Basics of Visualization

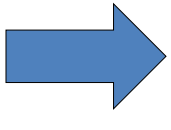
BIOS 6640, R for Data Science

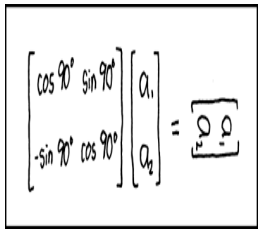
Based on John Canny's CS194 notes from UC-Berkeley

Data Scientist's Workflow

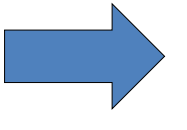
Sandbox

Digging Around in Data

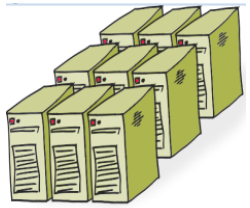




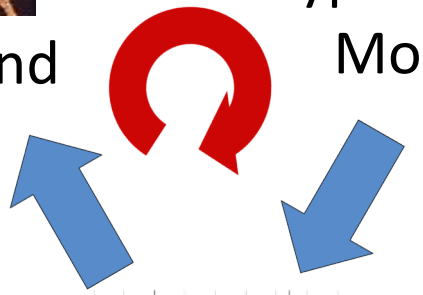
Hypothesize Model

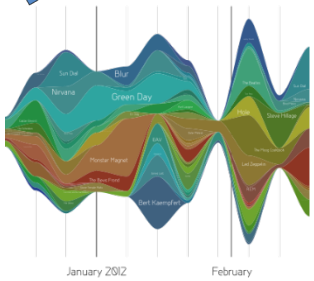


Production



Large Scale Exploitation





Evaluate Interpret

Data Scientist's Workflow

Sandbox

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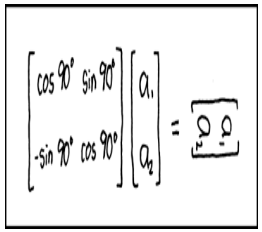
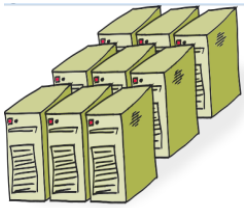
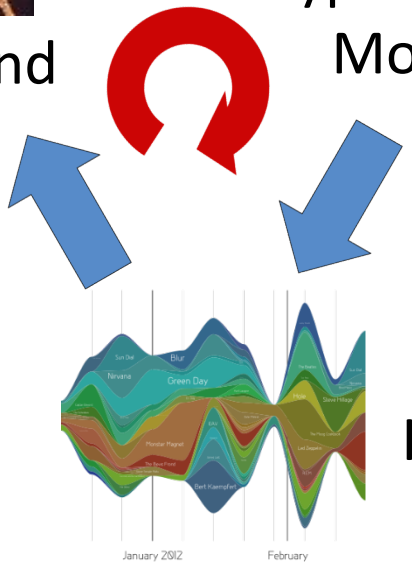


Hypothesize Model

Publish Information





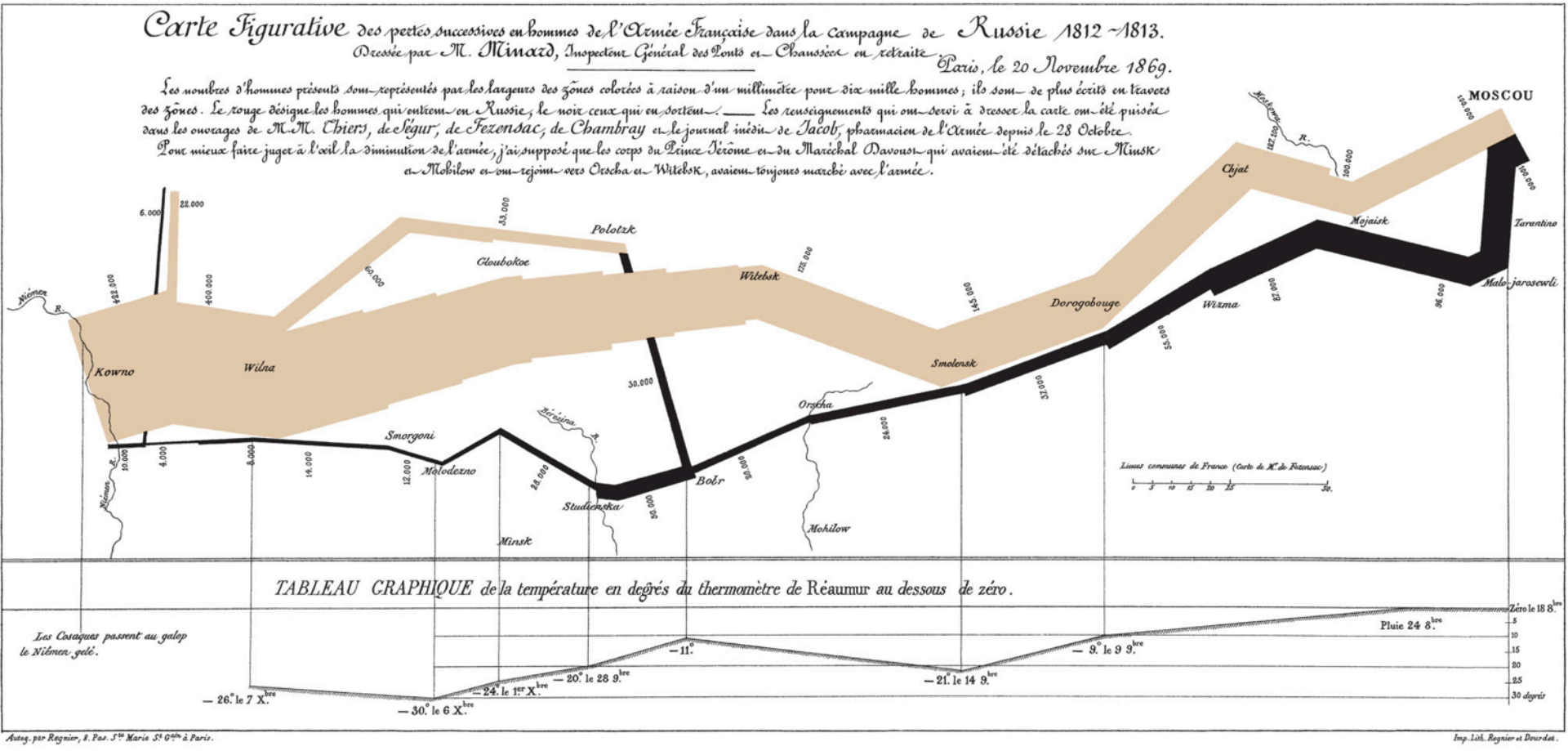
Evaluate Interpret

Outline

Visualization:

- Some great examples
- Some counter-examples
- Principles for Visualization Design

Charles Joseph Minard 1869
Napoleon's March



According to Tufte: "It may well be the best statistical graphic ever drawn."
5 variables: Army Size, location, dates, direction, temperature during retreat

