

# Lecture 4

## **Data Visualization**

- Demo: Baby Name Voyager
- Common DataVis Display Types

## **Visual DataStory Principles**

- Pie Chart | Bar Chart | Line Chart | Scatterplots | Multi-Dimensional

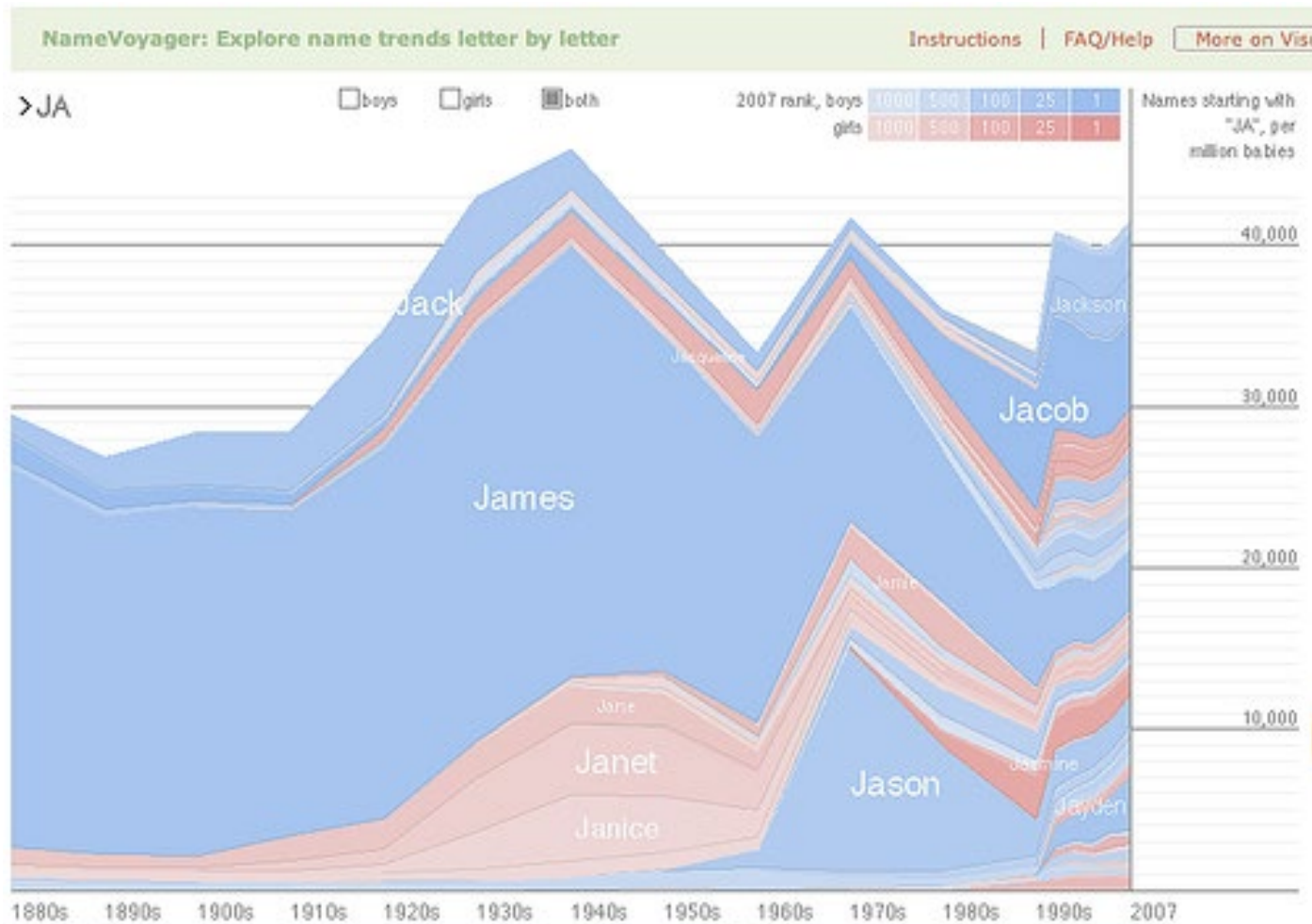
## **Motion Chart**

- 1<sup>st</sup> Visualization Assignment = Create Motion Chart using Tableau

## **DataVis Programming (optional)**

- 1<sup>st</sup> Visualization Assignment = OPTION DataVis prog. Using D3.js

# Demo – Baby Names Voyager

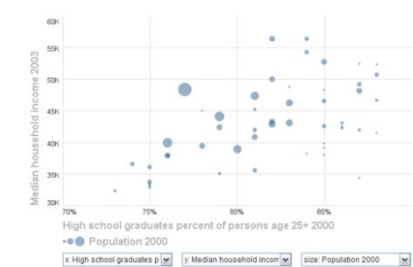
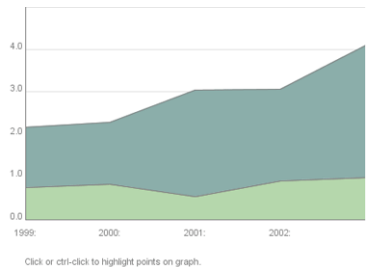
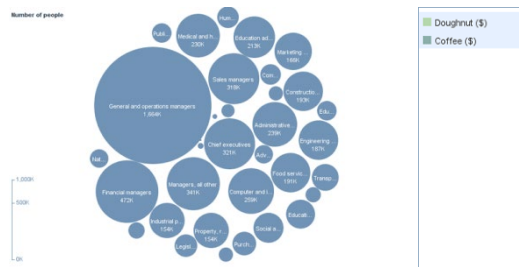
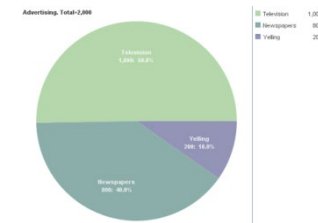
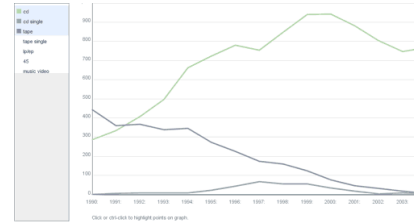
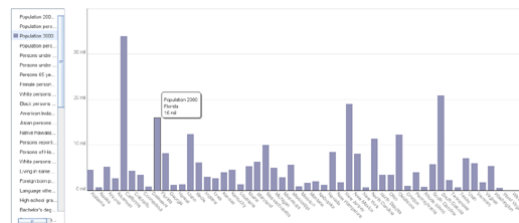
