UN5550 – Sp25

Visualization

Sujan Kumar Roy, PhD

T 01/21

Chart Selection – Andrew Abela

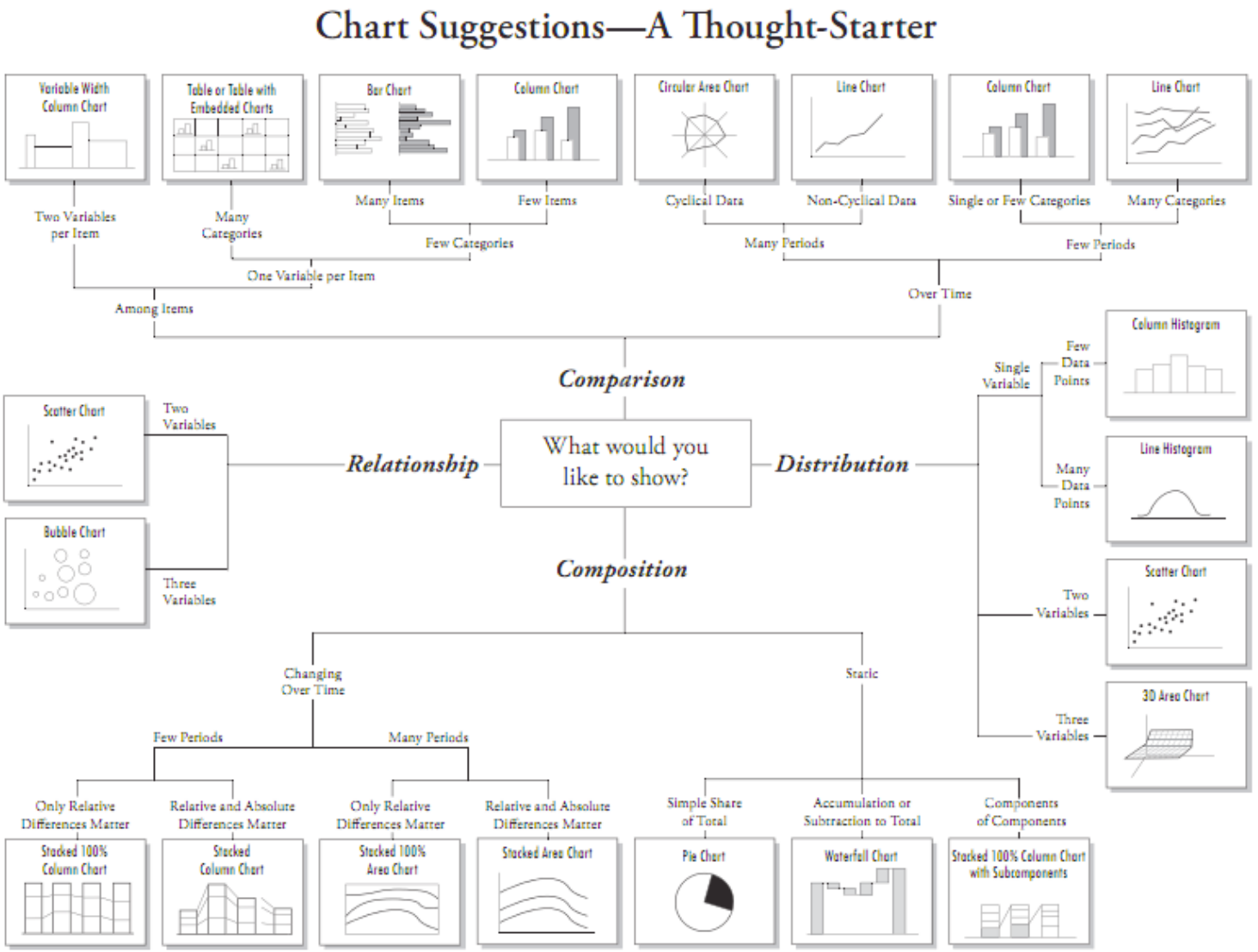
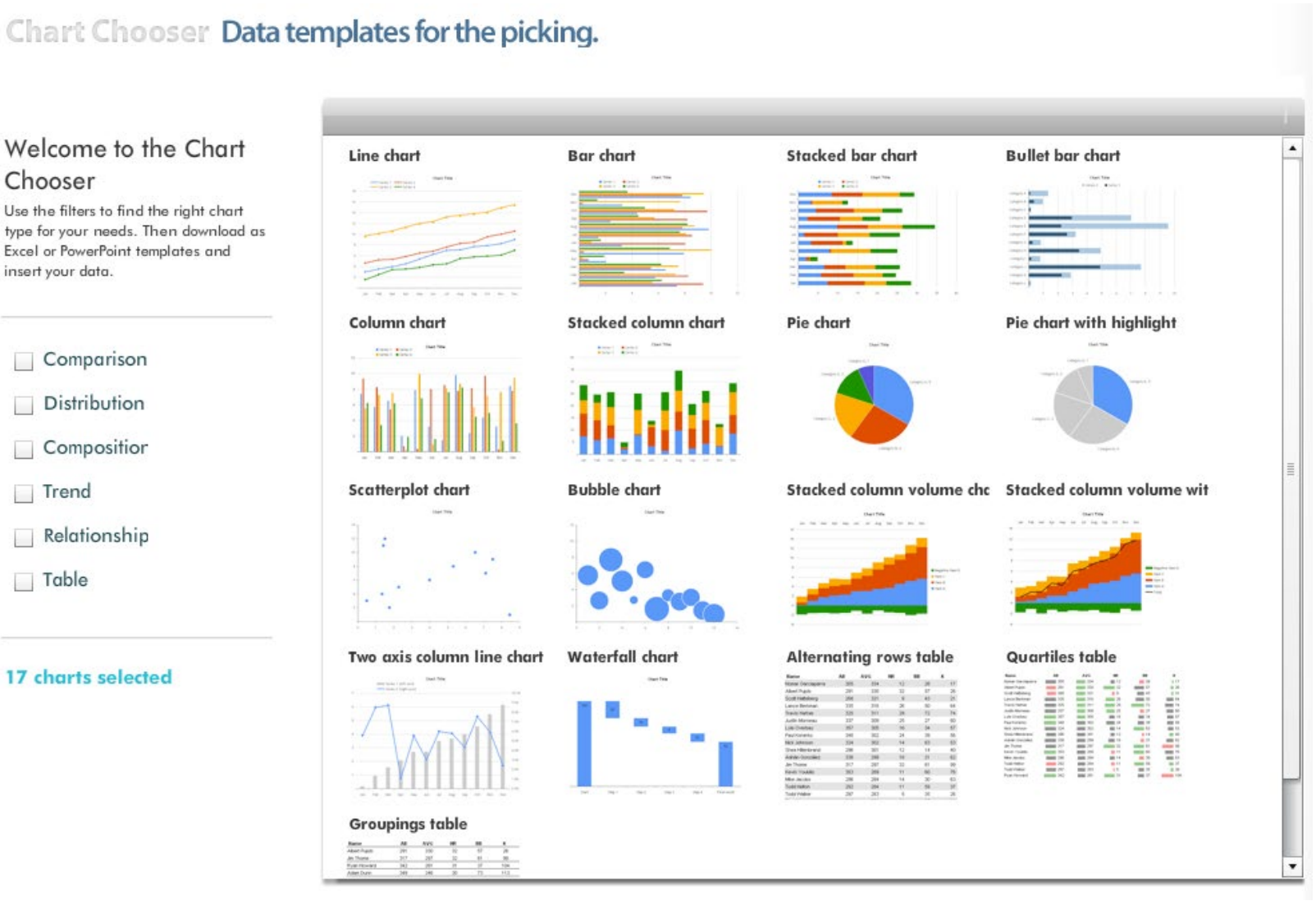
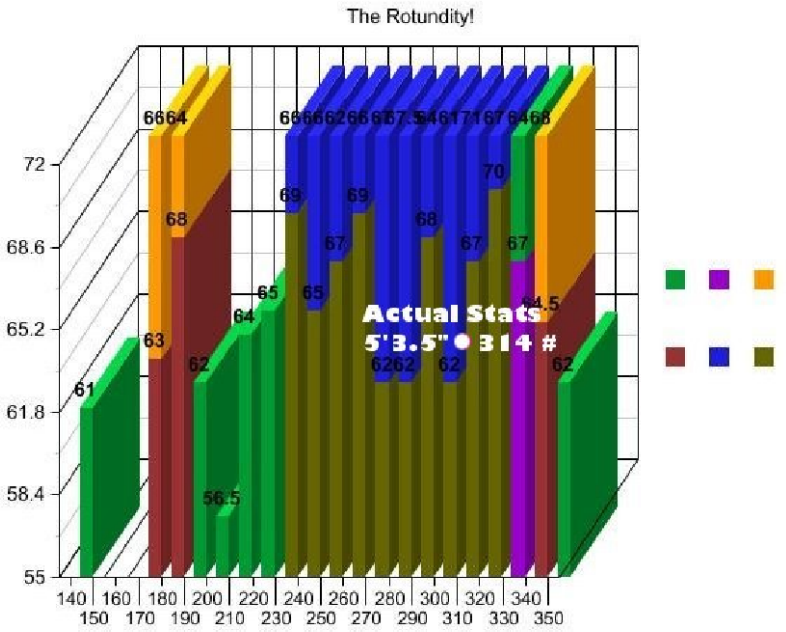
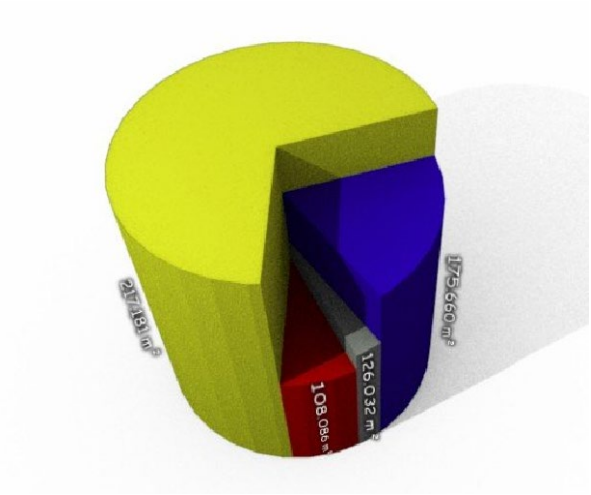


