Four Pillars of Effective Visualization Design

Noah Iliinsky
ComplexDiagrams.com
@noahi

Why Visualization?

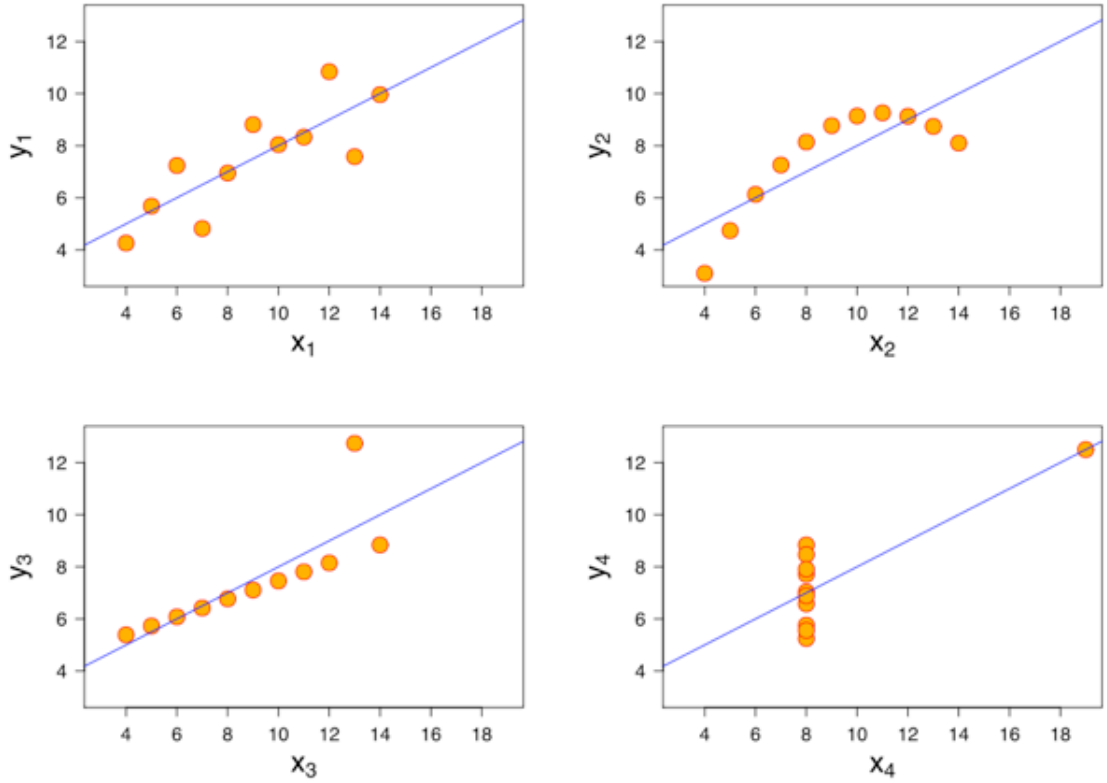
Why Visualization?

Anscombe's Quartet

I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

http://en.wikipedia.org/wiki/Anscombe%27s_quartet

Visualization makes data *accessible*.



http://en.wikipedia.org/wiki/Anscombe%27s_quartet

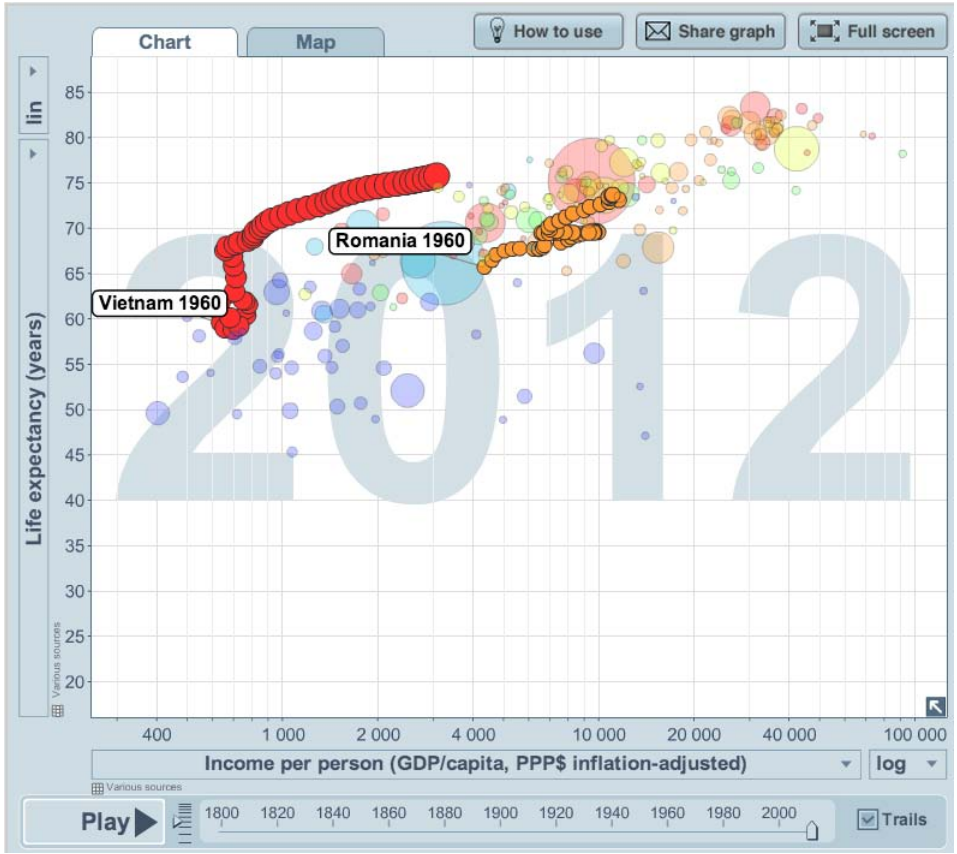
Your brain is a pattern-detecting machine.

We're extremely good at detecting *patterns* and *pattern violations*:

- trends
- gaps
- outliers

Why Stories?

Stories make data *relevant*.



Free material from gapminder.org

The Four Pillars

The Four Pillars of Visualization

This is the design process!