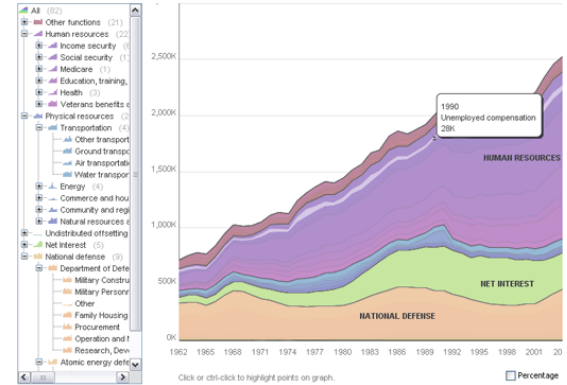


<http://www.babynamewizard.com/voyager>

# Data Visualization – Common Display Types

## Common Display Types

- Bar Charts 
- Line Charts 
- Pie Charts 
- Bubble Charts 
- Stacked Charts 
- Scatterplots 



# Visual DataStory Principles

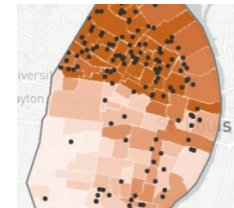
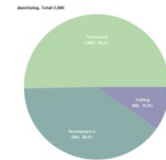
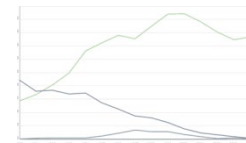
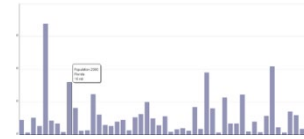
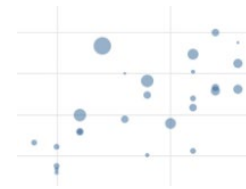
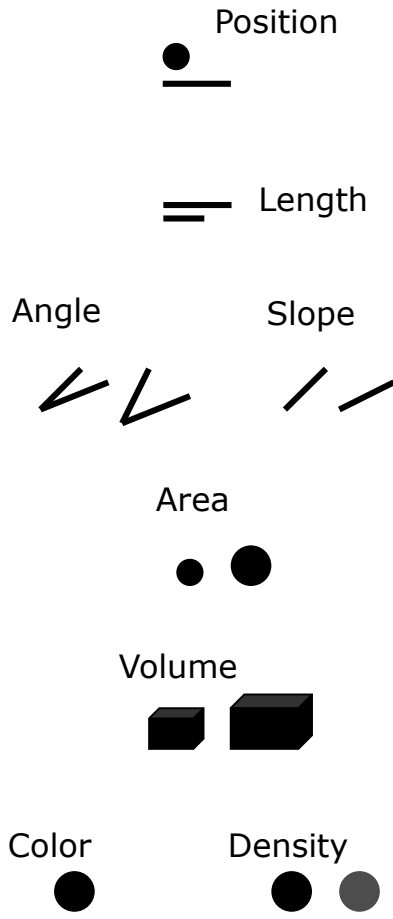
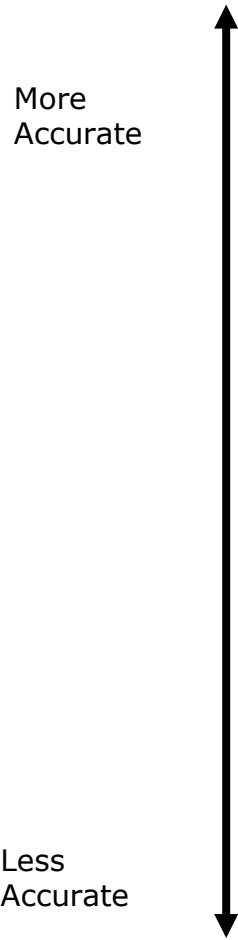
## **General Design Principles**

- **Leverage Effectiveness** of Different Visual Features to encode data
- **Create Visual Hierarchy**
  - Contrast
  - Size
  - Color