Another example

https://www.gapminder.org/fw/world-health-chart/

Outline

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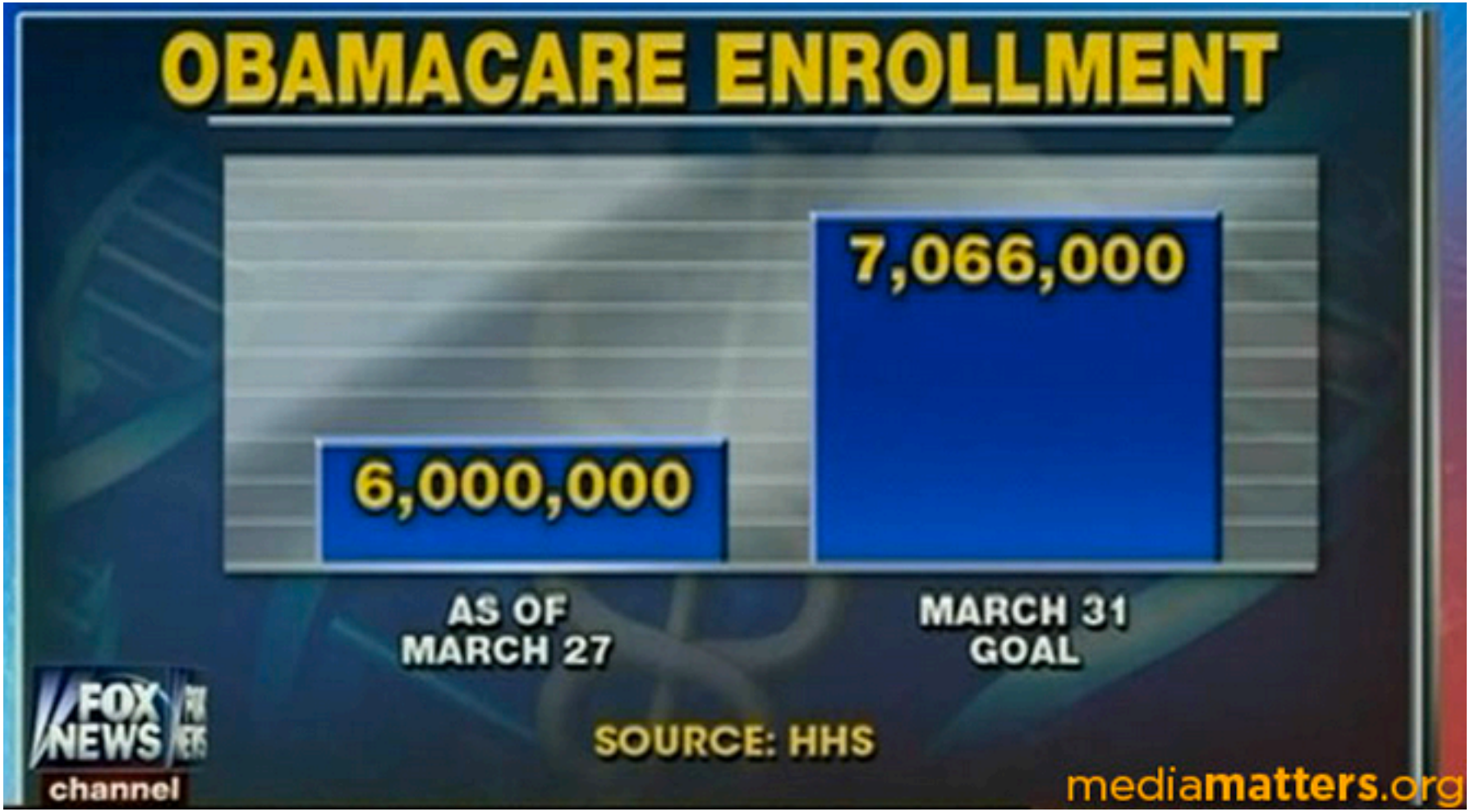
Some Anti-Examples

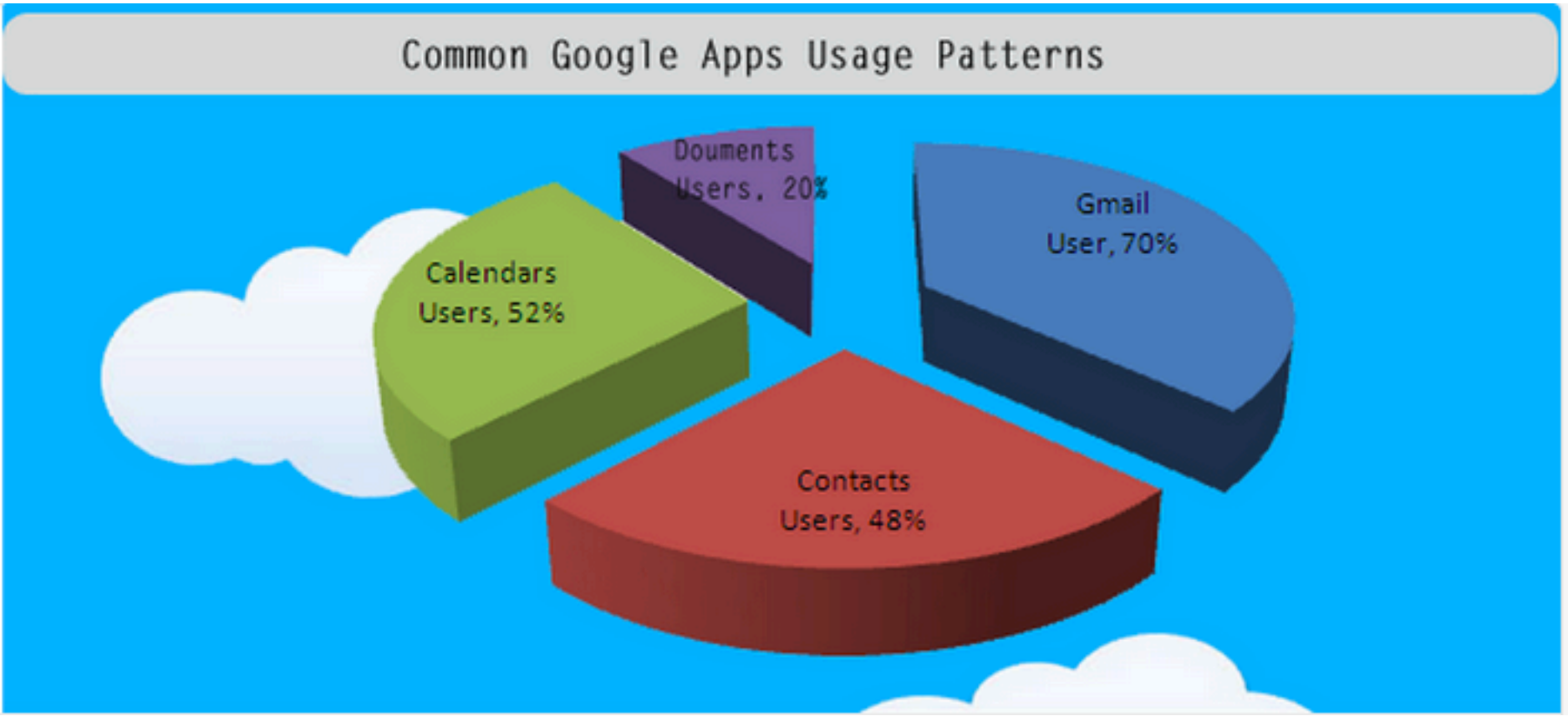
- Courtesy of WTFViz.net

Visualization to Educate?



