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Pibi

Visualization

Why Visualize?

2 Main Applications:

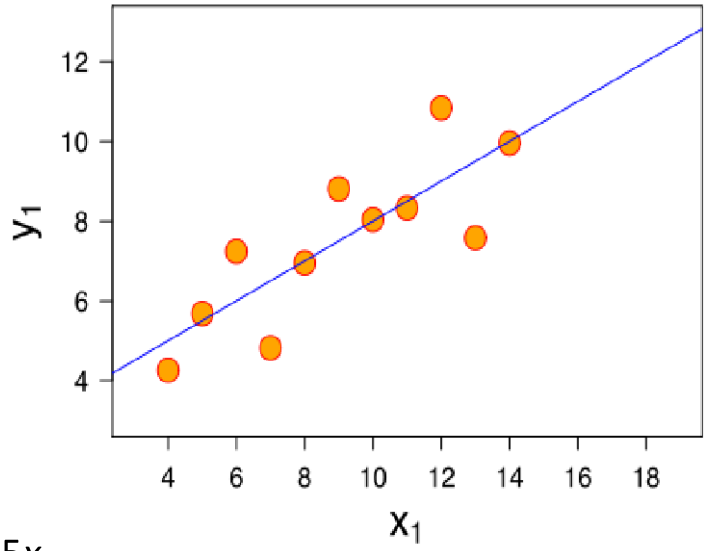
1. Exploration
    1. During data analysis
    2. Helps to find errors and create new hypotheses
    3. Often interactive

2. Reporting
    1. Report results to stakeholders (your boss, the scientific community, the general public)
    2. Must be carefully designed to match your audience
    3. Typically static (infographic)

Example: Exploration

I"	
x"	y"
10.0"	8.04"
8.0"	6.95"
13.0"	7.58"
9.0"	8.81"
11.0"	8.33"
14.0"	9.96"
6.0"	7.24"
4.0"	4.26"
12.0"	10.84"
7.0"	4.82"
5.0"	5.68"

Mean of *x*	9
Variance of *x*	10
Mean of *y*	7.5
Variance of *y*	3.75
Correlation between *x* and *y*	0.816
Linear regression line	$y = 3.0 + 0.5x$



Example: Exploration

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"	12.5"
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"