## **Display Types and Their Story Narratives**

- Pie Charts
- Bar Charts
- Line Charts
- Special Bar & Line Charts
- Scatterplots
- Multidimensional Data

# Recap – Accuracy Ranking Visual Features



# Recap – Ranking of Visual Properties for Different Data Types

## QUANTITATIVE

Position

Length

Angle

Slope

Area

Volume

Density

Color Saturation

Color Hue

## ORDINAL

Position

Density

Color Saturation

Color Hue

Texture

Connection

Containment

Length

Angle

## NOMINAL

Position

Color Hue

Texture

Connection

Containment

Density

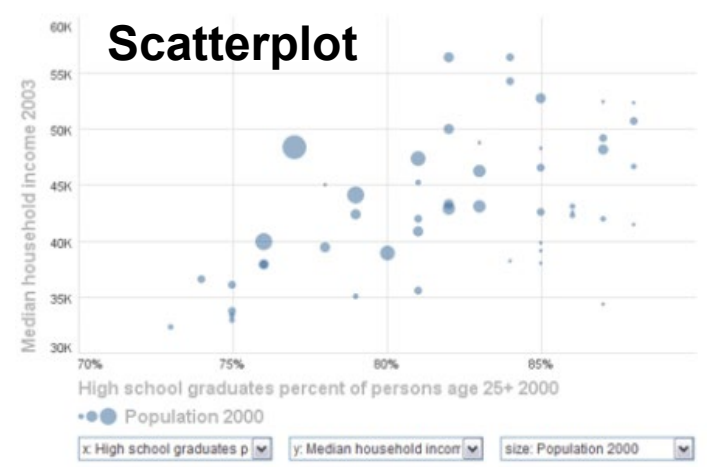
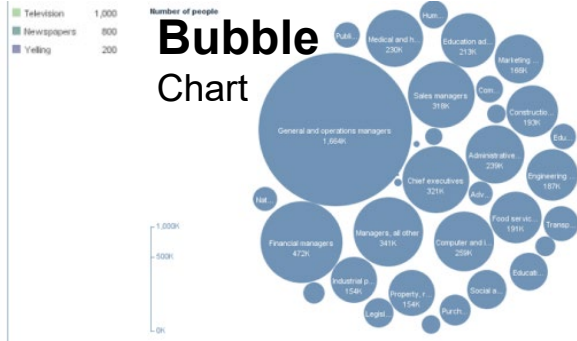
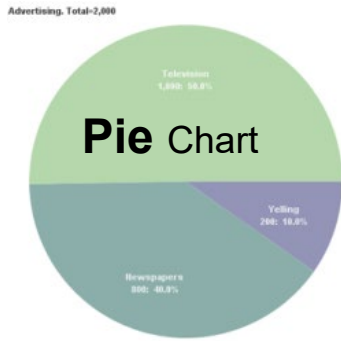
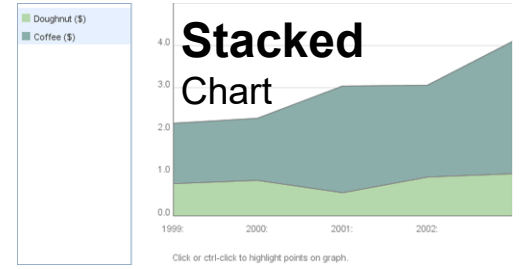
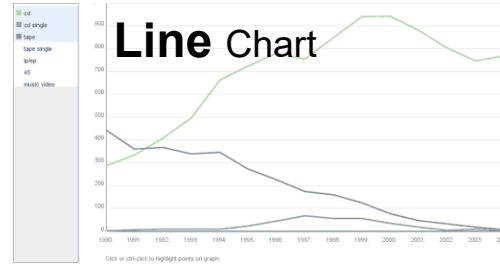
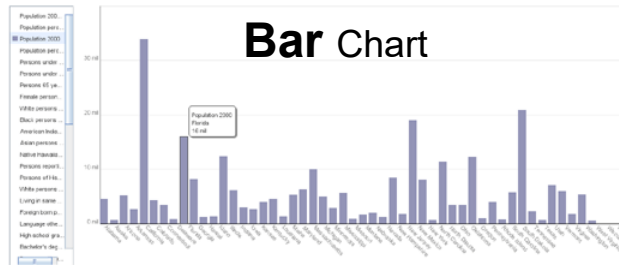
Color Saturation

Shape

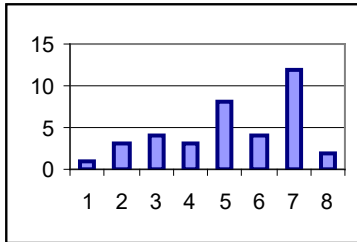
Length

# Data Visualization – Common Display Types

## Common Display Types

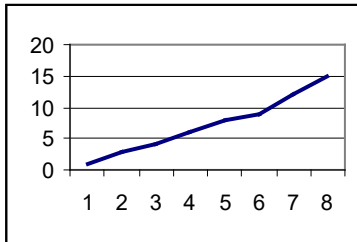


# Data Visualization: When to use which Display Type?



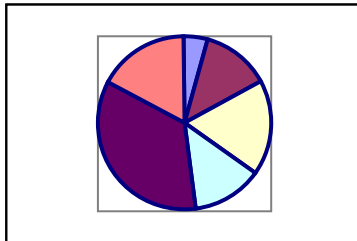
## Bar Graph

- **Comparison** of relative point values
- **Length**



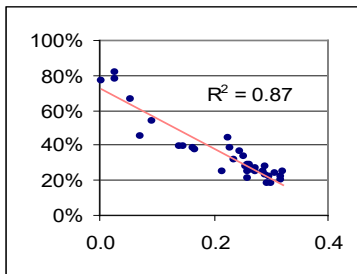
## Line Graph

- **Degree of Change**
- **Angle**



## Pie Chart

- **Differences in proportion** or **Relative relationships** among a few items
- **Angle**






