Loyola Marymount University
William H. Hannon Library

Raising the Bar:
Understanding Data Visualizations

Digital Citizen Workshop Series

Room Expectations

Stay muted during presentation unless answering a question.

Please use the reactions on the bottom panel for speaker feedback (e.g., thumbs up).

To ask questions, use the chat box.

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Workshop Agenda

Our objectives today include:

Objective 1
Learn strategies to read and analyze data visualizations

Objective 2
Apply elements of design in creating data visualizations

Objective 3
Understand inherent bias and its impact on data visualizations

LibGuide: https://libguides.lmu.edu/digcitizen/dataviz

What is a visual?

What is the purpose of a visualization?

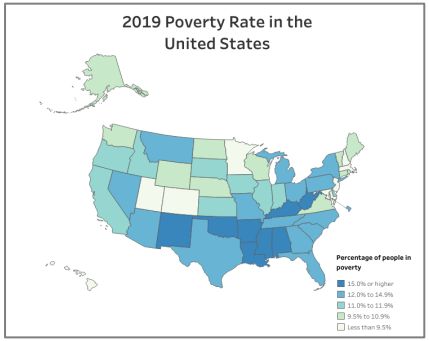
1. the representation of an object, situation, or a set of information as an image
2. the formation of a mental image of something

From *Oxford Languages*

Shallow

Intended to entertain or be purely aesthetic

Image from Pixbay.com



Deep

Intended to inform and help readers grasp a concept

Image from US Census

What is data visualization?

The graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualizations provide an accessible way to see and understand trends, outliers, and patterns in data.

From *Tableau*

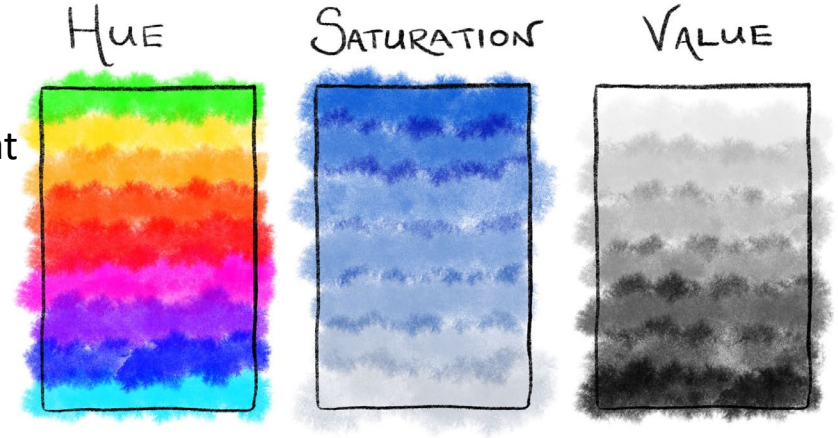
Image from Towards Data Science

Principles of Visualization

Design Principles

Color

- Basic elements of color:
  - Hue (color name)
    - Useful for comparing categories that are not ordered
  - Chroma (saturation)
    - Useful for ordered relationships
  - Value (brightness)
    - Useful for ordered relationships
- Context
  - Social, cultural, political, and more



Design Principles

Accessibility

- When choosing colors, consider your audience and accessibility
- Free tools can help! Viz Palette, Color Brewer 2

Normal color perception

Red color blindness

Green color blindness

Blue color blindness

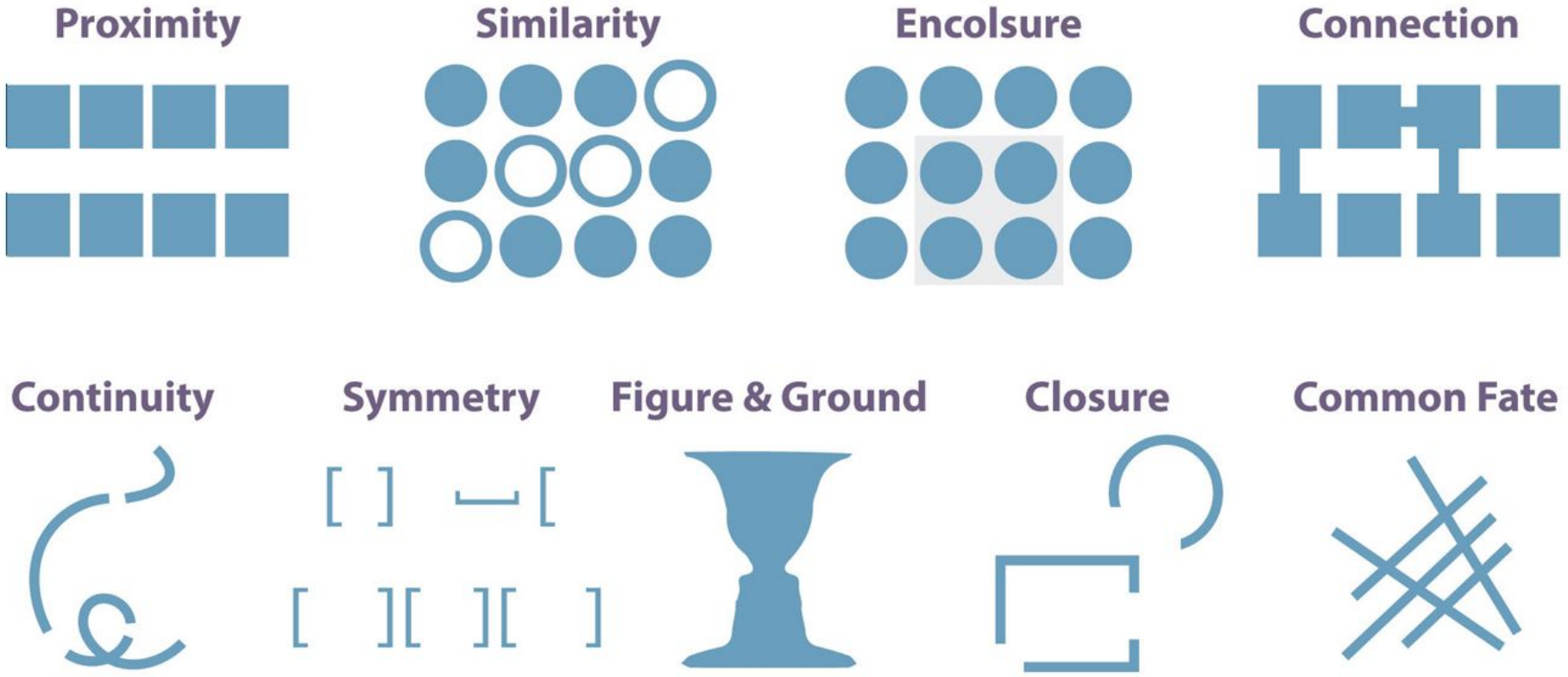
Images from http://daisymolving.github.io/2018/07/30/design-fundamentals-colour.html