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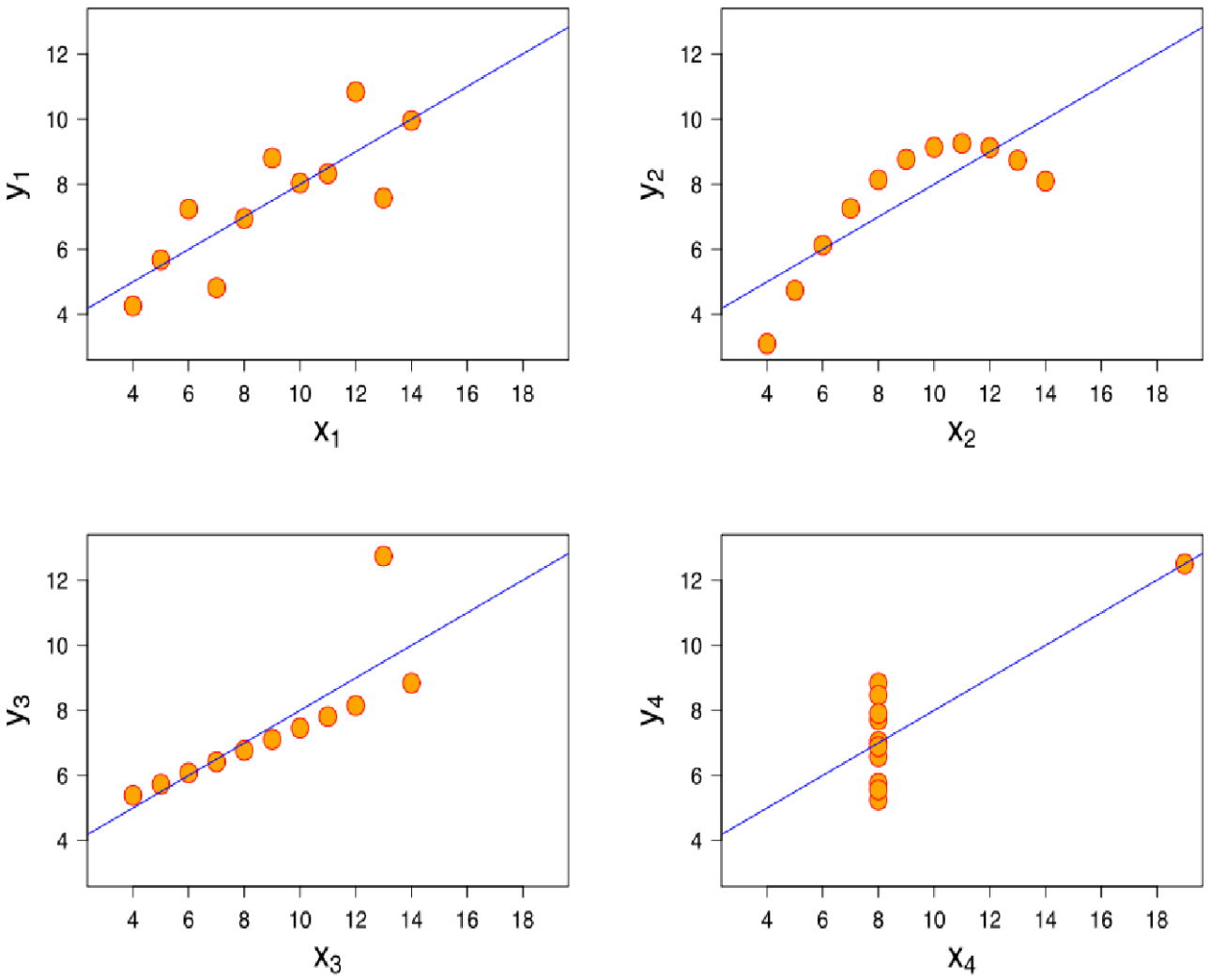
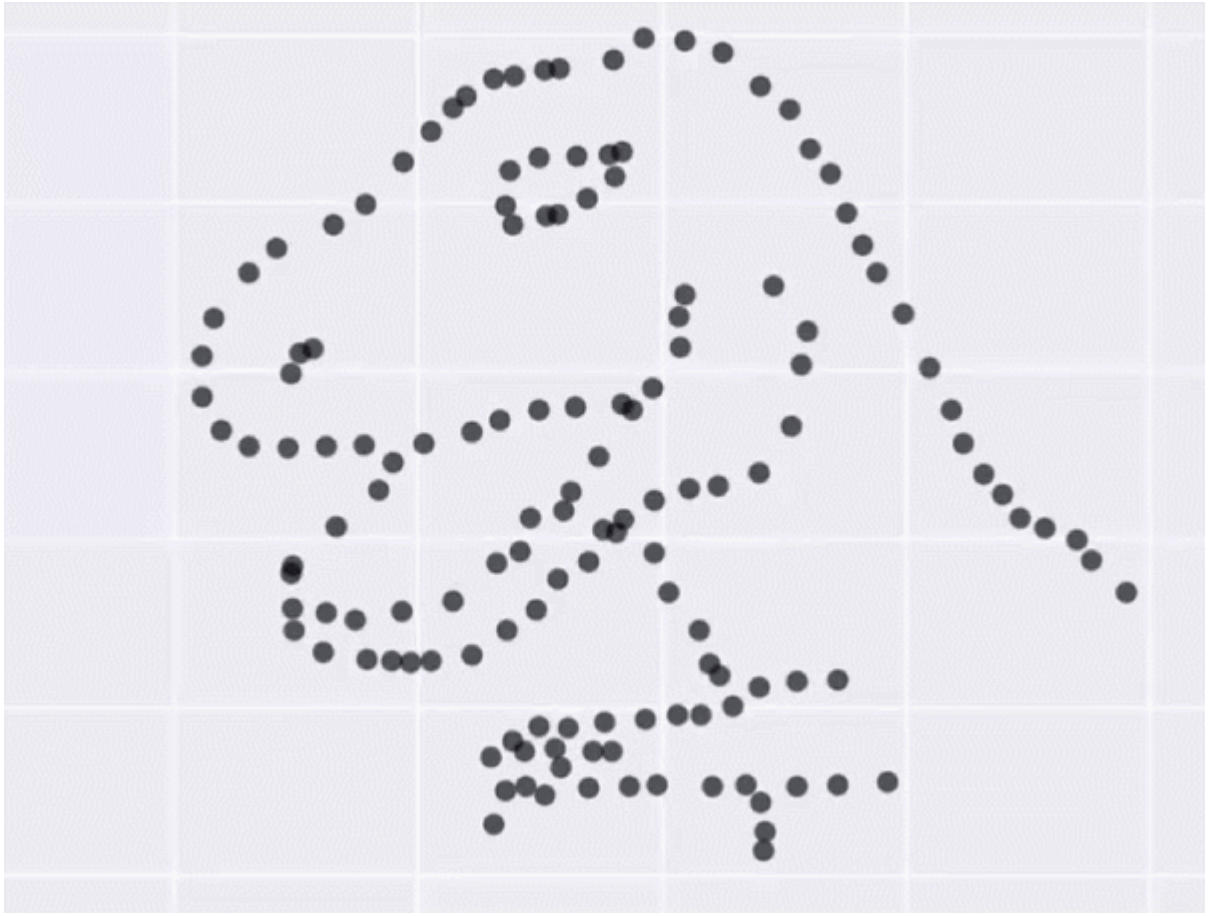
Example: Anscombe's quartet



https://en.wikipedia.org/wiki/Anscombe's_quartet
See also https://www.autodeskresearch.com/publications/samestats