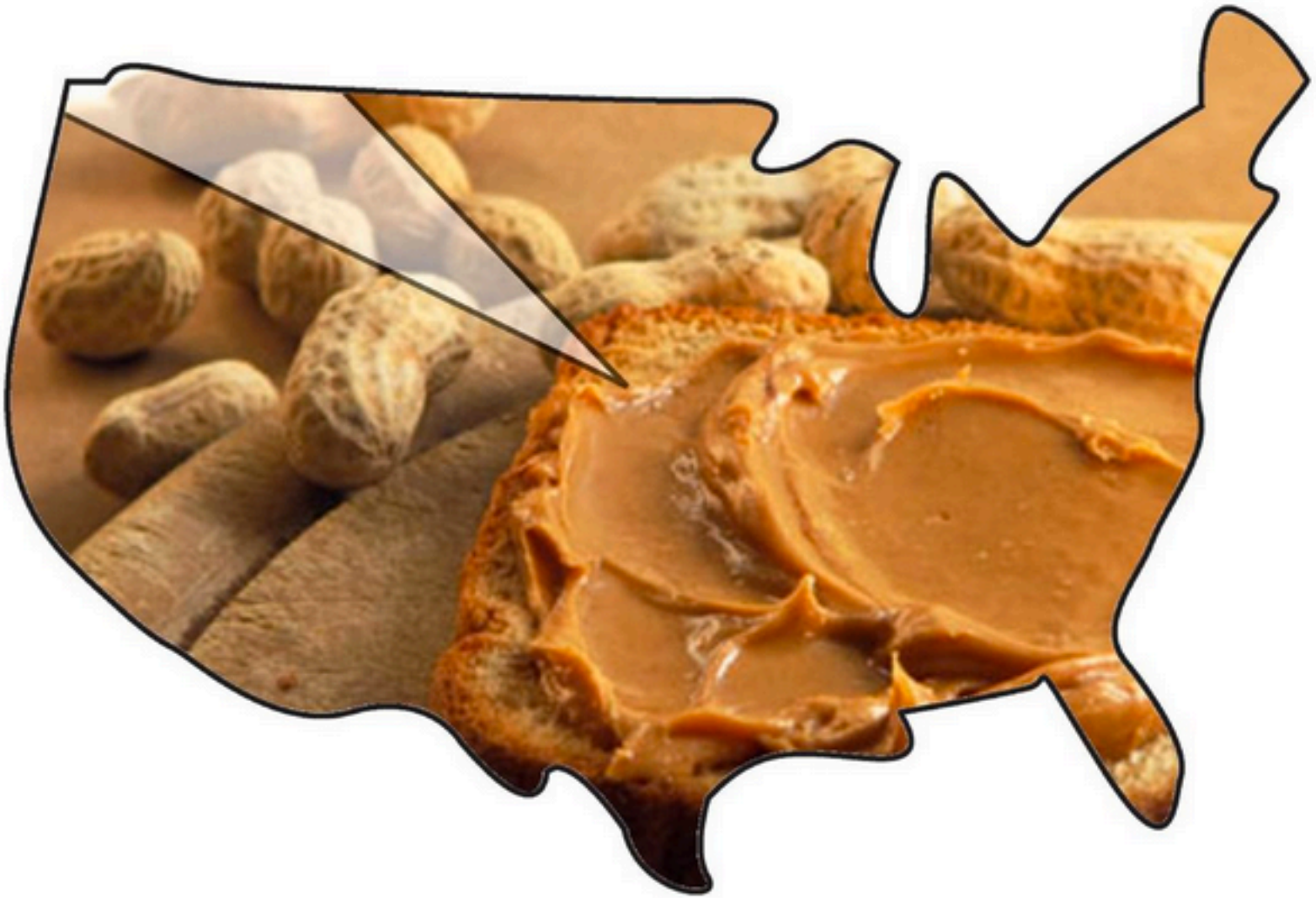
from wtfviz.net

Pie in the Sky?



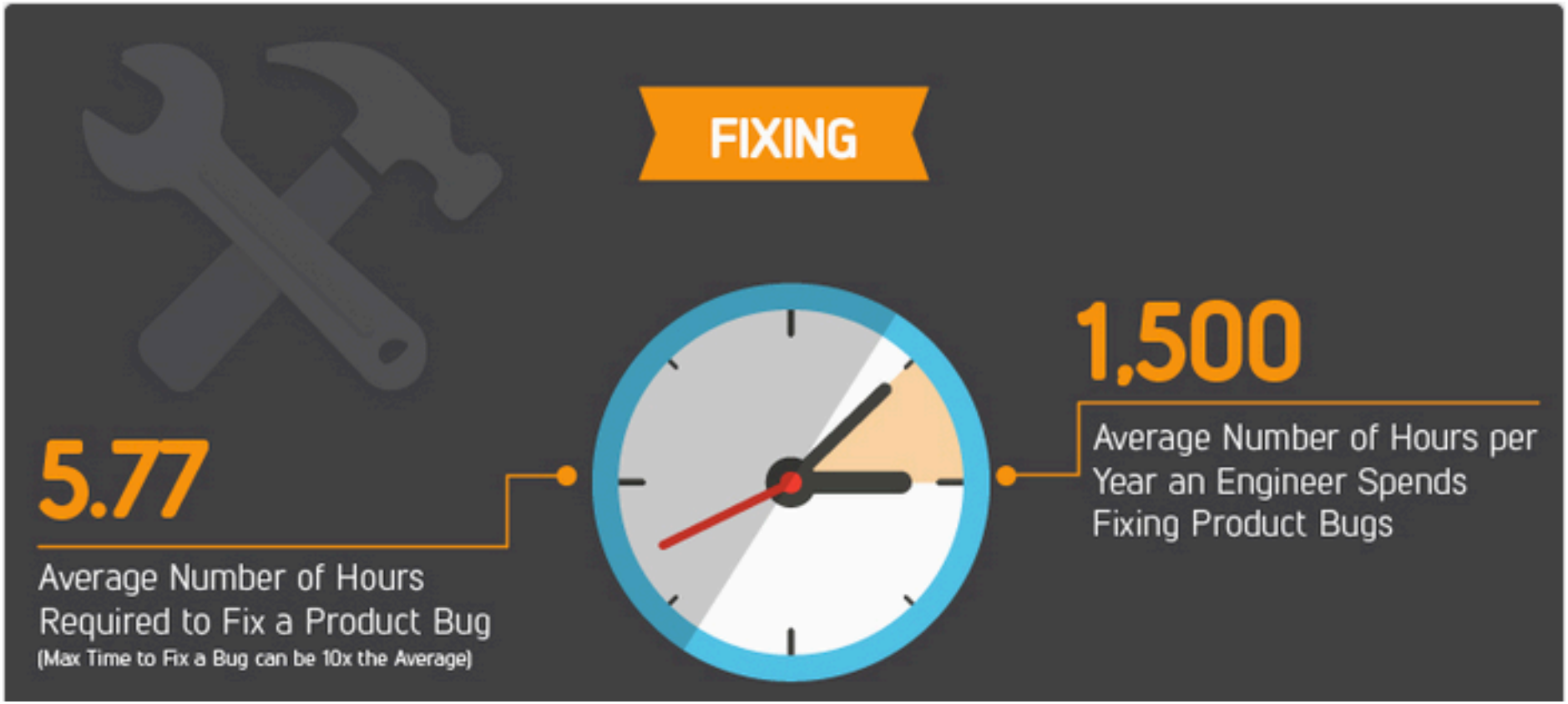
from wtfviz.net

90% of US Households Consume Peanut Butter



from wtfviz.net

Needs Fixing



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- Some great examples
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- Principles for Visualization Design