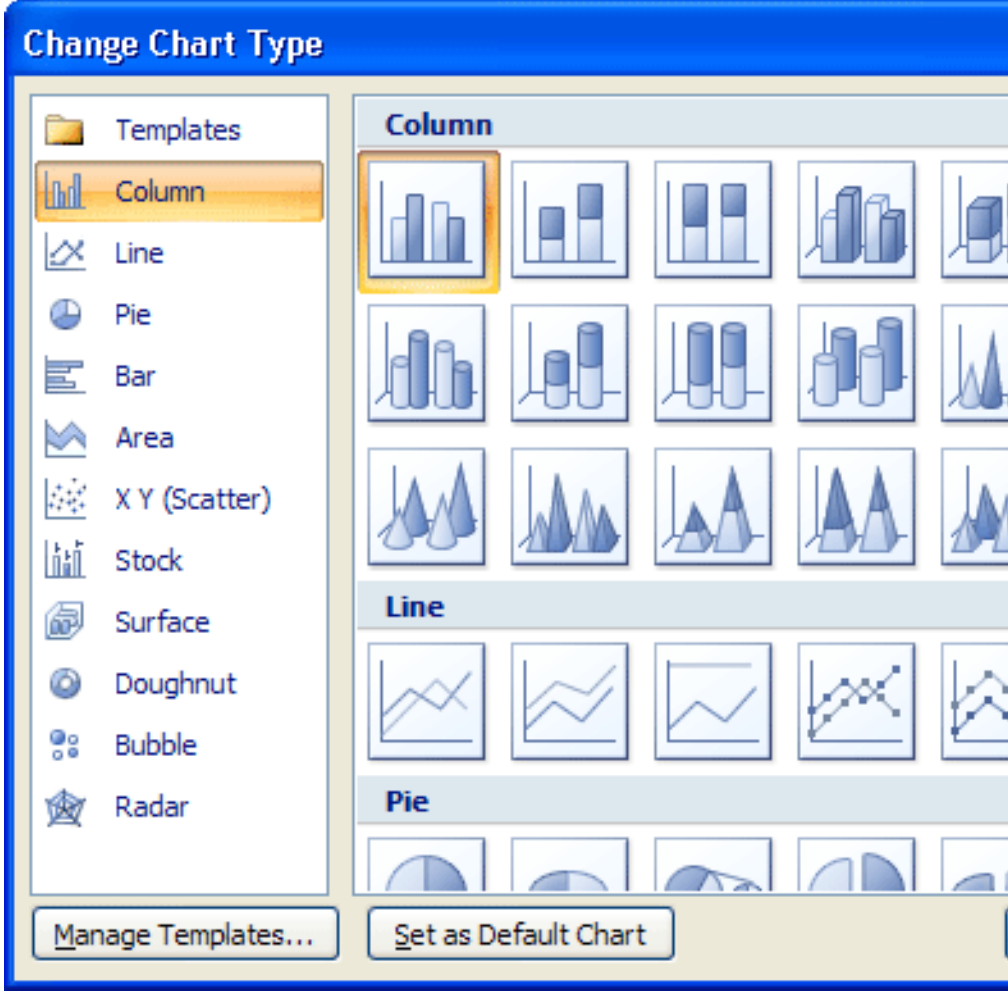
1. **purpose** – why this visualization
2. **content** – what to visualize
3. **structure** – how to visualize it
4. **formatting** – appeal and focus

http://complexdiagrams.com/4pillars

Purpose

Start here…





Not here.

Defining your purpose

- Why am I creating this visualization?
- Who is it for?
- What do they need to understand?
- What actions do I need to enable?
- How will it be consumed?
- What is the most important take-away message?



Your purpose should be specific

~~Show our data~~

yawn

Show our revenue and customer base improvements over the last three years to potential investors



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@noahi

Step 5: What graph do I use?
4: What data matters?
3: What Q's need answering?
2: What actions do I need to inform?
1: What do I care about?

RETWEETS 87 FAVORITES 85



11:34 AM - 17 Jan 2014

Data
Information
Answers
Actions

Success requires providing *answers*

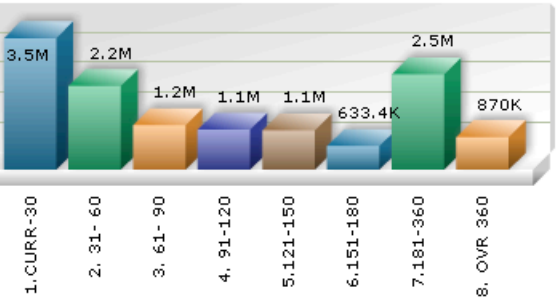
~~Revenues~~

The state of Washington shows the most improved revenues by percentage of all states from 2012-2015

Content

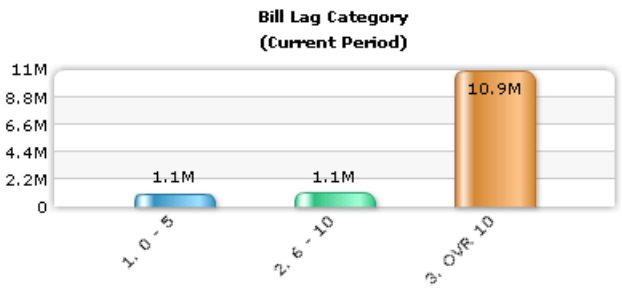
- **What** data matters?
- **What** relationships matter?
- Informed by purpose!
- What's *excluded* is as important as what's *included*.

