
# Visual Analytics Best Practices

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#tableau8

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4 4 8 3 3 3 5 0 1 0 3 8 6 3 2 0 5 0 6 1 3 3 4 3 6 1 5 8 6
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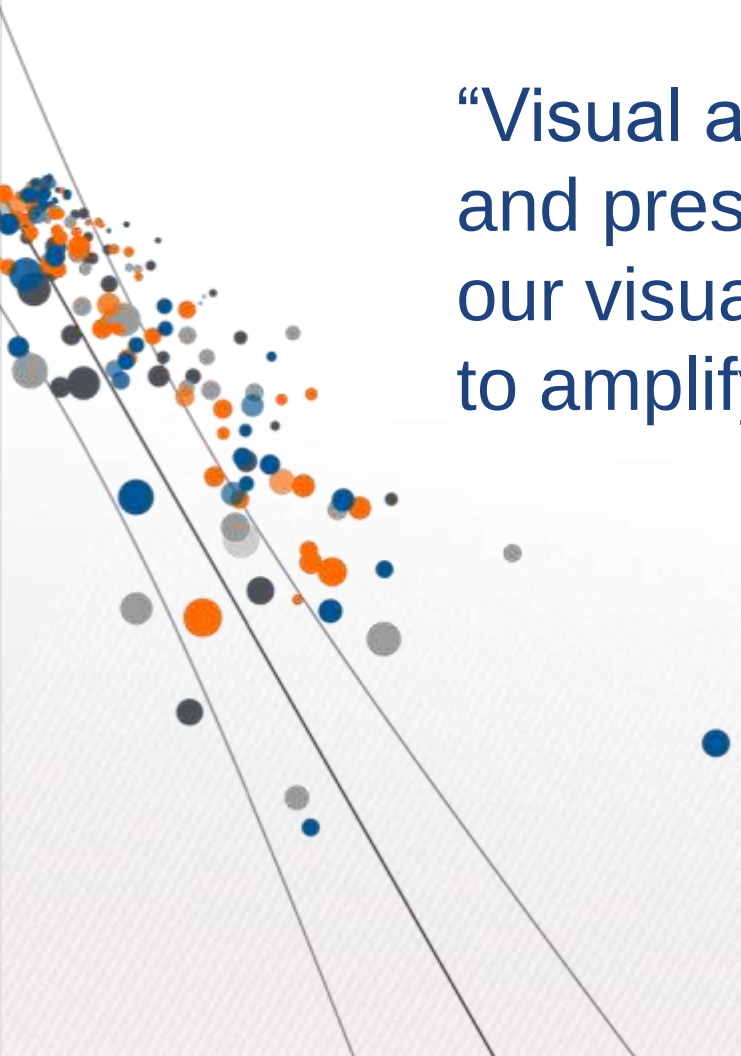
# What is Visual Analytics?



"Visual analytics is the representation and presentation of data that exploits our visual perception abilities in order to amplify cognition."

*- Andy Kirk, author of "Data Visualization: a successful design process"*

# Let’s Look at Some Data

| I | | II | | III | | IV | |
|---|---|---|---|---|---|---|---|
| x | y | x | y | x | y | x | y |
| 10 | 8.04 | 10 | 9.14 | 10 | 7.46 | 8 | 6.58 |
| 8 | 6.95 | 8 | 8.14 | 8 | 6.77 | 8 | 5.76 |
| 13 | 7.58 | 13 | 8.74 | 13 | 12.74 | 8 | 7.71 |
| 9 | 8.81 | 9 | 8.77 | 9 | 7.11 | 8 | 8.84 |
| 11 | 8.33 | 11 | 9.26 | 11 | 7.81 | 8 | 8.47 |
| 14 | 9.96 | 14 | 8.1 | 14 | 8.84 | 8 | 7.04 |
| 6 | 7.24 | 6 | 6.13 | 6 | 6.08 | 8 | 5.25 |
| 4 | 4.26 | 4 | 3.1 | 4 | 5.39 | 19 | 12.5 |
| 12 | 10.84 | 12 | 9.13 | 12 | 8.15 | 8 | 5.56 |
| 7 | 4.82 | 7 | 7.26 | 7 | 6.42 | 8 | 7.91 |
| 5 | 5.68 | 5 | 4.74 | 5 | 5.73 | 8 | 6.89 |

# Let's Look at Some Data

| I | | II | | III | | IV | |
|---|---|---|---|---|---|---|---|
| x | y | x | y | x | y | x | y |
| 10 | 8.04 | 10 | 9.14 | 10 | 7.46 | 8 | 6.58 |
| 8 | 6.95 | 8 | 8.14 | 8 | 6.77 | 8 | 5.76 |
| 13 | 7.58 | 13 | 8.74 | 13 | 12.74 | 8 | 7.71 |
| 9 | 8.81 | 9 | 8.77 | 9 | 7.11 | 8 | 8.84 |
| 11 | 8.33 | 11 | 9.26 | 11 | 7.81 | 8 | 8.47 |
| 14 | 9.96 | 14 | 8.1 | 14 | 8.84 | 8 | 7.04 |
| 6 | 7.24 | 6 | 6.13 | 6 | 6.08 | 8 | 5.25 |
| 4 | 4.26 | 4 | 3.1 | 4 | 5.39 | 19 | 12.5 |
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| 7 | 4.82 | 7 | 7.26 | 7 | 6.42 | 8 | 7.91 |
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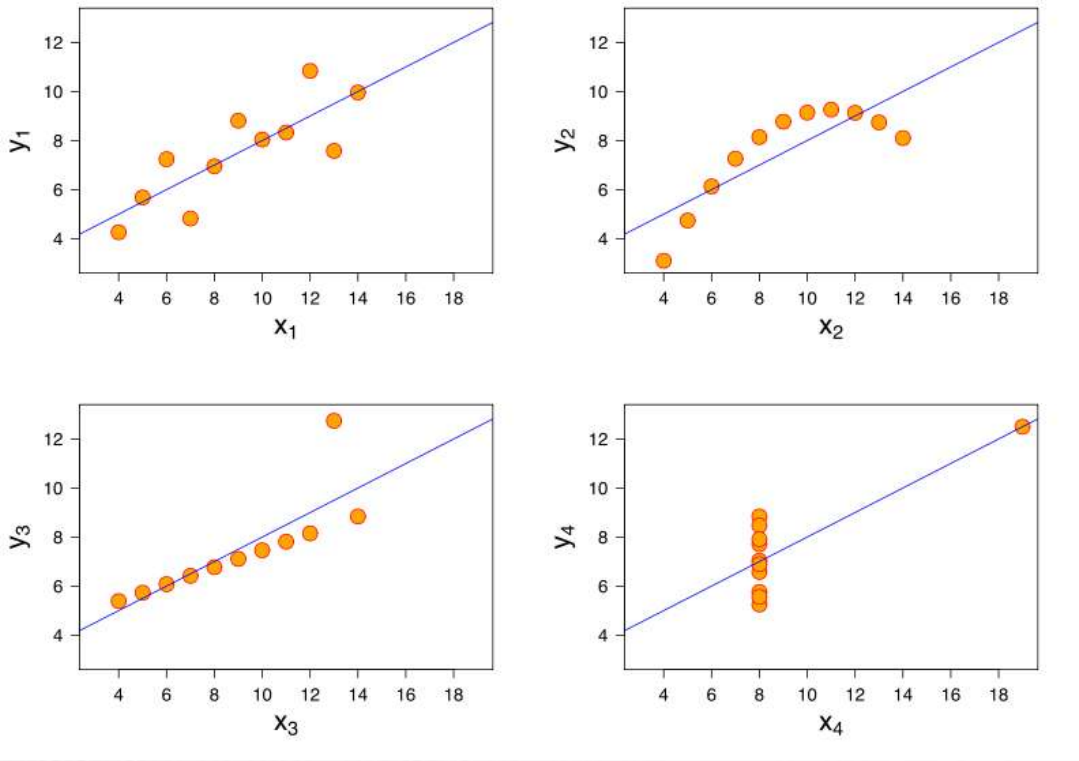
| Property | Value |
|---|---|
| Mean of x in each case | 9 (exact) |
| Variance of x in each case | 11 (exact) |
| Mean of y in each case | 7.50 (to 2 decimal places) |
| Variance of y in each case | 4.122 or 4.127 (to 3 decimal places) |
| Correlation between x and y in each case | 0.816 (to 3 decimal places) |
| Linear regression line in each case | y = 3.00 + 0.500x (to 2 and 3 decimal places, respectively) |

# Let's Look at Some Data … Visually




"Anscombe's Quartet"
Source: Wikipedia

# Agenda

1. Human Perception and Cognition
2. Visual Analysis Cycle
3. Visualization Best Practices

# Human Perception & Cognition

# Humans Are Slow at Mental Math

34
X 72
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# We’re Faster When We Use the World

```
   34
 X 72
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   68
 23[1]80
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 2448
```

# Much Faster

34
X 72
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68
$23^{1}80$
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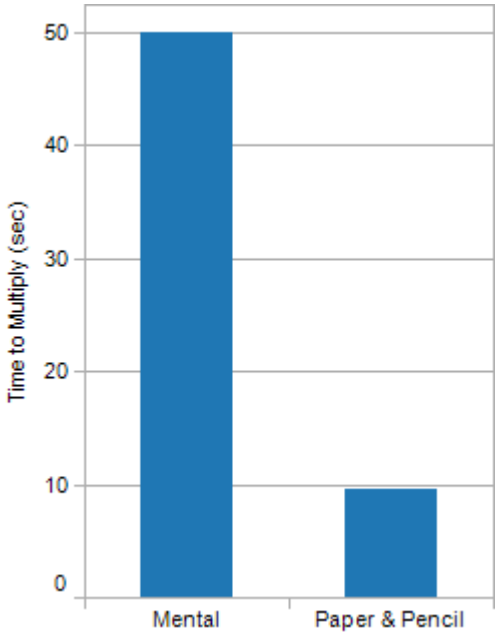
2448