## Scatter Plot

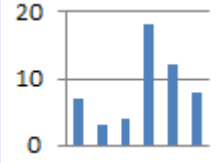
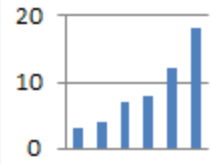
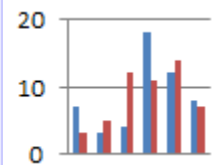
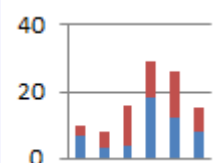
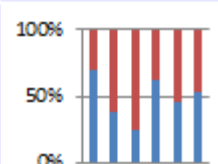
- **Relationship / correlation** between two indep. Variables
- **Clustering & Continuity**



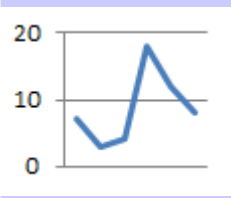
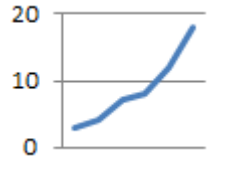
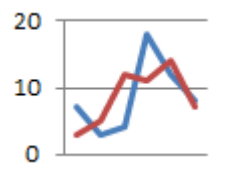
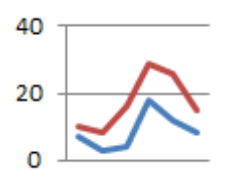
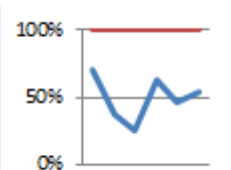
# Pie Chart – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>Pie Chart</b>		Angle	Numerical data for Ordinal / Categorical variable <b>1</b>	<b>Compare</b> part to whole
<b>Doughnut Chart</b>		Angle Length	Numerical data for Ordinal / Categorical variable <b>1</b>	<b>Compare</b> part to whole
<b>Bar Chart</b> Proportional		Length	Numerical data for Ordinal / Categorical variable <b>1</b>	<b>Compare</b> part to whole

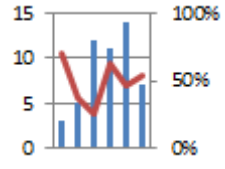
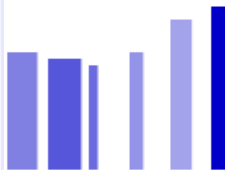
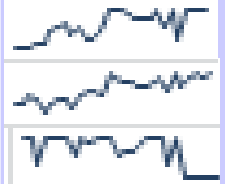

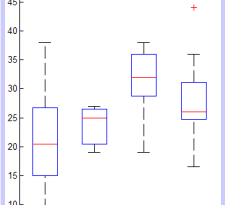
# Bar Chart – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>Bar Chart Simple</b>		Length	Numerical data for Ordinal / Categorical variable <b>1</b>	<b>Compare</b> values
<b>Bar Chart Sorted</b>		Length Continuity	Numerical data for <b>Categorical</b> variable <b>1</b>	<b>Compare</b> sorted values <b>Change</b>
<b>Bar Chart Grouped</b>		Length Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Compare</b> values
<b>Bar Chart Stacked</b>		Length Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Compare</b> totals and values within
<b>Bar Chart Proportional</b>		Length Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Compare</b> part to whole

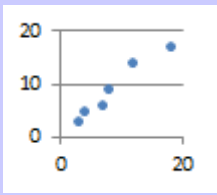
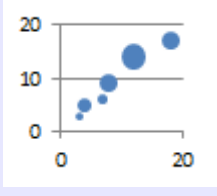
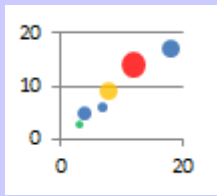
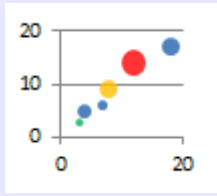
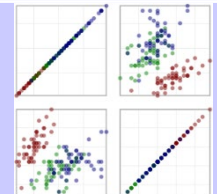
# Line Chart – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>Line Chart Simple</b>		Slope	Numerical data for Ordinal / Categorical variable <b>1</b>	<b>Change</b> of values May produce Shape
<b>Line Chart Sorted</b>		Slope Continuity	Numerical data for <b>Categorical</b> variable <b>1</b>	<b>Change</b> of sorted values <b>Shape</b>
<b>Line Chart Multi-Series</b>		Slope Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Change</b> of values
<b>Line Chart Stacked</b>		Slope Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Change</b> of totals and values within
<b>Line Chart Proportional</b>		Slope Color	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Change</b> of part to whole

