

Introduction to Visualizations



Learning Objectives

1. Develop hypotheses based on motivating problems and/or observations and identify appropriate data to address hypotheses.

Sports/Health and wellbeing
Volleyball
Food
Data in Health
Physics
video games
class disparity
quality education for all

Wealth Inequality
Sports
art/ceramics
Traveling
movies and music
Guitar
Data and marketing
Ecology and Environmental Conservation

Learning Objectives

1. Develop hypotheses based on motivating problems and/or observations and identify appropriate data to address hypotheses.
2. Identify and describe key elements in different types of data visualizations.

Learning Objectives

1. Develop hypotheses based on motivating problems and/or observations and identify appropriate data to address hypotheses.
2. Identify and describe key elements in different types of data visualizations.
3. Use web-based platforms to accurately present data sets through multiple visualizations.
4. Use an open-source programming language to compute summary statistics and visualize key patterns in the data.
5. Contribute to and present structured, web-based documentation that describes data exploration steps and visualization-based conclusions.

Reminder!

Date	Due	Links to in-class materials	Links to new assignments
W Jan 17			
F Jan 19			Reading: Gentle Chart Types Reading: Visualizations p. 19-32 Lab 1: Hall of Fame due 2:30pm Jan 26

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| Date | Due | Links to in-class materials | Links to new assignments |
|-----|-----|-----|-----|
|W Jan 17| | | |
|F Jan 19| |[Reading: Gentle Chart
Types] (https://chartio.com/learn/charts/essential-chart-types-for-data-visualization/)
</br> [Reading: Visualizations p.
19-32] (https://ebookcentral.proquest.com/lib/allegHENY-ebooks/reader.action?docID=427614)
</br> [Lab 1: Hall of Fame] (https://classroom.github.com/a/36z5e0tg) due 2:30pm Jan 26|
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Data

Data

Enobio Data:

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Data

Enobio Data:

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Enobio Data:

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Data

Data are meaningless without context

ECG Belt

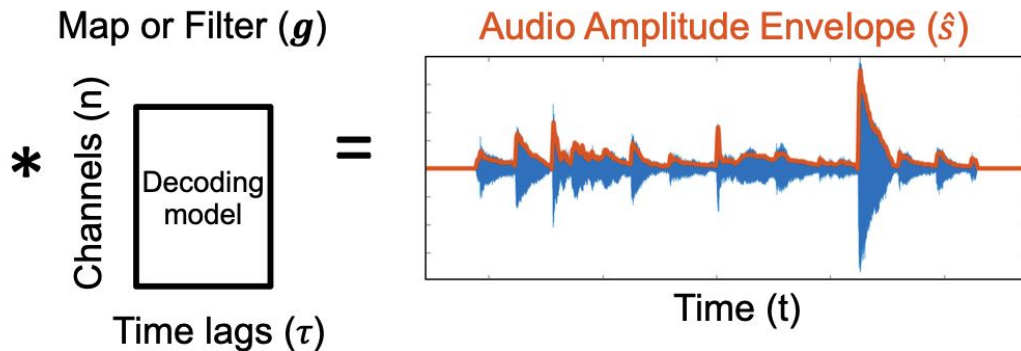
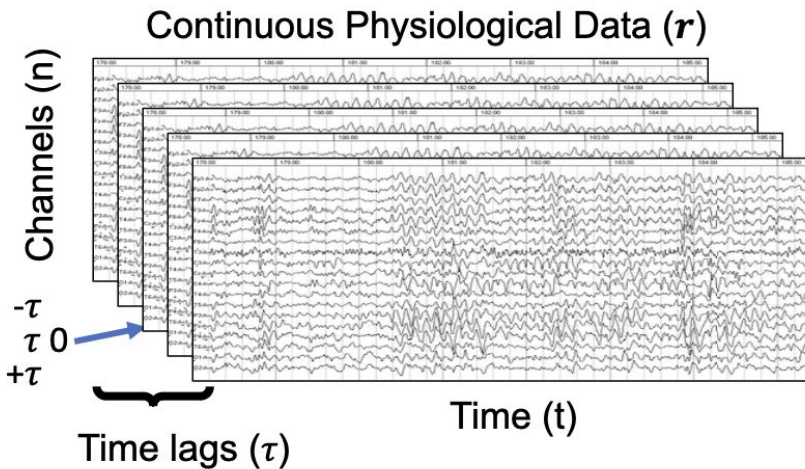