Example: The Datasaurus Dozen

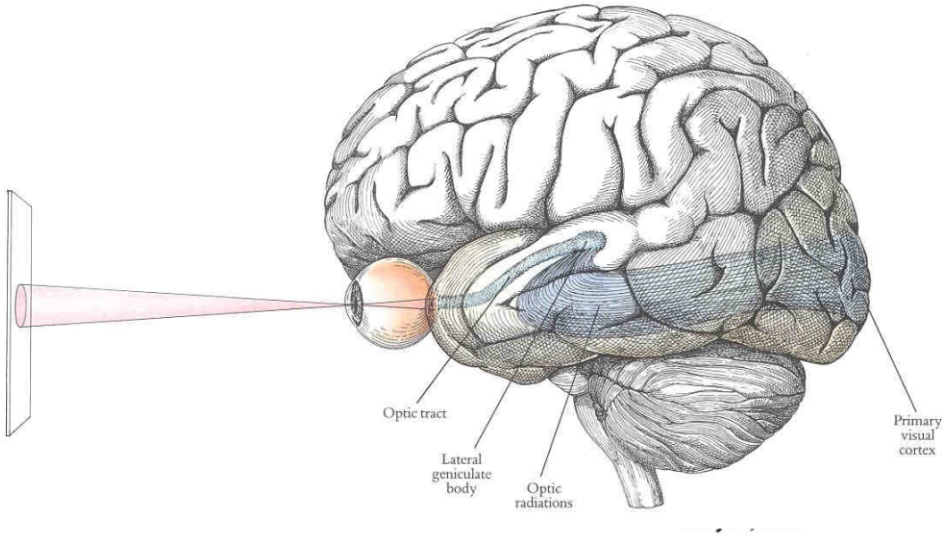


X Mean = 54.26, X SD = 16.76
Y Mean = 47.83, Y SD = 26.93, Correlation = -0.06

https://en.wikipedia.org/wiki/Anscombe's_quartet
See also https://www.autodeskresearch.com/publications/samestats

"… half of the human brain is devoted directly or indirectly to vision"