# We're Faster When We Can "See" Data

| | | Customer Segment | | | |
|---|---|---|---|---|---|
| Category | Sub-Category (group) | Consumer | Corporate | Home Office | Small Business |
| Furniture | Bookcases | -63.02 | -9,305.76 | -16,610.95 | -7,602.40 |
| | Chairs & Chairmats | 42,942.97 | 39,370.10 | 41,686.28 | 25,650.38 |
| | Office Furnishings | 12,099.80 | 27,374.47 | 42,196.25 | 18,757.40 |
| | Tables | -12,251.51 | -35,430.73 | -43,292.40 | -8,087.89 |
| Office Supplies | Appliances | 15,501.48 | 50,095.94 | 25,343.06 | 6,217.58 |
| | Binders and Binder Ac.. | 48,035.27 | 125,811.27 | 71,674.19 | 61,892.69 |
| | Envelopes, Labels, Pa.. | 16,907.52 | 31,230.67 | 25,508.13 | 33,476.65 |
| | Pens & Art Supplies | 2,621.68 | 1,670.40 | 1,580.82 | 1,691.88 |
| | Rubber Bands | 271.85 | -353.54 | -93.12 | 72.14 |
| | Scissors, Rulers and .. | -558.10 | -3,330.62 | -2,844.06 | -1,066.47 |
| | Storage & Organization | 5,752.65 | -2,086.83 | -23.24 | 3,021.57 |
| Technology | Computer Peripherals | 14,152.79 | 45,092.93 | 17,771.05 | 17,270.71 |
| | Copiers and Fax | 41,310.35 | 28,654.48 | 29,283.14 | 68,113.50 |
| | Office Machines | 51,454.78 | 180,356.22 | 39,386.23 | 36,515.70 |
| | Telephones and Com.. | 49,781.48 | 120,596.92 | 86,788.72 | 59,784.52 |

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| | Binders and Binder Ac.. | 48,035.27 | 125,811.27 | 71,674.19 | 61,892.69 |
| | Envelopes | 6,731.55 | 15,082.58 | 10,848.34 | 15,520.13 |
| | Labels | 1,349.23 | 5,608.87 | 3,073.87 | 3,645.20 |
| | Paper | 8,826.74 | 10,539.22 | 11,585.92 | 14,311.32 |
| | Pens & Art Supplies | 2,621.68 | 1,670.40 | 1,580.82 | 1,691.88 |
| | Rubber Bands | 271.85 | -353.54 | -93.12 | 72.14 |
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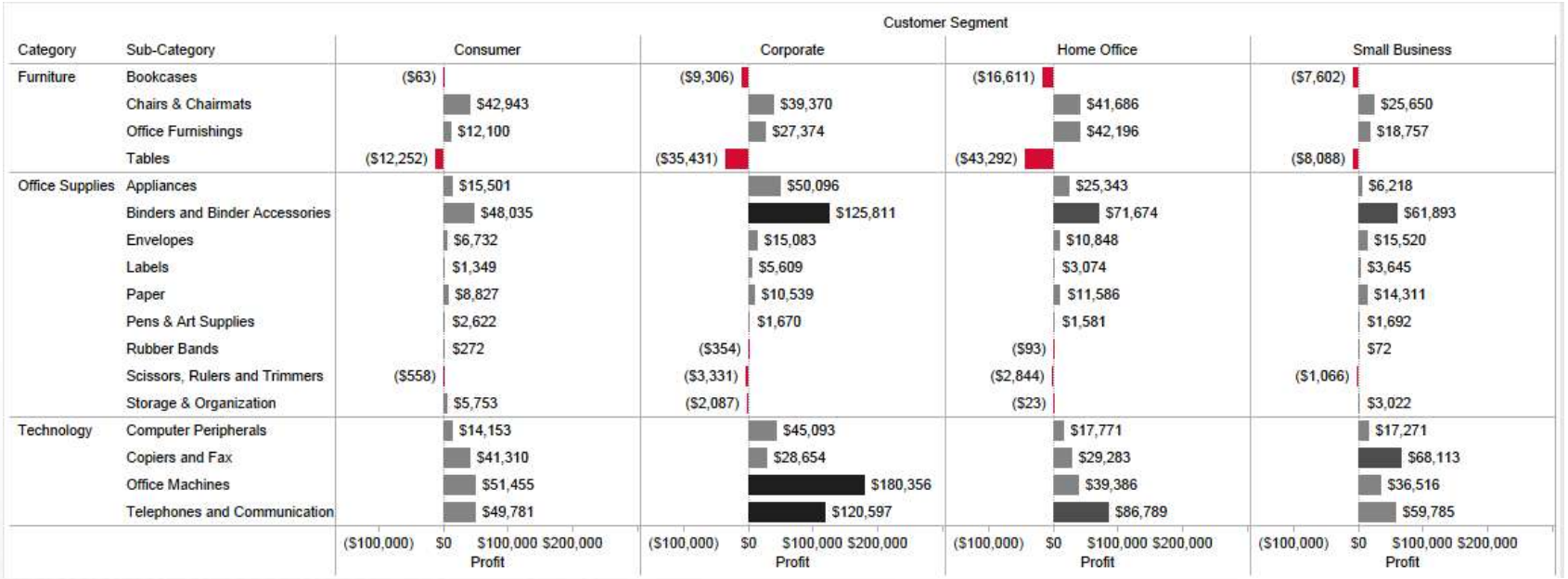
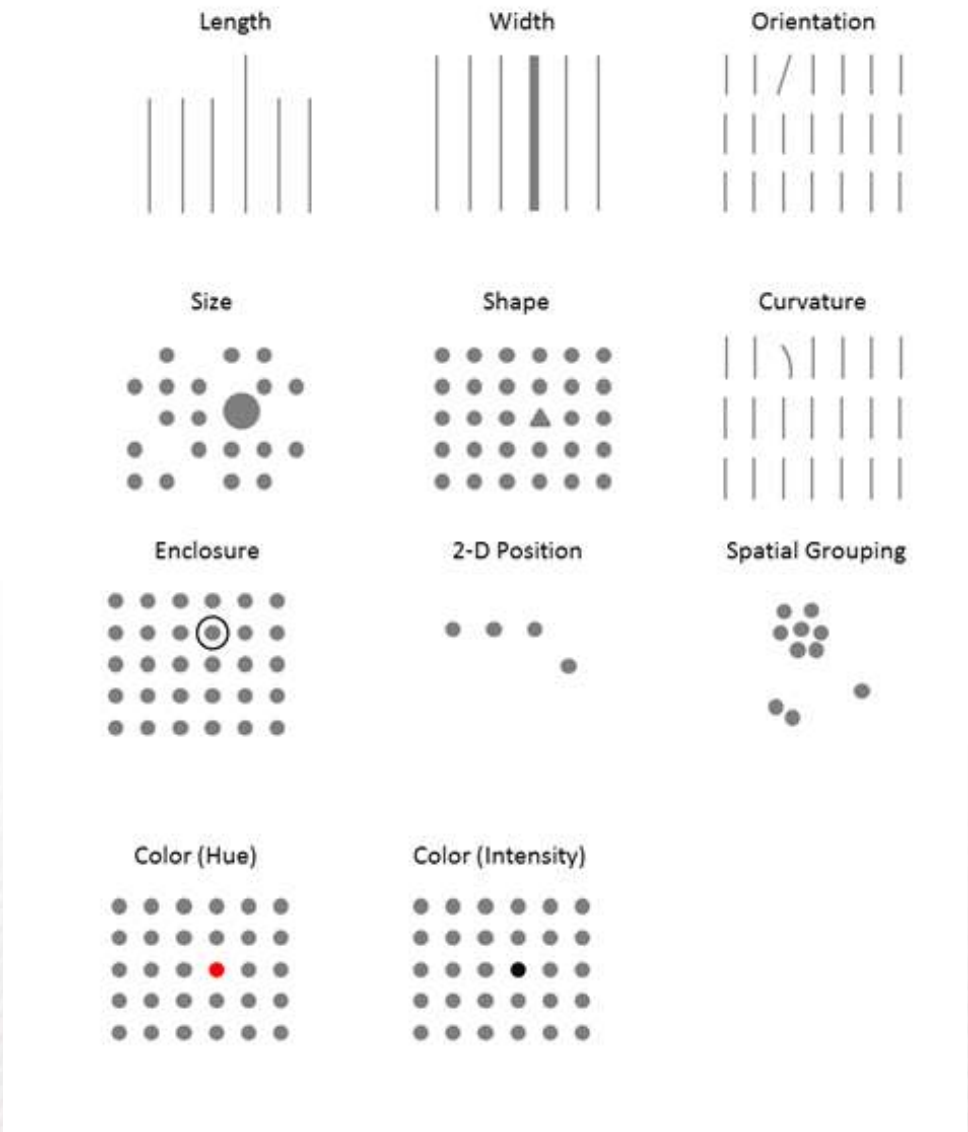
# We're Faster When We Can "See" Data



# Preattentive Visual Attributes



# Visual Interruptions Make People Slow

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# The Cycle of Visual Analysis