Design Principles

Gestalt Principles

- “Gestalt Principles are principles/laws of human perception that describe how humans **group similar elements**, **recognize patterns** and **simplify complex images** when we perceive objects.” *Interaction Design Foundation*

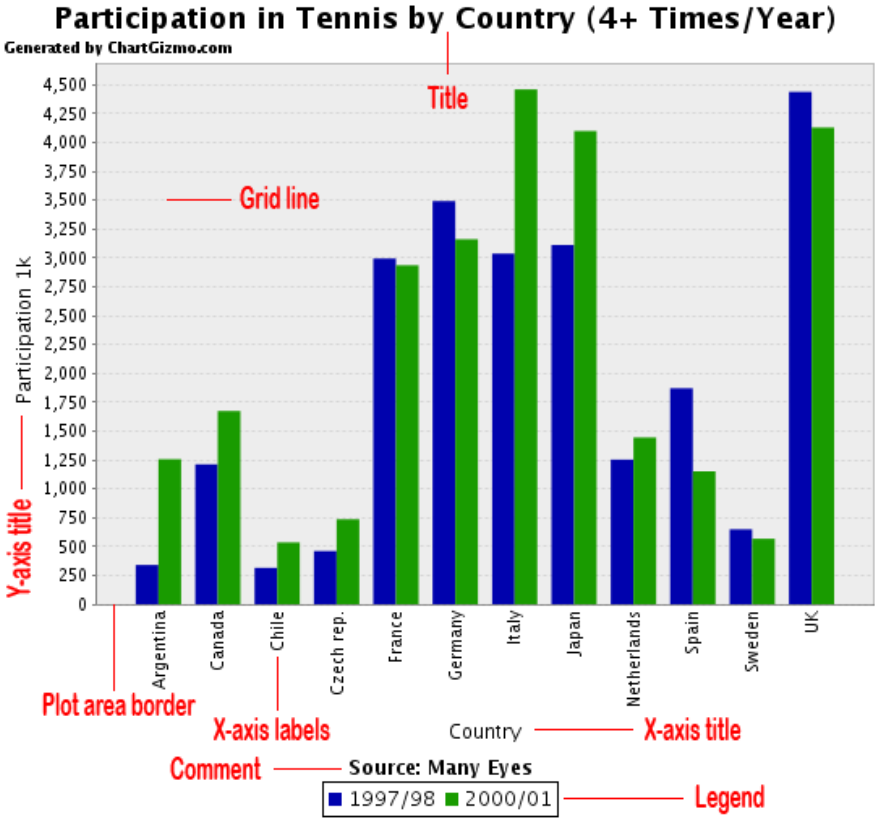
Gestalt Principles



Key Data Visualization Elements

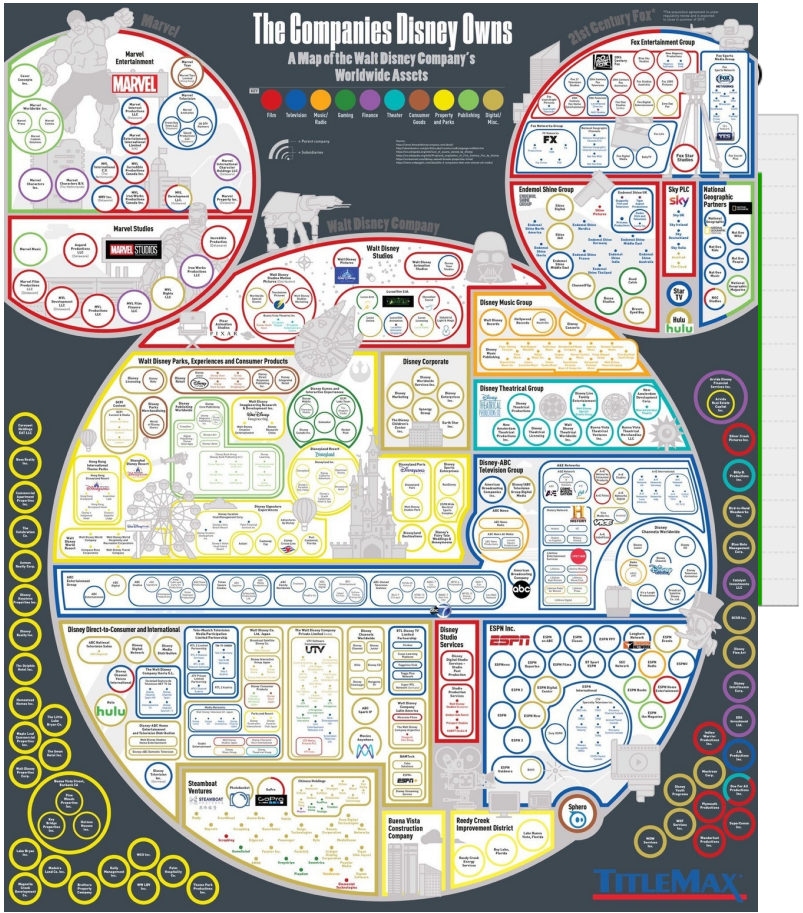
Don't Forget...

- Consider the readability of your visualization!
- Make sure to include labels:
  - Title
  - Axes/scale
  - Units
- Data Source
- Key/Legend (if needed)



General Best Practices

- Use consistency with intervals/scales
  - Y-axis should start at 0
- Order categories in a logical manner:
  - smallest to largest (or vice versa)
  - sequentially
- More content doesn't always equal better content



Spotting Misleading Visualizations

Bias in Visuals

- Visuals are inherently biased at multiple stages:
  - Creation of the visualization
    - Data, visualization tool, format
  - Interpretation of visualization
    - Confirmation bias, representational bias

To learn more, see *Cognitive Biases in Visualizations*, edited by Geoffrey Ellis

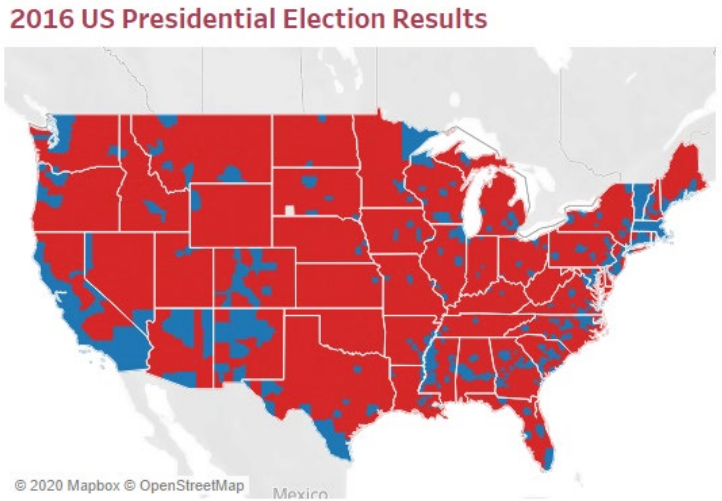
The DIG Method

- The Digital Image Guide (DIG) method is used to evaluate visualization
- Focuses on analyzing, interpreting, evaluating, and comprehending the visual