Mriganka Sur, MIT

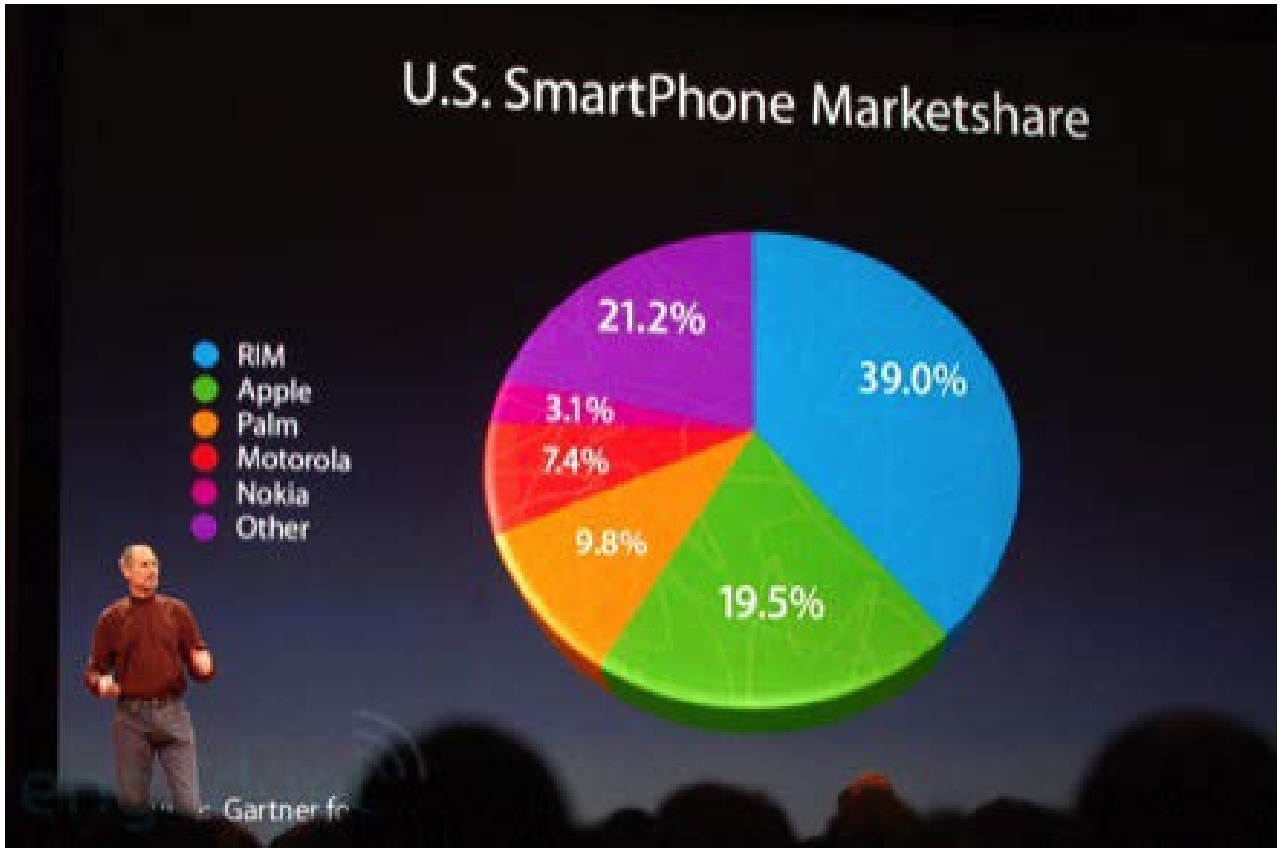


10 million bits per second

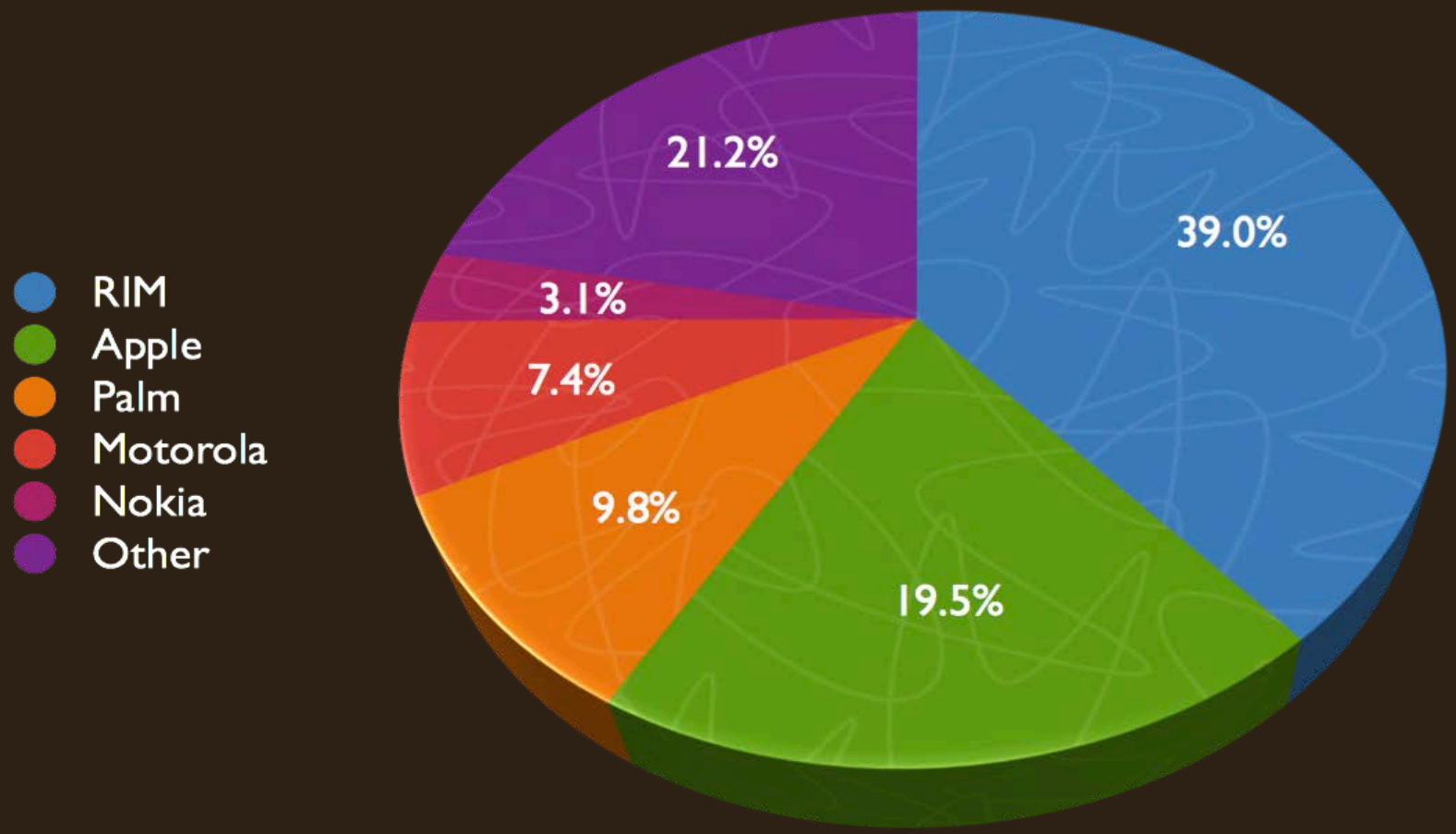
McLean & Freed, Current Biology (2006)