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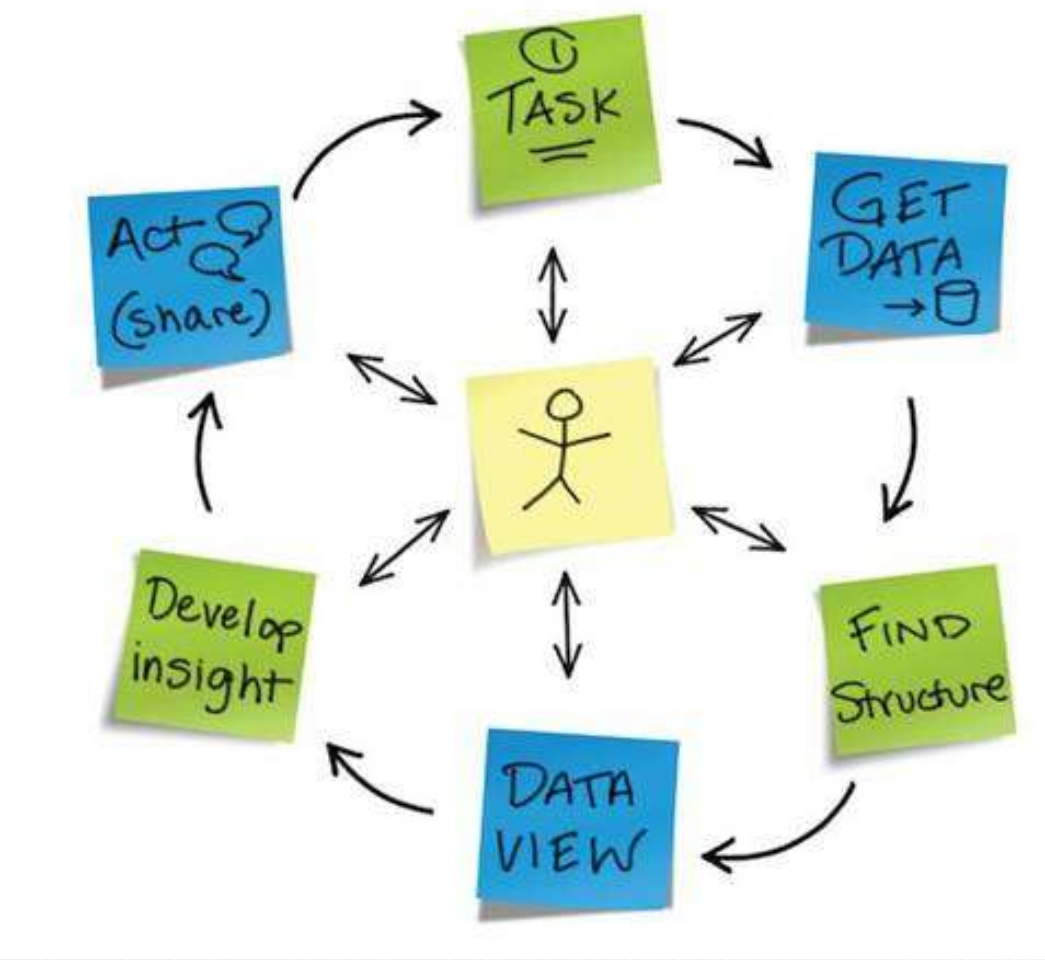
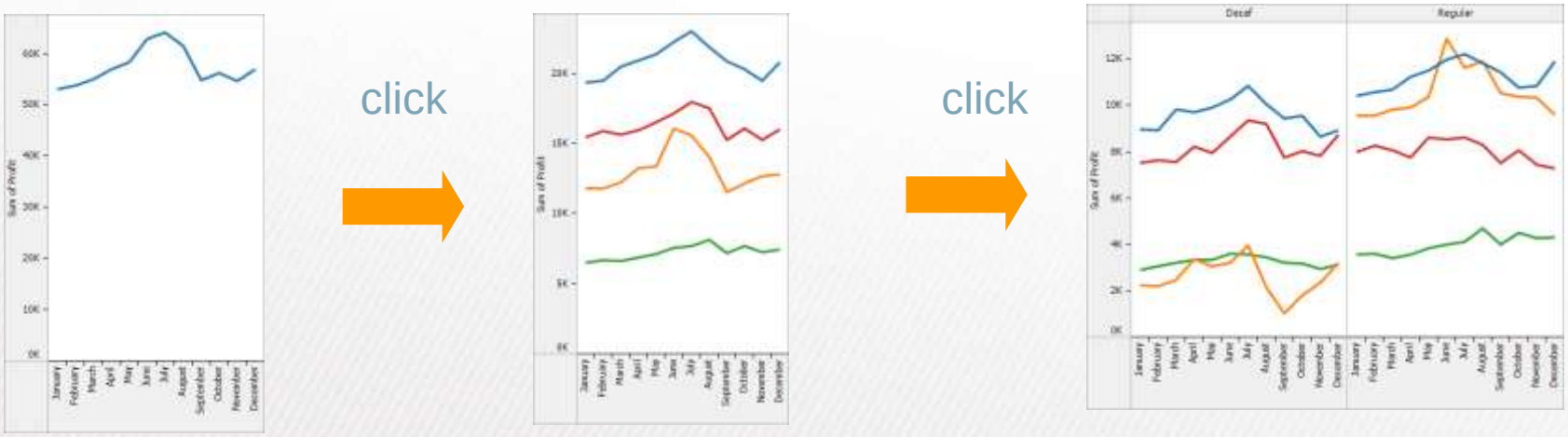


# Supporting the Cycle

- ***Incremental***: allow people to easily and incrementally **change the data** and **how they are looking at it**
- ***Expressive:*** there is **no single view** for all tasks and all data
- ***Unified***: leverage the **revolutionary changes** in database technology
- ***Direct***: **make the tool disappear** so the user can **directly interact** with the data



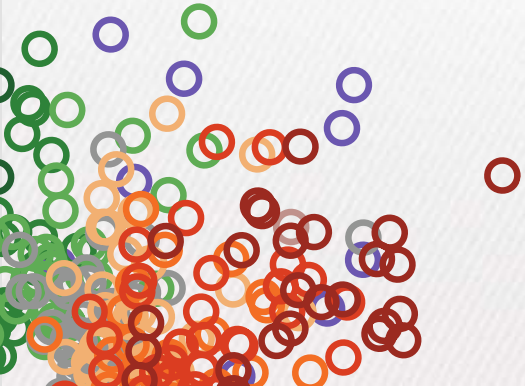
# Visualization Best Practices

# Best Practices Overview

1. Representing data for humans
2. Color
3. Maps
4. Creating dashboards

# Types of Data

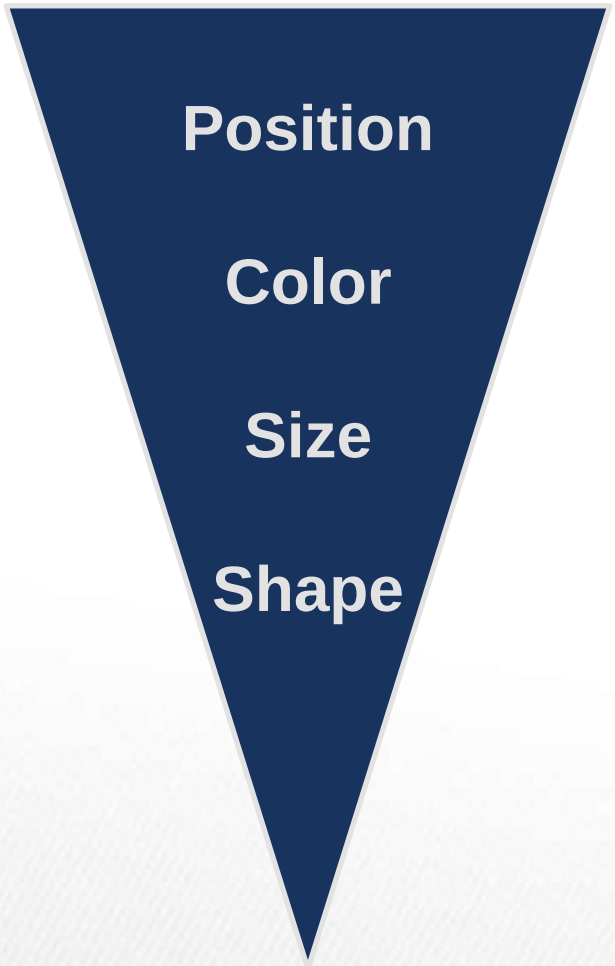
- Qualitative (nominal / categorical)
  - Arizona, New York, Texas
  - Sarah, John, Maria
  - Coors, Bud Light, Stella Artois
- Qualitative (ordinal)
  - Gold, silver, bronze
  - Excellent health, good health, poor health
  - Love it, like it, hate it
- Quantitative
  - Weight (10 lbs, 20 lbs, 5000 lbs)
  - Cost ($50, $100, $0.05)
  - Discount (5%, 10%, 12.8%)



# How Do Humans Like Their Data?

| Quantitative | Ordinal | Categorical |
| --- | --- | --- |
| Position | Position | Position |
| Length | Size | Shape |
| Size | Color Intensity | Different Colors |
| Color Intensity | *Different Colors | |
| | *Shape | |