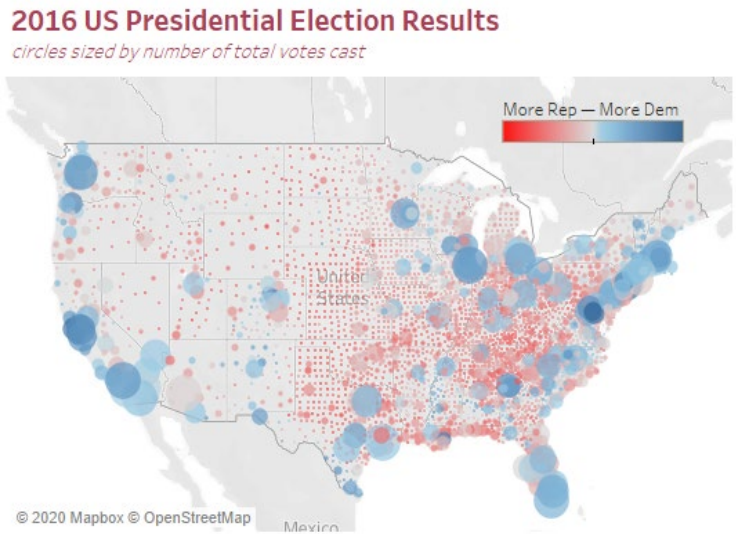
The DIG Method

ANALYZING
1. Review and describe the image. 2. Review the text. 3. React to the image.
INTERPRETING
1. Determine the source (creator, publisher, and/or website) of the image. 2. Determine the message of the image. 3. Search for other sources to further contextualize the image.

Example Using DIG



versus



Misleading

More accurate

Spotting Misleading Visualizations Activity

Misleading Visualization Activity

- In breakout rooms, view the following visualizations:

  Bit.ly/DataVizActivity_1

- For each misleading visualization, use the DIG method to determine how it is misleading
  - View the DIG method on the LibGuide at: https://libguides.lmu.edu/digcitizen/dataviz
- For each visualization, how can it be made better?
- You will have 10 minutes to complete activity.

Image 1

Common Misleading Mistake:

- Truncating or altering the y-axis

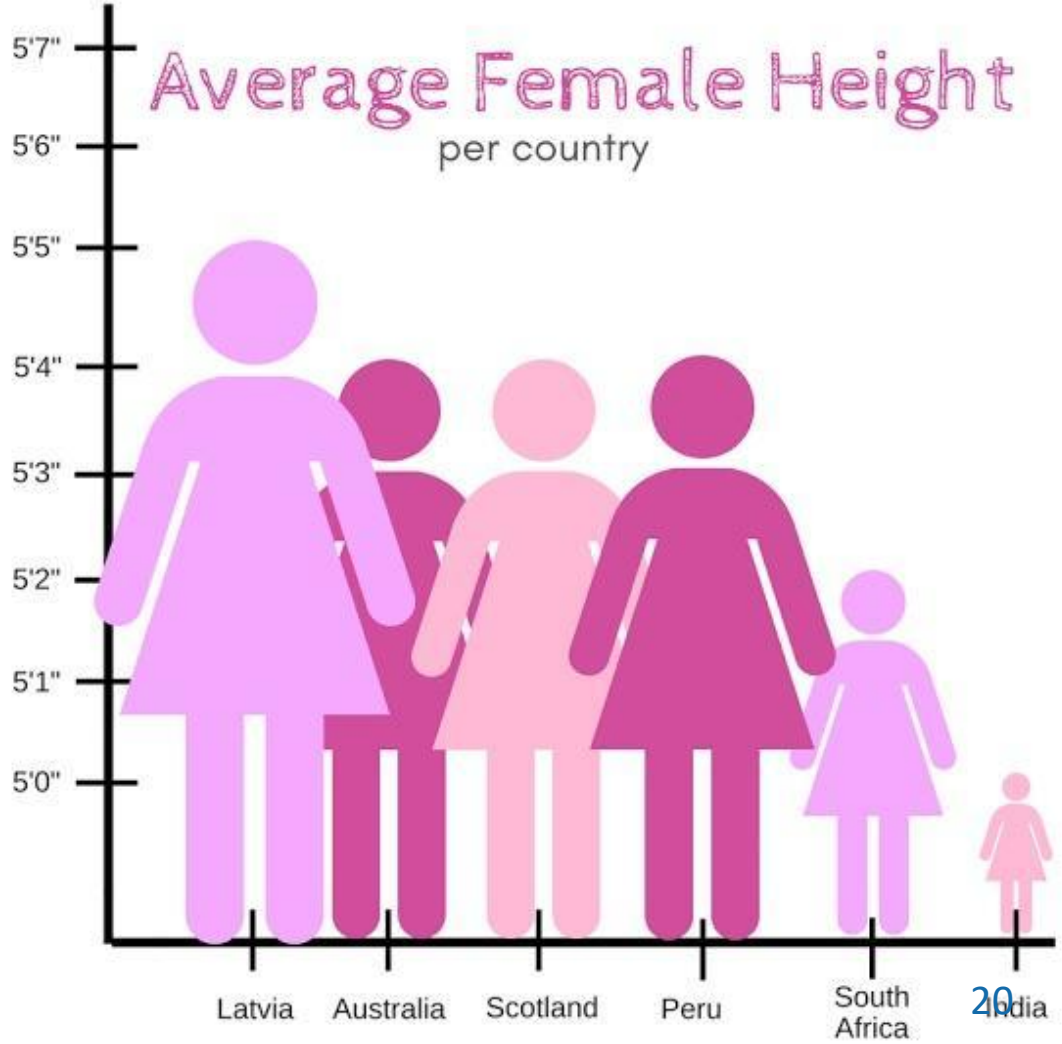
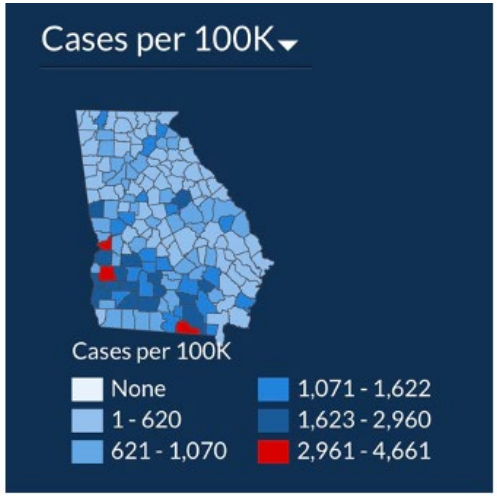
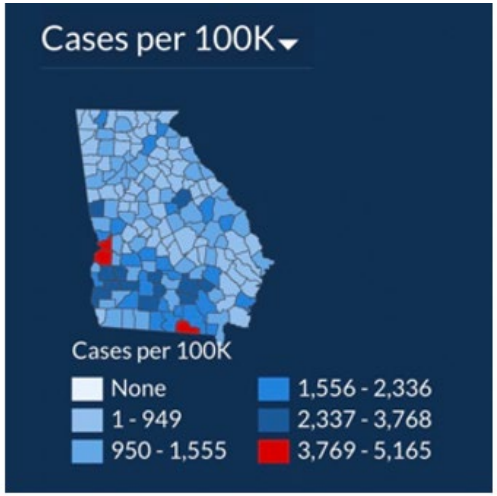


