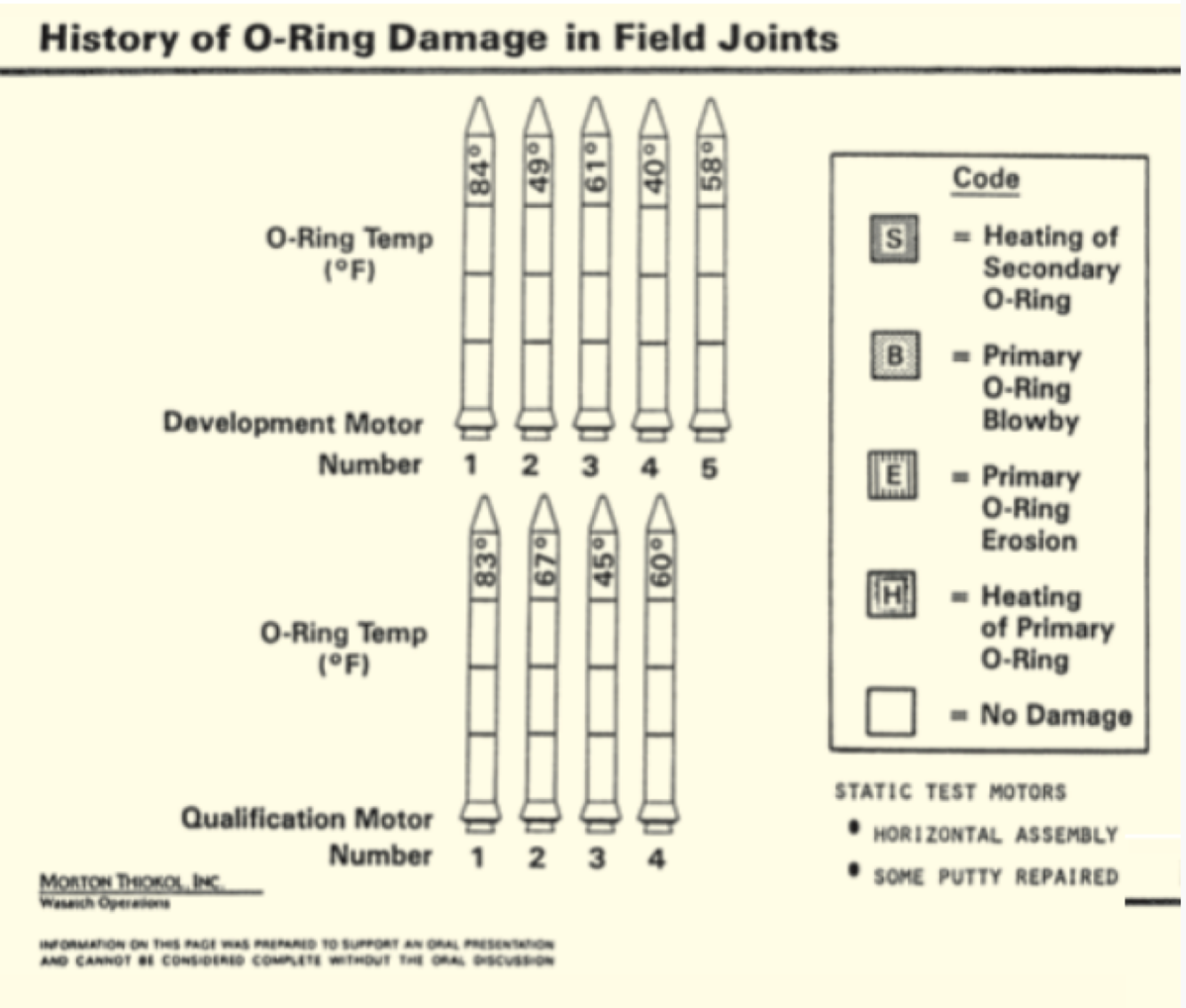
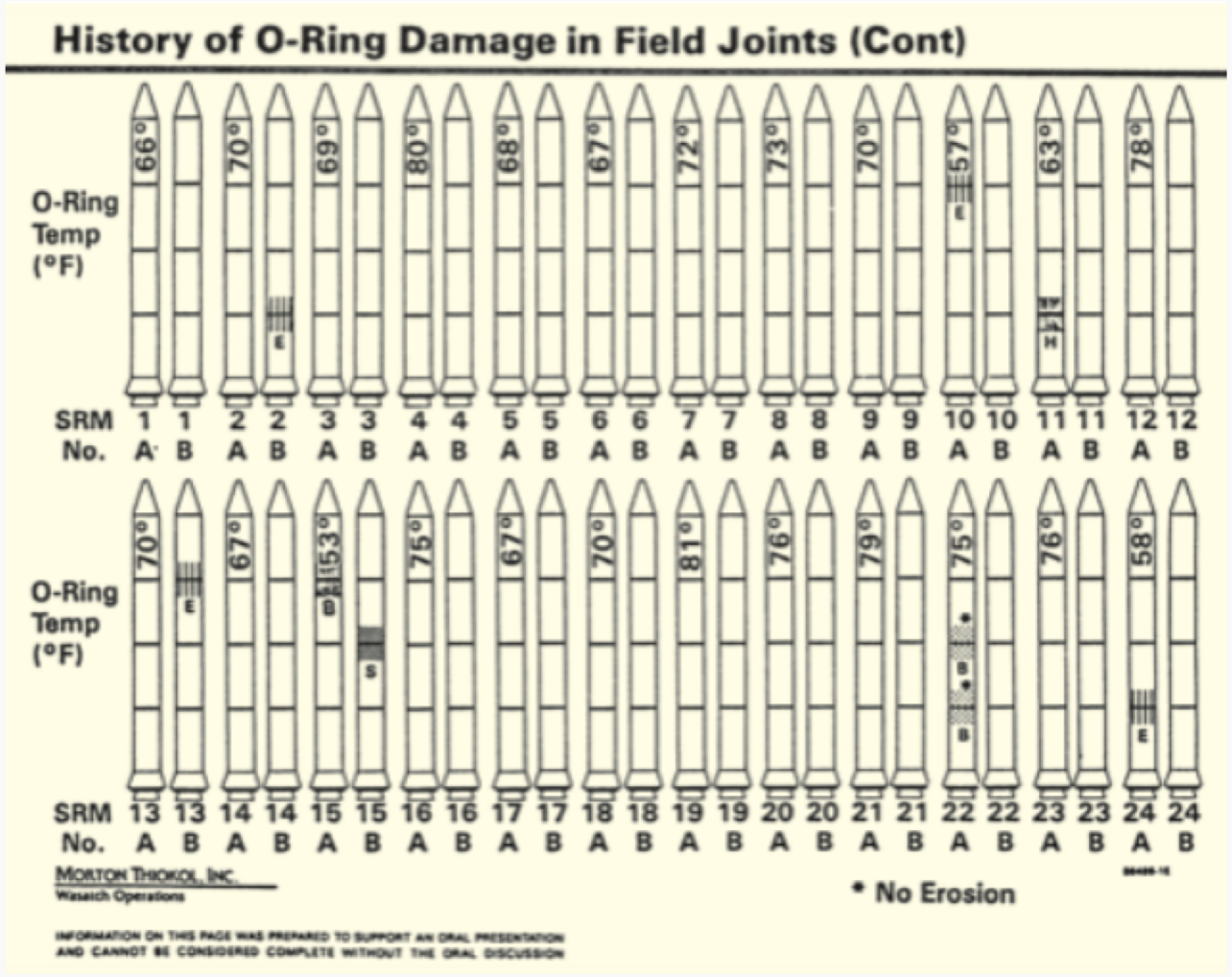