Visualization Definitions

- "Transformation of the symbolic into the geometric"
  [McCormick et al. 1987]

- "... finding the artificial memory that best supports our natural means of perception." [Bertin 1967]

- "The use of computer-generated, interactive, visual representations of data to amplify cognition."
  [Card, Mackinlay, & Shneiderman 1999]

Uses for Data Viz

A: Support reasoning about information (analysis)

- Finding relationships
- Discover structure
- Quantifying values and influences
- Should be part of a query/analyze cycle

B: Inform and persuade others (communication)

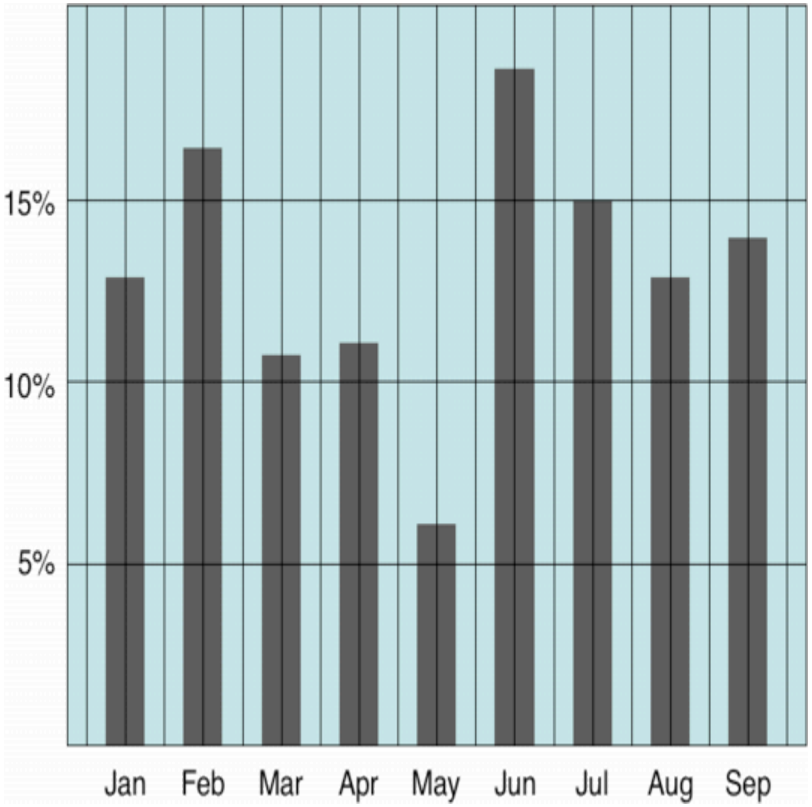
- Capture attention, engage
- Tell a story visually
- Focus on certain aspects, and omit others

Principle 1

- Simplify !

Chart Design: Simplifying

- Example from Tim Bray



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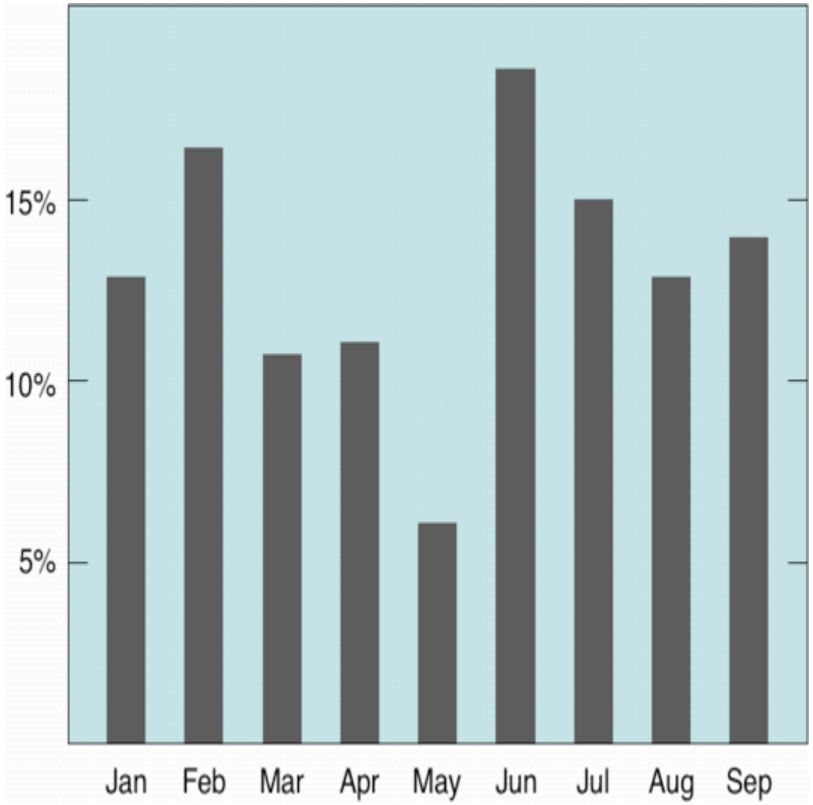

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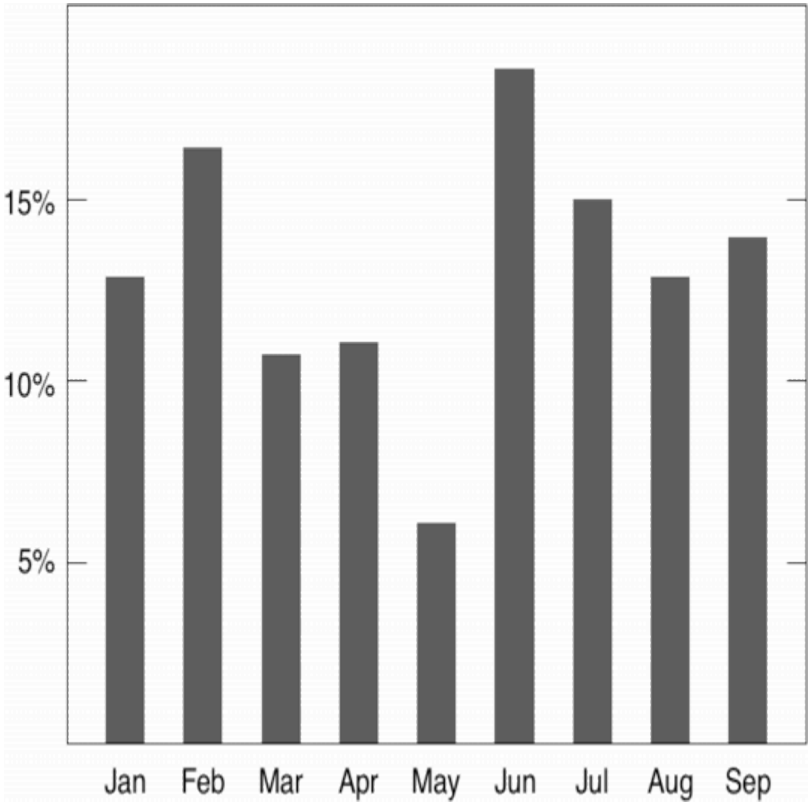