Hospital Aging Summary



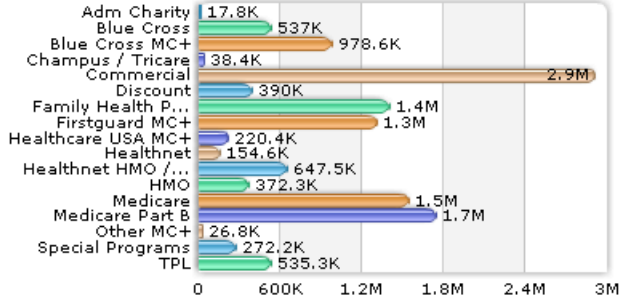
Export Data Settings

Hospital Bill Lag Category Summary



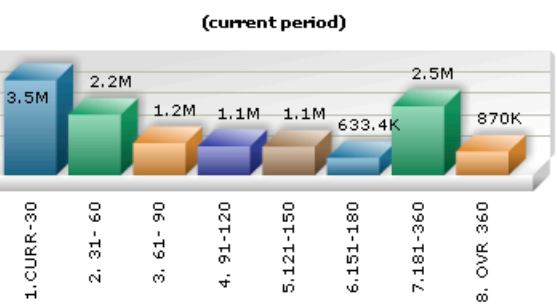
Full size Export Data Settings

Hospital Payer Summary



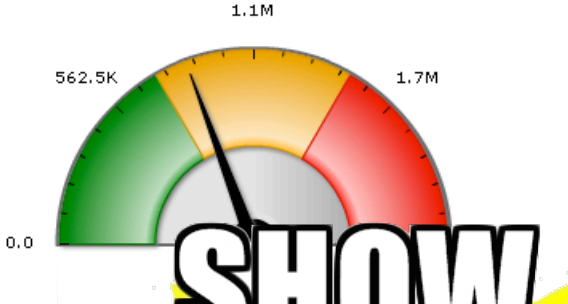
Full size Export Data Settings

McKesson ATB Aging Summary



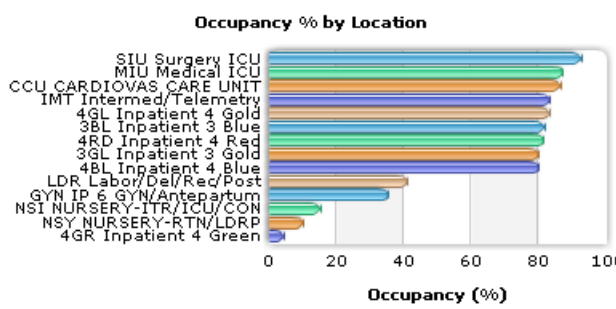
Export Data Filter: inactive Settings

McKesson ATB Aging (Over 360 Days)



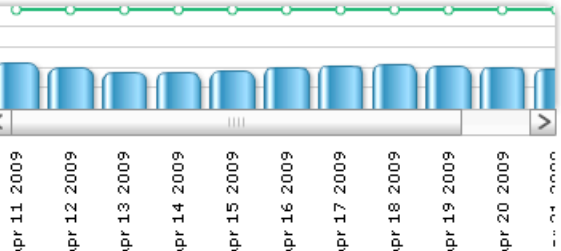
Full size Export Data Settings

McKesson Occupancy Percentage



Full size Export Data Settings

McKesson Occupancy Trend

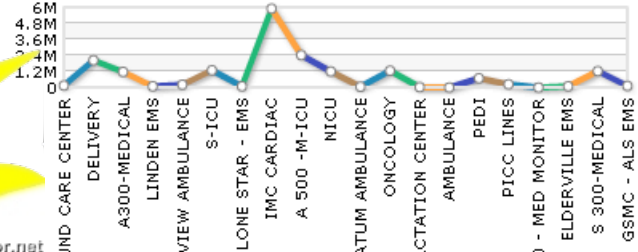


Meditech Mo

Showing 1 to 88 of 88

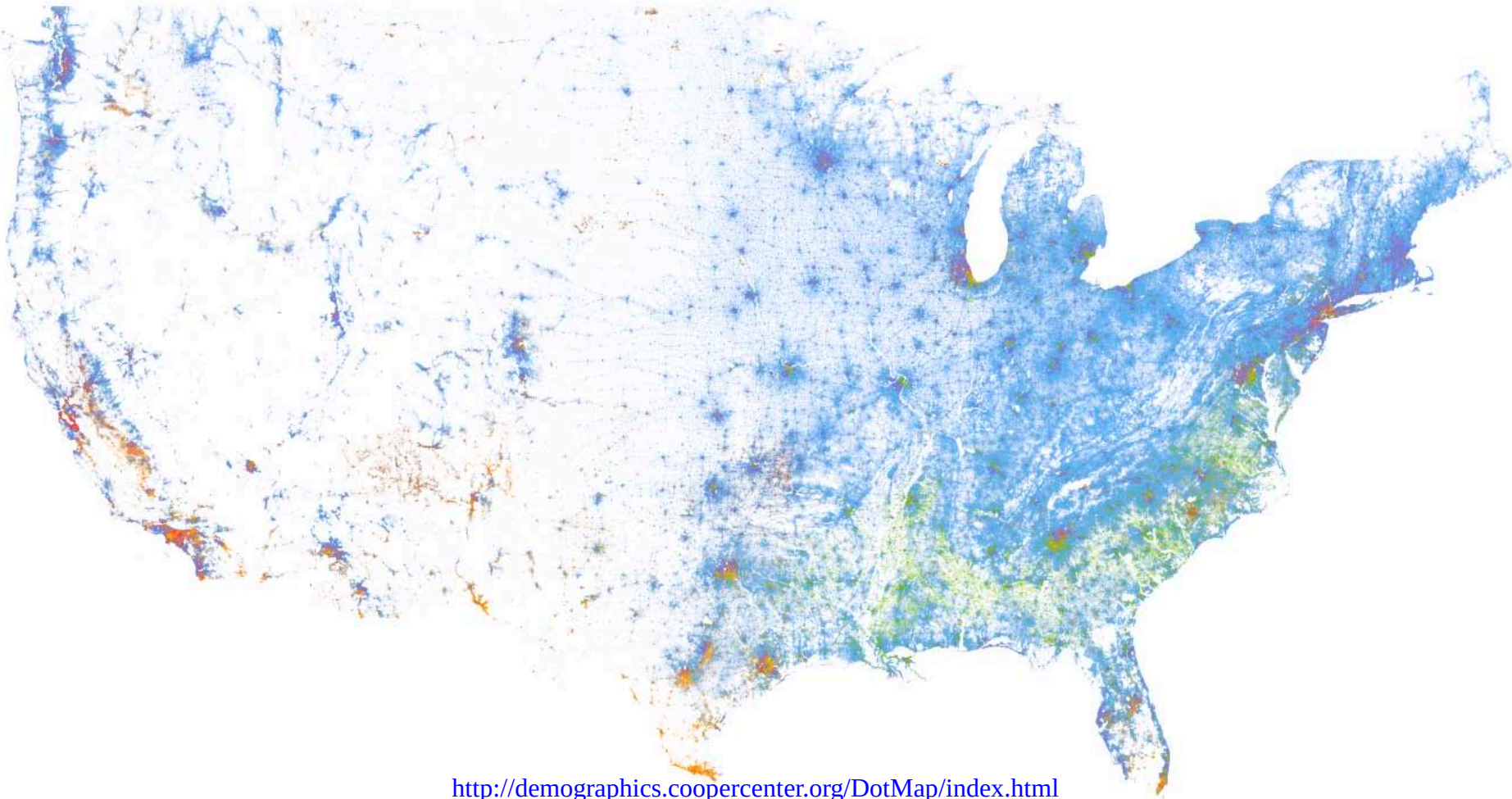
Dept Number	Dept Na...	...ours
16710	E.R.	
16721	[illegible]	
158450	[illegible]	
16730	[illegible]	
16727	[illegible]	
17420	[illegible]	
16745		
16290		
16732		
16011		
16009		
16280		

Meditech MTD Revenue by Dept (Top 20)





Content: less is more, guided by purpose



http://demographics.coopercenter.org/DotMap/index.html

Content selection focuses attention



http://demographics.coopercenter.org/DotMap/index.html

Less content simplifies learning



DO I NEED AN UMBRELLA?