Image 2



Posted July 2, 2020
Total Cases: 48,207
Total Deaths: 2,102

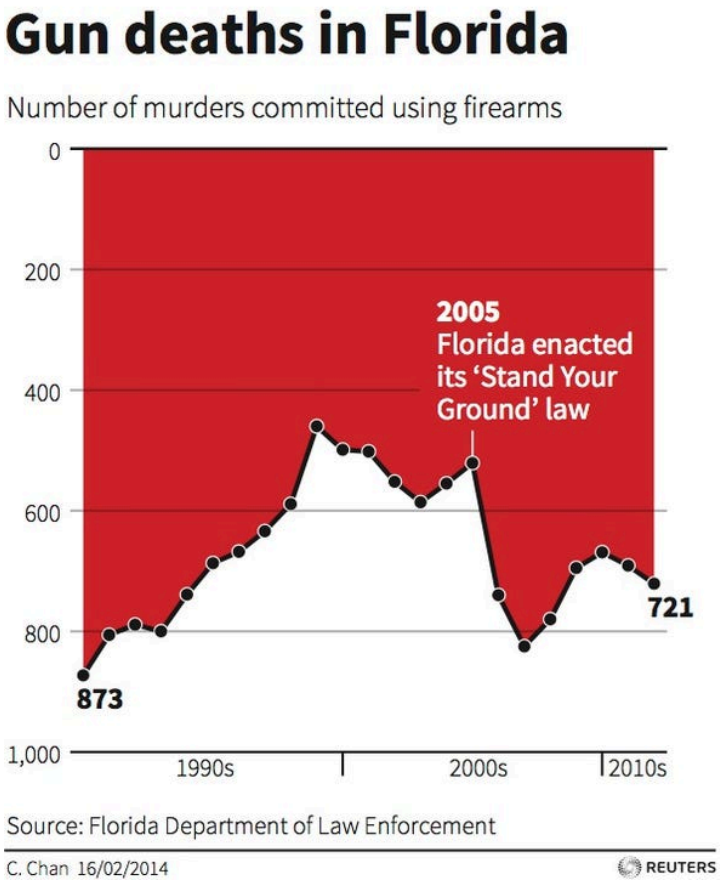


Posted July 17, 2020
Total Cases: 135,183
Total Deaths: 3,132

Common Misleading Mistake

- Inconsistent ranges and categories
- Misusing color gradient

Image 3



Remember social conventions for reading visualizations!

- Reading from bottom left
- Lower numbers on bottom of y-axis

Forms of Visualization

Types of Visualizations

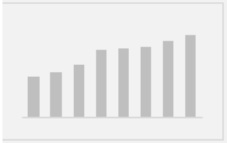
- Different forms have different functions
- Different types of data need different forms
  - Quantitative versus categorical
- Choosing the form suited to your data can improve the readability and communication of your message!