Chart Selection – Juice Analytics

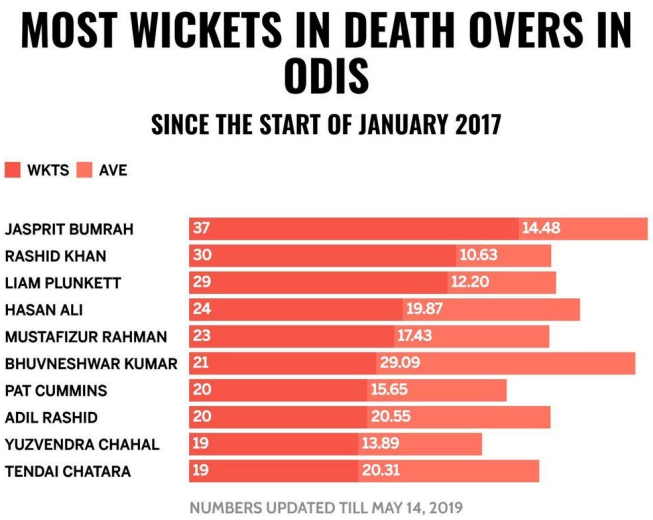


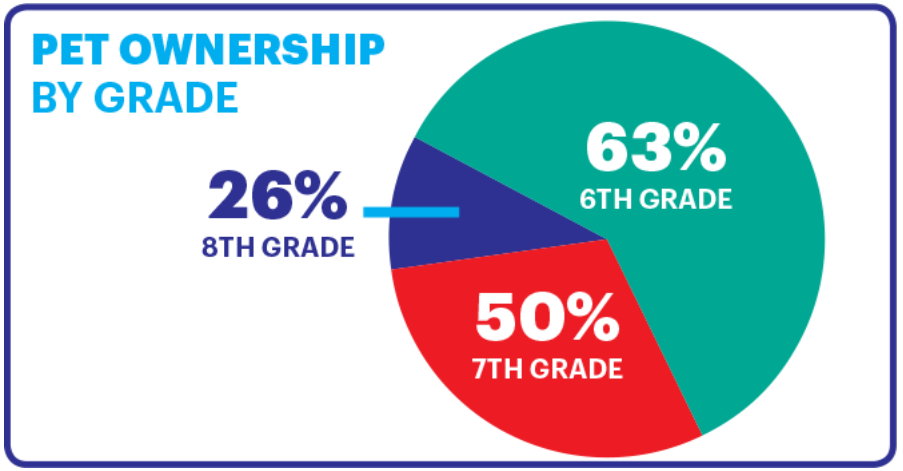
Bad Visualizations

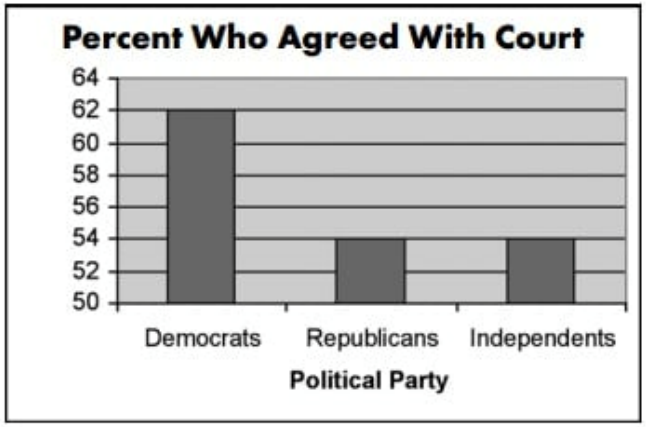


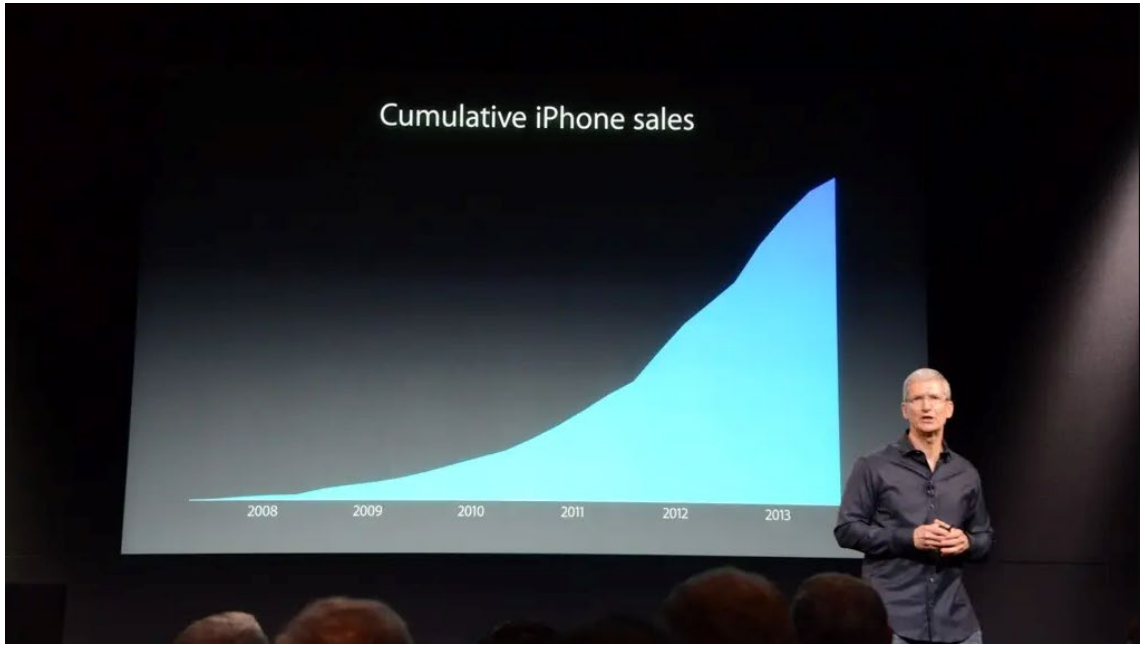


Bad/Misleading Visualizations









Other Aspects of Visualization

- Cognitive and Human-factors with visualization
  - Rules and principles of scientific visualization:
  - http://www.siggraph.org/education/materials/HyperVis/percept/visrules.htm
- Artistic aspects of visualization
  - Edward Tufte: http://www.edwardtufte.com/tufte/
- Many more data types
- Good practices

Two Primary Goals of Viz

- **Explore/Calculate**
  - Analyze
  - Reason about Information
- **Communicate**
  - Explain
  - Make Decisions
  - Reason about Information

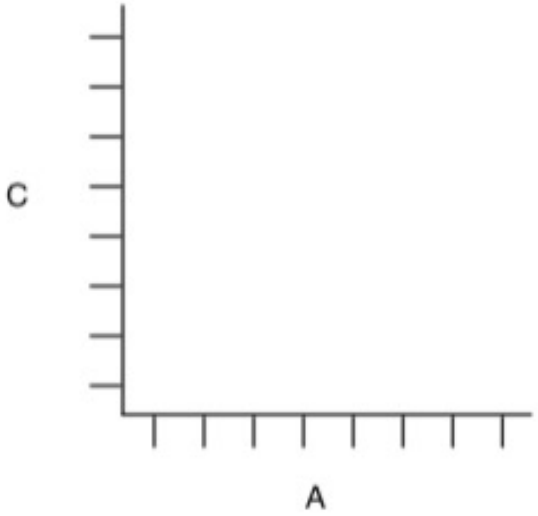
Anatomy of a Graph

- Framework
  - Sets the stage
  - Kinds of measurements, scale, …
- Content
  - Marks
  - Point symbols, lines, areas, bars, …
- Labels
  - Title, axes, tic marks, …