98112

Well, do I?

Seattle, WA

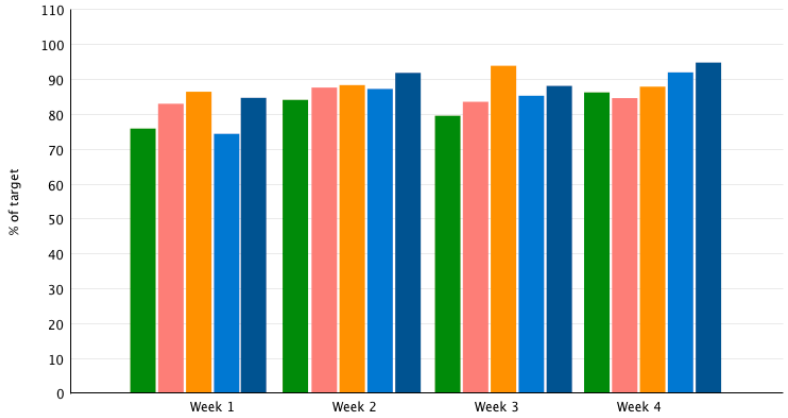
Overcast (49°)

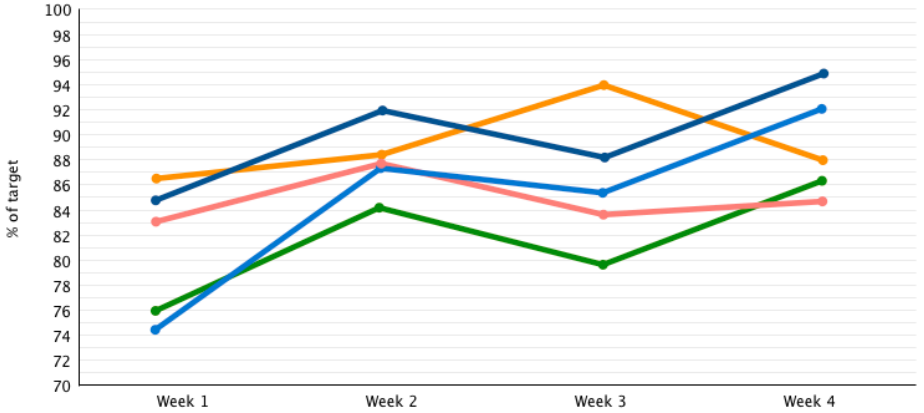
NOPE

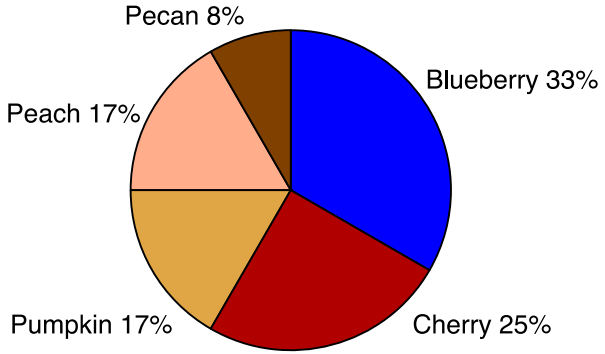
Example purposes

- **Comparison**: *rank* airports by the number of weather-delayed departures
- **Change**: show rates of malaria, *over the last 10 years* for these countries
- **Composition**: show relative *contribution* to revenue by product line
- **Correlation**: show how free school lunches *affect* graduation rates
- **Geography**: show population density *per country*

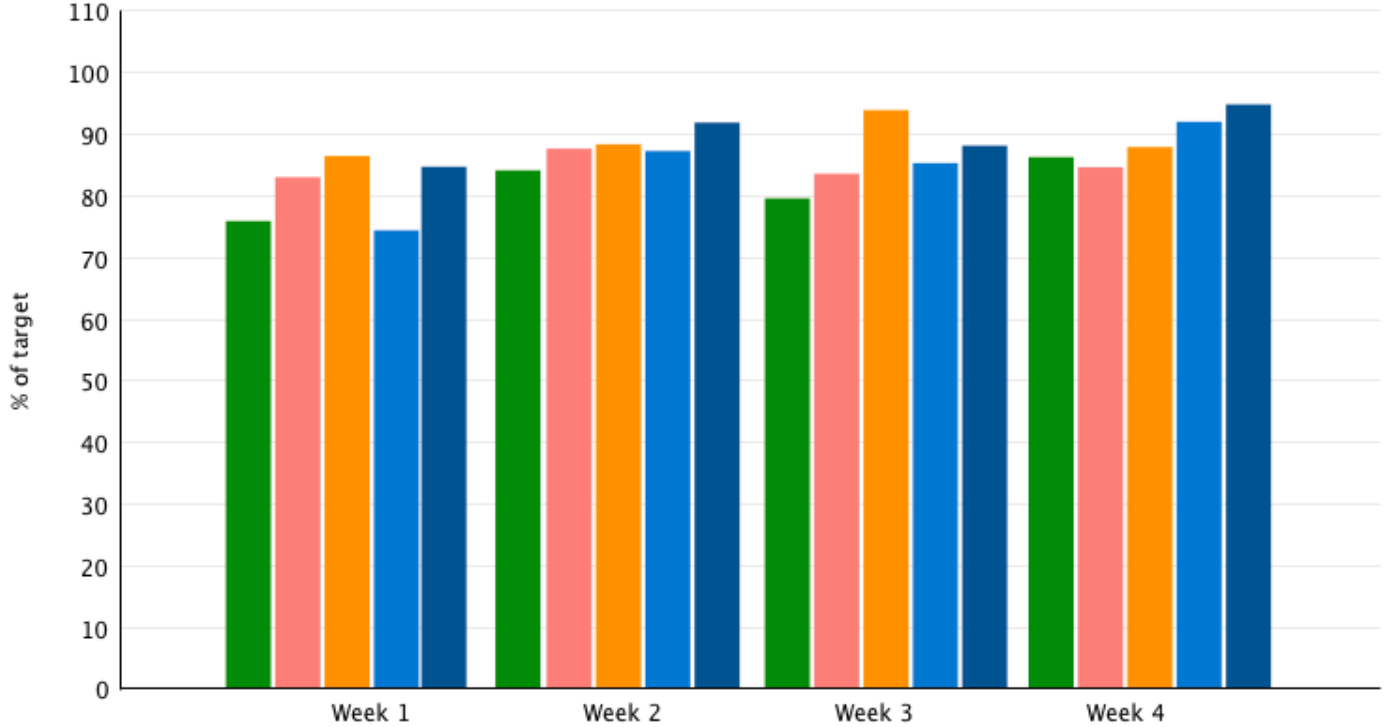
Different structures reveal different data, serve different purposes