EEG Cap



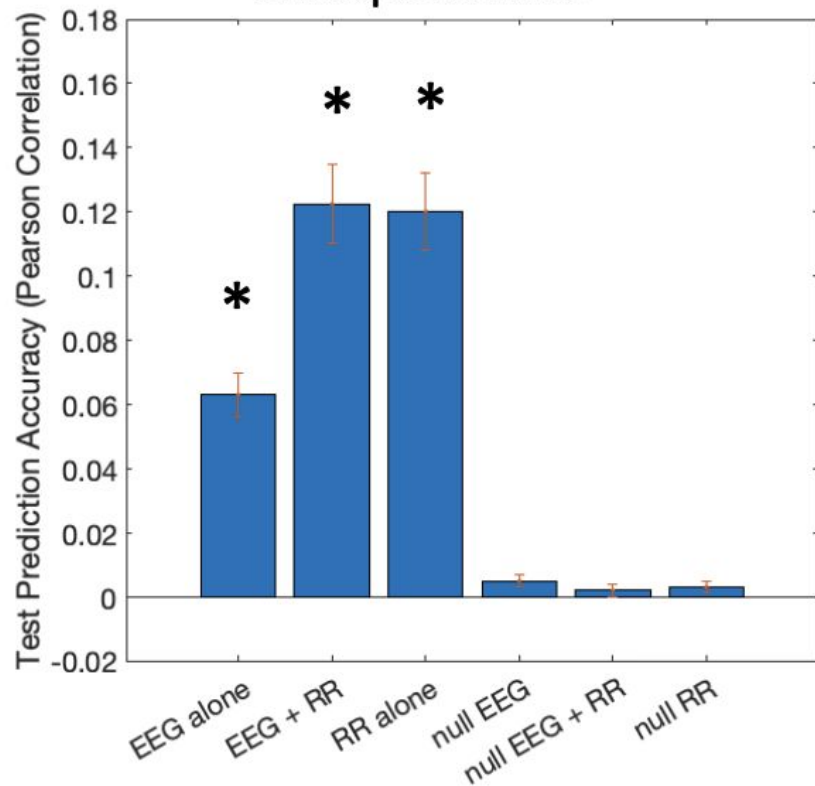
Data Cleanup

- Detrending
- Mean-centering
- ICA deconstruction/reconstruction
- Peak detection
- Envelope construction
- Lagged Correlation
- Prediction
- Comparison