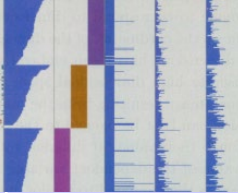
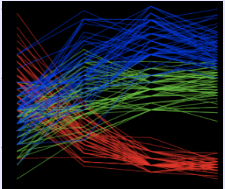
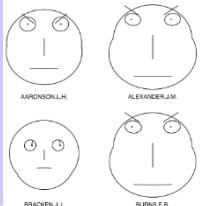
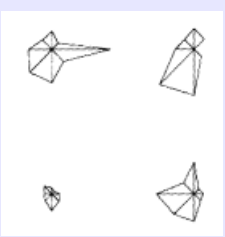

# Special Bar & Line Charts – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>Bar + Line Chart</b>		Length Slope	Numerical data for Ordinal / Categorical variables <b>2</b>	<b>Compare</b> and <b>Change</b>
<b>Bar Chart Multivariate</b>		Length Width Color Hue	Numerical data for Ordinal / Categorical variables <b>3</b>	<b>Compare</b> values
<b>Sparklines</b>		Slope Shape	Numerical data for Ordinal / Categorical variables <b>3+</b>	<b>Compare</b> shapes <b>Change</b>
<b>Stream Graph</b> Stacked Areas		Slope Color	Numerical data for Ordinal / Categorical variables (time) <b>2+</b>	<b>Change</b> of totals and values within
<b>Box Plot</b>		Length Shapes	Numerical data for Ordinal / Categorical variable <b>1</b> aggregated	<b>Compare</b> distributions Identify outliers

# Scatterplot – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>Scatterplot</b> Simple		Degree of Proximity and Continuity	Numerical variables <b>2</b>	<b>Correlation &amp; Shape</b> could indicate type of Causality
<b>Scatterplot</b> Bubbles		Degree of Proximity and Continuity Differences in Area Size	Numerical variables <b>3</b>	<b>Correlation Compare</b>
<b>Scatterplot</b> Bubbles and Color		Proximity and Continuity Area Size and Color	Numerical variables Categorical variable <b>4</b>	<b>Correlation Compare</b>
<b>Motion Chart</b>		Proximity and Continuity Area Size and Color Motion Flow	Numerical variables Categorical variable Time variable <b>5</b>	<b>Correlation Compare</b> <b>Continuity</b>
<b>Scatterplot</b> Matrix		Proximity and Continuity Color Motion	Numerical variables Categorical variable <b>5+</b>	<b>Correlation Similarity</b> Outliers

# Multi-Dimensional – Visual DataStory

Display Type		Visual Encoding	Variables	Story Narrative
<b>TableLens</b>		Shape Slope Color	Numerical variables <b>5+</b>	<b>Correlation</b> <b>Similarity</b> Outlier
<b>Parallel Coordinates</b> Point becomes Line_		Slope Proximity Color	Numerical variables <b>5+</b>	<b>Correlation</b> <b>Similarity</b> Difference
<b>Chernoff Faces</b>		Angle Length Shape	Numerical variables <b>5+</b>	<b>Compare</b> <b>Similarity</b> Difference
<b>Star Charts</b>		Length Shape	Numerical variables <b>5+</b>	<b>Compare</b> <b>Similarity</b> Difference
<b>Nightingale Charts</b>		Size Shape Color	Numerical variables <b>5+</b>	<b>Compare</b> <b>Similarity</b> Difference