Elements of a Plot

Geometric Objects

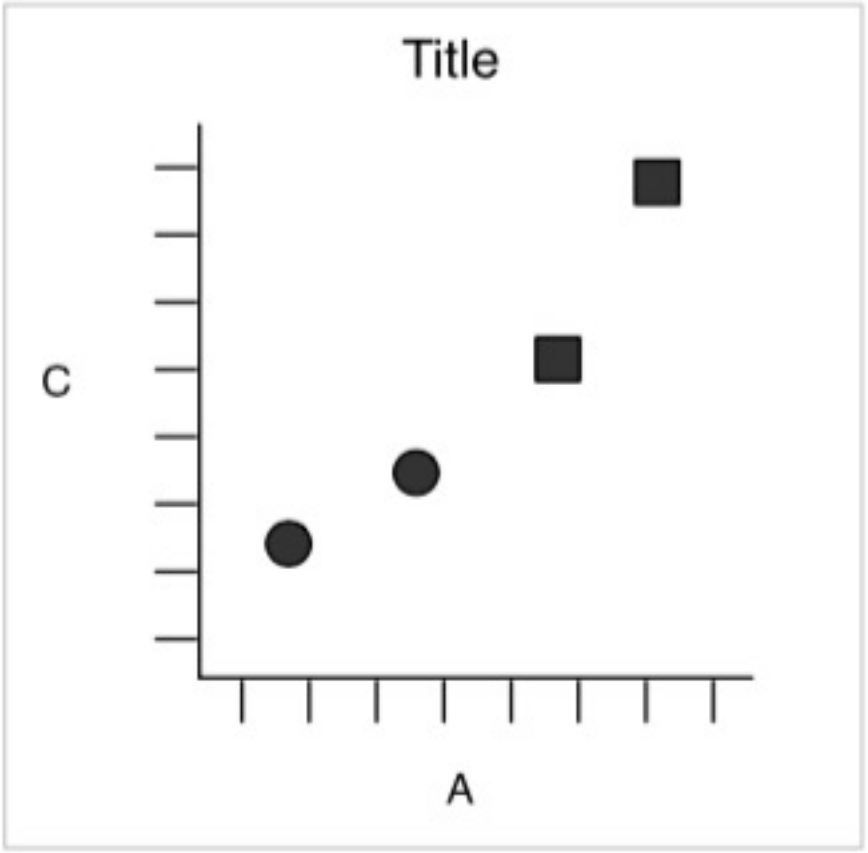
Scales & Coordinates



Annotations

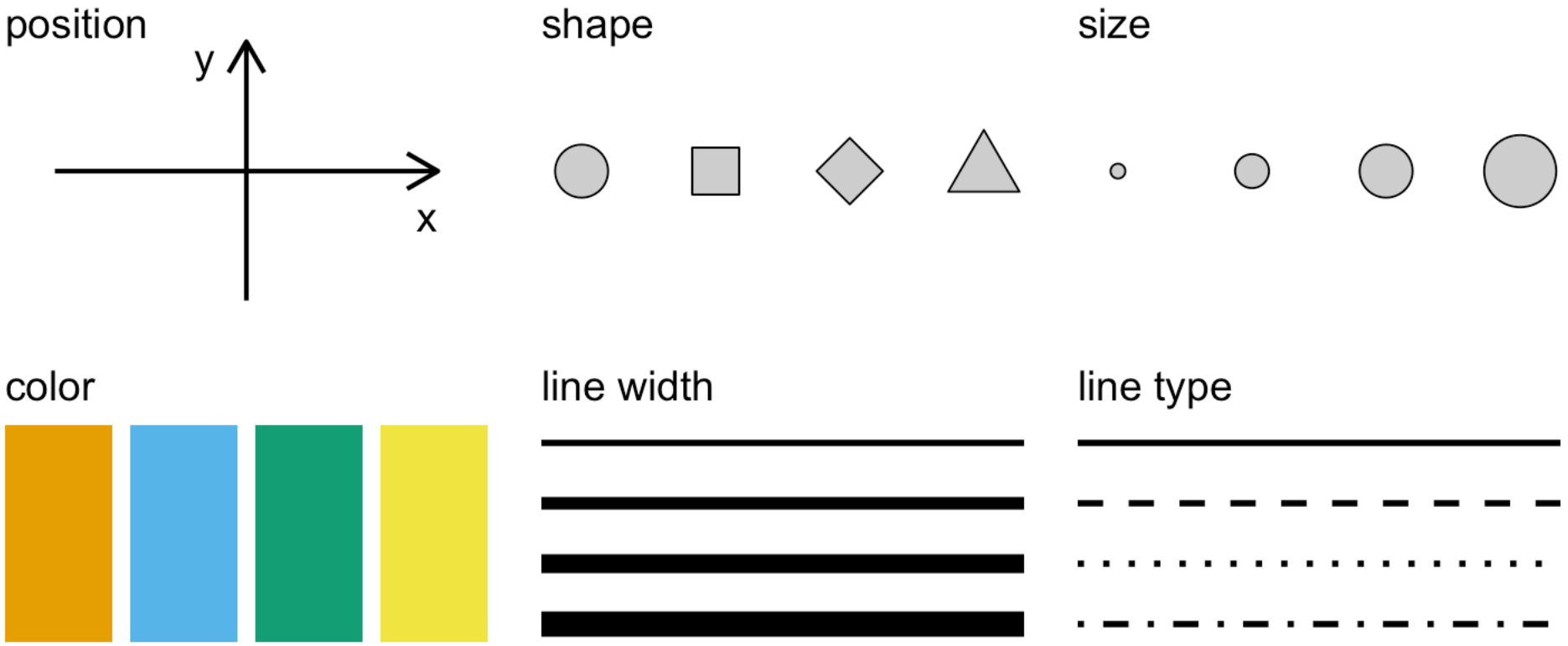
Wickham 2010

Elements of a Plot



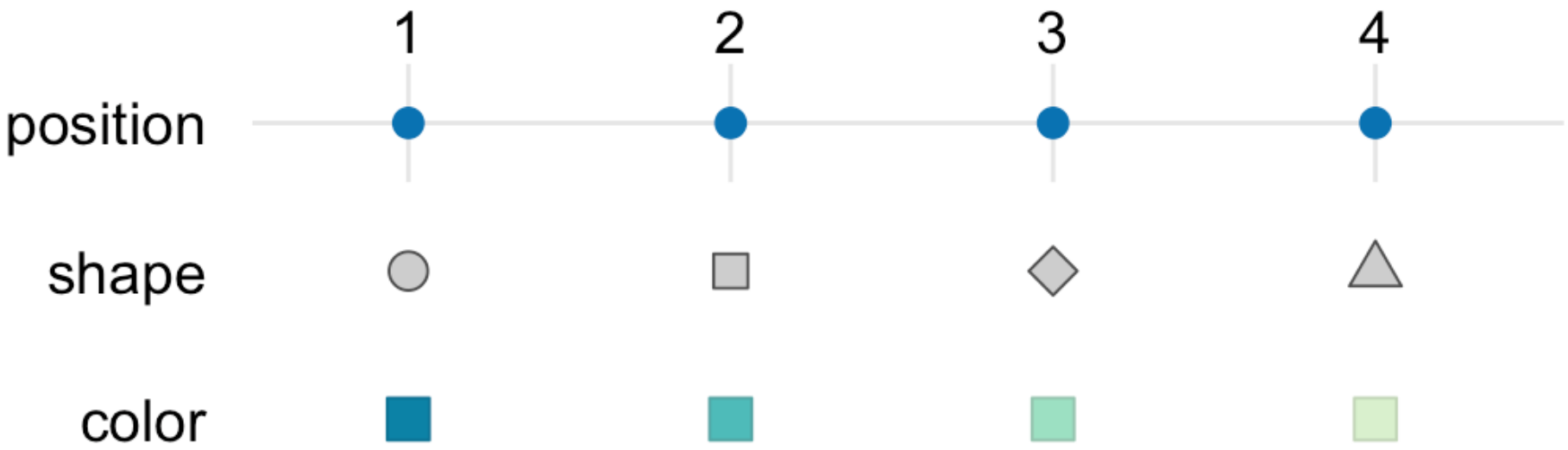
Wickham 2010

Aesthetics of a Plot



Wilke 2018

Aesthetics Map Data to Visual Representation



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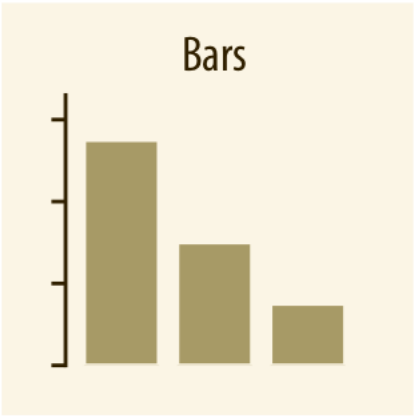
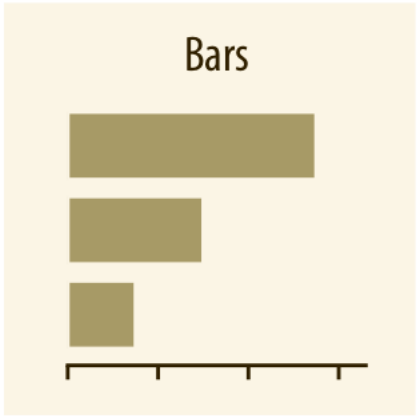
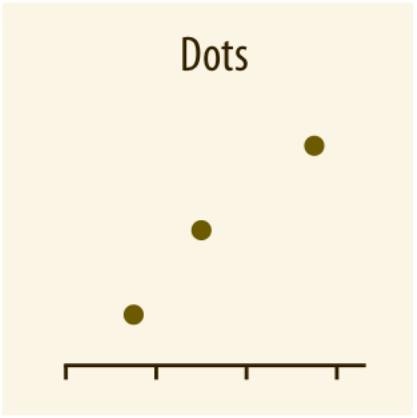
Amounts