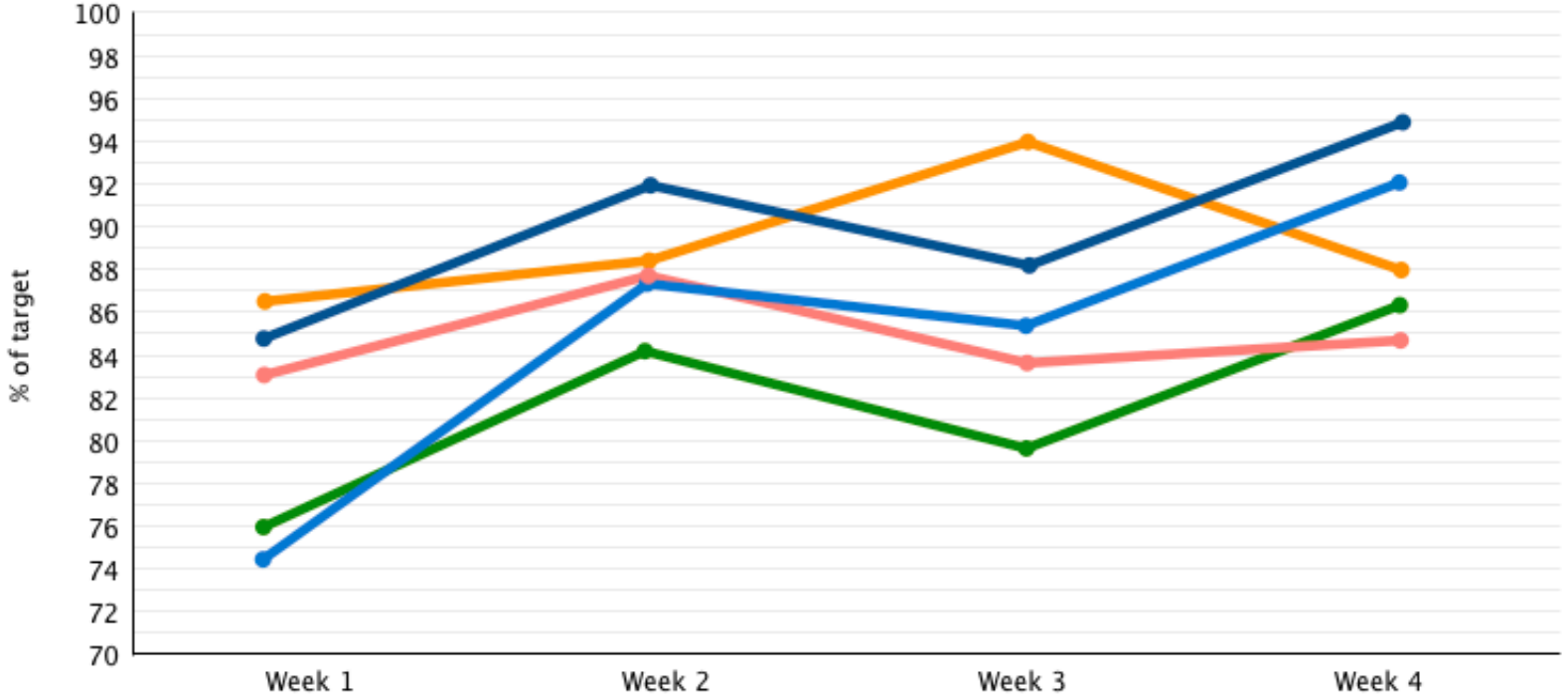


Structure: bars support comparison



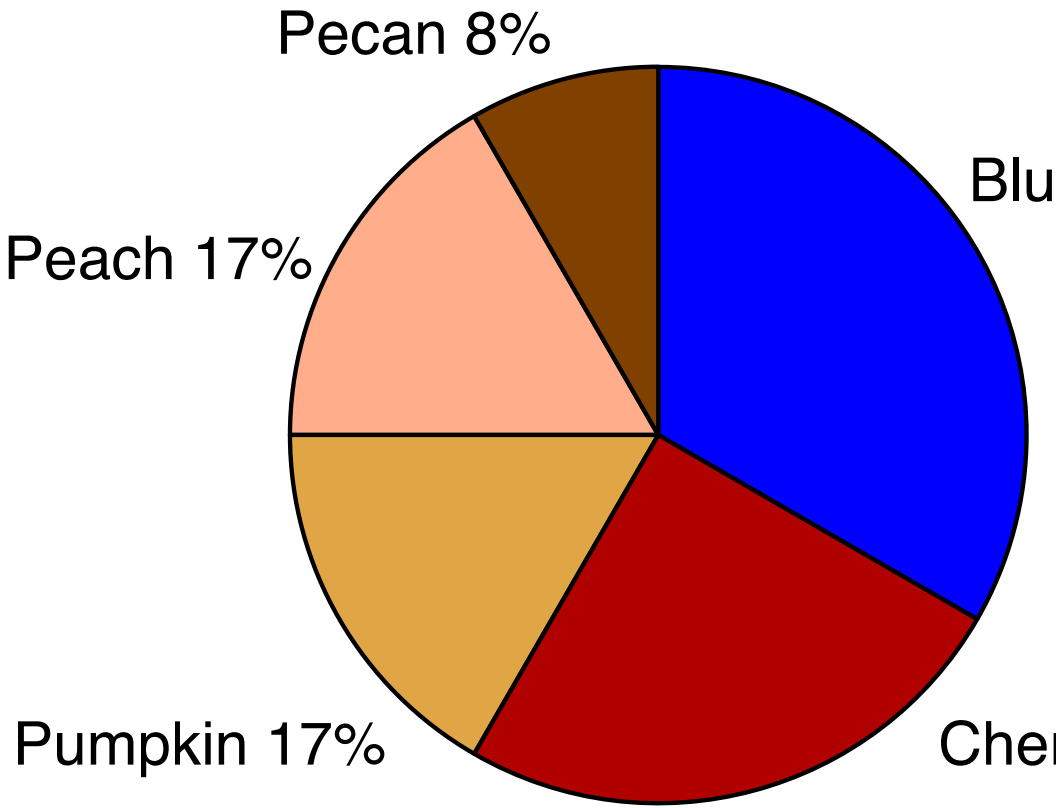
- Value vs. category (count, region)
- Value vs. multiple categories (count, region, age)