Image from "Approaches to the Mind: Introduction to Cognitive Science" Heather Bortfeld, Brown U.

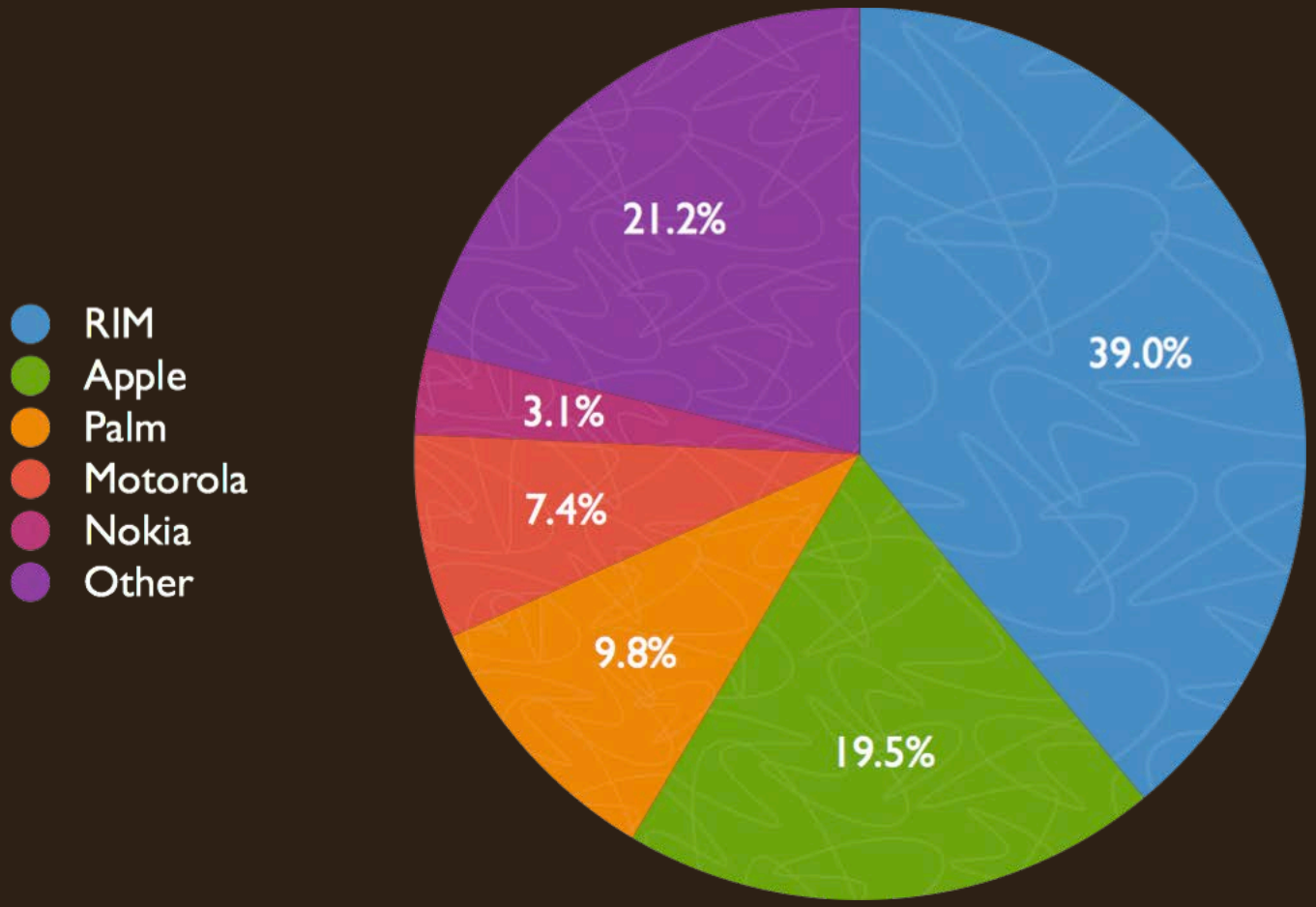
Example: Reporting



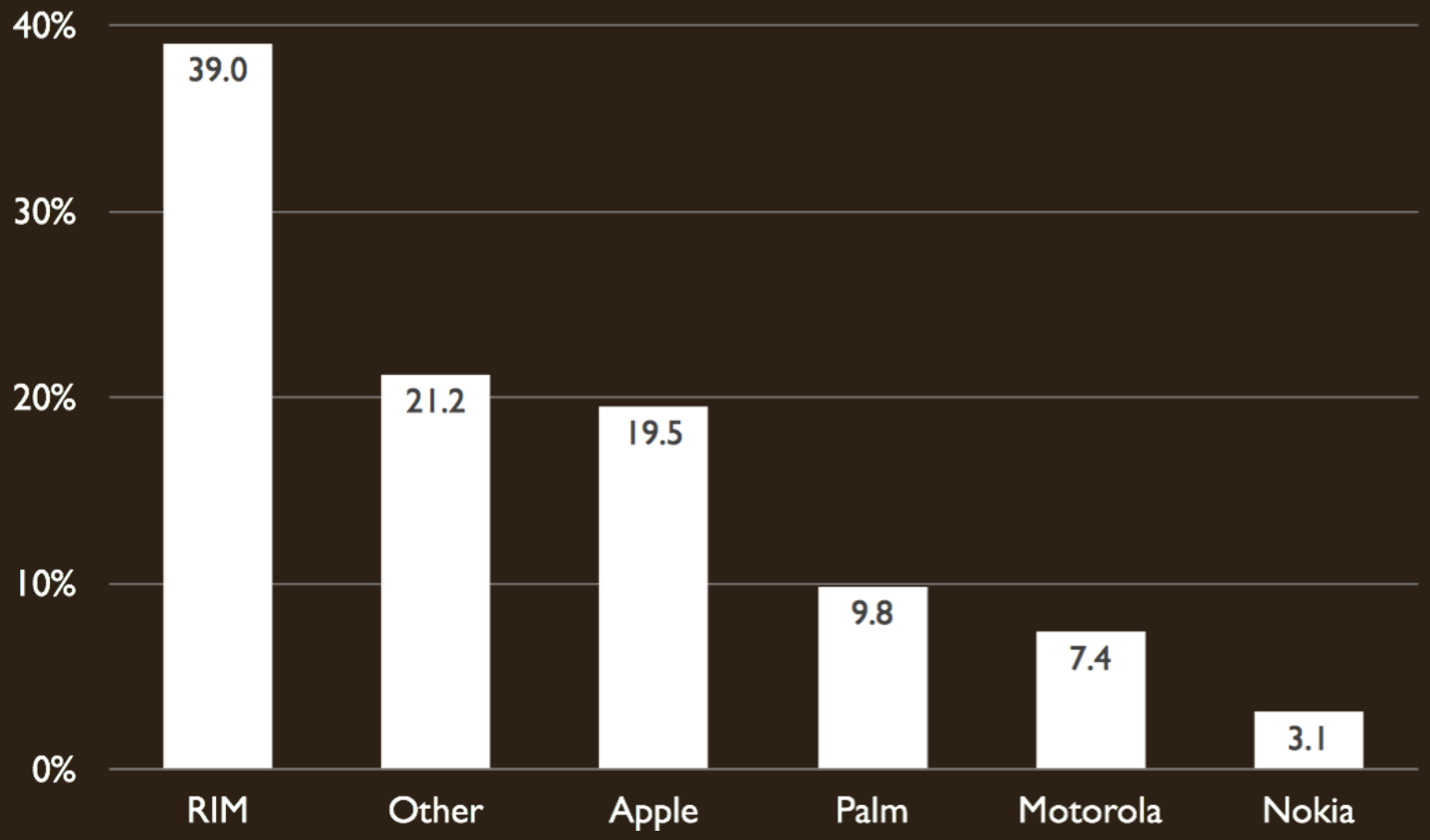
U.S. Smartphone Marketshare



U.S. Smartphone Marketshare



U.S. Smartphone Marketshare



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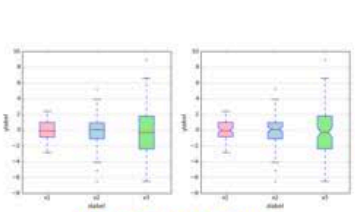
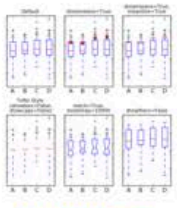
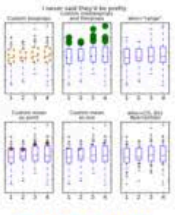
Plotting in Python w/ matplotlib