# How Do Humans Like Their Data?

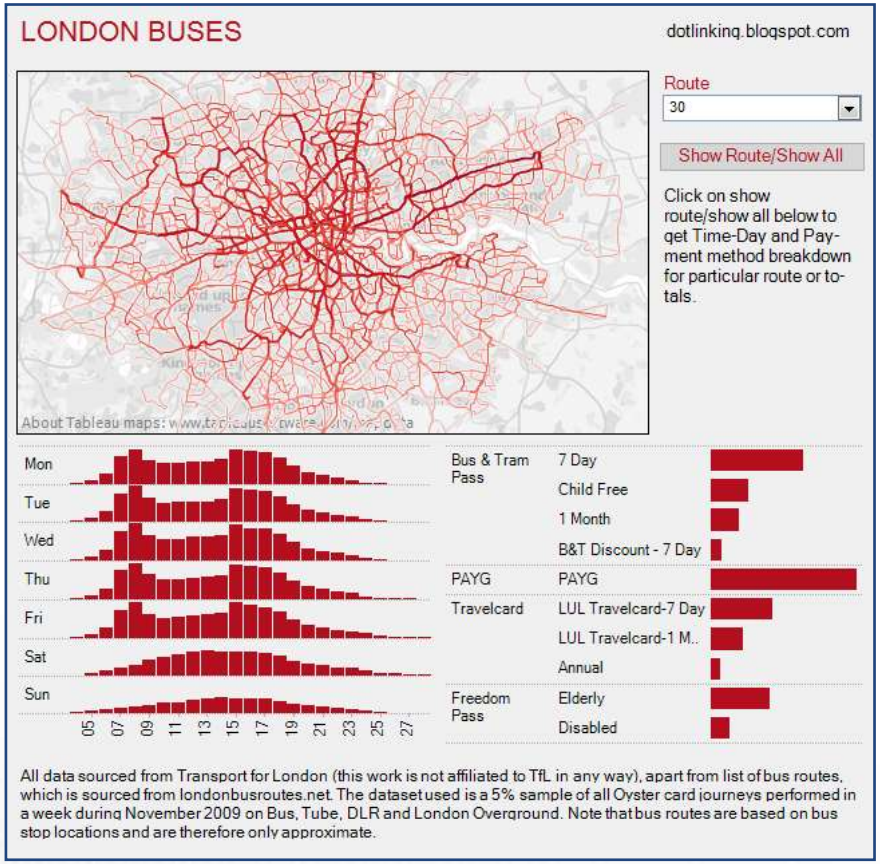



*More important*

*Less important*

# How Do Humans Like Their Data?

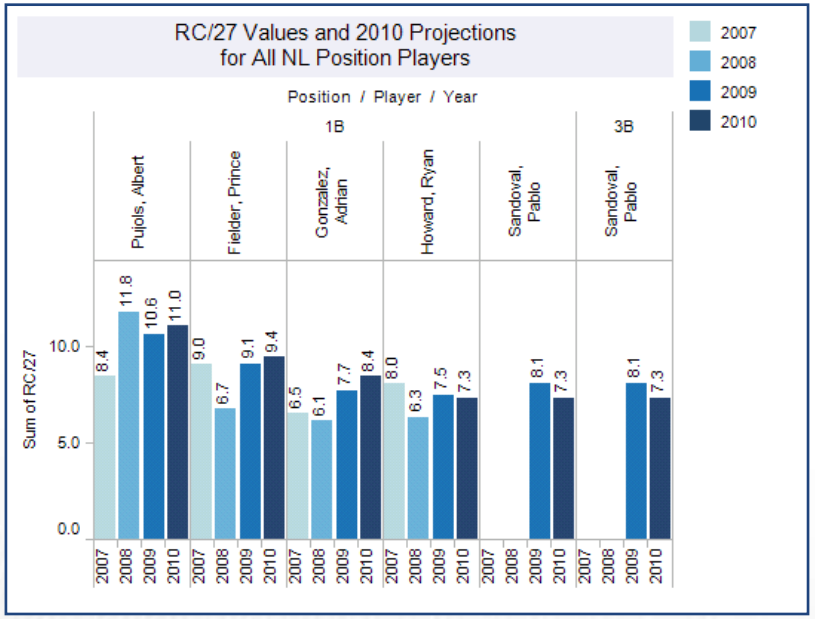
- ***Time***: on an x-axis
- ***Location***: on a map
- ***Comparing values***: bar chart
- ***Exploring relationships***: scatter plot
- ***Relative proportions***: treemap



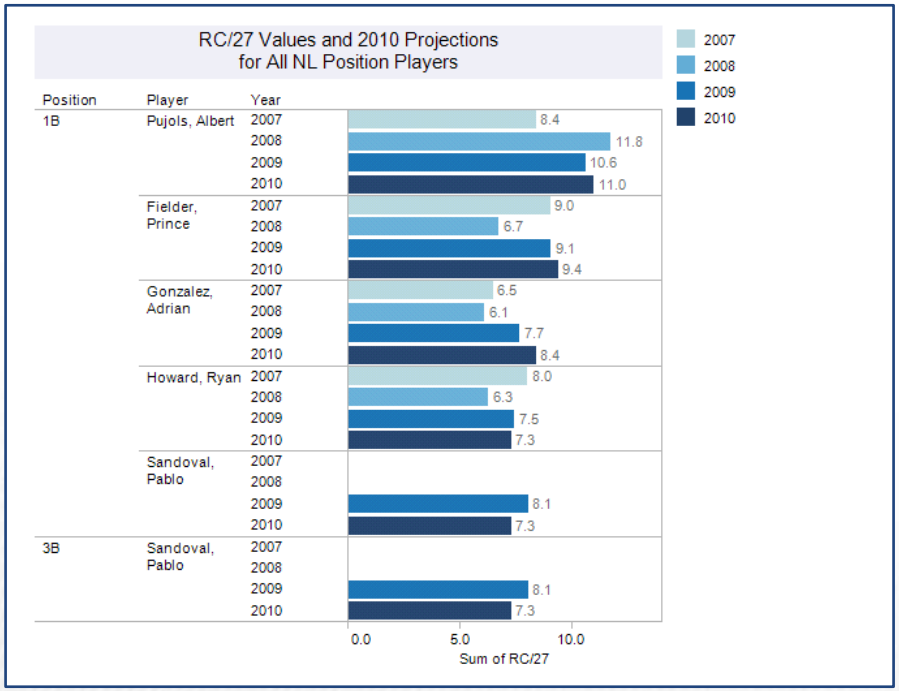
# How Do Humans Like Their Data?