Structure: lines imply time, continuity



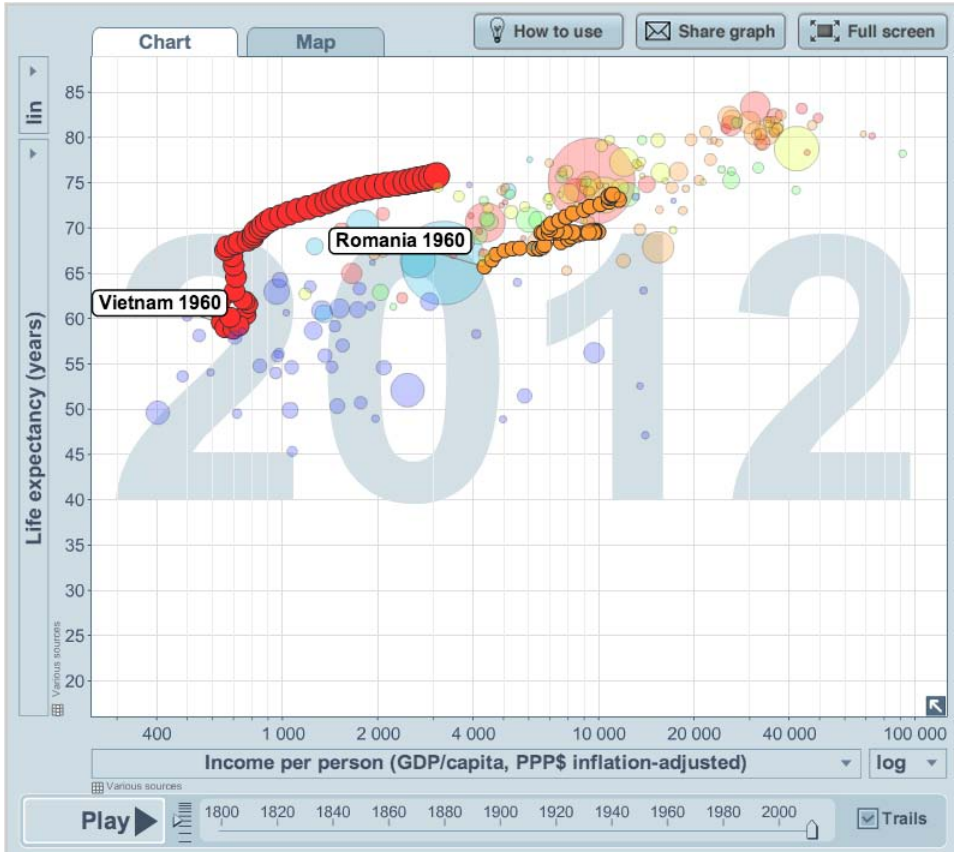
- Line graphs are the standard for change over time
- Too many lines look like spaghetti

Structure: pies represent composition



- Few relevant slices
- Not much precision required
- Slices ordered by size

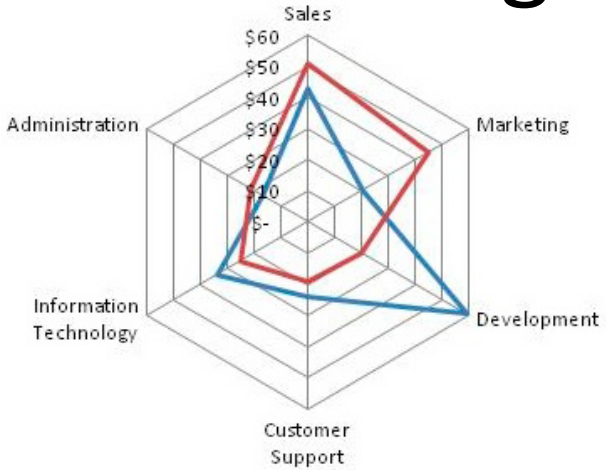
Structure: Scatter plots show correlation.



- Compares relationship of data on major axes
- Room for 3-5 more encodings
- Don’t get too crazy…

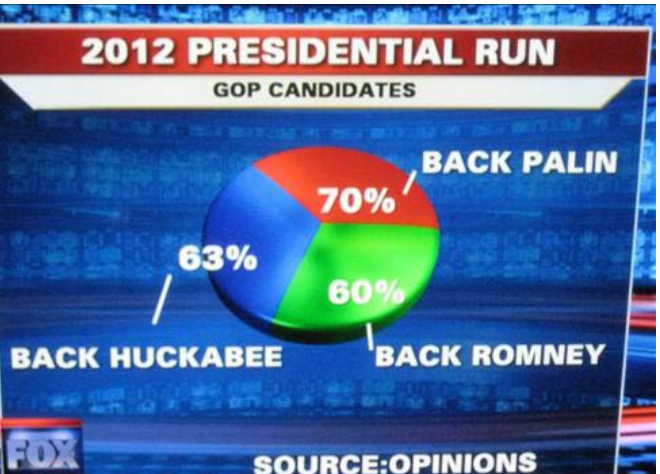
Free material from gapminder.org

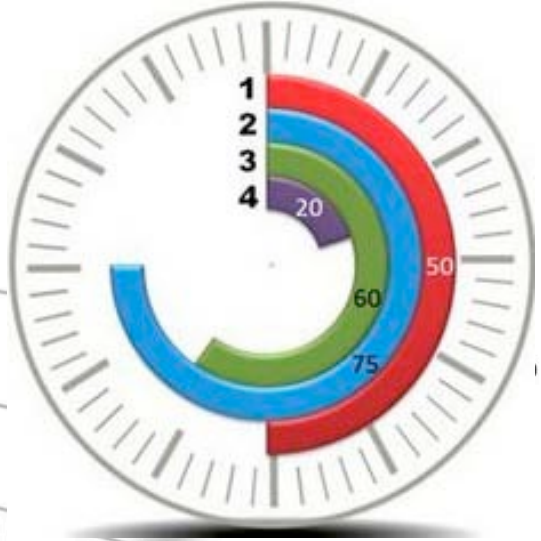
Avoid these graphs



- Radar graphs
- Non-100% pies
- Circular graphs
- 3D anything

These distort data





http://en.wikipedia.org/wiki/File:Spider_Chart.jpg
http://www.presentation-process.com/doughnut-chart.html
http://www.socialmediaexaminer.com/SocialMediaMarketingIndustryReport2013.pdf