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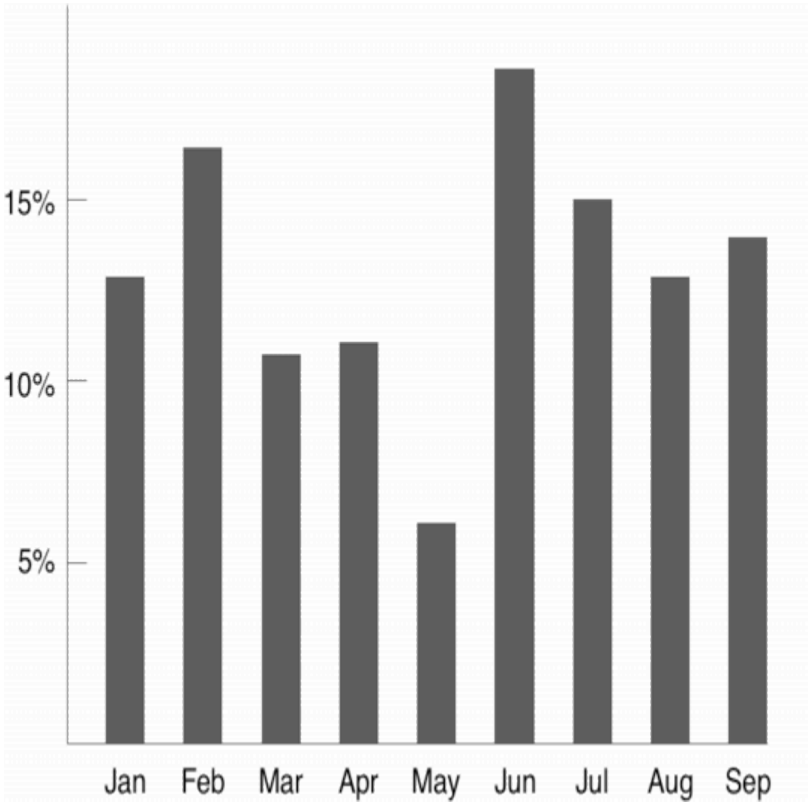

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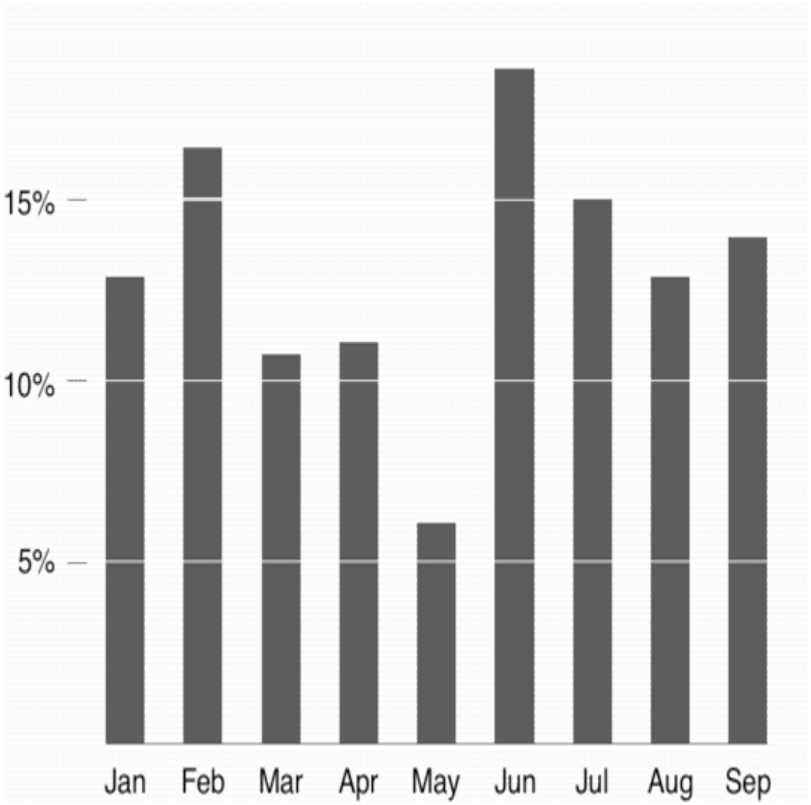

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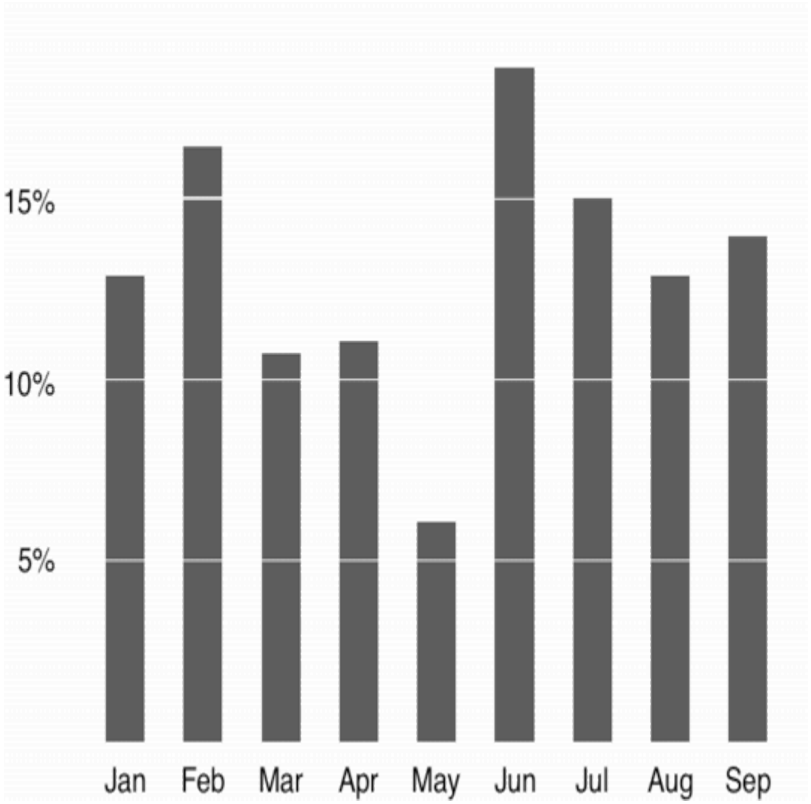