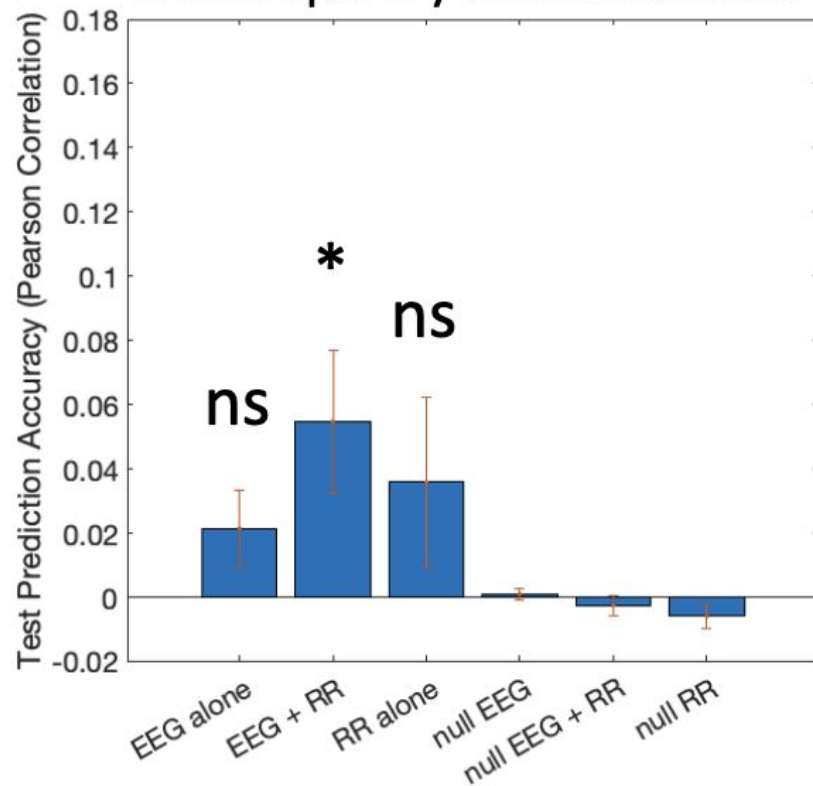


Visualization

Baroque Music

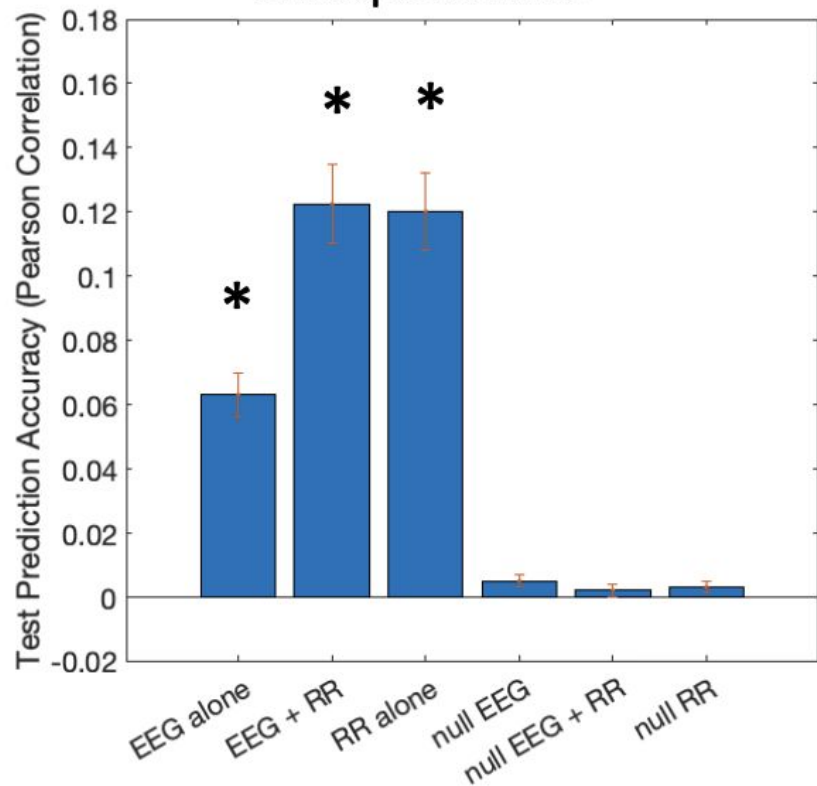


Contemporary Classical Music

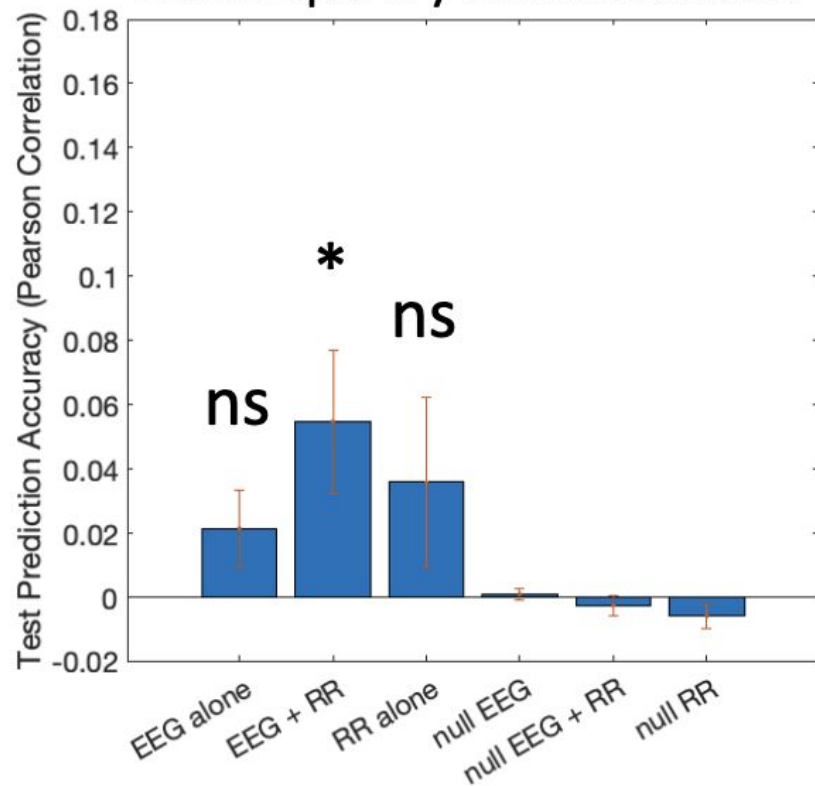


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Baroque Music



Contemporary Classical Music



The Scientific Method

Observation / Question

Topic for research and experimentation or question that needs to be answered

Research

Find out about the topic.

Hypothesis

Predict the outcome to the problem.

Experiment

Develop a procedure to test the hypothesis.

Collect Data

Record the results of the experiment.

Analysis

Examine the data.

Conclusion

Compare the hypothesis to the experiments results.

Foundation

Raw Data: Usually in CSV or text file with rows and columns

Large data files cannot be interpreted in raw format

CSV

Comma-separated variable

or tab, or semicolon, or space...

^^^ delimiters

after specifying delimiters, a parser can read data and create rows and columns

CSV

Import

Select the type of file you want to import:

☒ CSV file

Text files that contain comma-separated values.

☐ HTML file

Hyper-text markup files from your computer.

☐ Text file

Text files, which import best when separated by tabs or spaces.

Cancel

Import

Text Import Wizard - Step 1 of 3

The Text Wizard has determined that your data is Delimited.

If this is correct, choose Next, or choose the Data Type that best describes your data.

☒ Delimited

- Characters such as commas or tabs separate each field.