A CLASSIFICATION OF CHART TYPES

Data comparison charts

Comparison

Bars



Dot plot

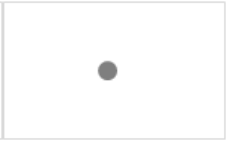
Bullet

1D Scatterplot

Heat map

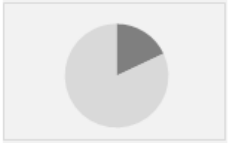
Slope

Alert



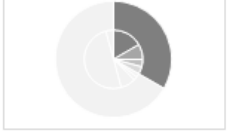
Composition

Pie



Pareto

Multidimensional Pie



Distribution

Histogram

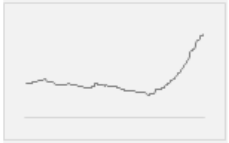
1D Scatterplot

Boxplot

Data reduction charts

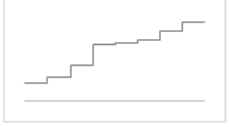
Evolution

Line

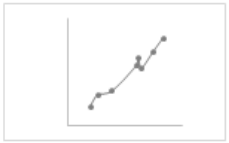


Horizon

Step

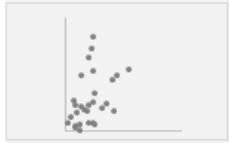


Connected Scatterplot



Relationship

Scatterplot



Connected Scatterplot

Bubble

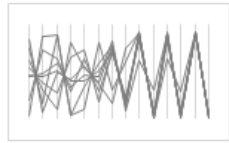
Profiling

Grouped bars

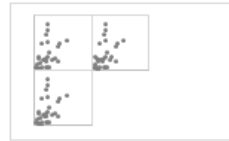
Cycle plot

Reorderable matrix

Parallel Plot



Scatterplot matrix



Horizon

Trellis

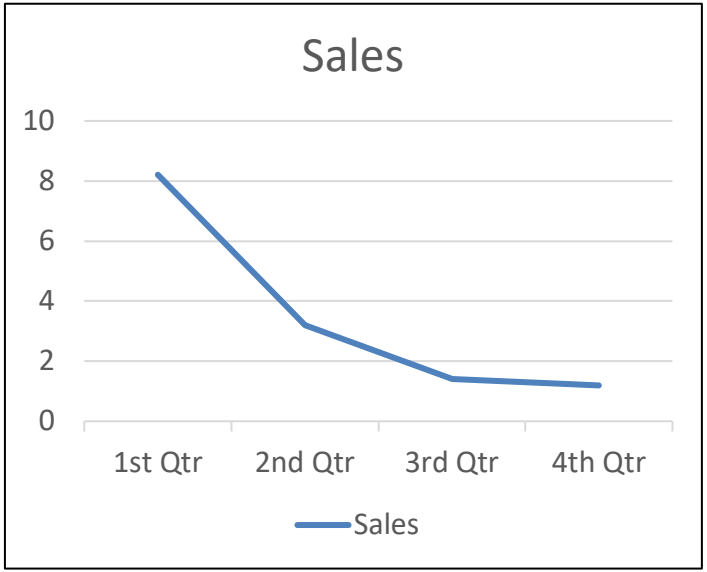
v 0.9

excelcharts.com

Common Types of Visualizations

Line

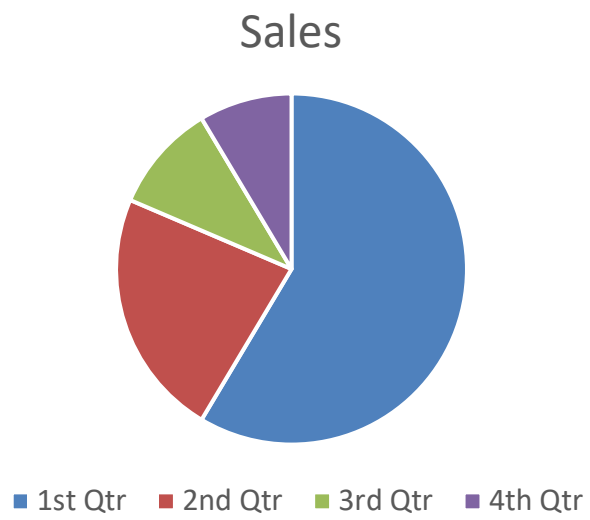
- Best for showing value **changes over time**
- Comparing lots of data at same time
- Forecasting data



Common Types of Visualizations

Pie

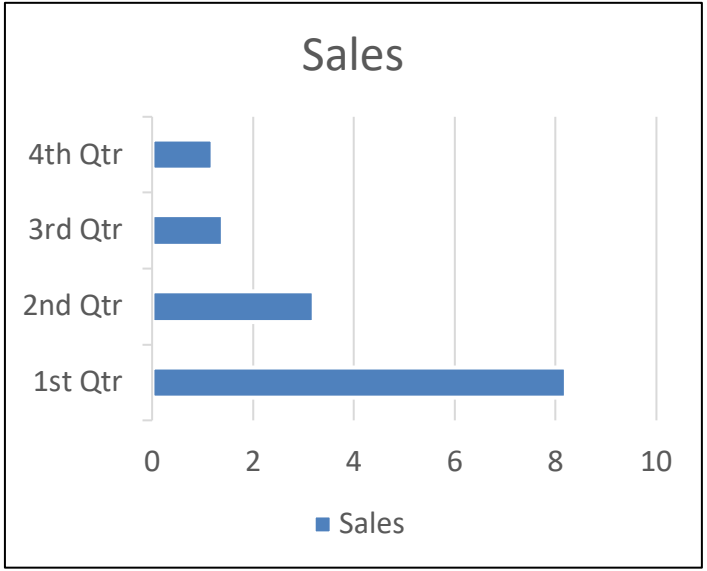
- Used for **part-to-whole** relationships
- Conveying a segment as *relatively* small or large
- Note: exact comparisons are difficult



Common Types of Visualizations

Bar

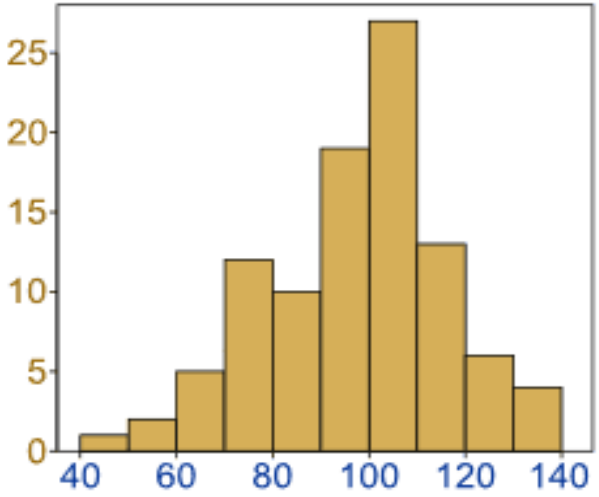
- Best for **categorical** data or **group-based** data
- Tip: intentionally order bars