## Orient data so people can read it easily

Good




*Better*

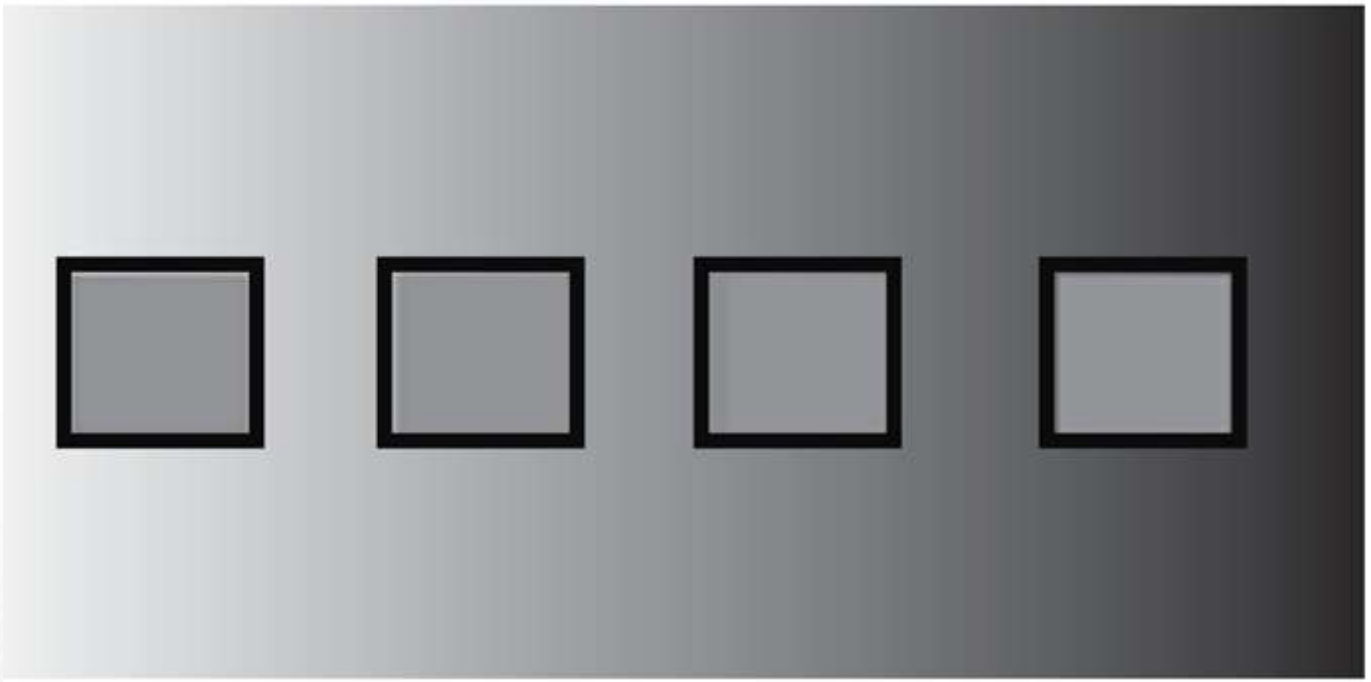


# Color Me Impressed

## Color perception is relative, not absolute

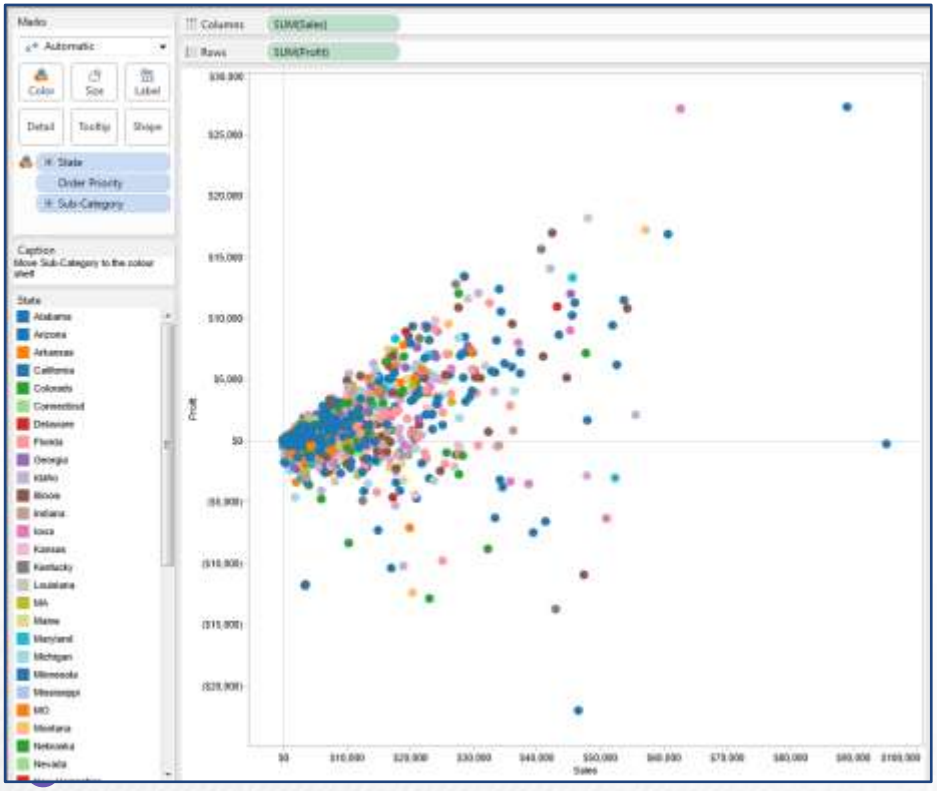
# Color Me Impressed

## Provide a consistent background



# Color Me Impressed

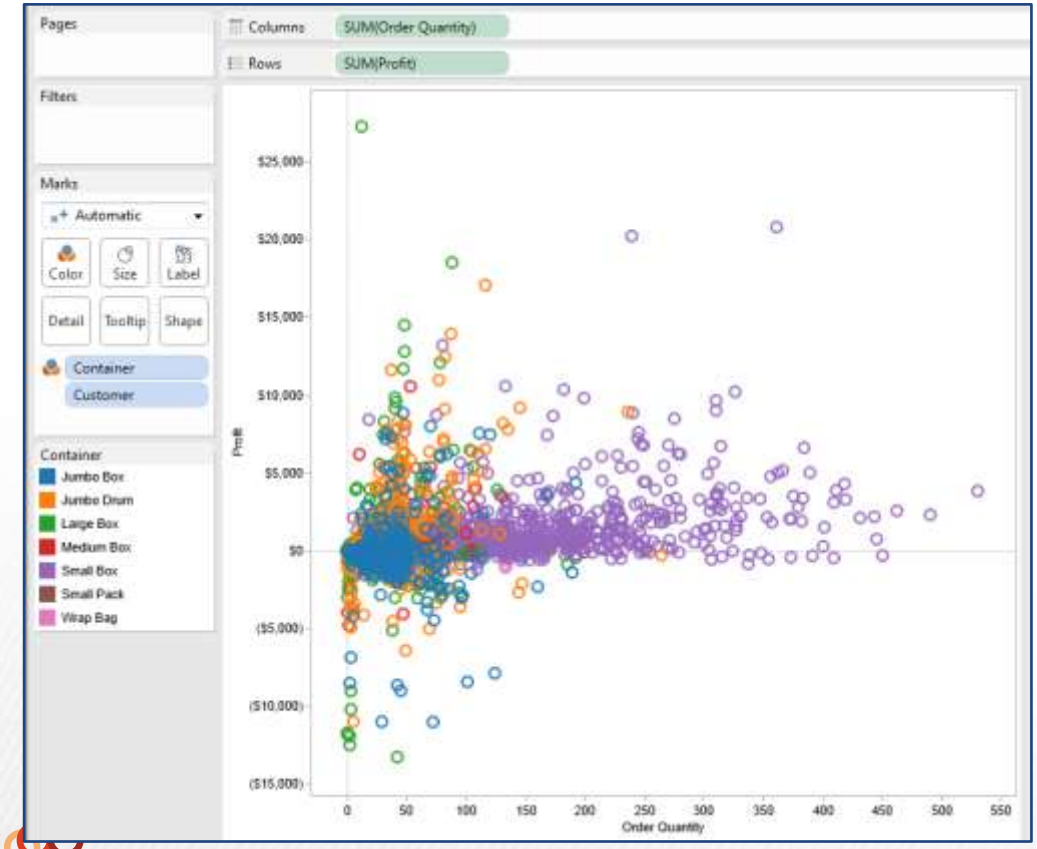
## Humans can only distinguish ~8 colors




*This is not helpful.*

# Color Me Impressed

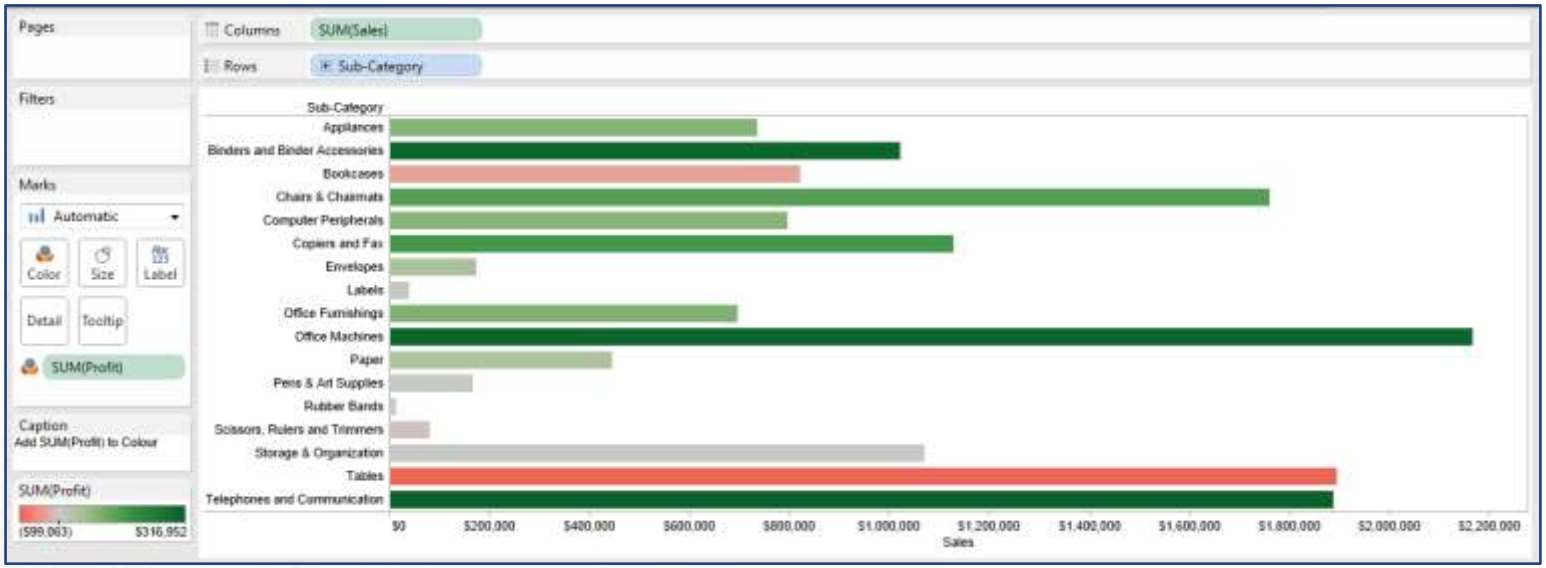
## Humans can only distinguish ~8 colors