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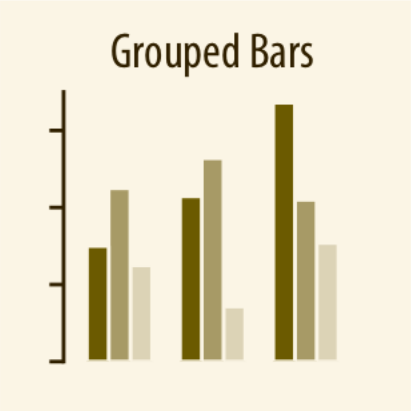
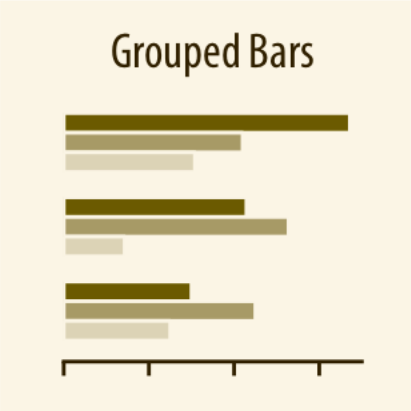
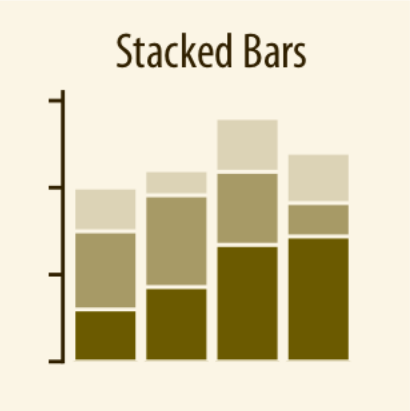
Amounts – Two or More







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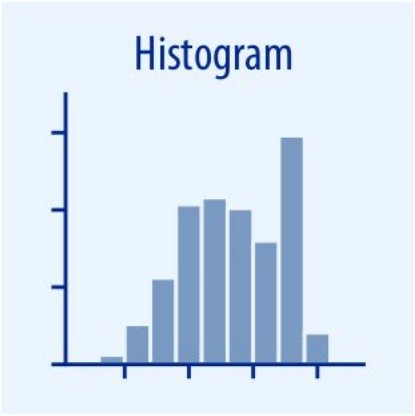
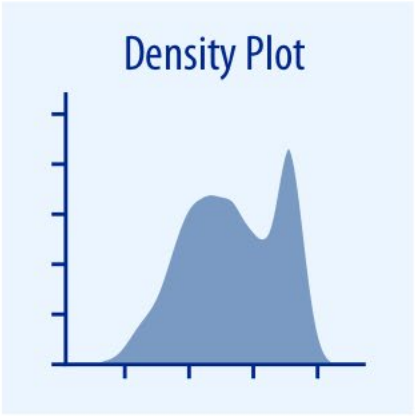
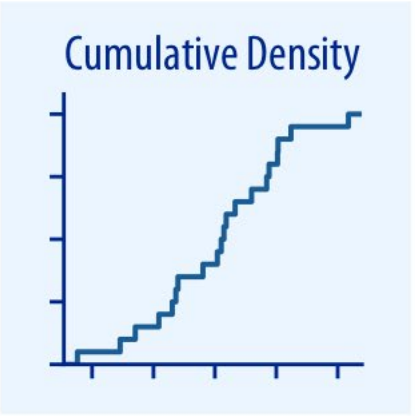
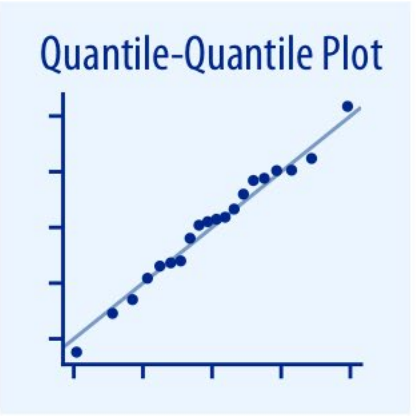
Distributions