Scope


History of O-Ring Damage in Field Joints
O-Ring Temp (°F)
84° 49° 61° 40° 58°
Development Motor Number
1 2 3 4 5
O-Ring Temp (°F)
83° 67° 45° 60°
Qualification Motor Number
1 2 3 4
Code
S = Heating of Secondary O-Ring
B = Primary O-Ring Blowby
E = Primary O-Ring Erosion
H = Heating of Primary O-Ring
= No Damage
STATIC TEST MOTORS
• HORIZONTAL ASSEMBLY
• SOME PUTTY REPAIRED
MORTON THIOKOL, INC.
Wasatch Operations
INFORMATION ON THIS PAGE WAS PREPARED TO SUPPORT AN ORAL PRESENTATION AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION


History of O-Ring Damage in Field Joints (Cont)
O-Ring Temp (°F)
66° 70° 69° 80° 68° 67° 72° 73° 70° 57° 63° 78°
SRM No.
1 A 1 B 2 A 2 B 3 A 3 B 4 A 4 B 5 A 5 B 6 A 6 B 7 A 7 B 8 A 8 B 9 A 9 B 10 A 10 B 11 A 11 B 12 A 12 B
O-Ring Temp (°F)
70° 67° 53° 75° 67° 70° 81° 76° 79° 75° 76° 58°
SRM No.
13 A 13 B 14 A 14 B 15 A 15 B 16 A 16 B 17 A 17 B 18 A 18 B 19 A 19 B 20 A 20 B 21 A 21 B 22 A 22 B 23 A 23 B 24 A 24 B
MORTON THIOKOL, INC.
Wasatch Operations
• No Erosion
INFORMATION ON THIS PAGE WAS PREPARED TO SUPPORT AN ORAL PRESENTATION AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION