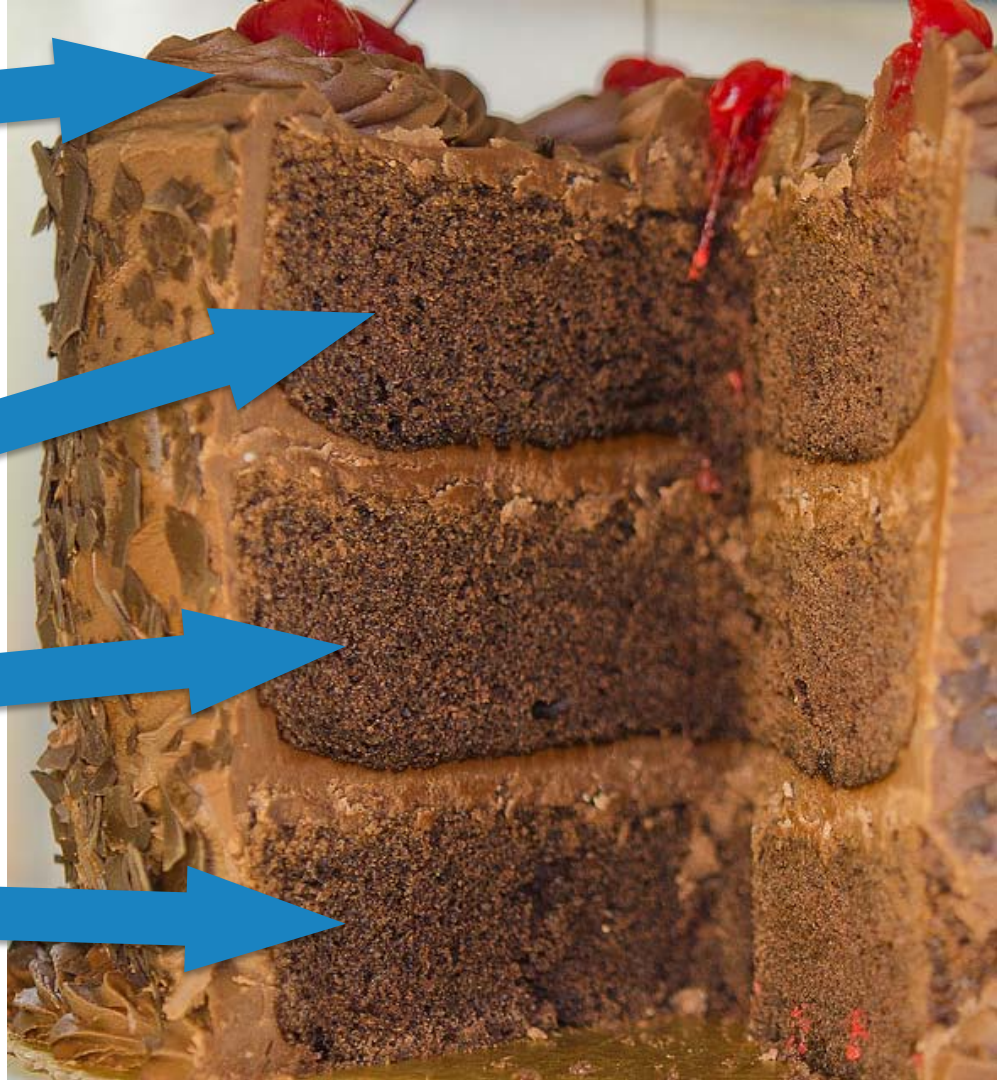
Formatting

adds appeal and focus

Structure

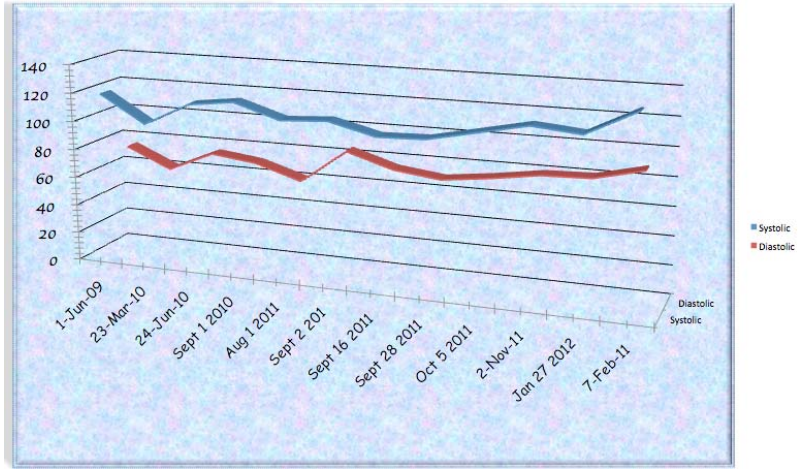
Content

Purpose

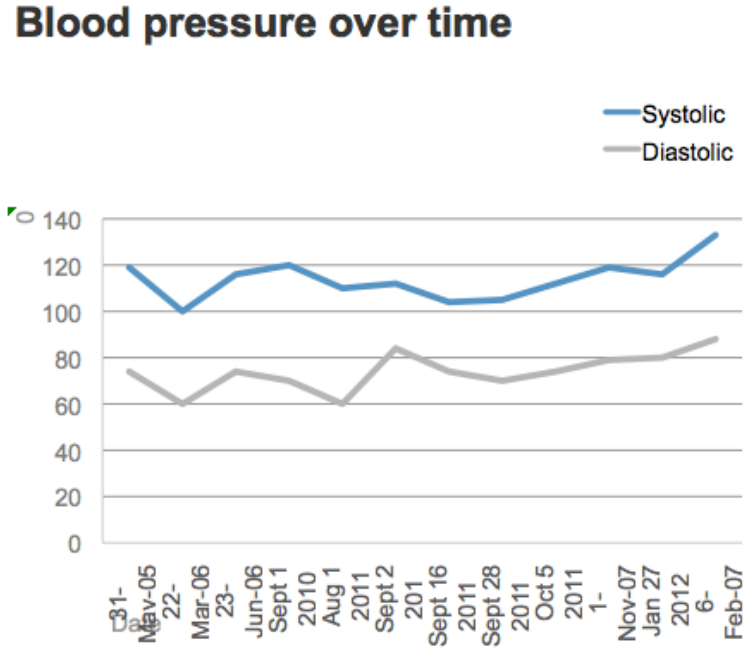


Formatting highlights what's important

Focus on the data, remove the distractions.