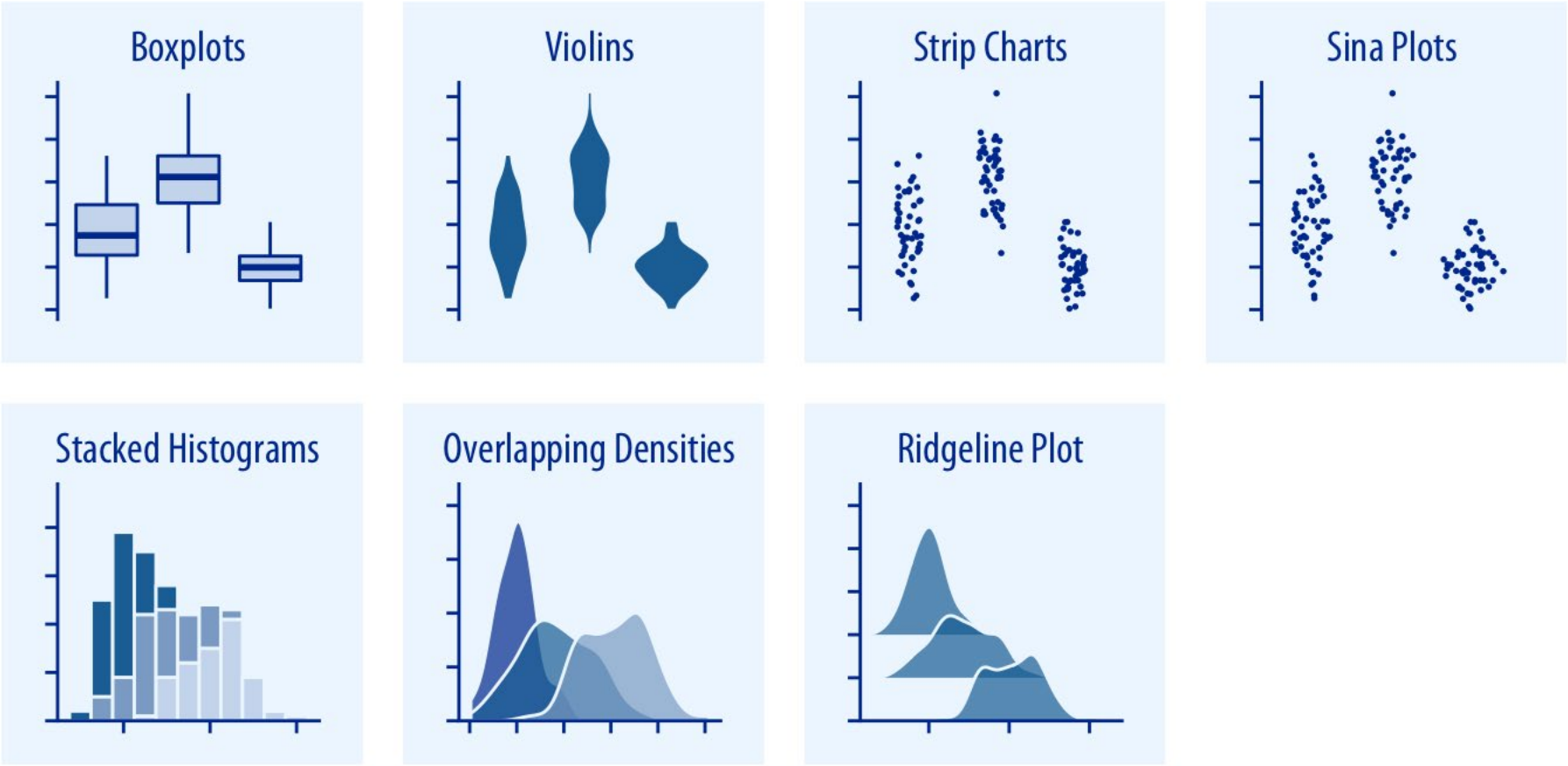






Wilke 2018

Distributions: Multiple



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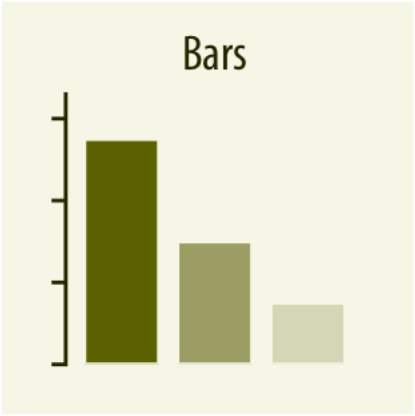
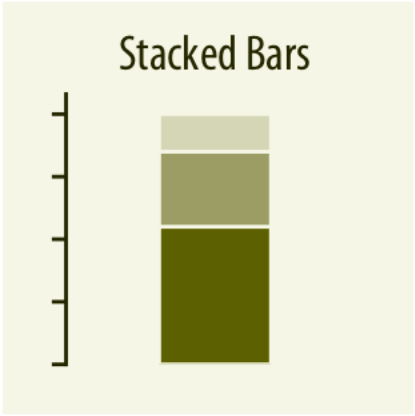
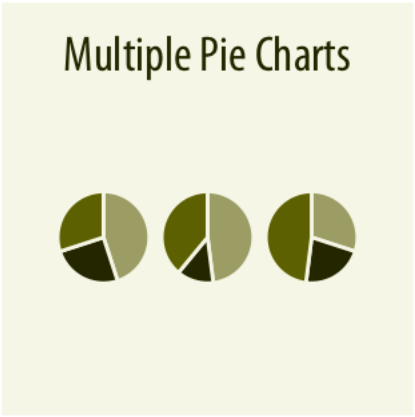
Proportions

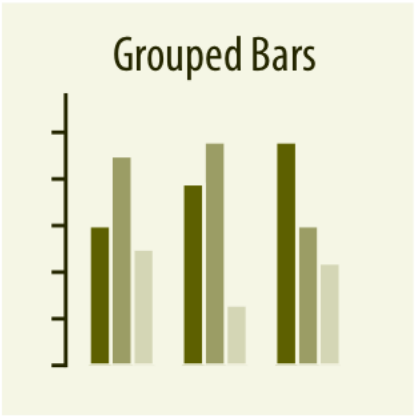


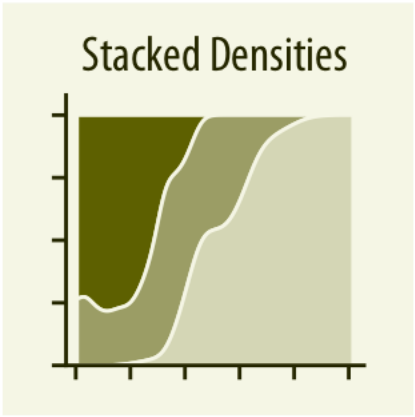


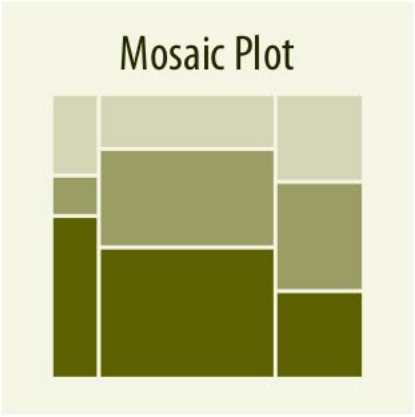
Wilke 2018

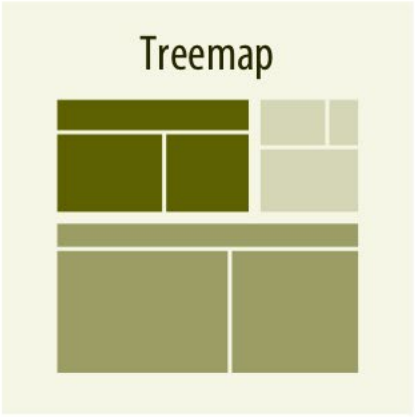
Proportions: Multiple











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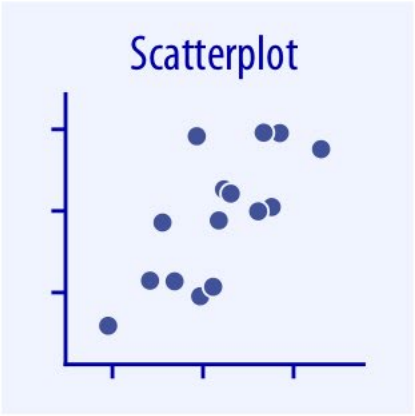
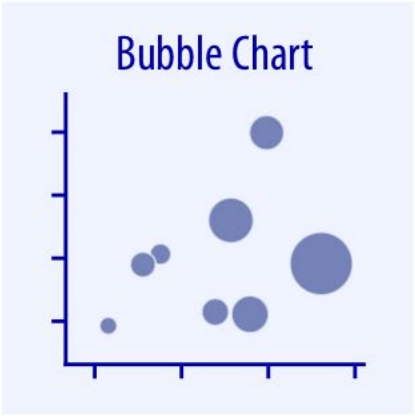
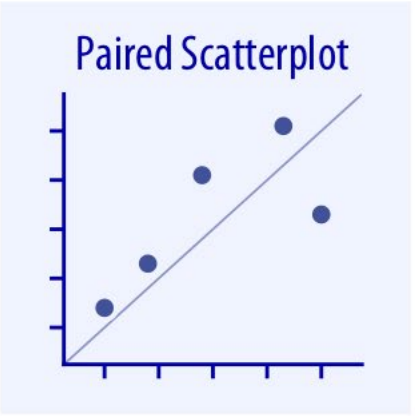
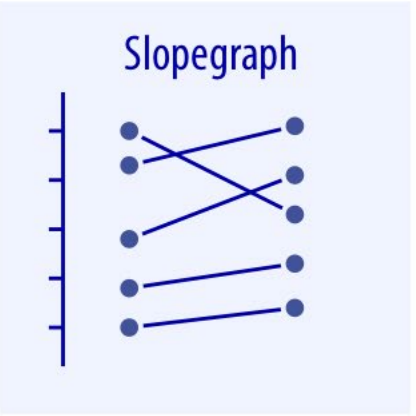
X-y Relationships









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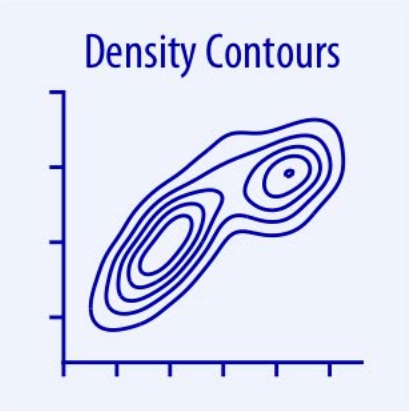
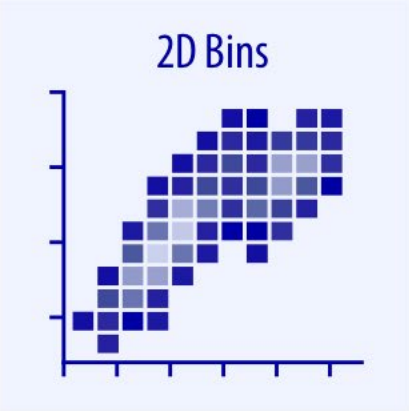
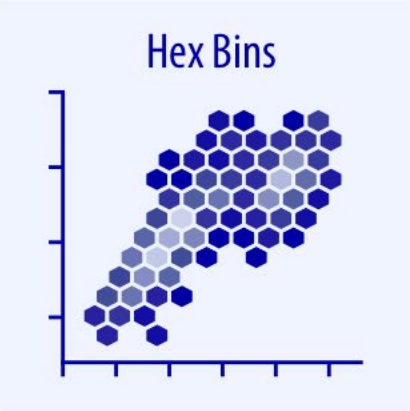
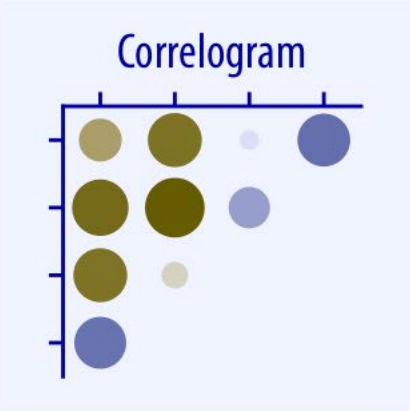
X-y Relationships with lots of data