*This is helpful.*

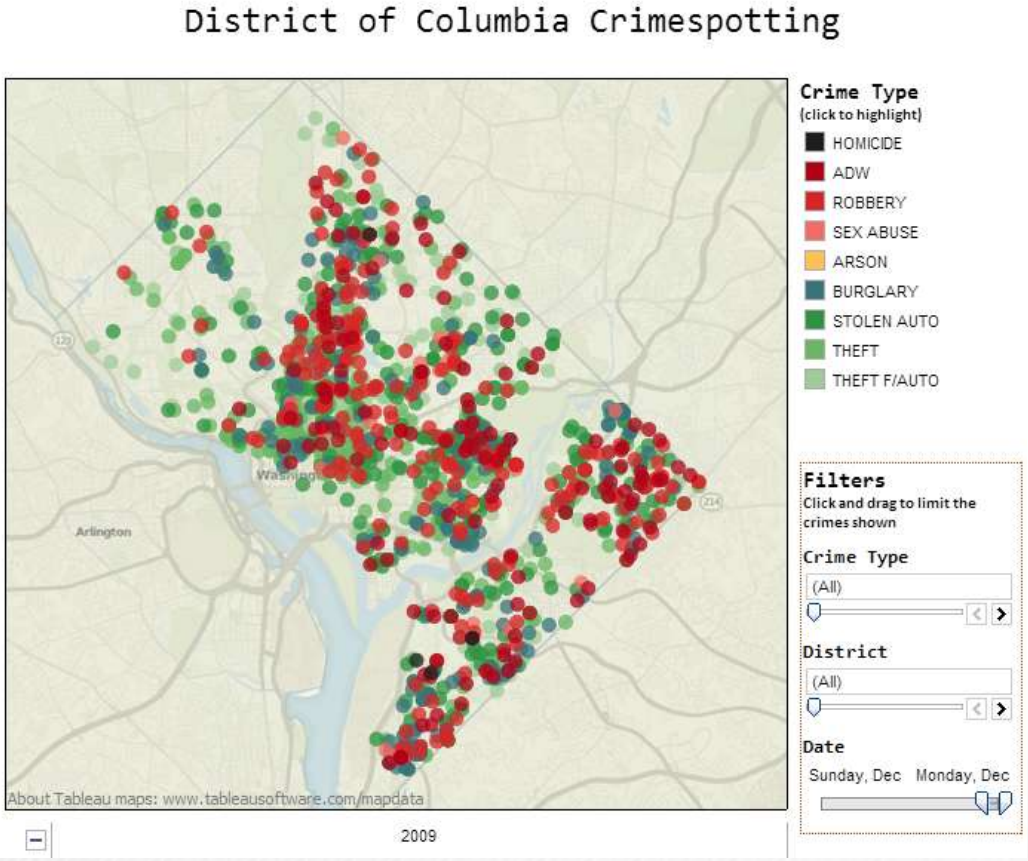
# Color Me Impressed

## For quantitative data, color intensity and diverging color palettes work well



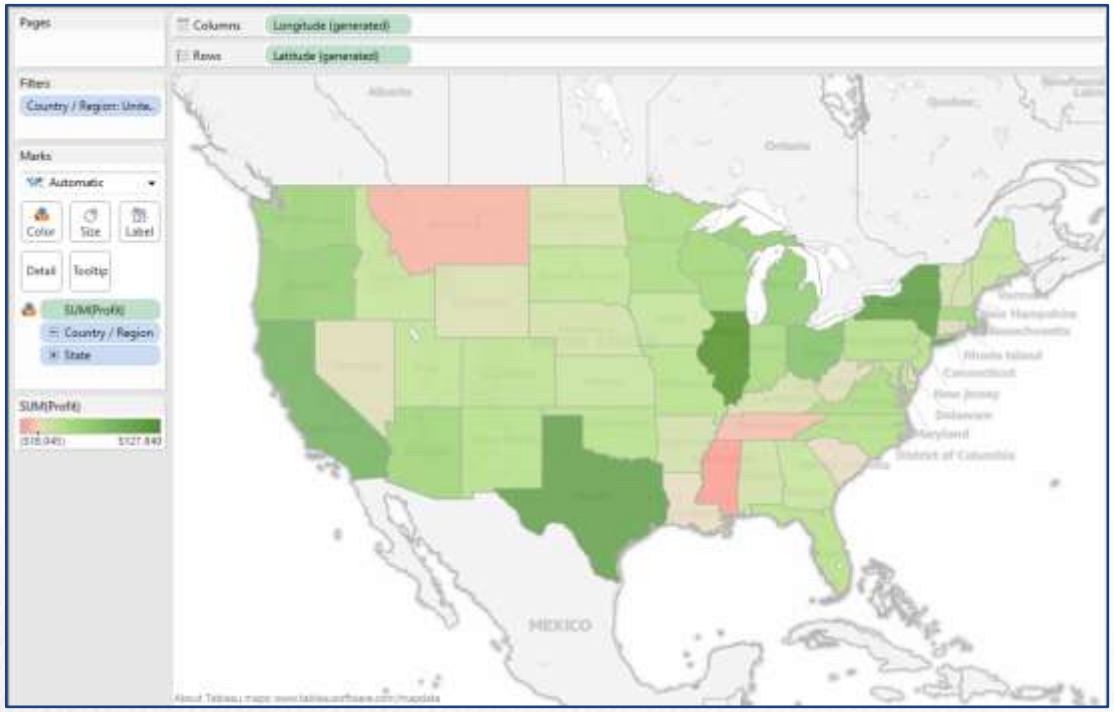
# Mapping to Insight

## Use maps when location is relevant



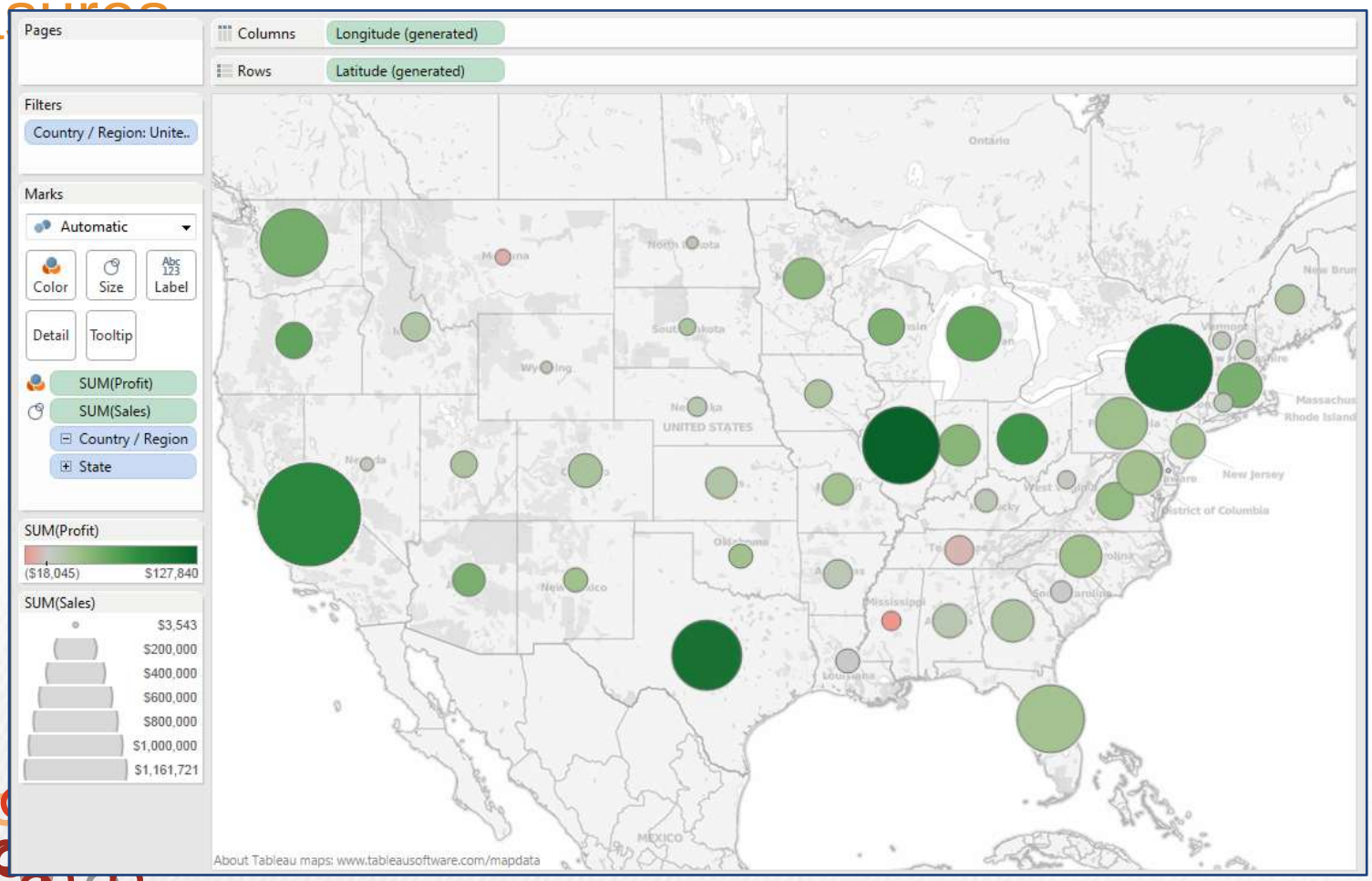
# Mapping to Insight

## Use filled maps (“cloropleths”) for defined areas and only ONE measure



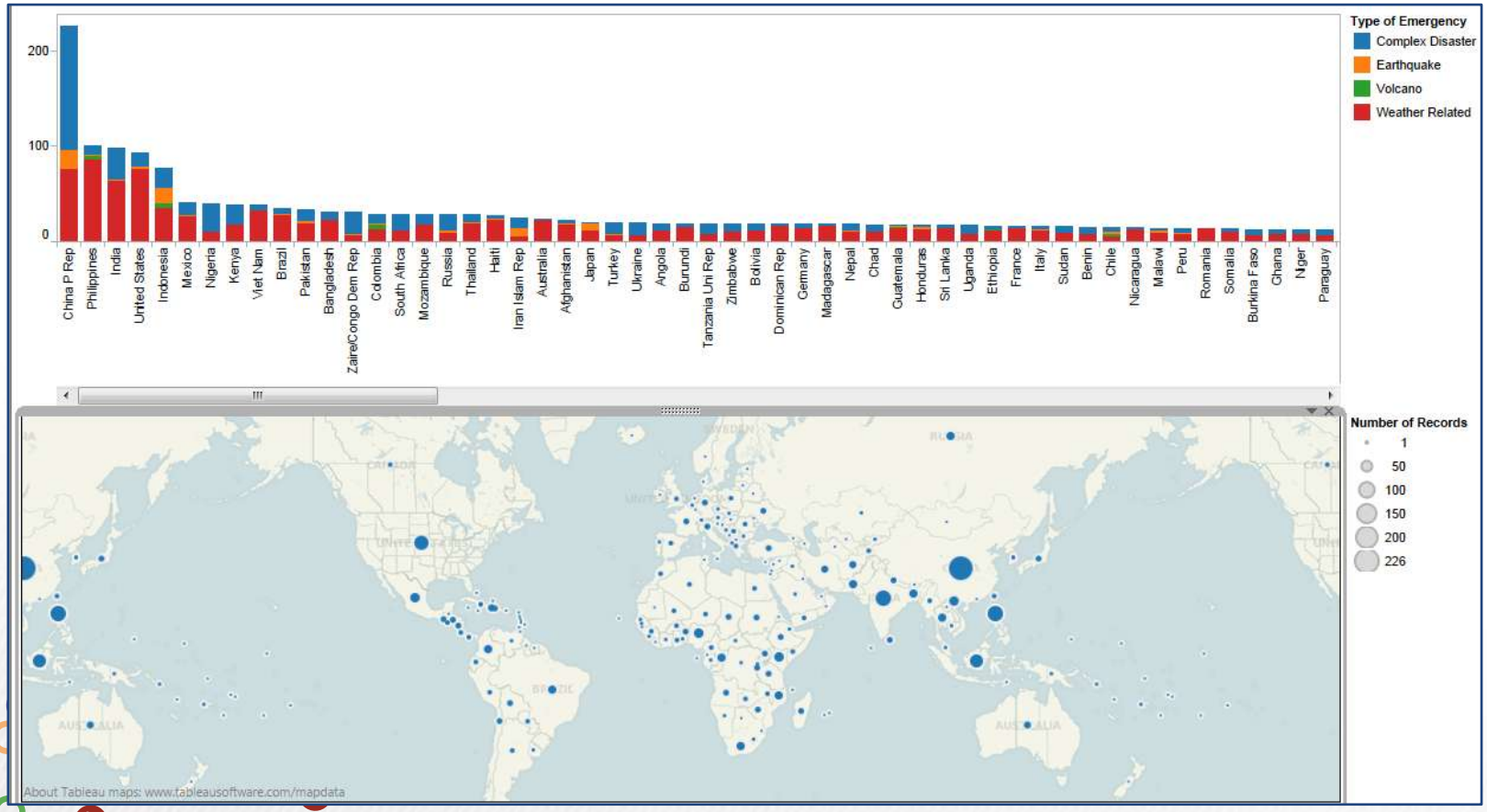