☐ Fixed width

- Fields are aligned in columns with spaces between each field.

Start import at row: 1

File origin: Macintosh

Preview of selected data:

Preview of file /Users/graber/Documents/Stu.../S15_trial_1_7202023_11191927.35.txt.

1	11174163.115	cpuFixedPeriodFlag
2	11174163.185	cpuSeqStart
3	11174163.218	cpuMetronome
4	11174761.503	cpuMetronome
5	11175359.721	cpuMetronome
6	107663.062	tap
7	11175848.106	cpuTap
8	11175961.380	cpuMetronome
9	401.306	tap

Cancel

< Back

Next >

Finish



Text Import Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains.

Delimiters

☐ Tab


☐ Semicolon

☒ Comma

☐ Space

☐ Other:

☐ Treat consecutive delimiters as one

Text qualifier: " 

Preview of selected data:

```
11174163.115 cpuFixedPeriodFlag
11174163.185 cpuSeqStart
11174163.218 cpuMetronome
11174761.503 cpuMetronome
11175359.721 cpuMetronome
107663.062 tap
11175848.106 cpuTap
11175961.380 cpuMetronome
401.306 tap
```

CSV




Text Import Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains.

Delimiters

☒ Tab ☐ Treat consecutive delimiters as one

☐ Semicolon Text qualifier: " 

☐ Comma

☐ Space

☐ Other:

Preview of selected data:

11174163.115	cpuFixedPeriodFlag
11174163.185	cpuSeqStart
11174163.218	cpuMetronome
11174761.503	cpuMetronome
11175359.721	cpuMetronome
107663.062	tap
11175848.106	cpuTap
11175961.380	cpuMetronome
401.306	tap

Cancel < Back Next > Finish

Data Types / Variables

look out
overloaded
terms

Text Import Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains.