Scope

Lesson: keep it simple… enough

Scope

"You should have stayed with the soup question. The object of a question is to obtain information that matters only to us"

-- Sean Connery in Finding Forrester (movie)

Scope

- Making plots is effectively providing an answer to an implicit question
- You get to pick the answer
- Ensure the answer doesn't leave the viewer with uncertainty as to what it's answering or the completeness of the answer
- A good plot should invoke and inspire new questions

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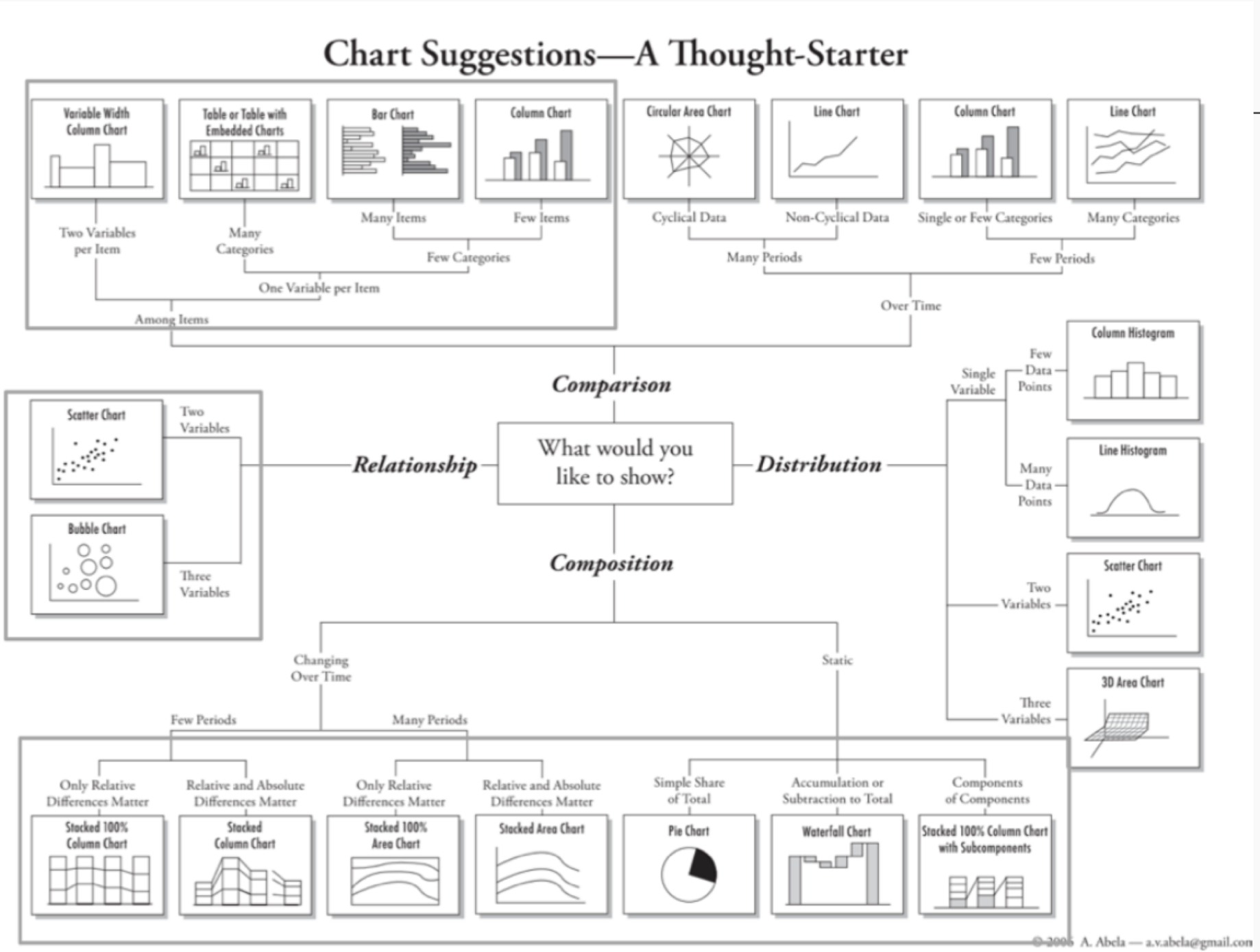
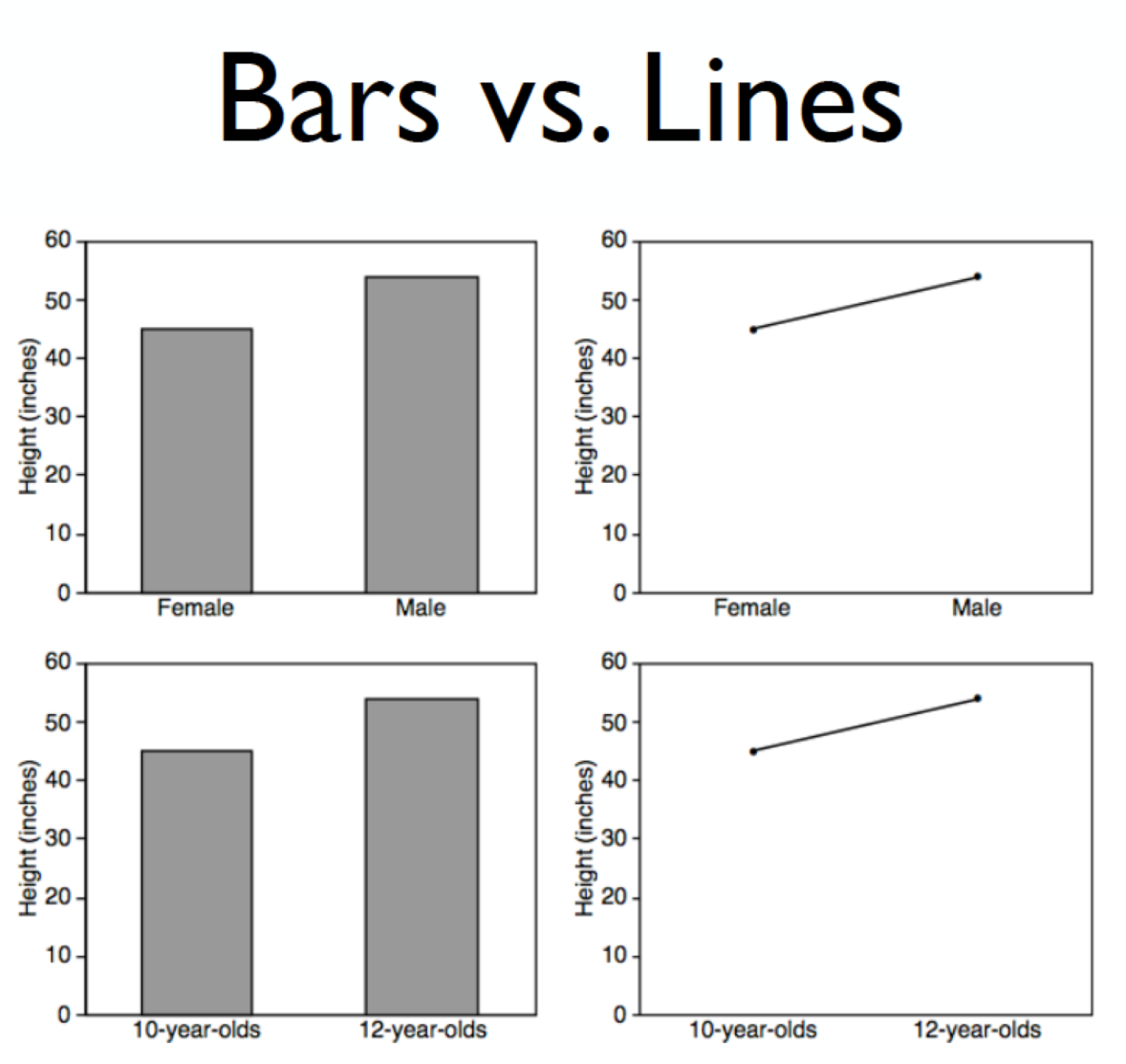
Displays