# Mapping to Insight

## Filled maps won't work for multiple measures



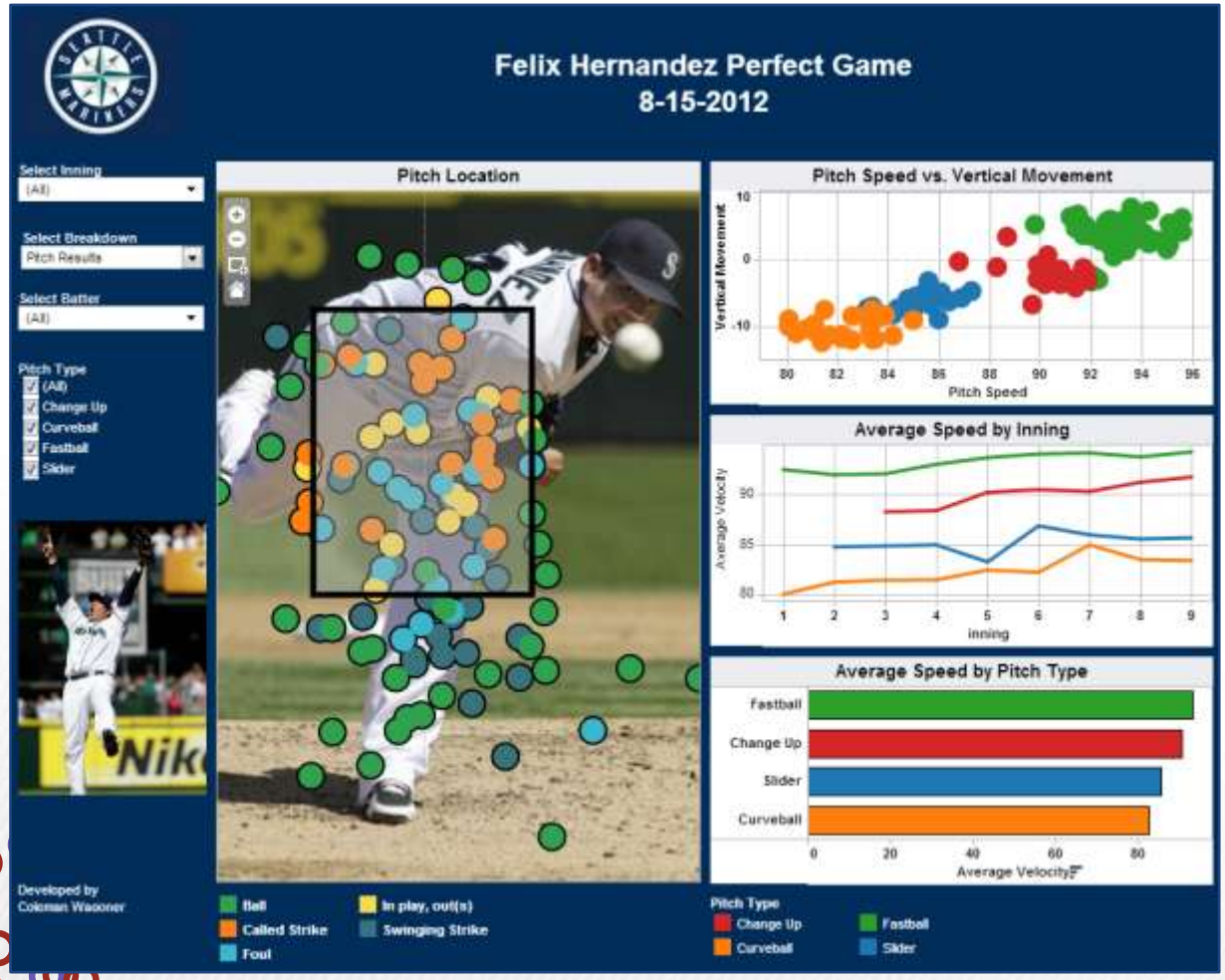
# Mapping to Insight

## Don’t use maps just because you can



# Mapping to Insight

## Maps don’t have to be geographic

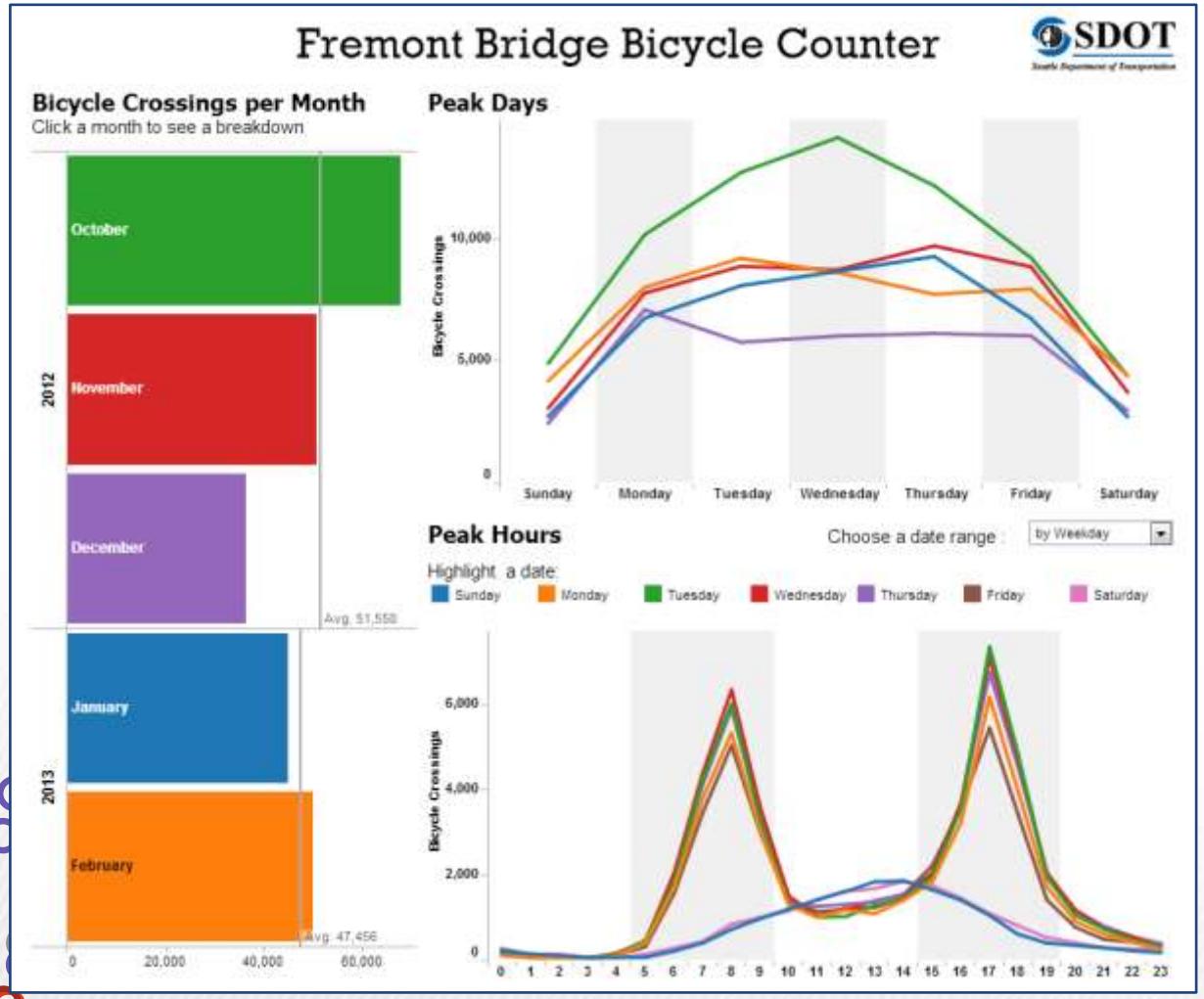


# Mapping to Insight

## Maps don’t have to be geographic

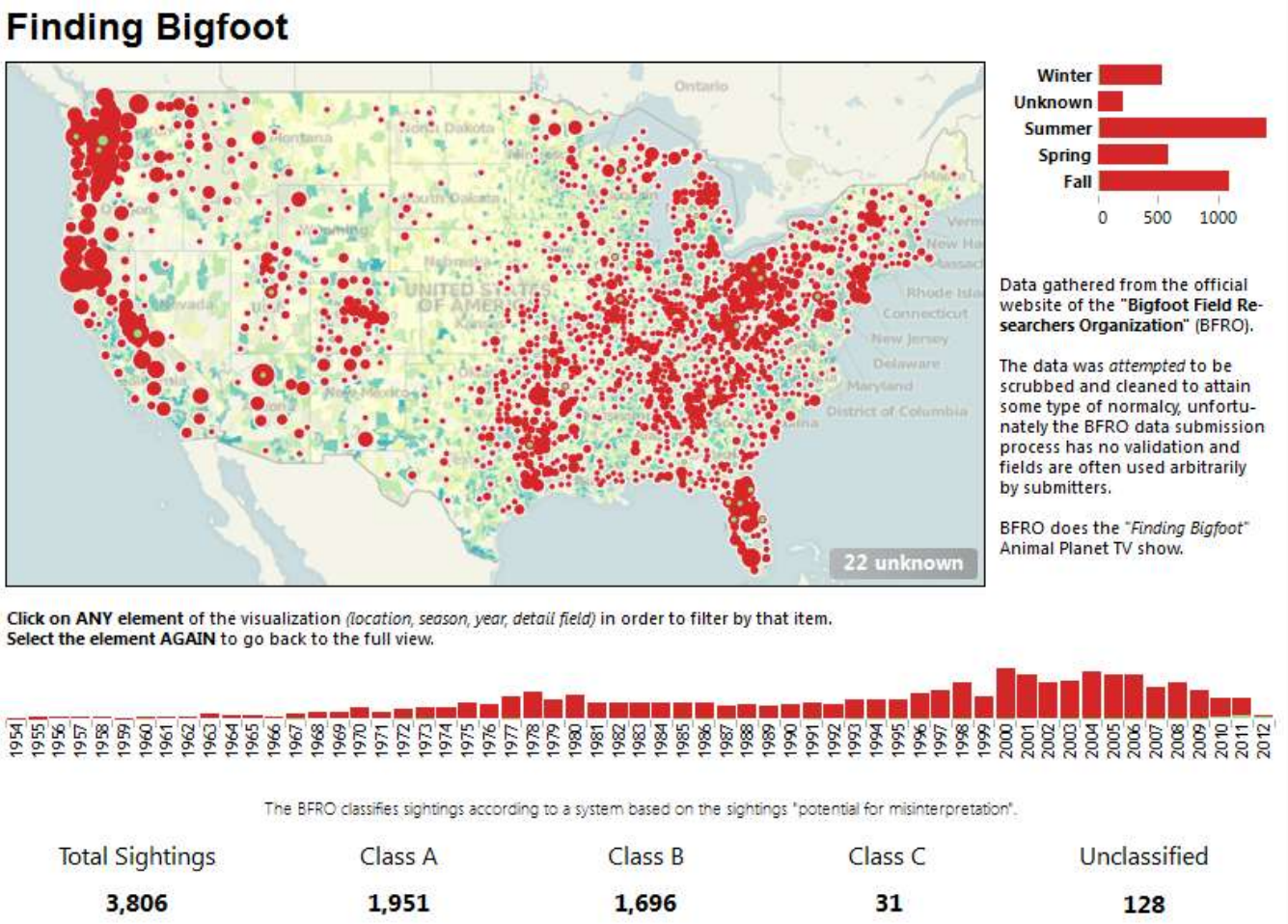
# Dashboards

## Dashboards bring together multiple views



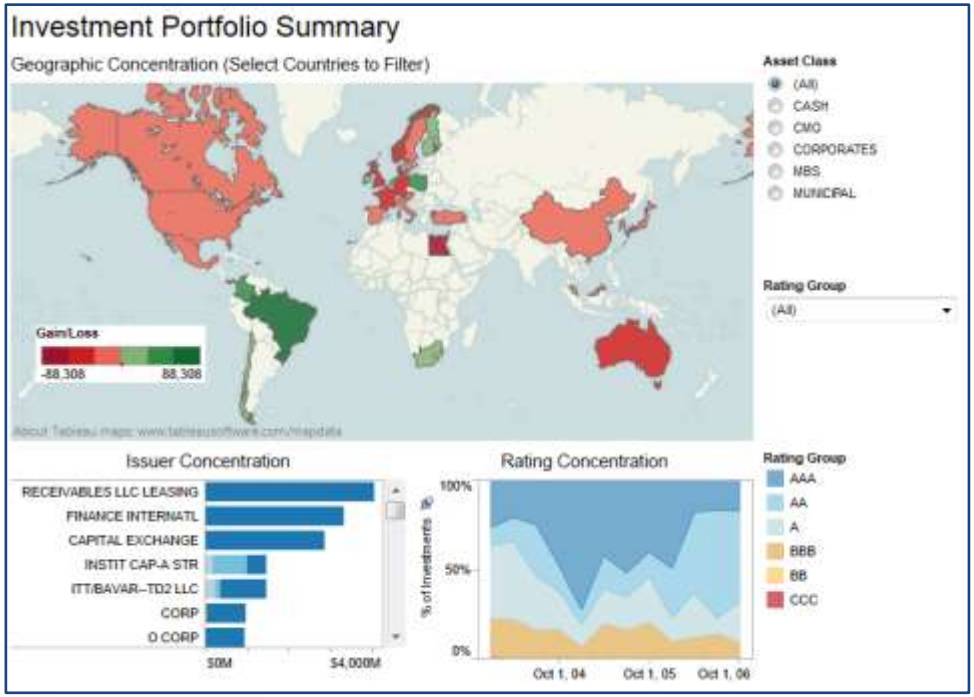