# Recap – Information Visualization – Key Design Principles

## **Interactivity** [d3](#)

Immediate Feedback

## **Linked Displays** [d3](#)

Overview → Zoom+Filter → Details-on-Demand

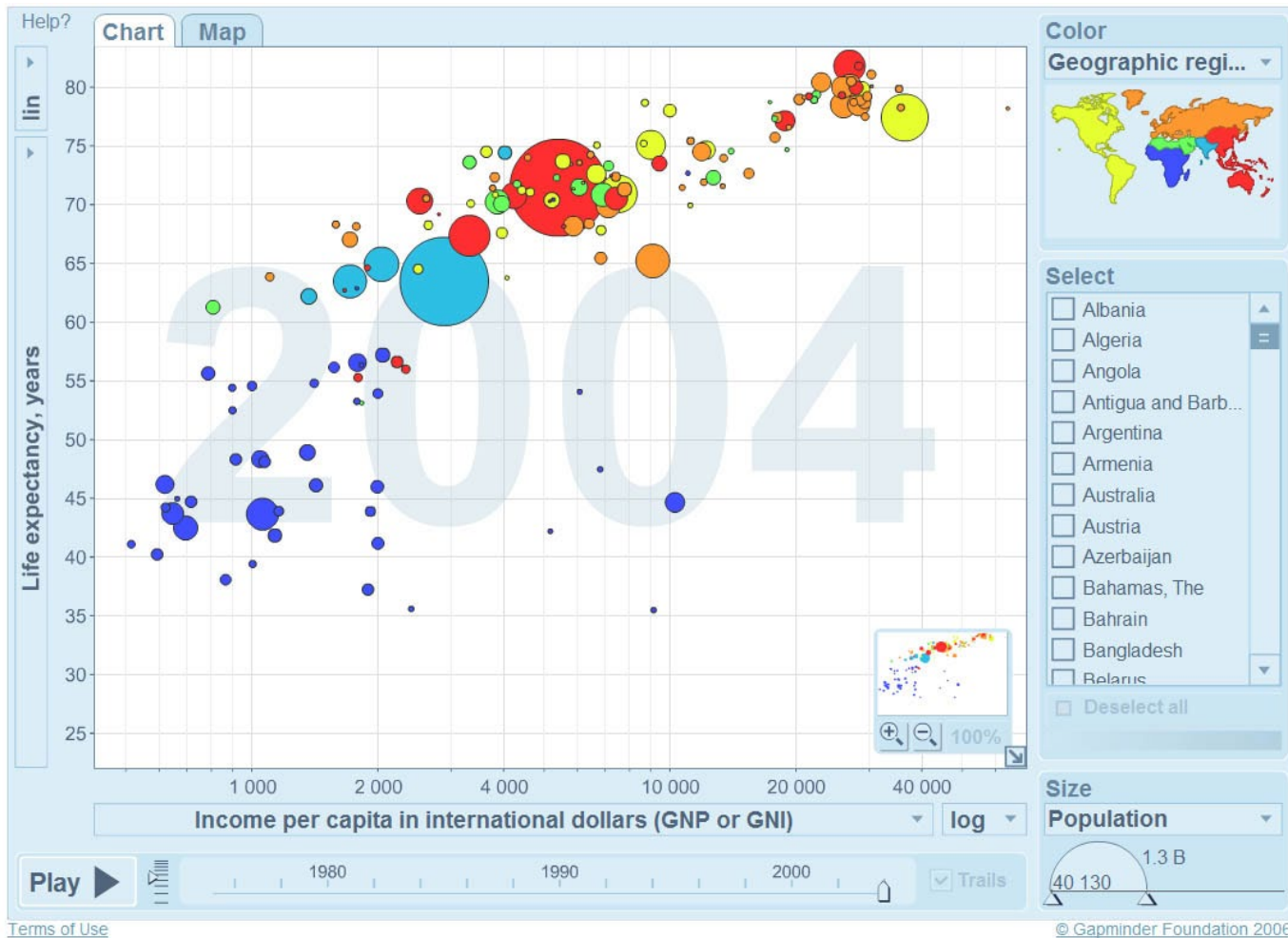
## **Dynamic Queries**

Focus + Context [d3](#)