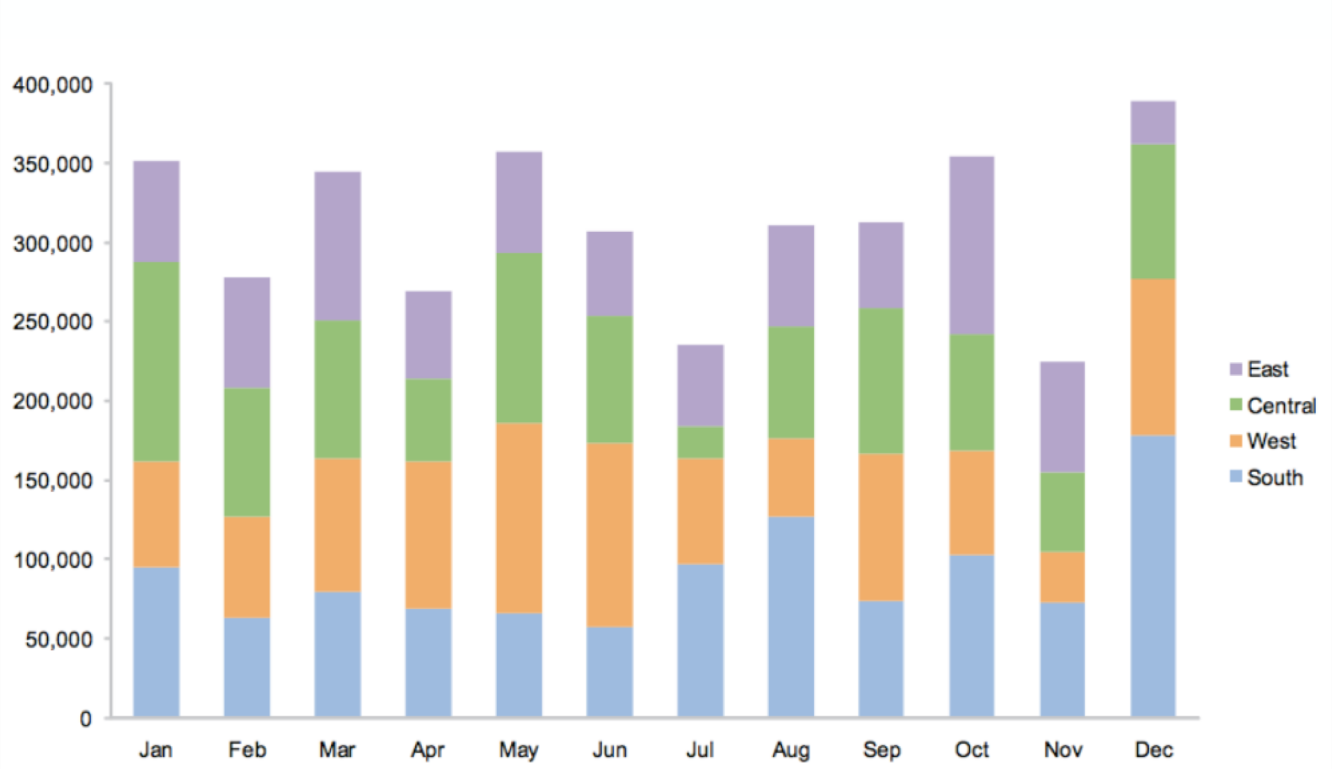
http://extremepresentation.typepad.com/blog/files/choosing_a_good_chart.pdf