Common Types of Visualizations

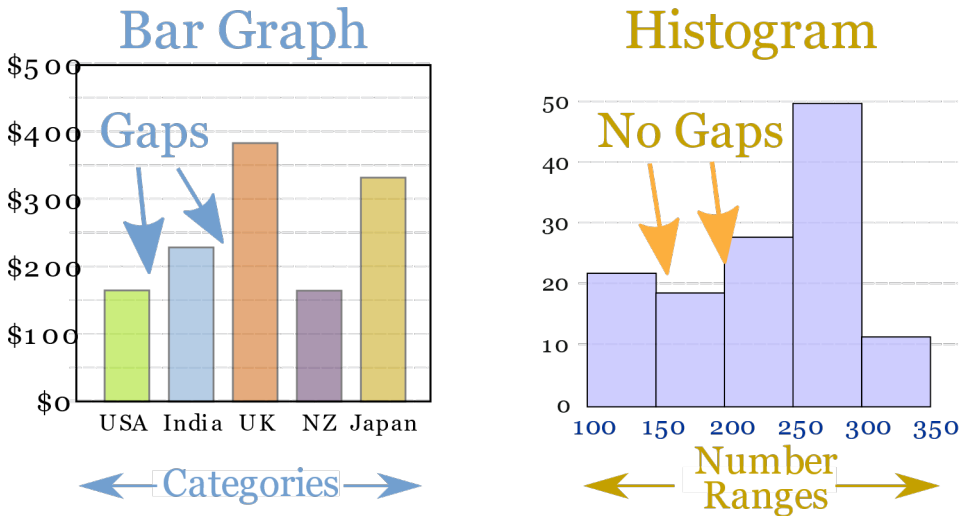
Histogram

- Similar to a bar chart
- Best for **grouping** numbers into **ranges**



https://www.mathsisfun.com/data/histograms.html

Bar versus Histogram

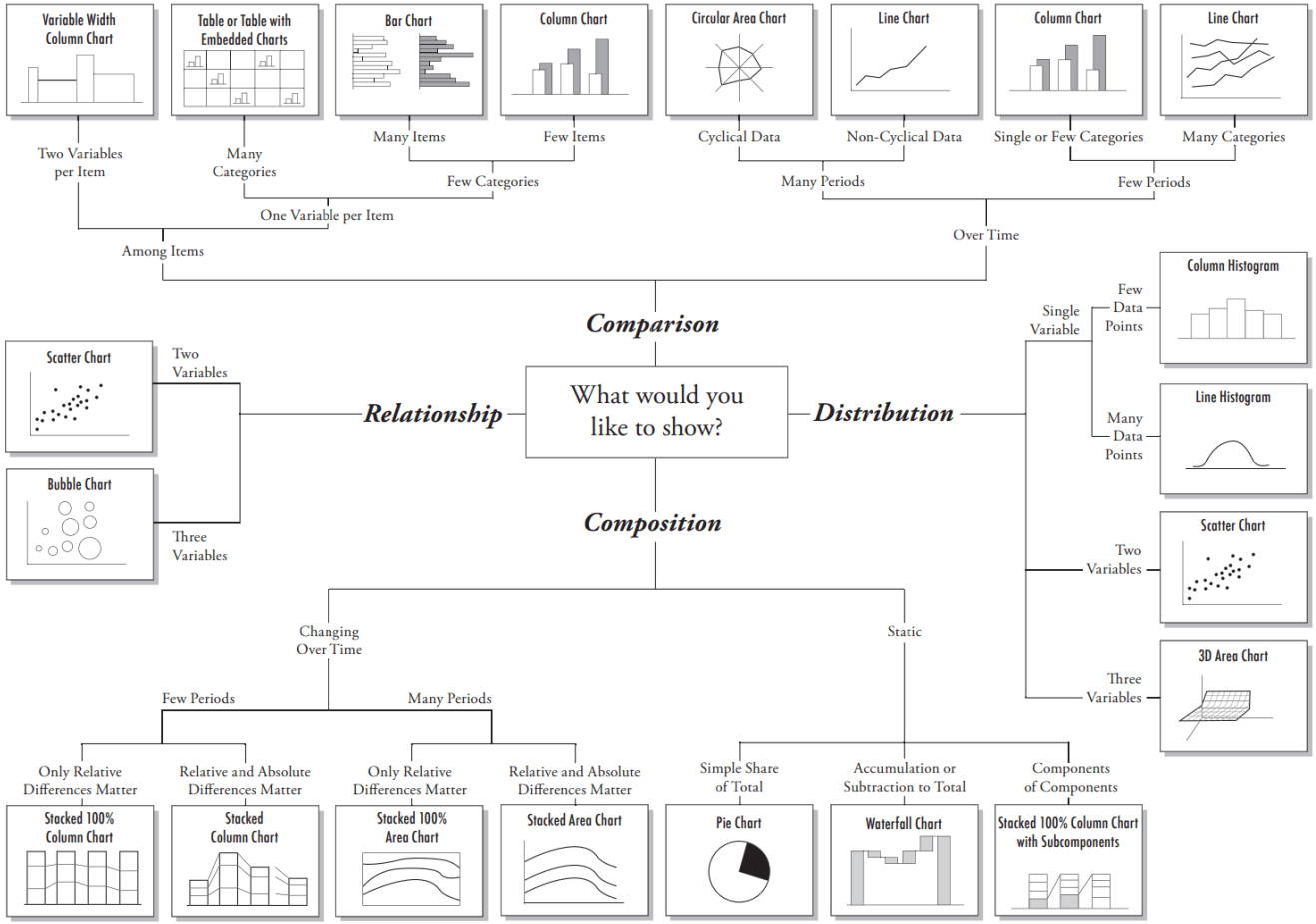


https://www.mathsisfun.com/data/histograms.html

Maps

- Maps are also visualizations!
- Useful for showing geographically based datasets
- Multiple types of maps, with common types including:
  - Bubble Maps
    - Displays location and population
  - Dot Maps
    - Displays location

Chart Suggestions—A Thought-Starter



Tools for choosing

- Storytelling with Data Chart Guide
  - http://www.storytellingwithdata.com/chart-guide
- Data Viz Catalogue:
  - https://datavizcatalogue.com/
  - Includes sorting by function

Selecting a Form Activity

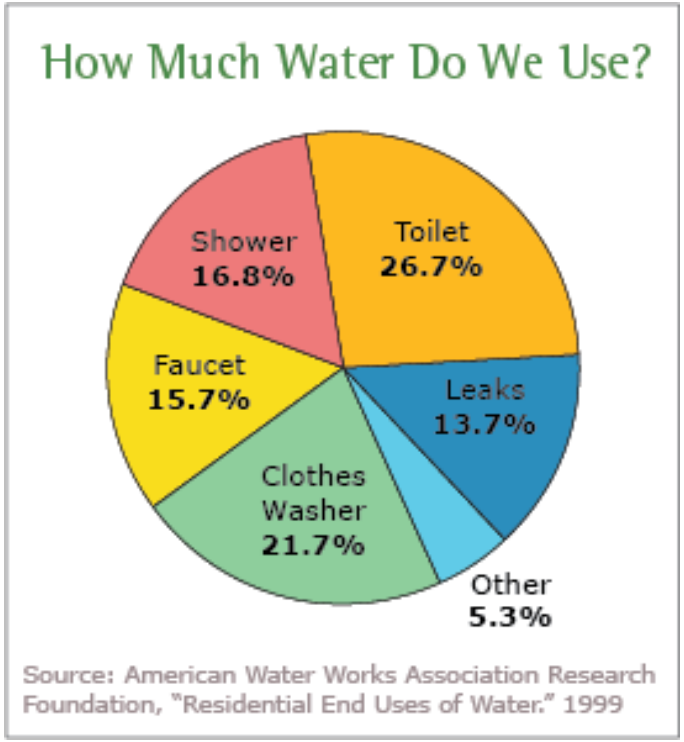
Selecting a Form Activity

Bit.ly/DataVizActivity_2

- In breakout rooms, review the following scenarios.
- For each scenario, determine the appropriate type of visualization to best represent the data. Choose from bar chart, histogram, line graph, map, or pie chart.
  - View the chart comparison on the LibGuide at: https://libguides.lmu.edu/digcitizen/dataviz
- You will have 10 minutes to complete the activity.