## **Animate Transitions** [d3](#)

Increase Information Density

# Gapminder – Motion Charts



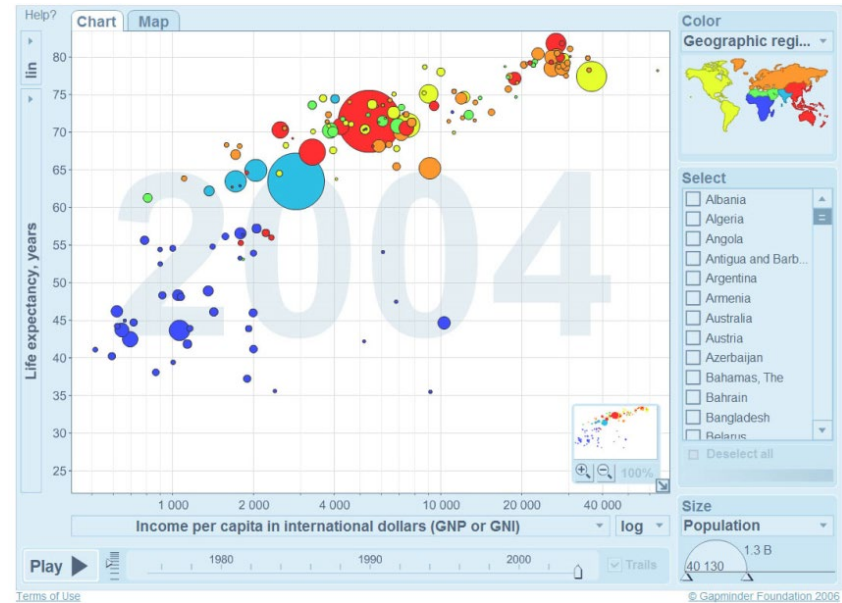
<http://www.gapminder.org/>



# Google Motion Chart

## Format Your Data

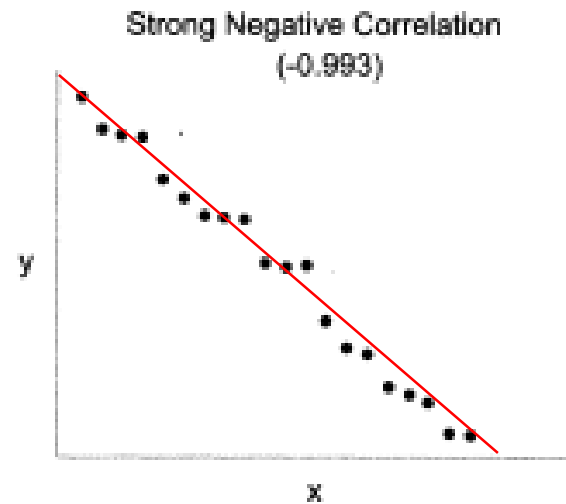
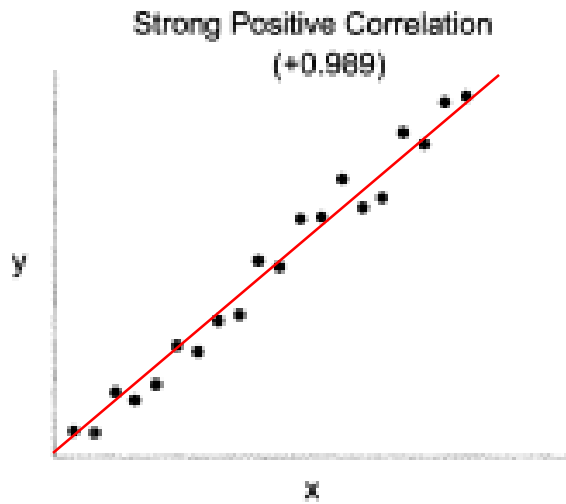
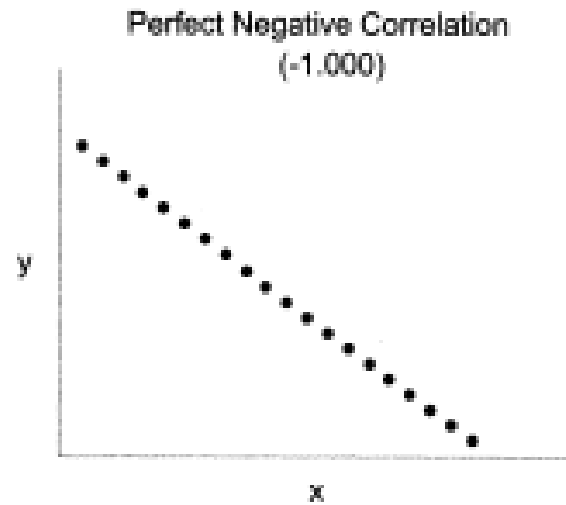
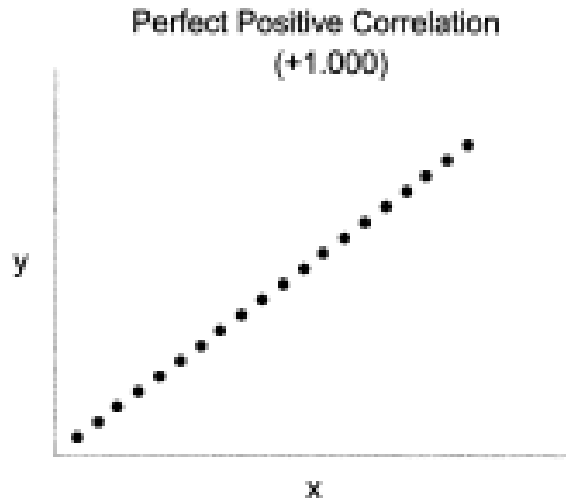
Example : what is needed for effective Motion Chart