# Dashboards

## Dashboards should pass the 5-second test



# Dashboarding for the 5-second Test

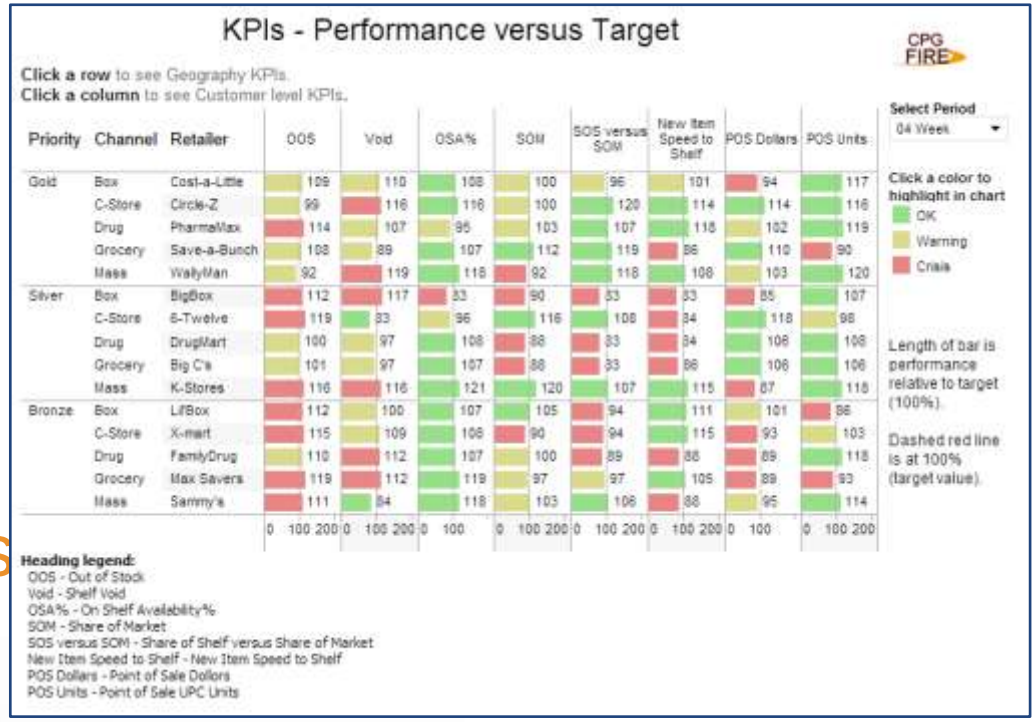
- Most important view goes on top or top-left
- Legends go near their views
- Avoid using multiple color schemes on a single dashboard
- Use 5 views or fewer in dashboards
- Provide interactivity



# Dashboarding for the 5-second Test

Use your words!

- Titles
- Axes
- Key facts and figures
- Units
- Remove extra digits in numbers
- Great tooltips



Help **people**
**see** and **understand**
their **data**