Displays: comparisons

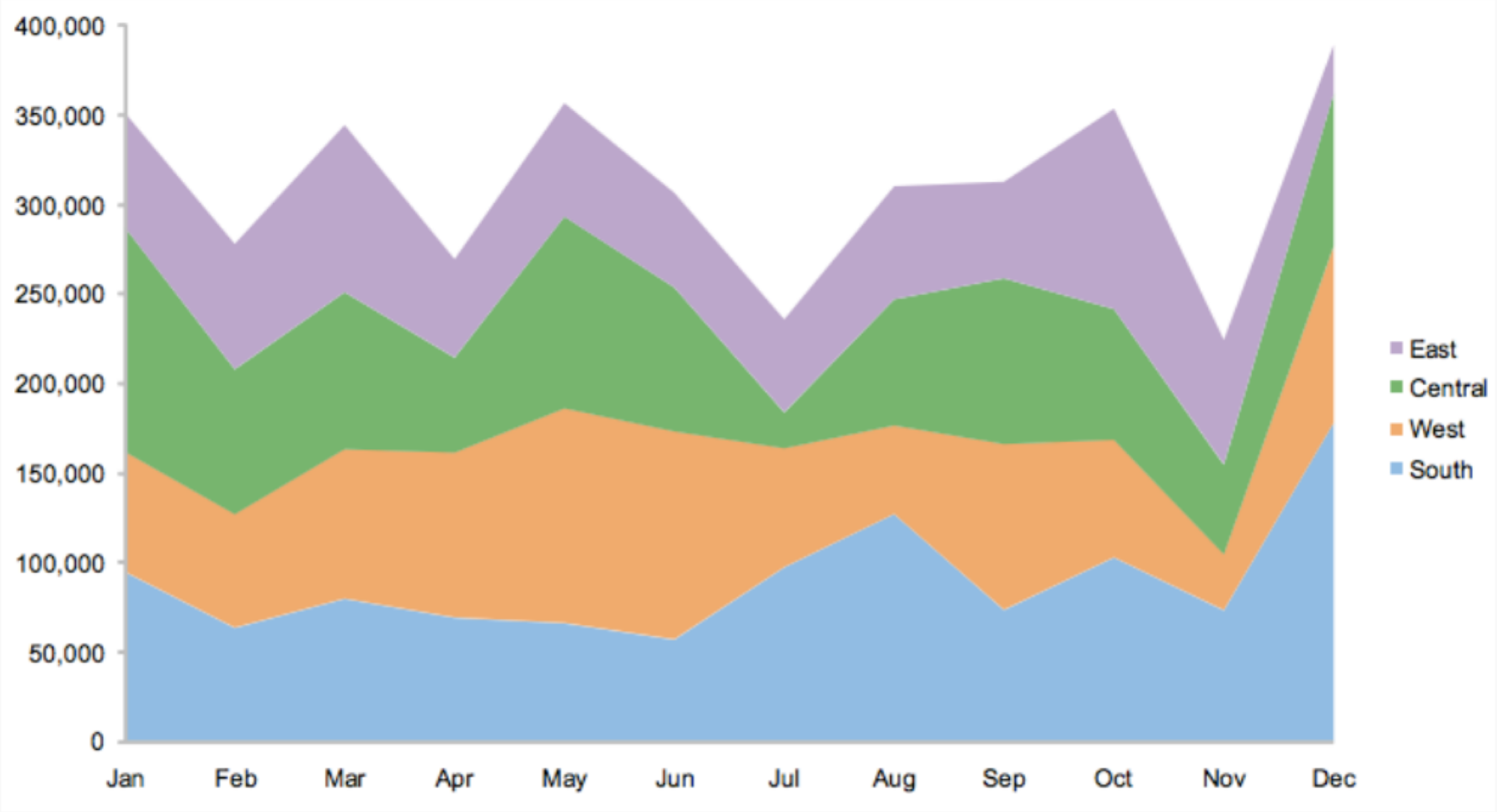


Displays: proportions

Displays: proportions



Displays: proportions