Delimiters

☒ Tab


☐ Semicolon

☐ Comma

☐ Space

☐ Other:

☐ Treat consecutive delimiters as one

Text qualifier: 

Preview of selected data:

11174163.115	cpuFixedPeriodFlag
11174163.185	cpuSeqStart
11174163.218	cpuMetronome
11174761.503	cpuMetronome
11175359.721	cpuMetronome
107663.062	tap
11175848.106	cpuTap
11175961.380	cpuMetronome
401.306	tap

Cancel < Back Next > Finish

Numbers
Continuous

Categories
Categorical

Data Types

Continuous

Categorical

Univariate

Bivariate

Multivariate

Rules of Thumb

Show the data

Simplify

Reduce Clutter

Revise

Be Honest

Distortion

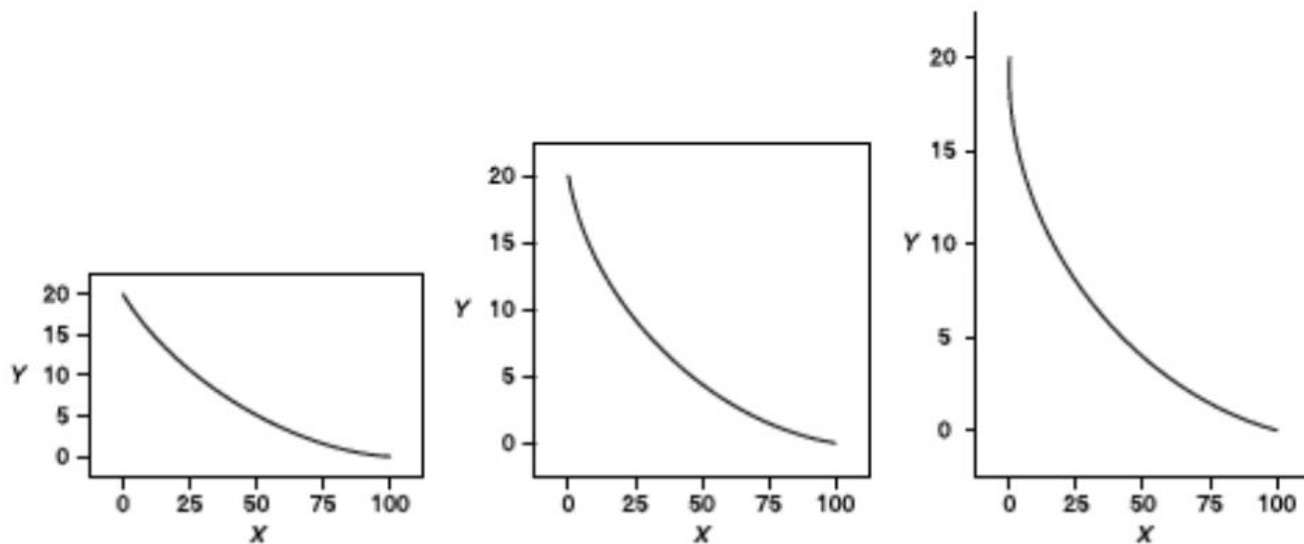


Figure 2.4 Making a more dramatic statement by adjusting only the aspect ratio

Distortion

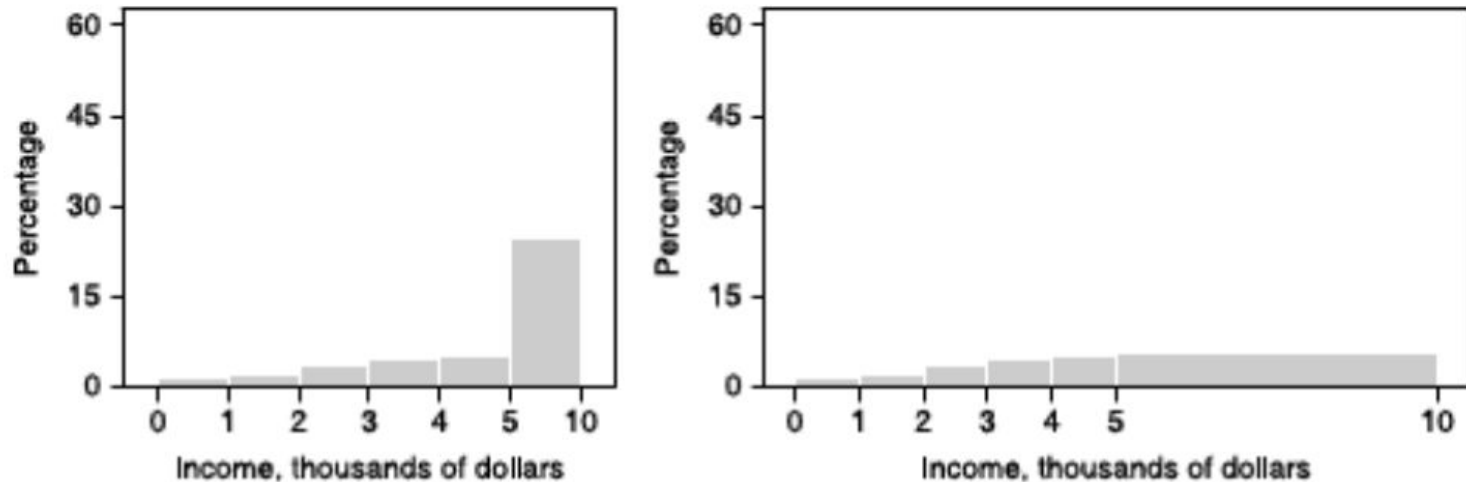