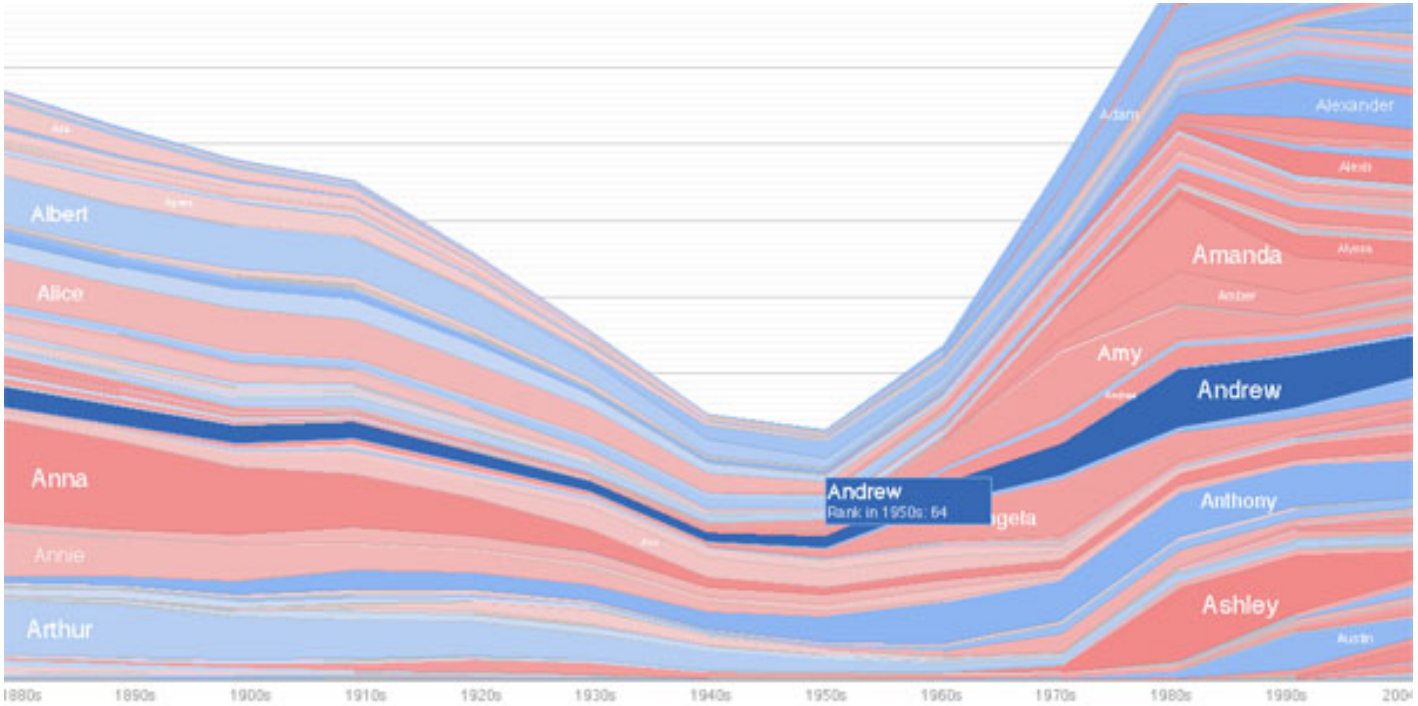
Principle 1: Simplify

- Tables and charts
  - Reduce chartjunk/tablejunk; increase data-ink ratio
  - Lessons from perception: Limit the number of objects displayed at once

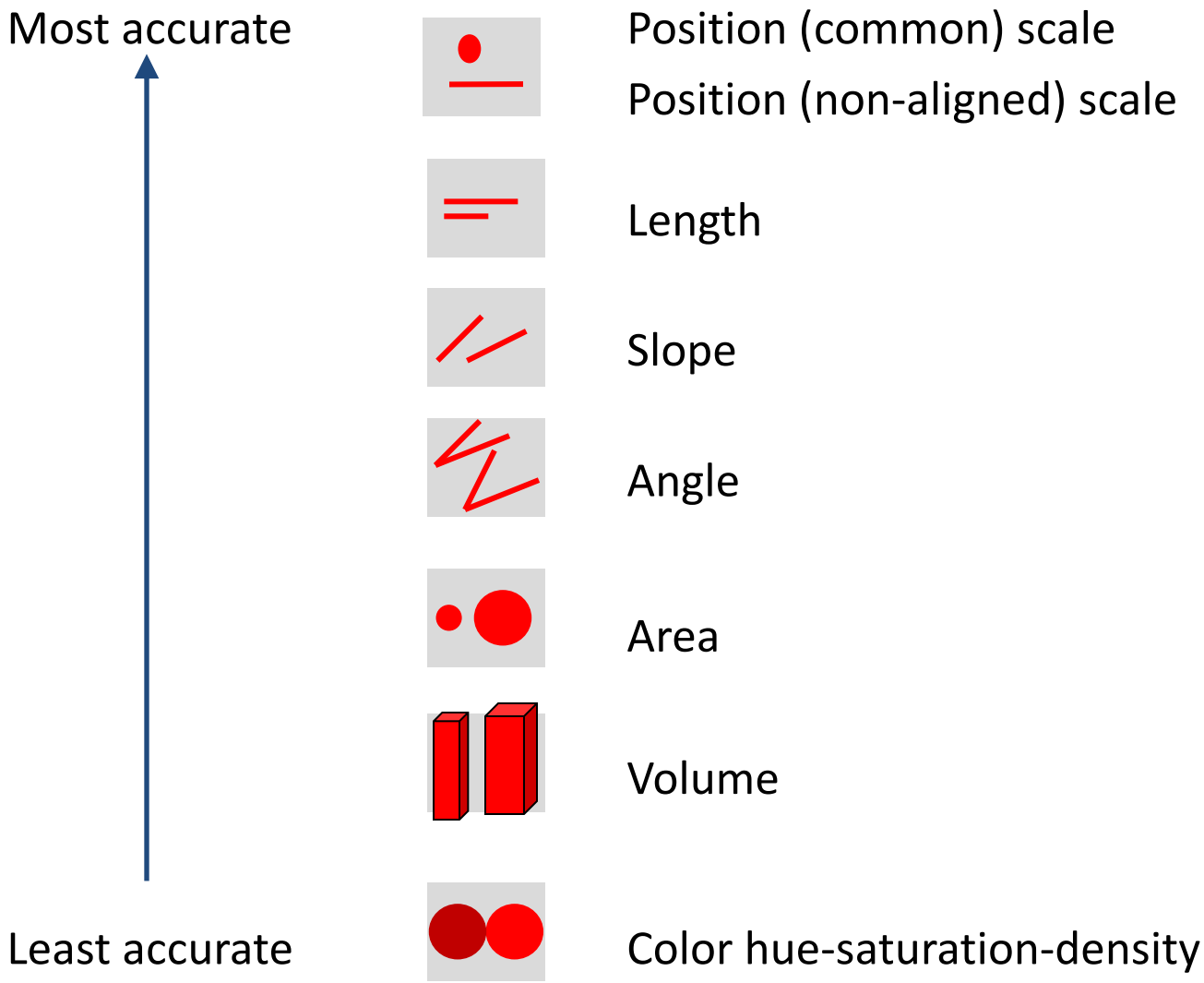
- Beware:
  - Gratuitous 3D
  - Shadows
  - Gratuitous animation
- How do you tell if a feature is gratuitous?
  Ask whether using it reveals more information.

Interactive Chart Design: Simplifying

- With interactive charts you can keep things very simple by **hiding** and **dynamically revealing** important structure.
- On an interactive chart, you reveal the information most useful for **navigating** the chart.