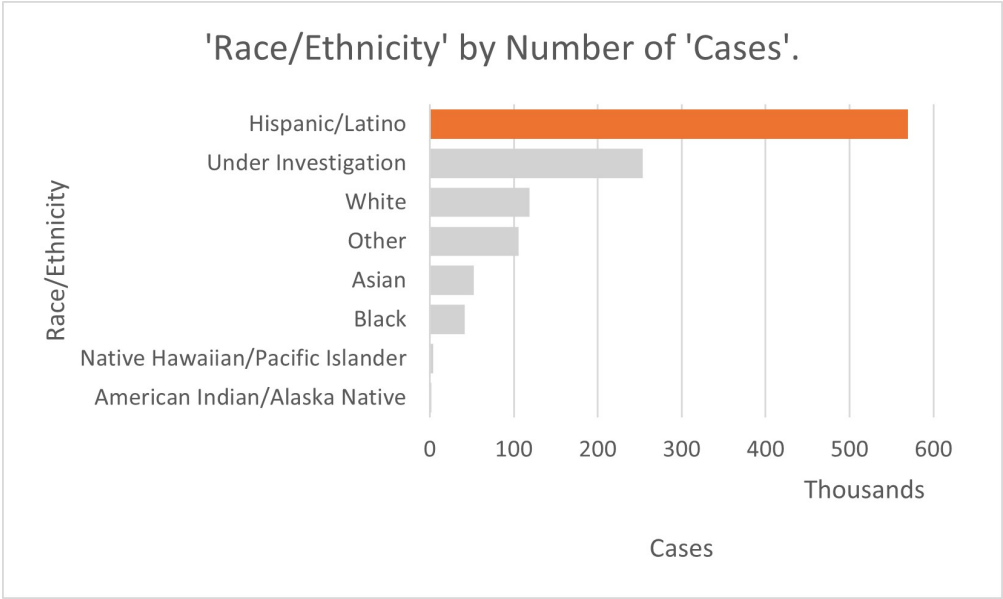
Scenario #1

Using average residential data from the American Water Works Association, visually represent the percent of total water usage each water-using household item uses. The categories include shower, toilet, faucet, washing machine, leaks, and other.



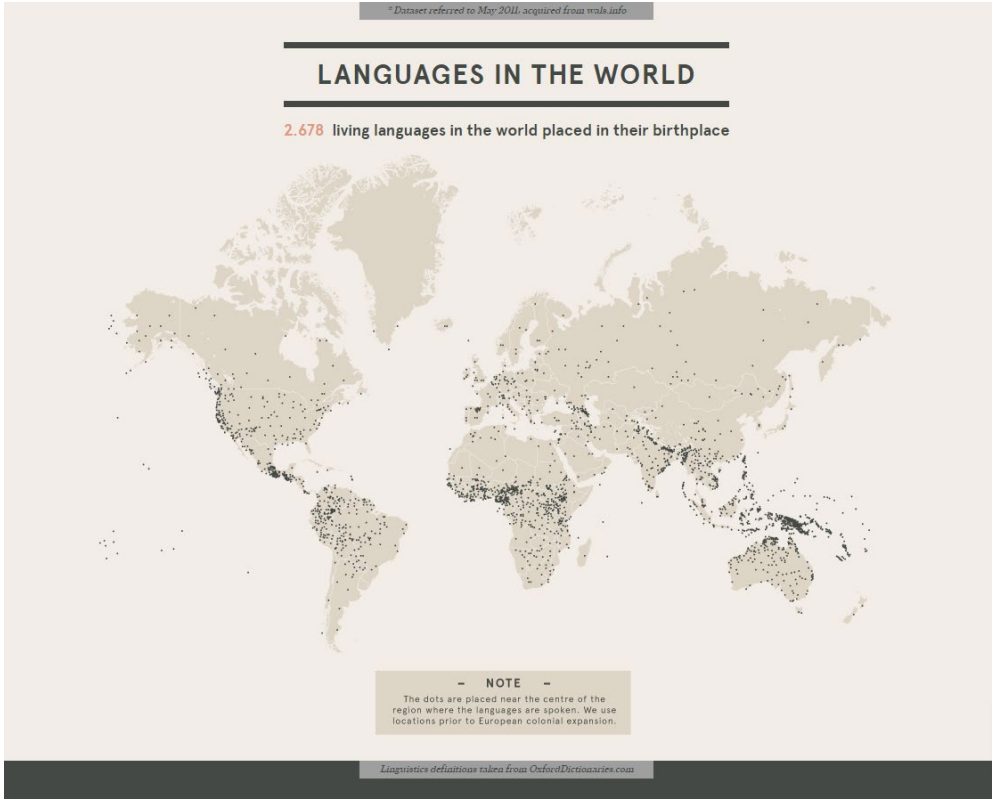
Scenario #2

Scenario: Based on COVID-19 data from the “Los Angeles County Case Summary,” how would you visually represent the number of cases by Race/Ethnicity in Los Angeles County?



Scenario #3

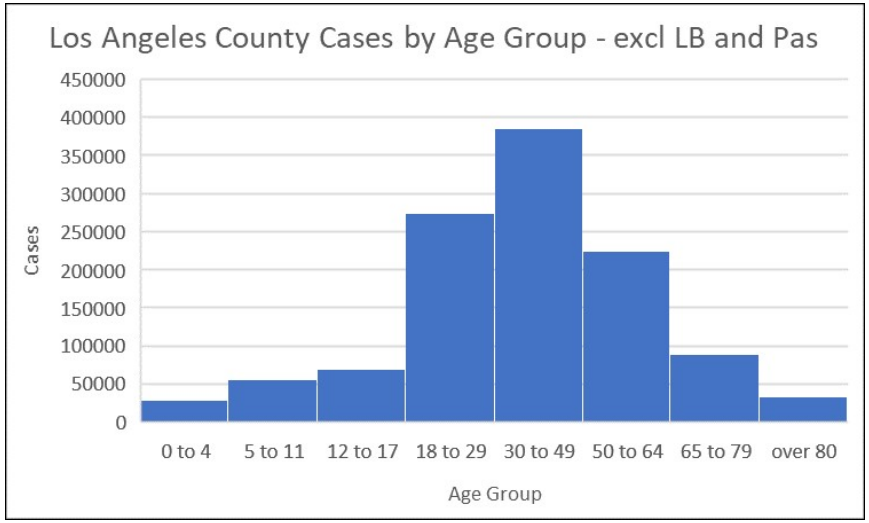
Scenario: Based on data from the World Atlas of Language Structures (WALS) database, 2,678 living languages currently exist in the world. How would you visually represent the languages corresponding with the birthplace of each language?