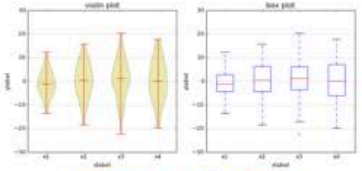
- http://matplotlib.org/
- 2D plotting library for high-quality figures

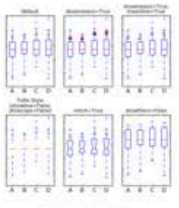
http://matplotlib.org/gallery.html

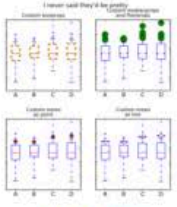

boxplot_color_demo

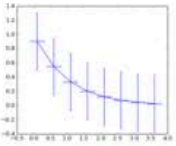

boxplot_demo

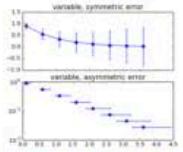

boxplot_demo

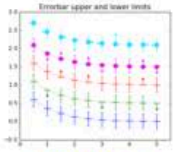

boxplot_vs_violin_demo

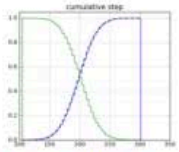

bxp_demo

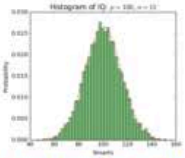

bxp_demo

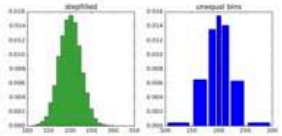

errorbar_demo


errorbar_demo_features


errorbar_limits


histogram_demo_cumulative

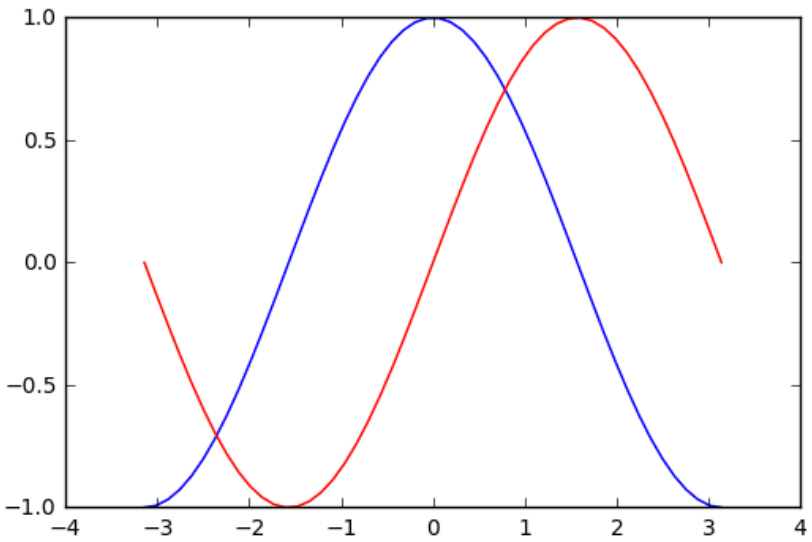

histogram_demo_features


histogram_demo_histtypes

Plotting in Python w/ matplotlib

- http://matplotlib.org/
- 2D plotting library for high-quality figures
- Can be embedded in jupyter