Principle 2: Understand Magnitudes



Principle 3: Use Color

- Color
  - Choose colors based on the information you want to convey
    - Sequential
    - Diverging
    - Categorical
  - Use online resources to discover and record your color schemes
    - Color Brewer
    - Kuler
    - Colour Lovers
  - Where possible, use your organization's palette

Principle 3: Use Color

- Color

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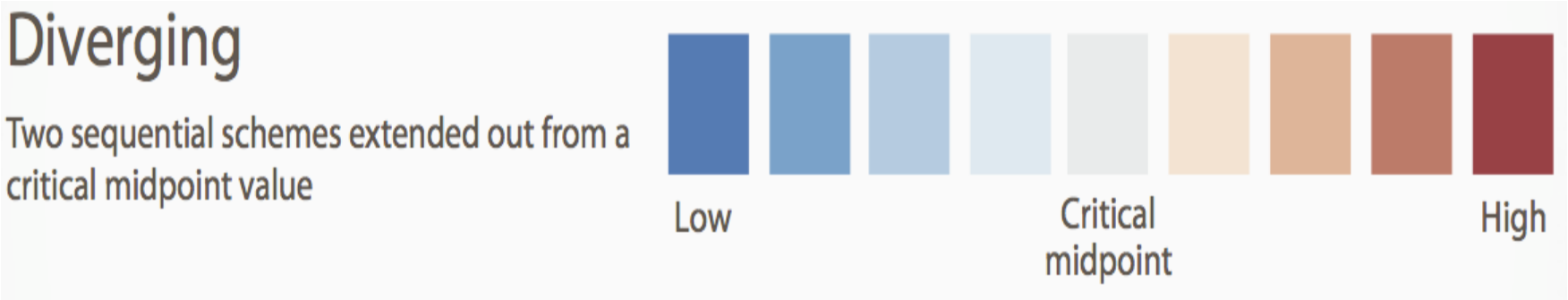
- Color



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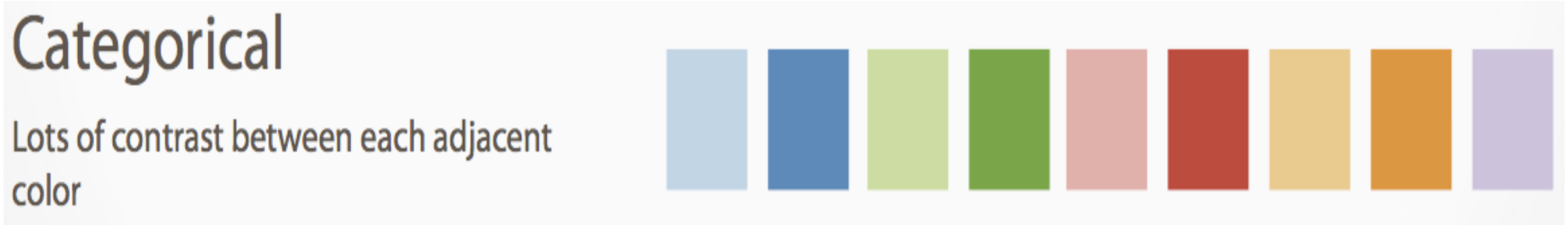
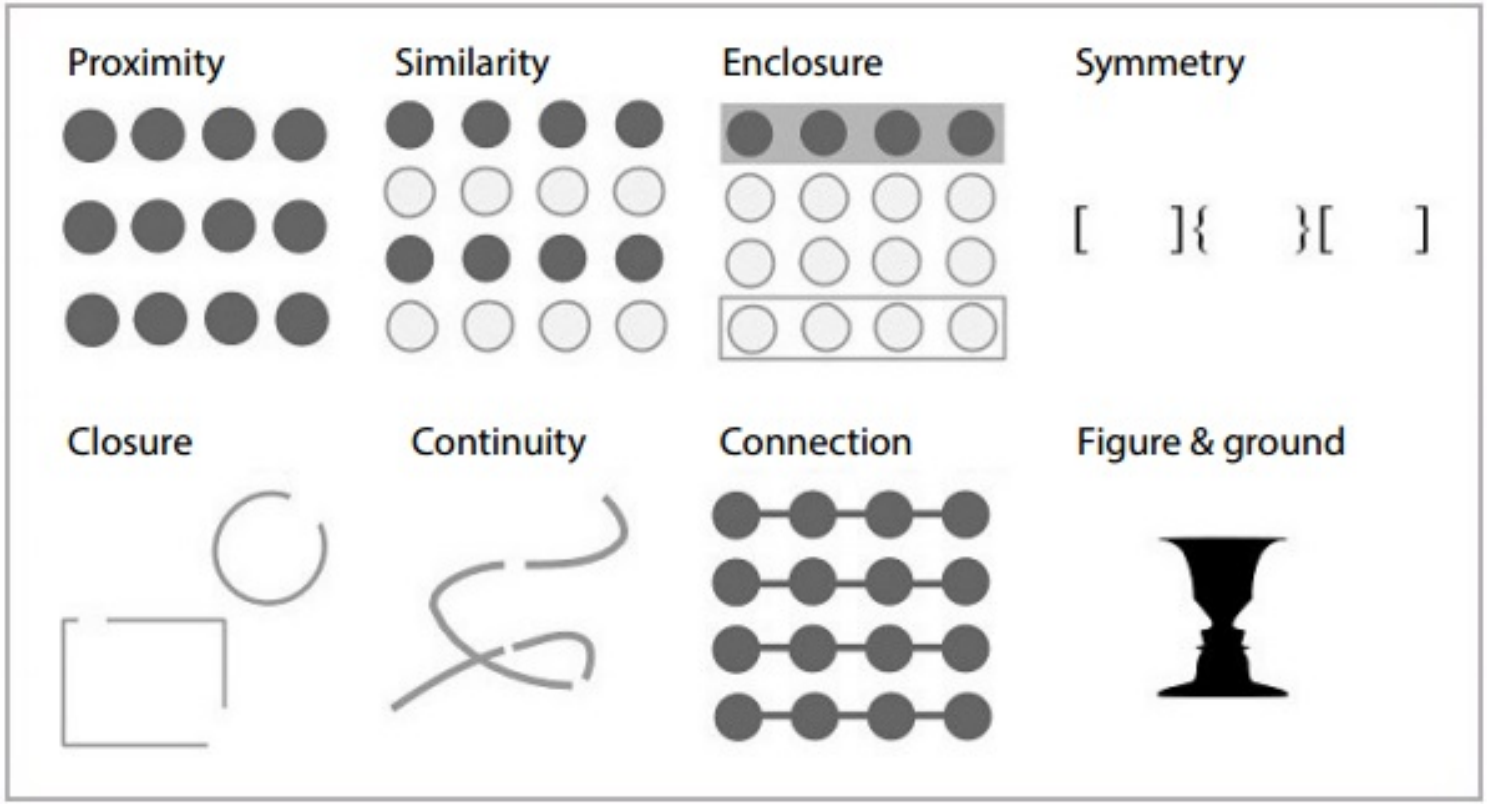