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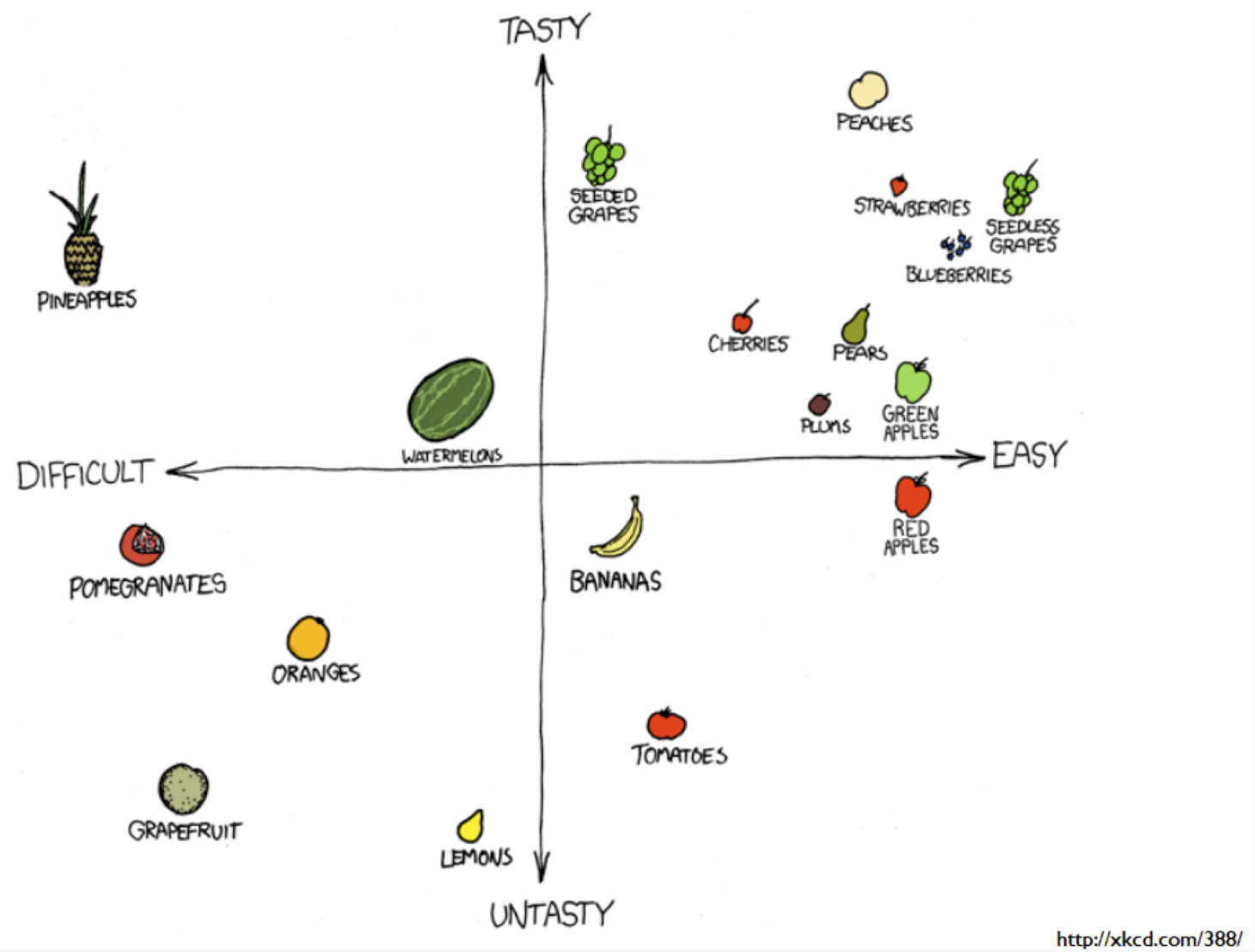
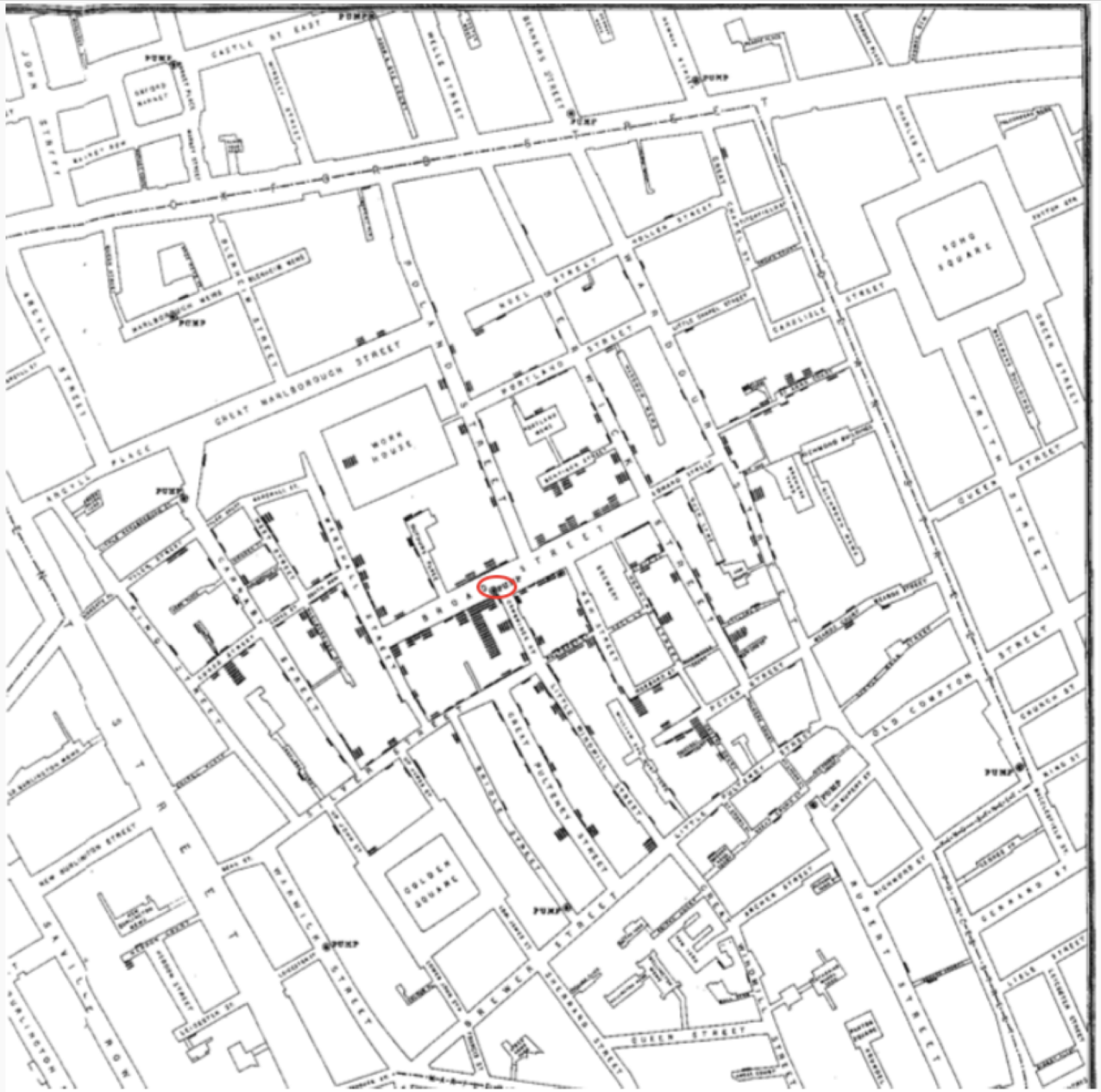