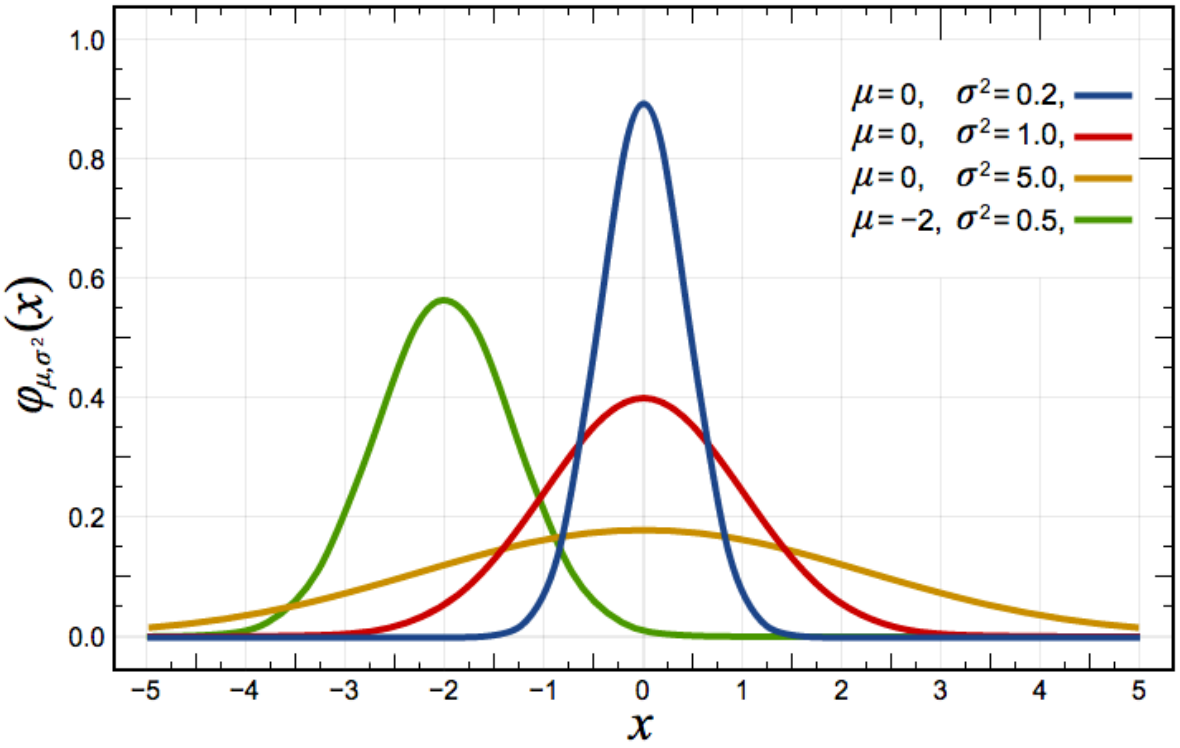
```
In [6]: # shorter:
        plt.plot(X, C, 'b-', X, S, 'r-')

Out[6]: [<matplotlib.lines.Line2D at 0x112a09e90>,
         <matplotlib.lines.Line2D at 0x112a160d0>]
```



Plotting in Python w/ matplotlib

1. Follow tutorial:
   http://www.labri.fr/perso/nrougier/teaching/matplotlib/

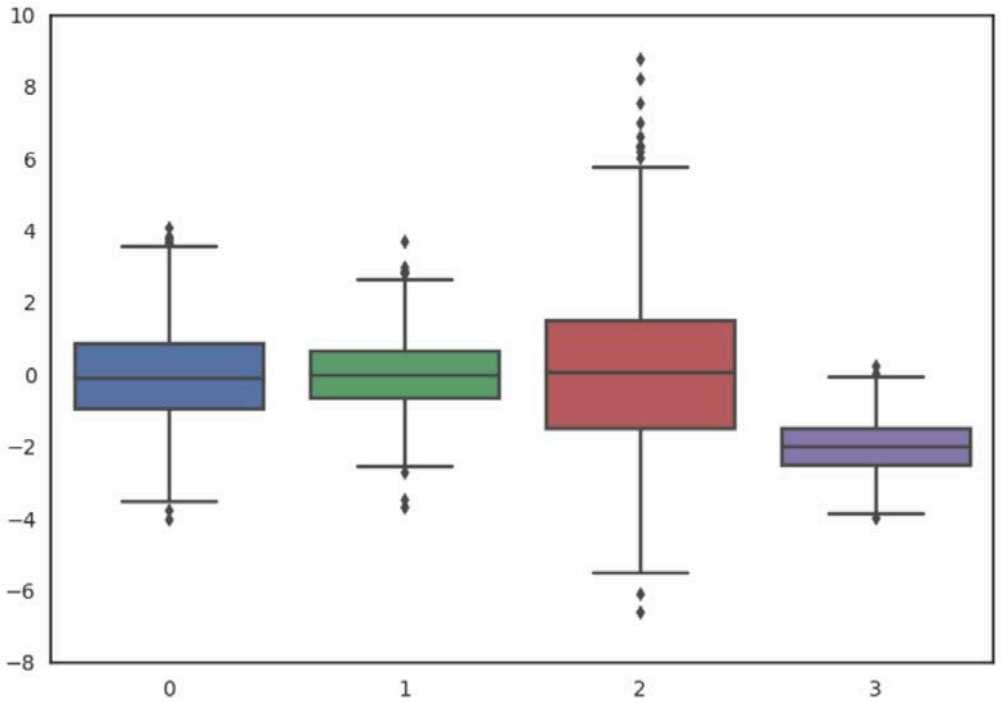
2. Reproduce plots



Seaborn

- High-level Library based on matplotlib
  - Themes
  - Color palettes
  - Plots (boxplots, histograms, heatmaps, …)

```
sns.boxplot(data = X)
```



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Tasks

1. Update your repository from remote
2. Open ‘Day1_Visualization’ notebook
3. Follow matplotlib tutorial
4. Reproduce plots given in notebook as closely as possible