Figure 2.5 An irregular scale distorts magnitudes of unit values

Distortion

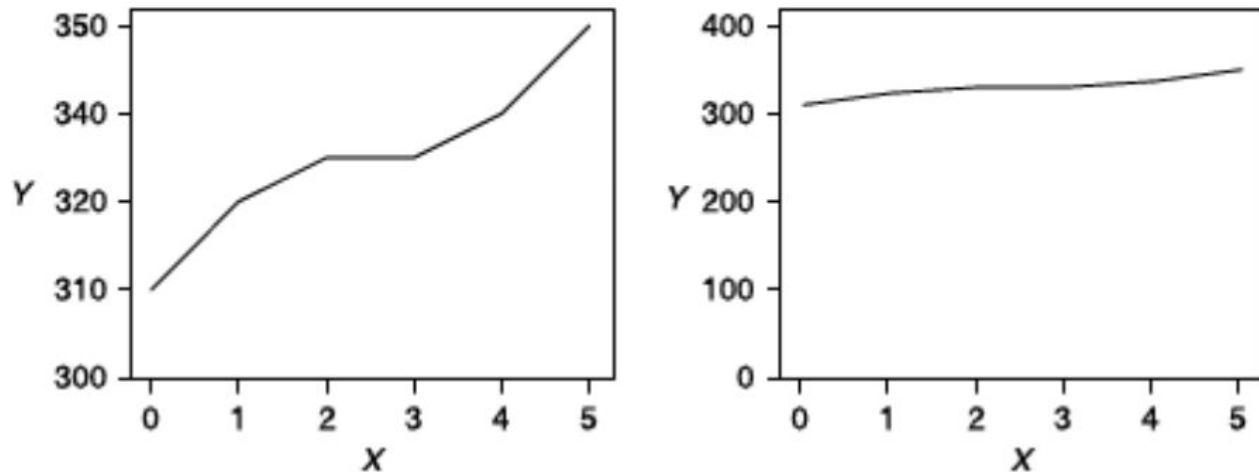


Figure 2.6 Increasing the range of a scale may hide important detail

Gestalt Principles

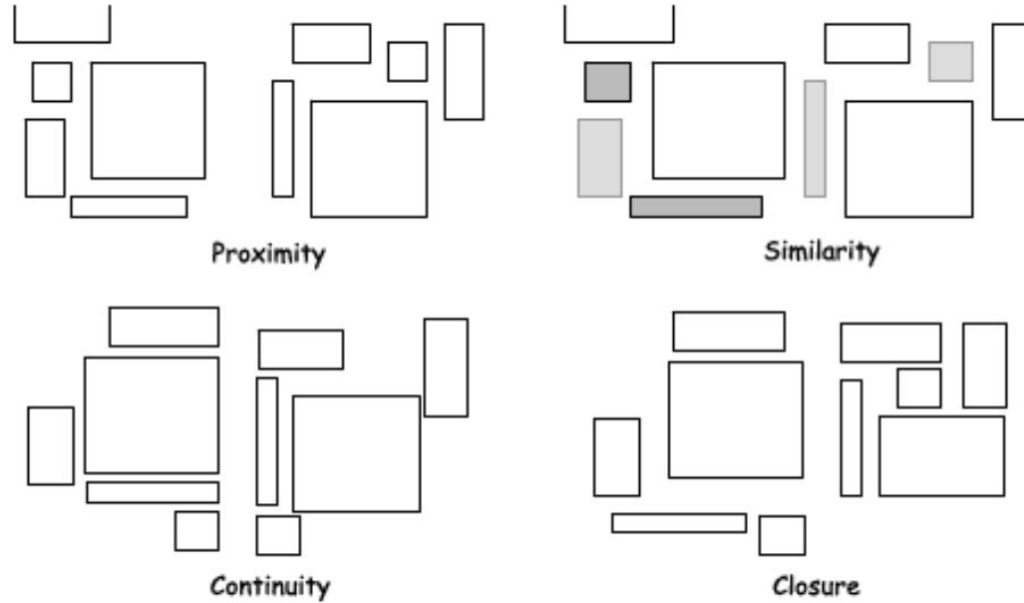


Figure 2.7 Illustrating Gestalt principles

Figure Components

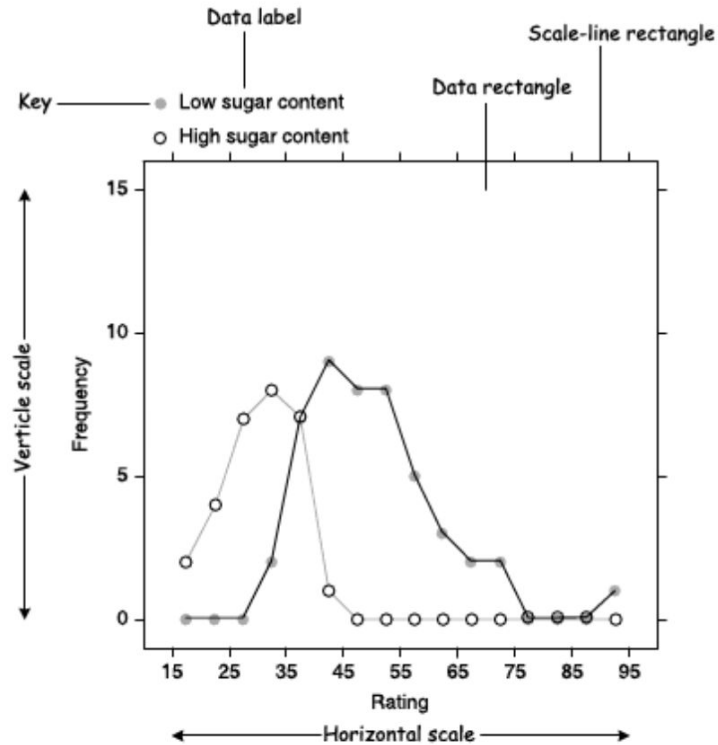


Figure 2.13 Anatomy of a graph

Practice Plotting

$x = [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]$

$y = [0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0]$

plot: $(x_1, y_1), (x_2, y_2), (x_3, y_3), \text{etc.}$

- Breakdown:
 - look at x range (determine min and max)
 - look at y range (determine min and max)
 - locate x value on horizontal scale
 - locate y value on vertical scale
 - draw marker
 - label everything

Practice Plotting

$x = [10, 100, 1000, 10000, 100000, 1000000, 10000000, 100000000, 1000000000, 10000000000]$

$y = [0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0]$

plot: $(x_1, y_1), (x_2, y_2), (x_3, y_3), \text{etc.}$

- Breakdown:
 - look at x range (determine min and max)
 - look at y range (determine min and max)
 - locate x value on horizontal scale
 - locate y value on vertical scale
 - draw marker
 - label everything

Log scaling

$x = [10, 100, 1000, 10000, 100000, 1000000, 10000000, 100000000, 1000000000, 10000000000, 100000000000]$

$x = [2, 4, 8, 16, 32, 64, 128, 256, 1024, 2048]$

$\log_{\text{base}}(x_n) \implies$ how many times can you divide out the base from x_n ?

Plotting without a computer...