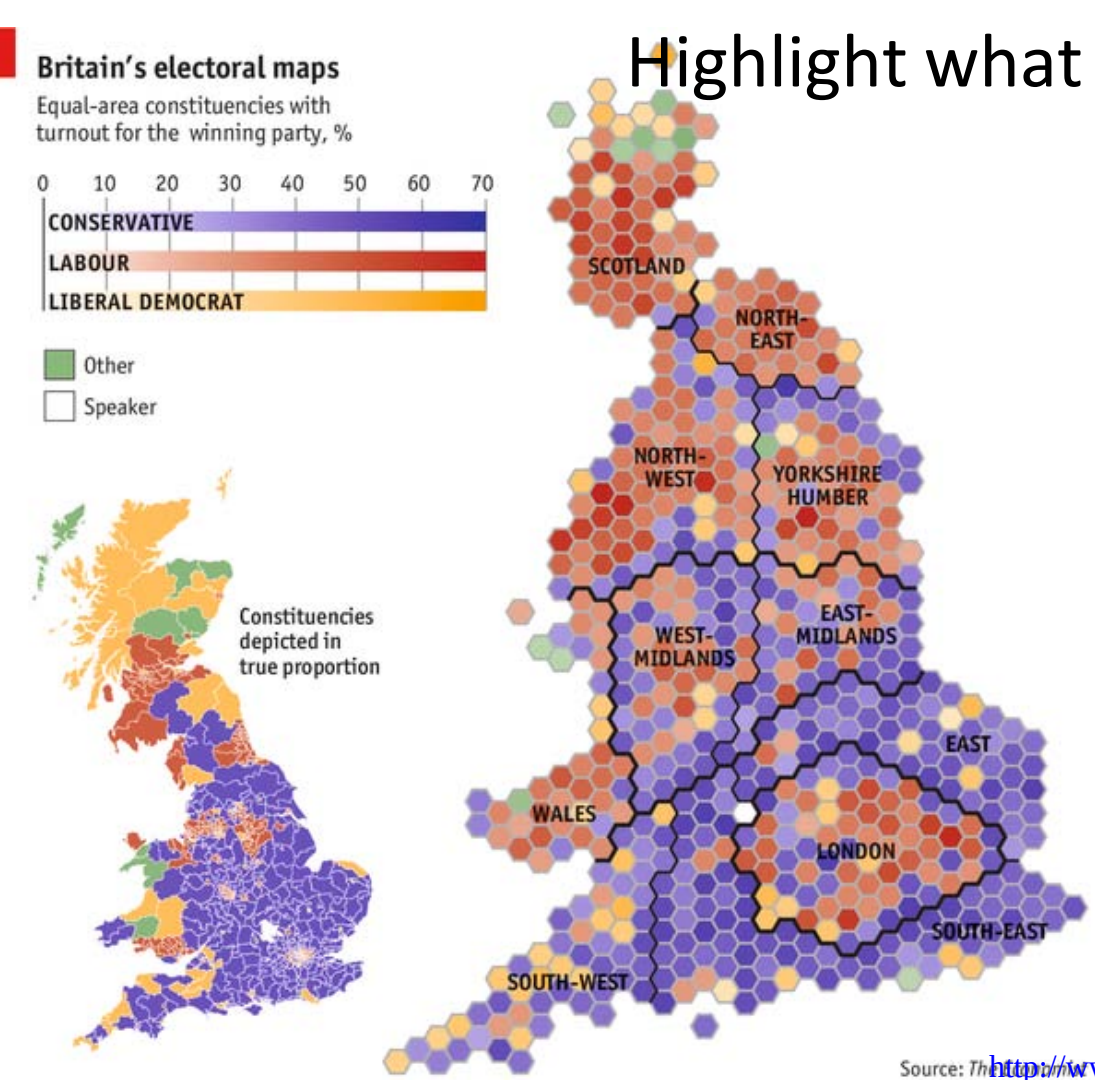


Bad & distracting!



Much clearer!

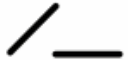
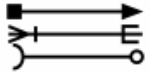
Highlight what matters, remove the rest



- Geography is modified to show logical meaning
- Colors encode party.
- Saturation encodes turnout.
- Outlines group regions.
- All other details removed.

http://www.economist.com/blogs/graphicdetail/2013/04/mapping-britain

Visual Encoding Properties and Best Uses

Visual Encoding		Properties		Best Uses			
Example	Encoding	Ordered	Useful values	Quantitative	Ordinal	Categorical	Relational
	position, placement	**yes**	**infinite**	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	**optional** (alphabetical or numbered)	**infinite**	Good	Good	Good	Good
	length	**yes**	**many**	Good	Good		
	size, area	**yes**	**many**	Good	Good		
	angle	**yes**	medium/few	Good	Good		
	pattern density	**yes**	few	Good	Good		
	weight, boldness	**yes**	few		Good		
	saturation, brightness	**yes**	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	**infinite**			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	**yes**	few		Good		

http://complexdiagrams.com/properties

Summary

- Clear **purpose**, accounting for who and why, is crucial.
- Edit down **content** to only what's necessary.
- Select a **structure** that supports your purpose and reveals your content.
- Use **formatting** to focus, not to distract.

Thank you!
Reference & Resources

- @noahi Twitter is the best way to get in touch
- http://complexdiagrams.com/4pillars
- http://complexdiagrams.com/properties
- More on designing visualizations (1h 50m)
- My favorite talk: When Not to Use Maps (11m)
- Cole Nussbaumer's Excel template
- QuickSight annoucement