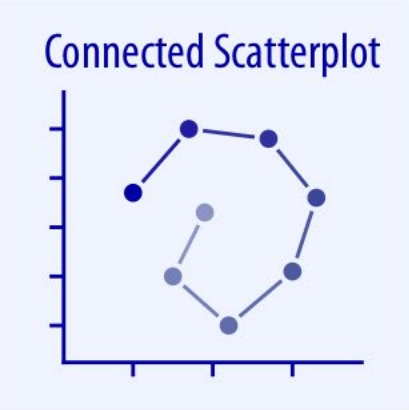


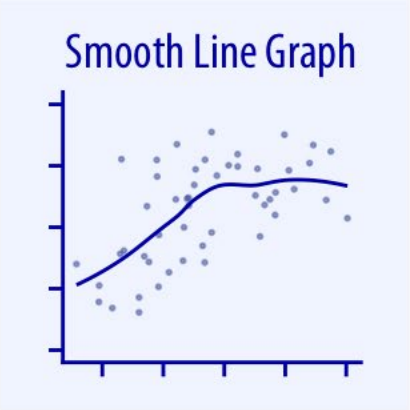






Adding Time





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Geospatial Data

Map

Choropleth

Cartogram

Cartogram Heatmap

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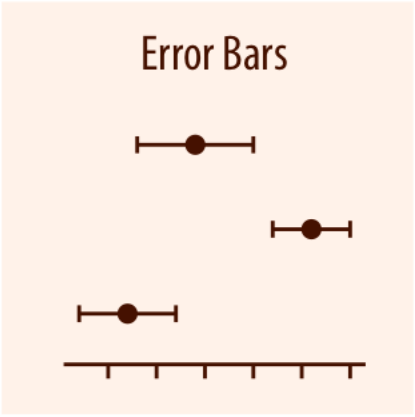
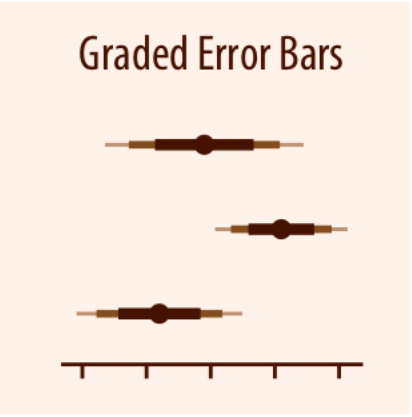
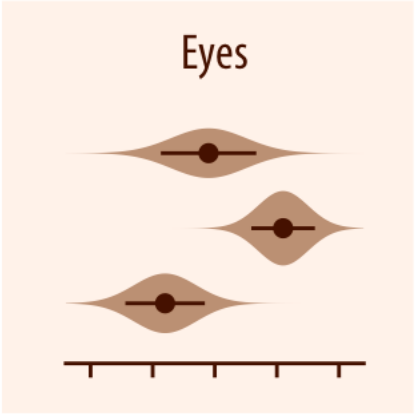
Uncertainty

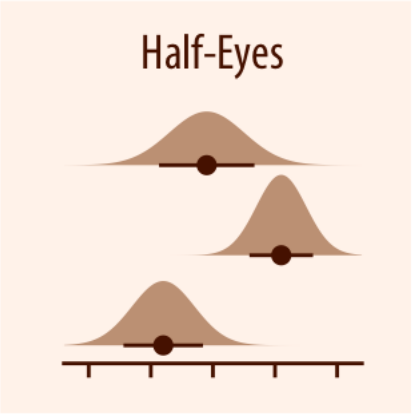


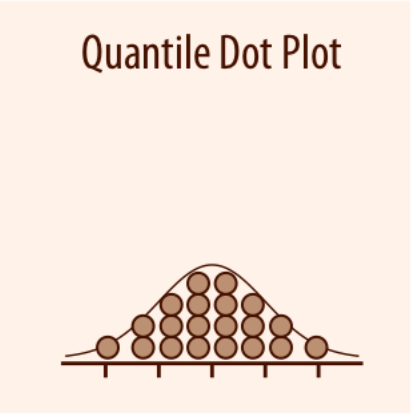


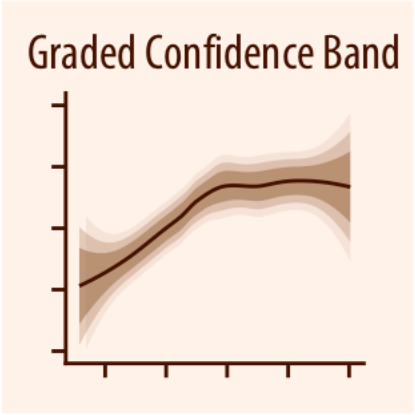
Wilke 2018

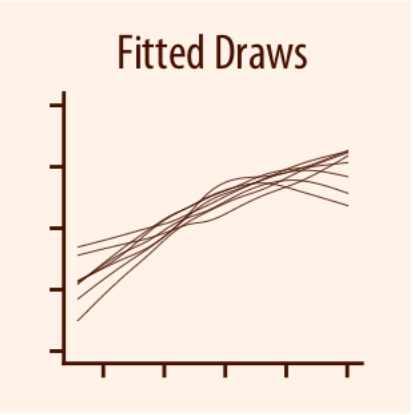
Uncertainty











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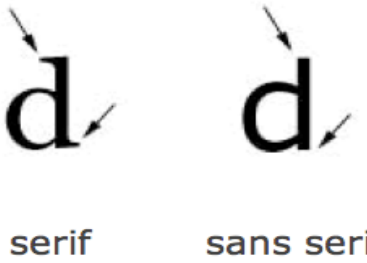
Design Considerations

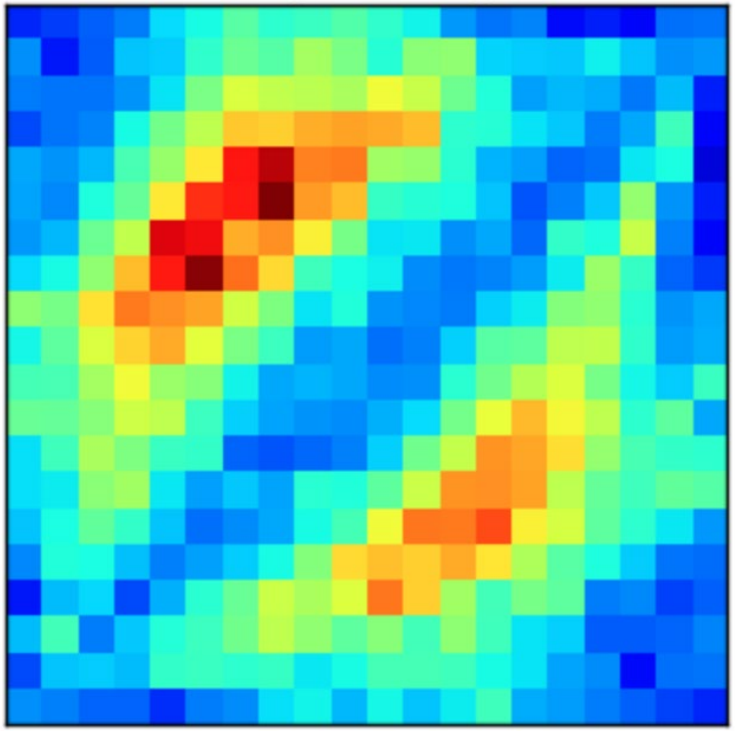
- Reduce chartjunk/tablejunk; increase data-ink ratio
- Lessons from perception: Limit the number of objects displayed at once
- Typography: capitalization, serif/non-serif
- Colors
  - Color scheme
  - Contrast, emphasis



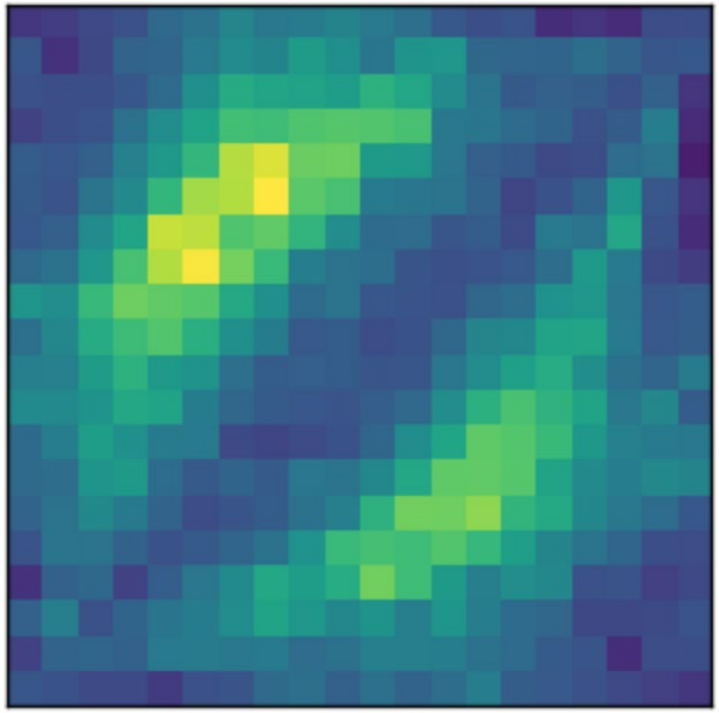
- 6 Gestalt Psychology principles (1912):
  - For groups of objects: proximity, similarity, enclosure, connection
  - Visual representation: closure, continuity

Color Choices Matter!