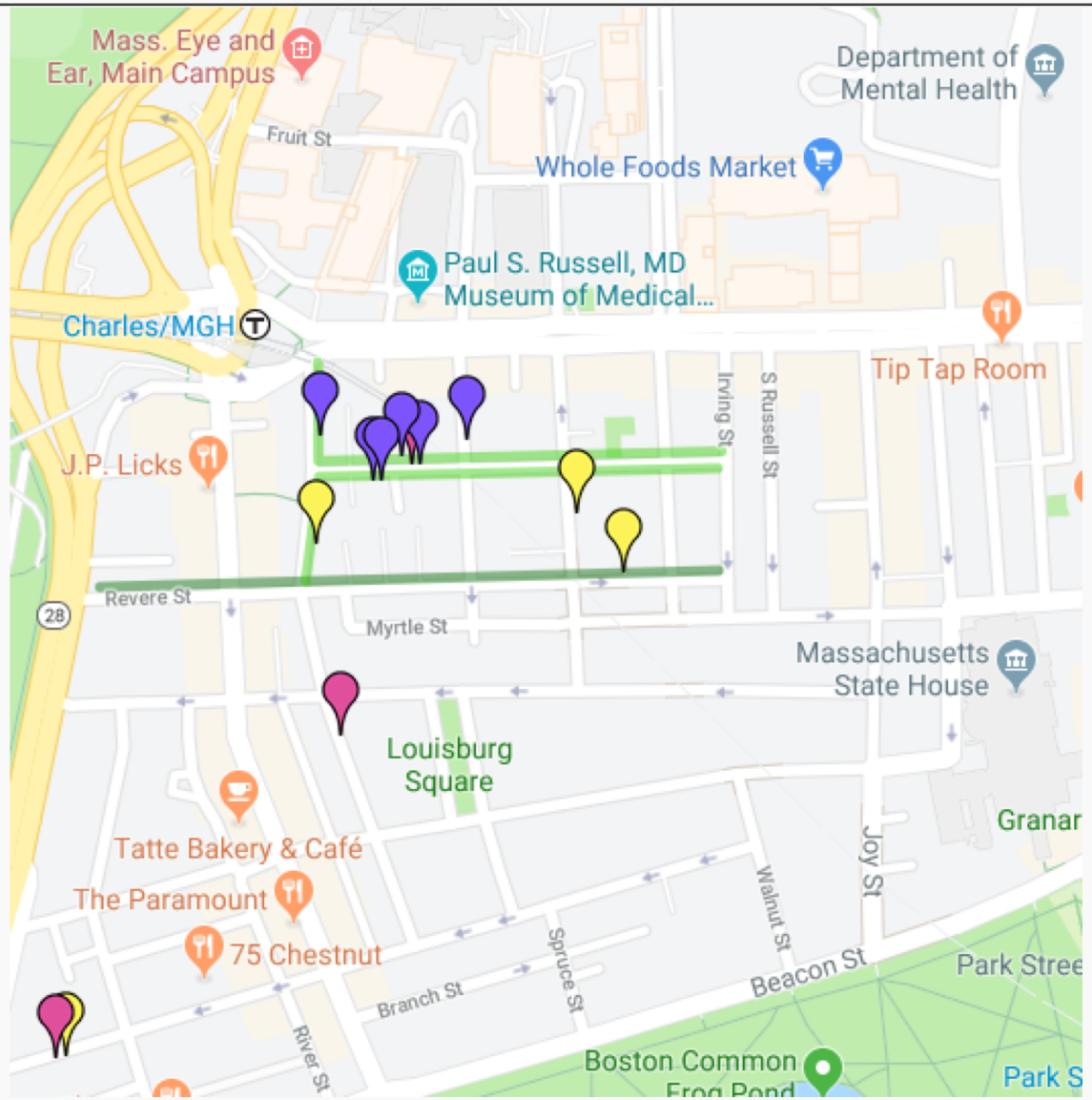
Displays: proportions



London Cholera Epidemic

-- Edward Tufte,
Visual and Statistical
Thinking

Displays: proportions



friday @ 10:30am
sunday @ 5pm
saturday @ 2pm
sunday @ 2pm
friday @ 11:30am
1st and 3rd wed
2nd and 4th wed
2nd and 4th wed
saturday @ 3pm
sunday @ 4:30pm
friday @ 7:30pm
saturday @ 8pm
friday @ 8pm
saturday @ 6pm
saturday @ 7
saturday @ 6