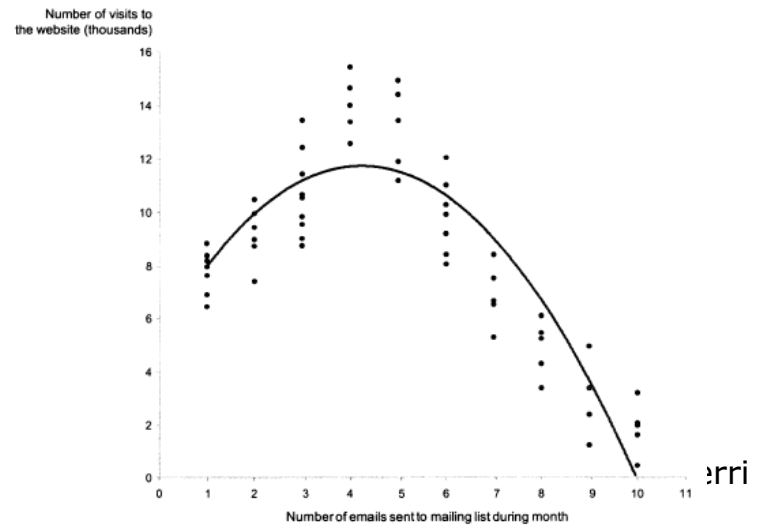
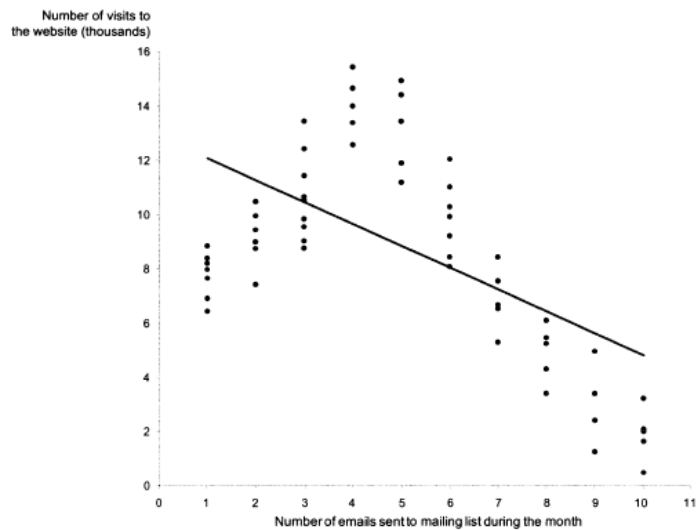
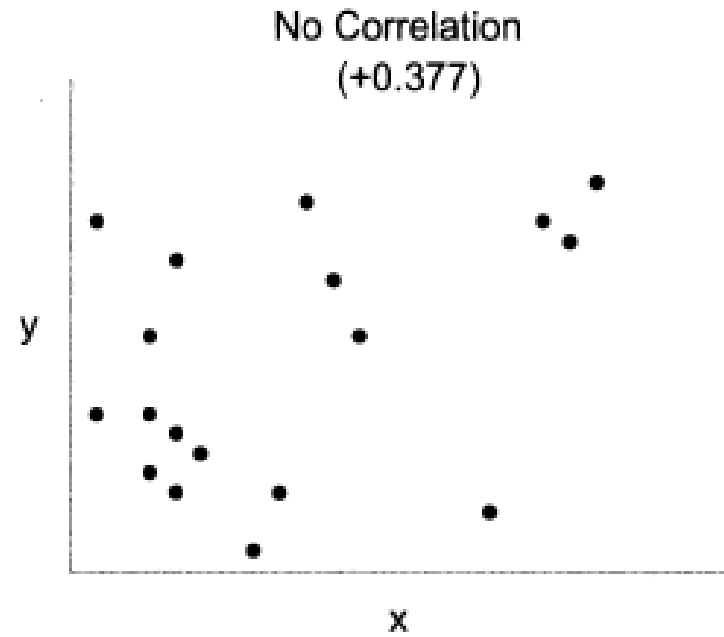
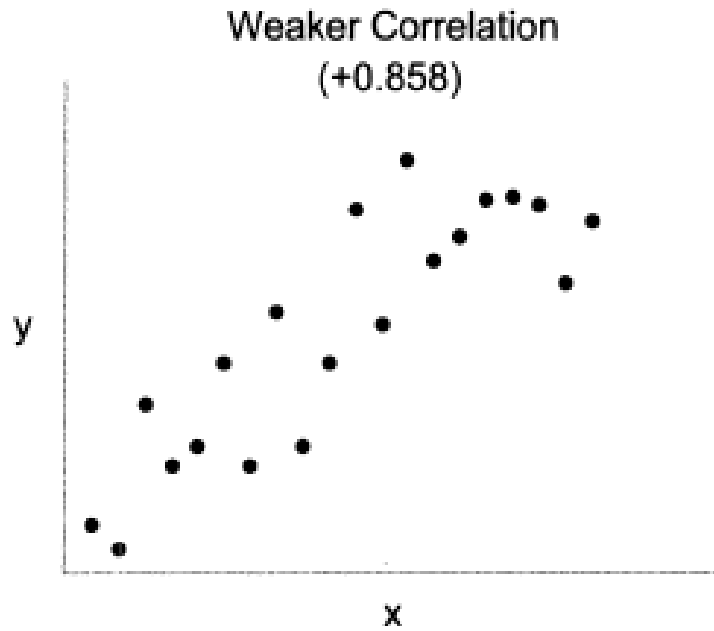
## 1<sup>st</sup> Visualization – Motion Chart Requirements

- Time data dimension
- At least **three independent data dimensions** that can be displayed on the x and y axes of the scatterplot
- At least **one categorical data dimension**
- At least one relevant data dimension than be used for **size coding**
- In Total, at least **six data variables**

# Scatterplot – Visual Correlation Patterns

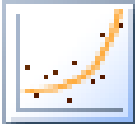


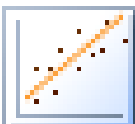
# Scatterplot – Visual Correlation Patterns




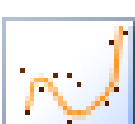
# Scatterplot – Visual Correlation Patterns


**Trend/Regression Type**


  **Exponential**

  **Linear**

  **Logarithmic**

  **Polynomial**      Order:

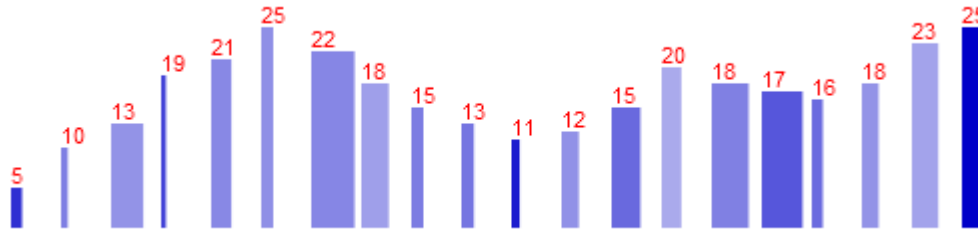
  **Power**

  **Moving Average**      Period:

# 1<sup>st</sup> Visualization – D3 DataVis Programming Option

## **(Optional) Vis 1: D3 VisProg** (15%)

- Visualize **3 variables**: height, width and opacity



- How to **Position**?
  - Top / Left coordinate system
  - y is function of height
- How to **Access Variables**?
  - Data is 2D array of 3-tuples |
  - `d[index]`
- How to compute **Width**?
  - Define max width and scale based on variable
- How to compute **Opacity**?
  - At least 0.25 and at most 1 | scale based on variable