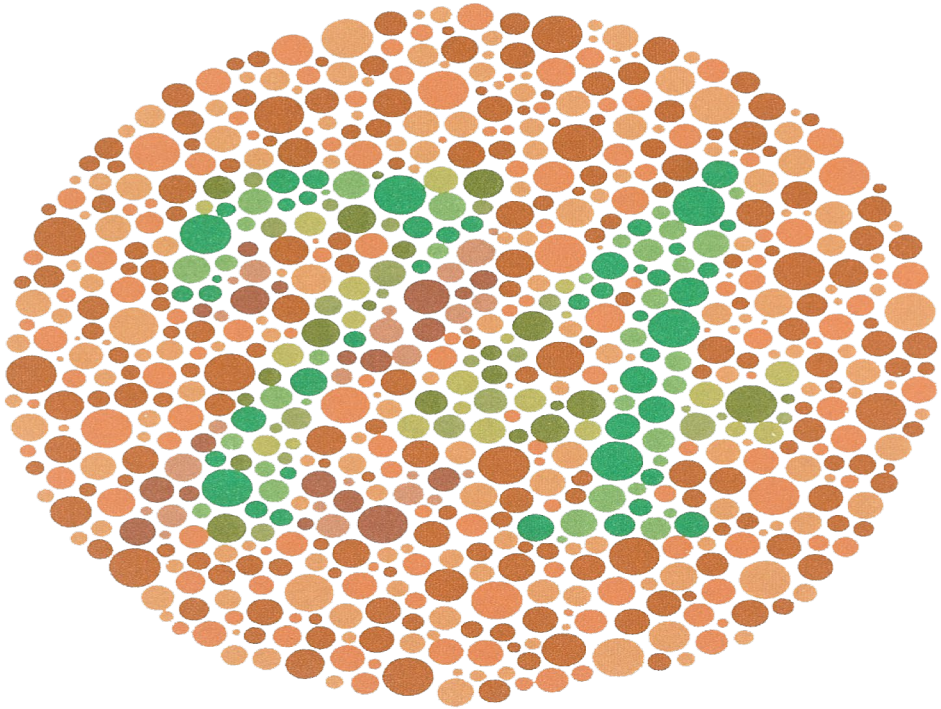
Jet Colormap



Viridis Colormap



Color Choices Matter!

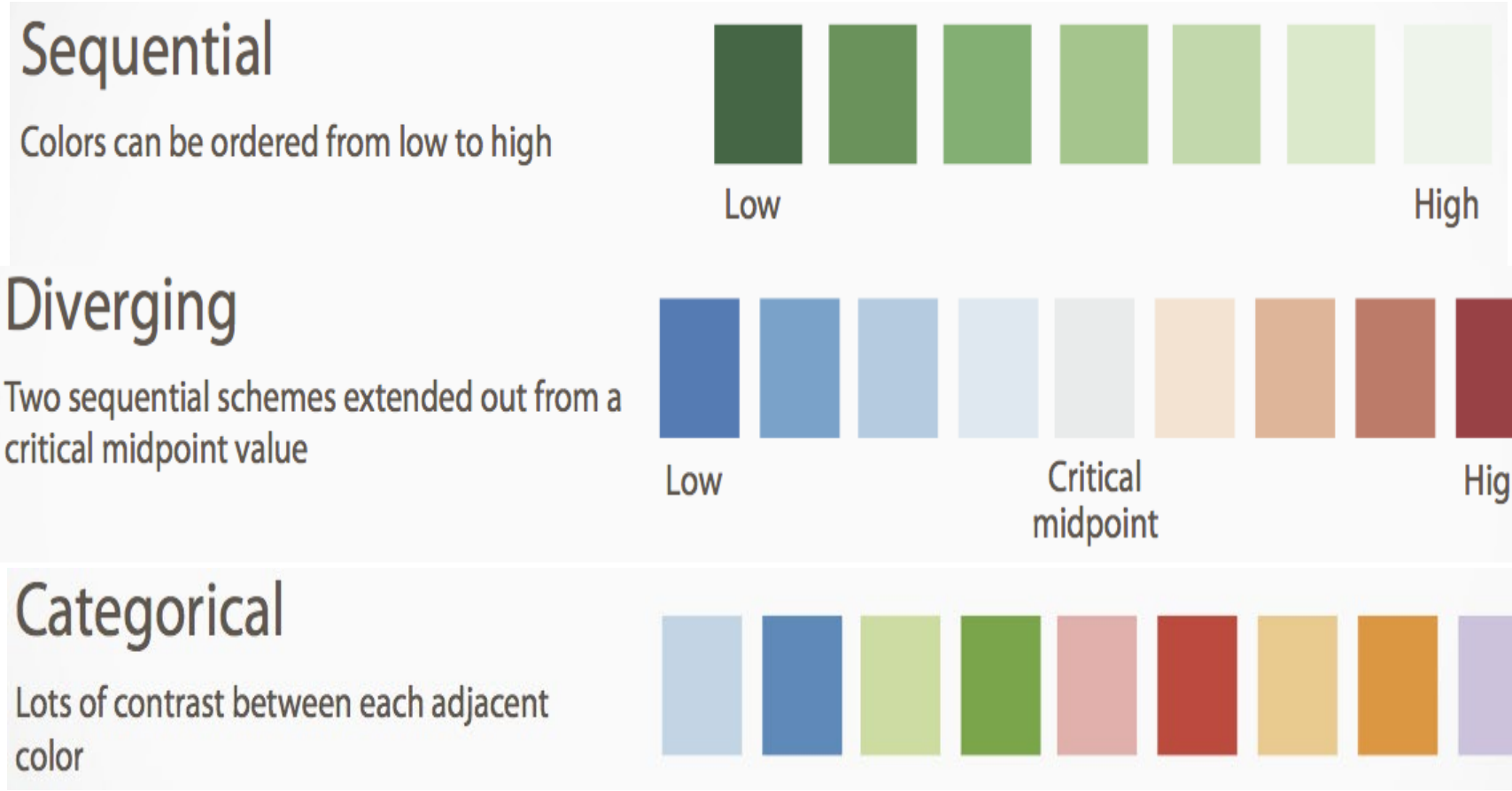


Design Considerations

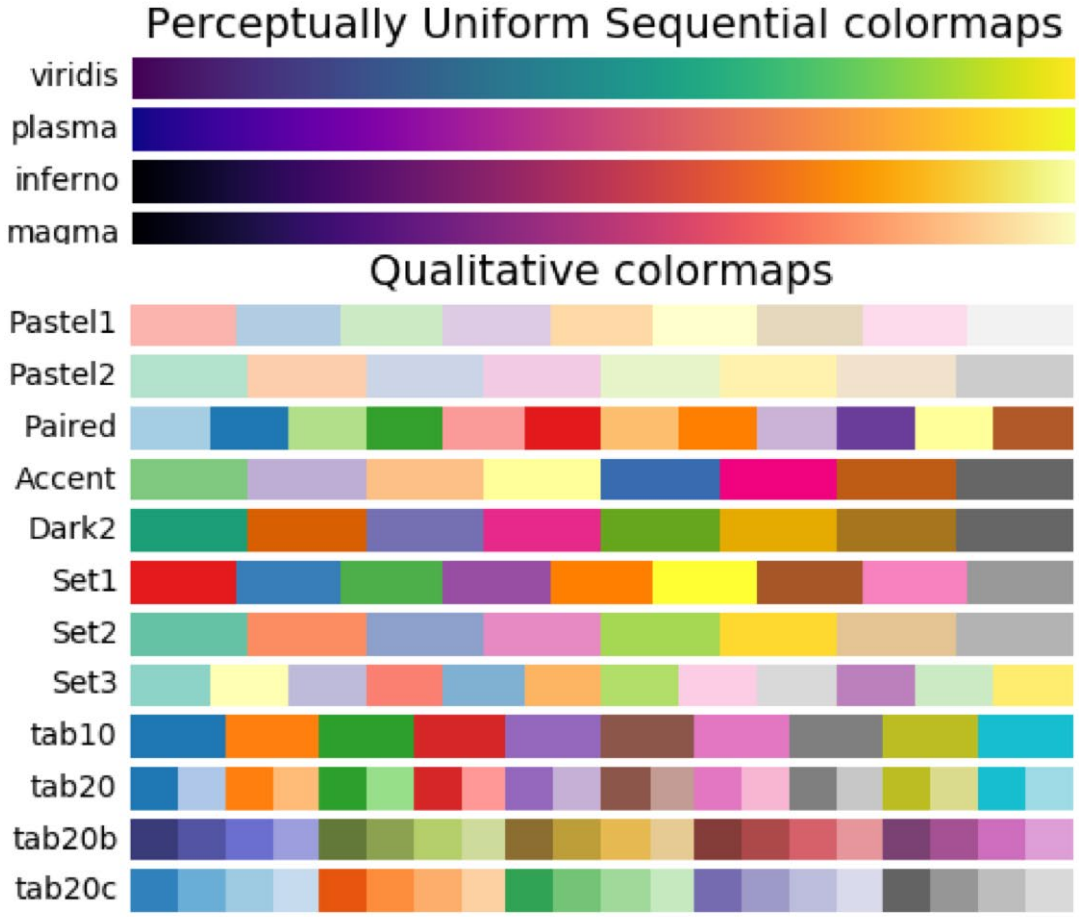
- Color
  - Choose colors based on the information you want to convey
    - Sequential
    - Diverging
    - Categorical
  - Use online resources to discover and record your color schemes
    - Color Brewer
    - Kuler
    - Colour Lovers
  - Be aware of colorblindness issues
    - https://thenode.biologists.com/data-visualization-with-flying-colors/research/
    - https://jfly.uni-koeln.de/color/