Source: http://www.puffpuffproject.com/languages.html

Scenario #4

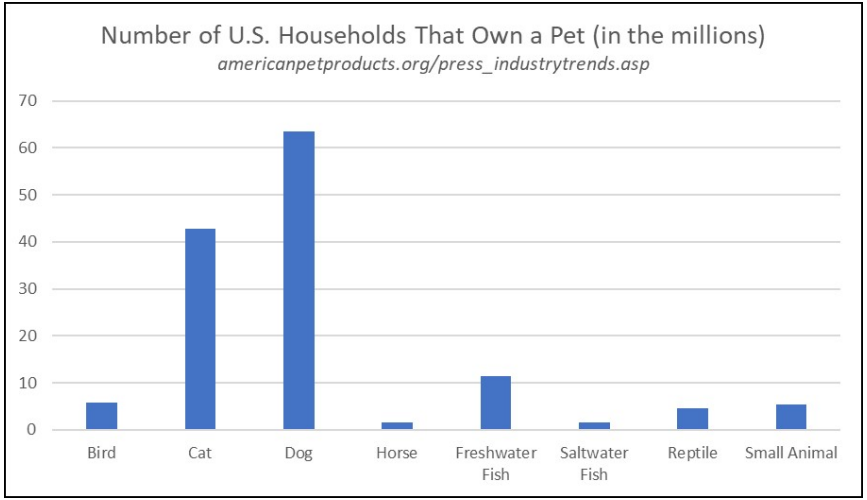
Scenario: Based on the data from Los Angeles County on COVID-19 cases, how would visually represent the number of cases per age group within LA County?



Source: http://publichealth.lacounty.gov/media/coronavirus/locations.htm

Scenario #5

Using the data from American Pet Products, how would you visually represent the number of households that own a pet by pet type (bird, cat, dog, horse, freshwater fish, saltwater fish, reptile, small animal)?



Visualization Tools

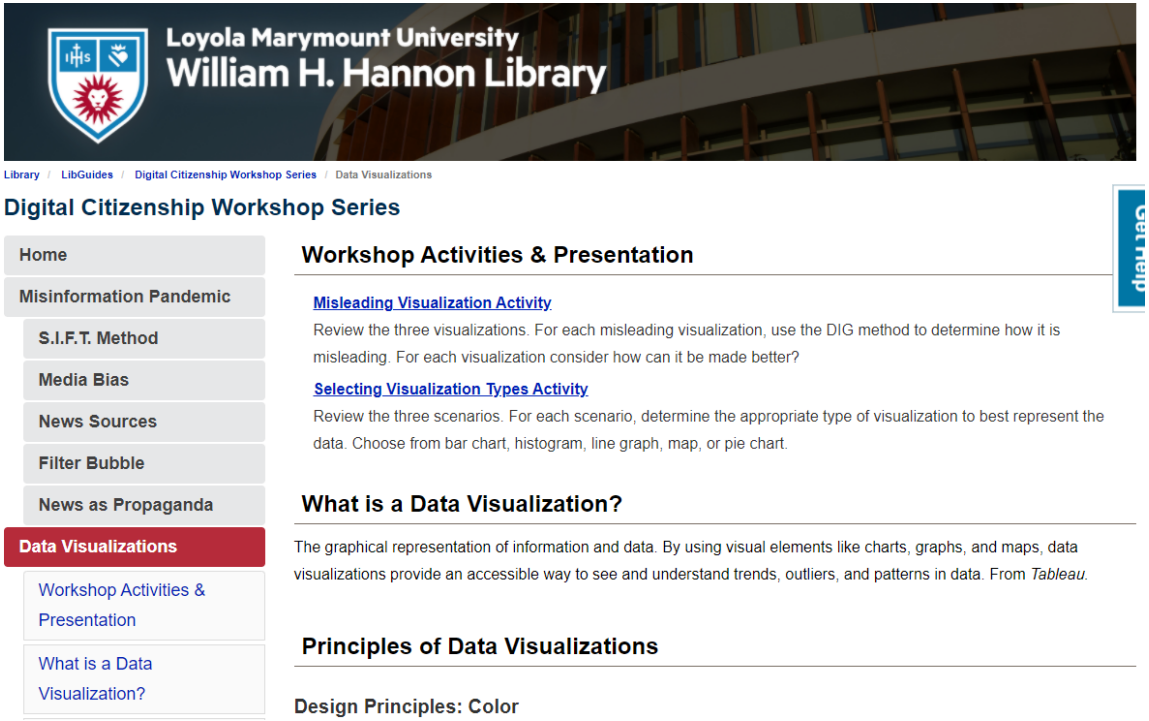
- Tableau
  - Free version
  - Year long educational access available for students
- Excel
  - Ability to create basic or more advanced visuals
- R
  - Used for statistical analysis
  - Can create visualizations using different libraries

Wrap-Up

- Principles of Visualization:
  - Color
  - Gestalt Principles (how humans naturally group visuals)
- Assessing a Visualization
  - DIG Method
- Types of Visualizations
  - Picking chart/graph type based on your data and story

Resources

LibGuide Link: https://libguides.lmu.edu/digcitizen/dataviz



Evaluation Form

We appreciate your feedback!

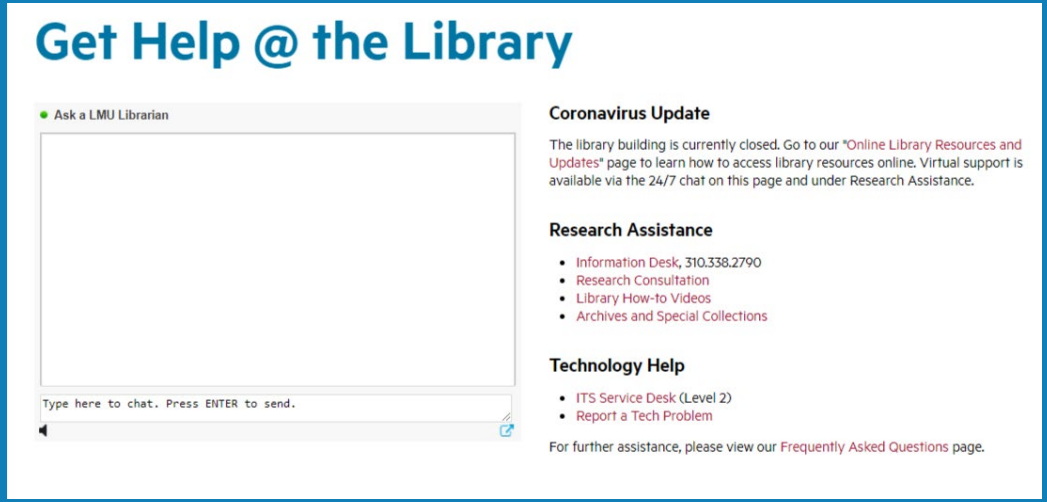
https://libguides.lmu.edu/digcitizen/feedback

Questions?

Shelby Hallman
Shelby.Hallman@lmu.edu

Nicole Murph
Nicole.Murph@lmu.edu

Nataly Blas
Nataly.Blas@lmu.edu



Digital Citizen Workshop Series