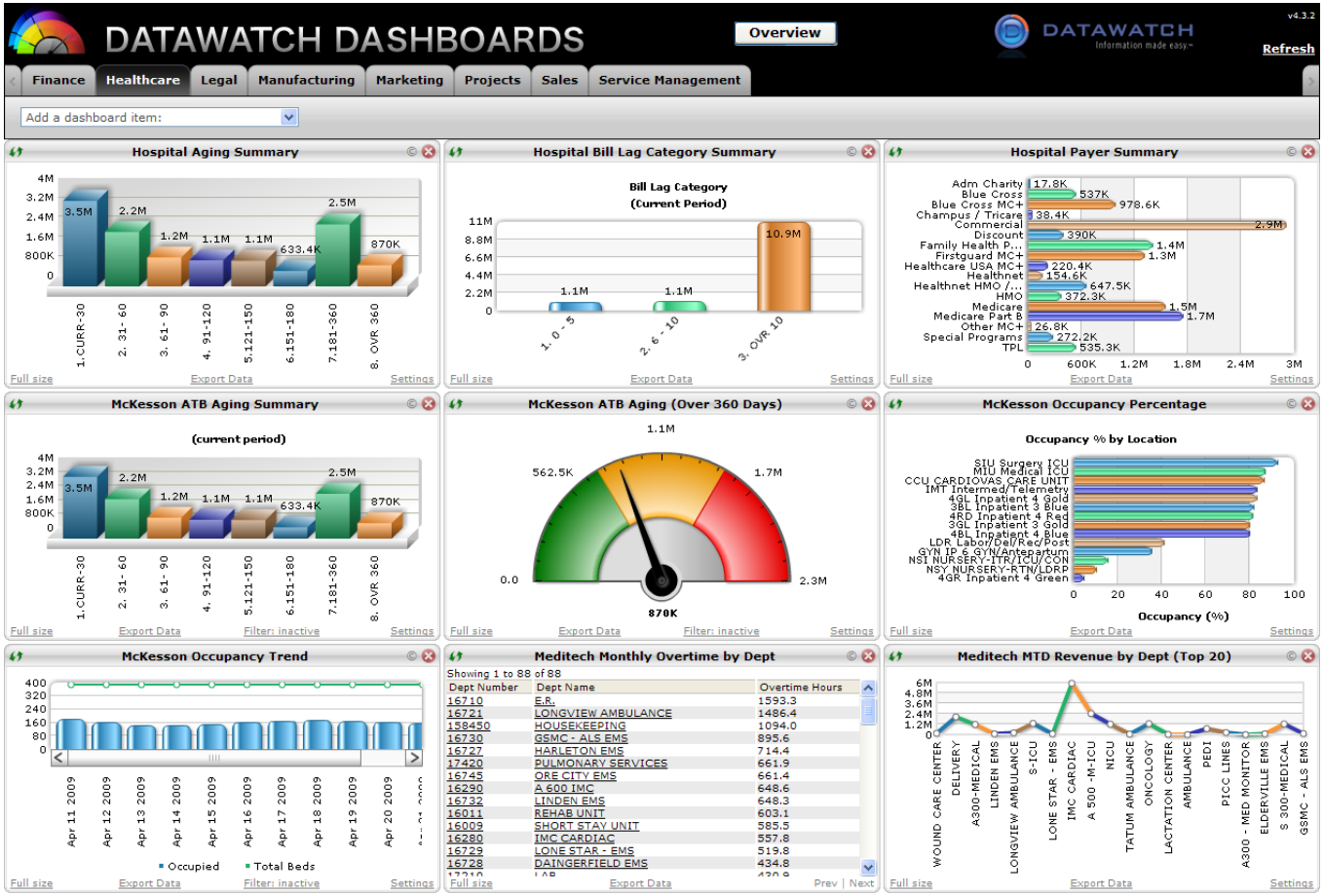
Principle 4: Use Structure

- Gestalt Psychology principles (1912):



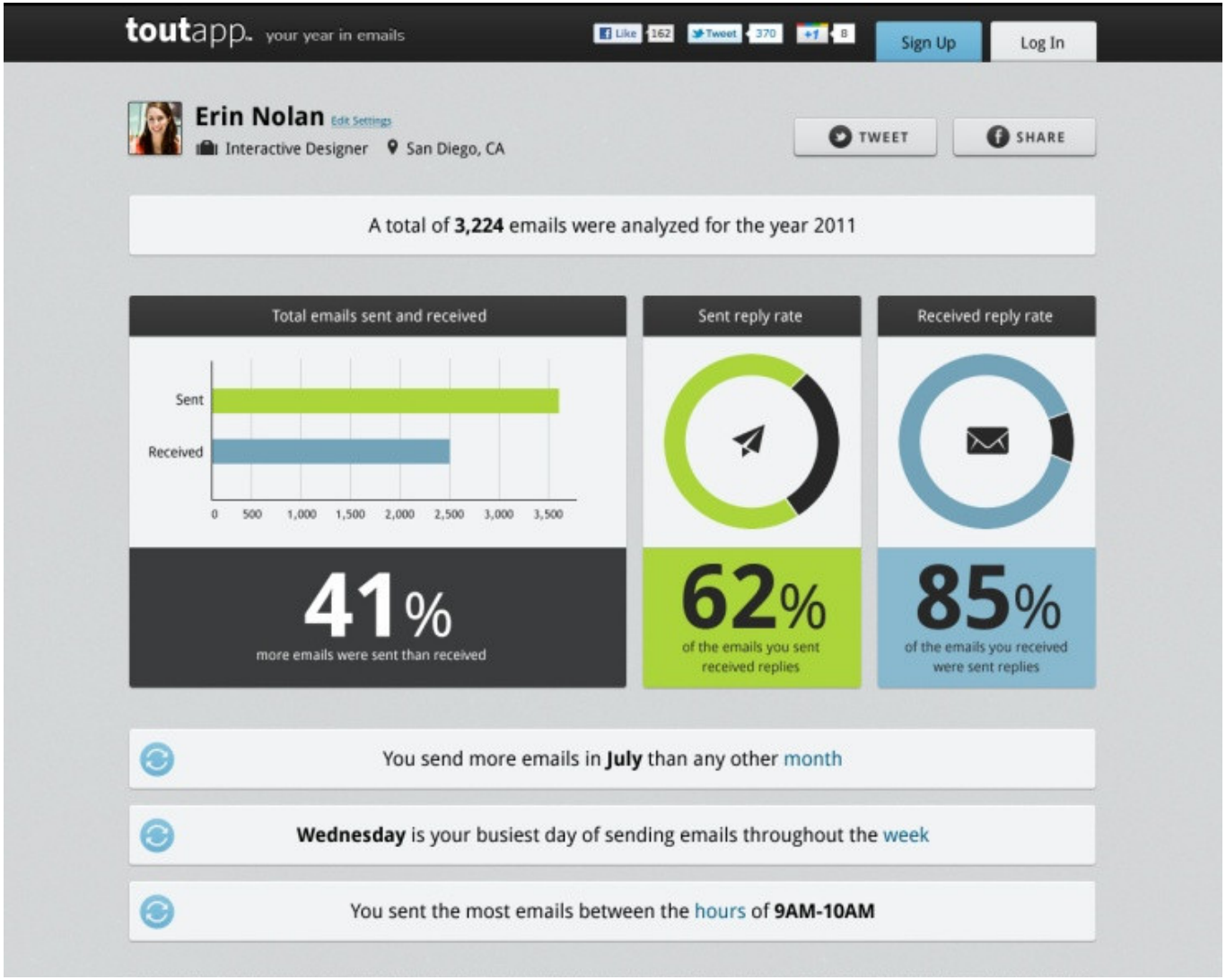
Source http://blog.fusioncharts.com/2014/03/how-to-use-the-gestalt-principles-for-visual-storytelling-podv/

Principle 4: Use Structure (but not like this)



Source https://www.vocalabs.com/blog/my-dashboard-pet-peeve

Principle 4: Use Structure



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