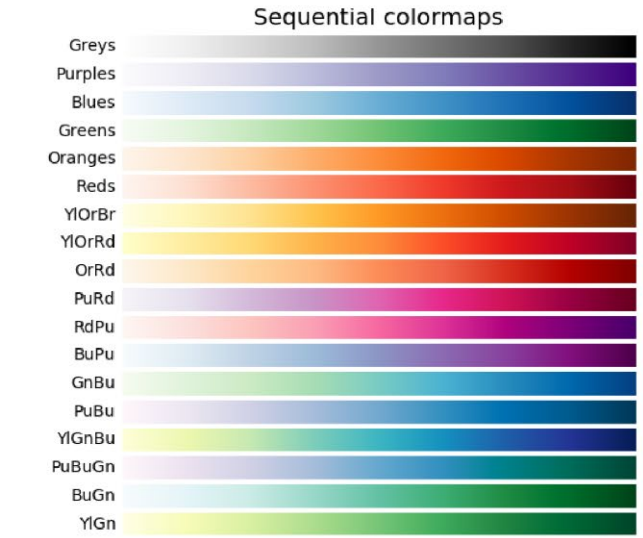
Design Considerations

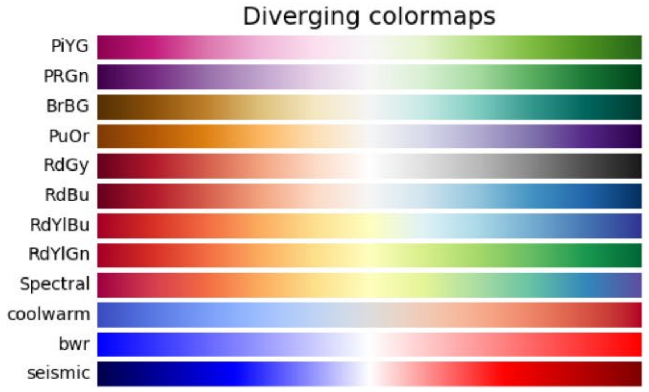
- Color



Color Schemes

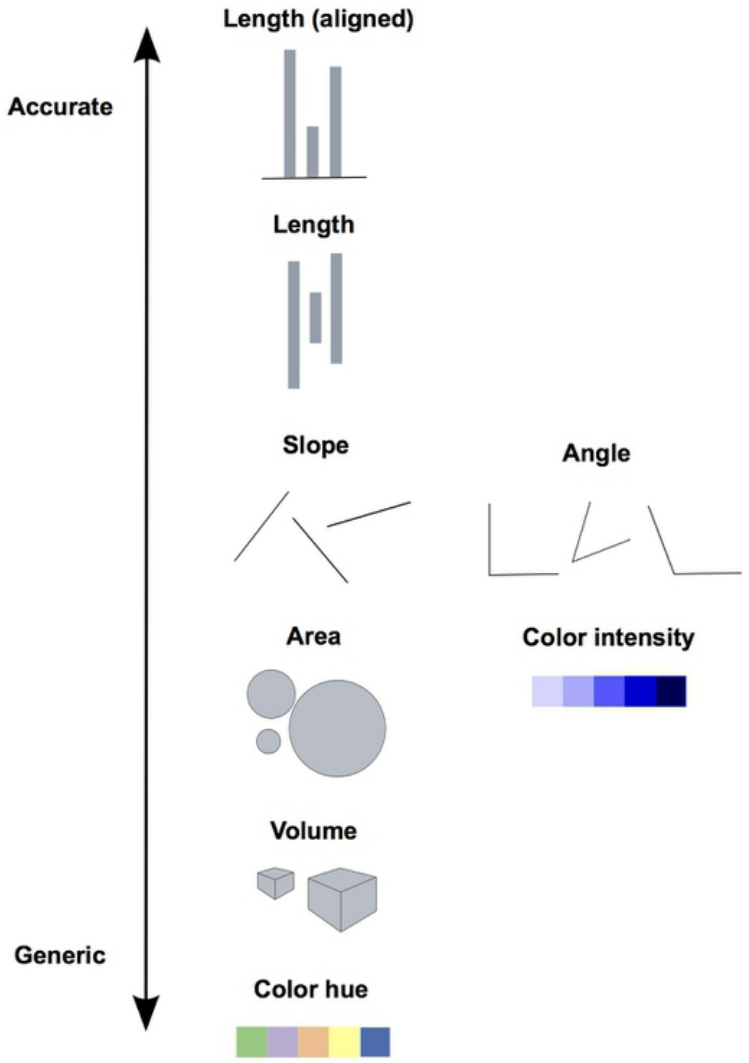






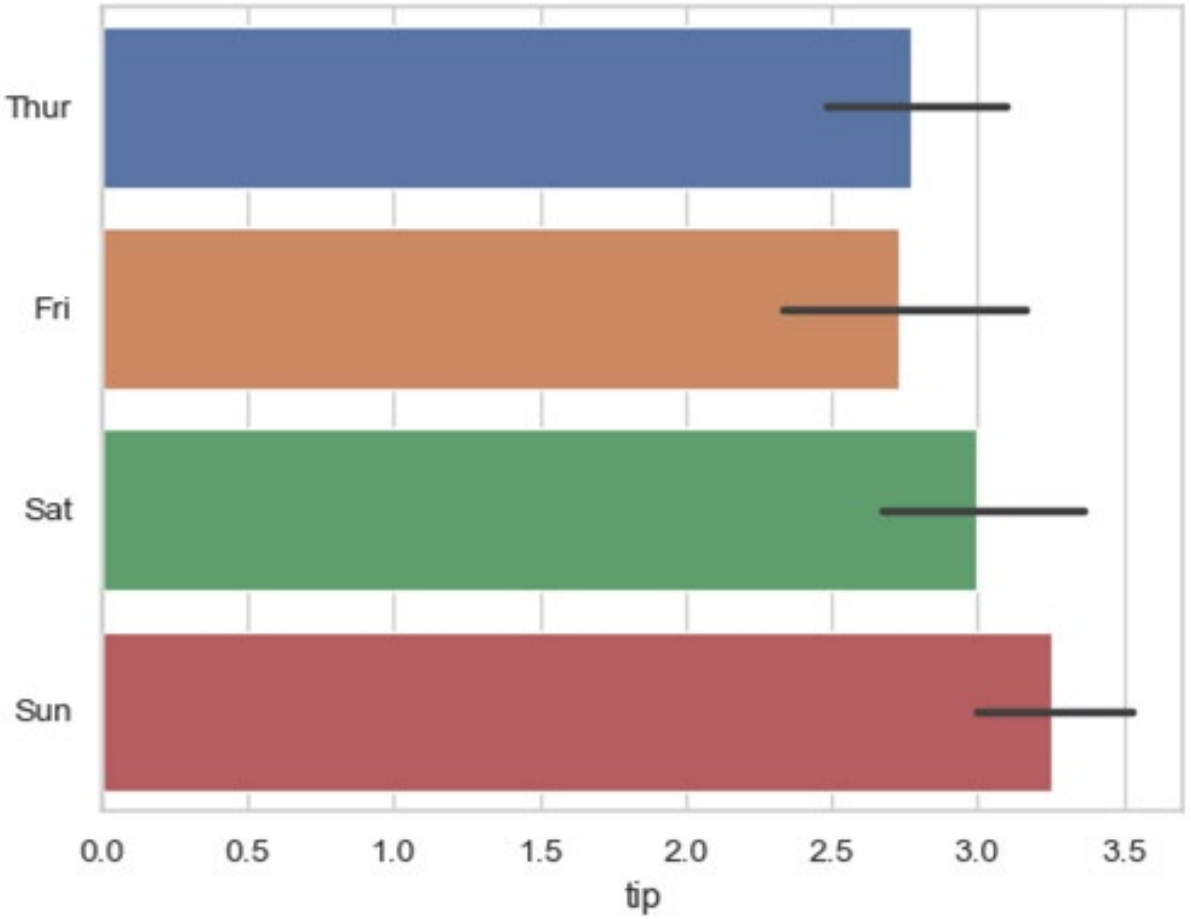
Not all Marks are Good!

- Accuracy of judgements depend on type of mark.
- Aligned lengths most accurate
- Color least accurate



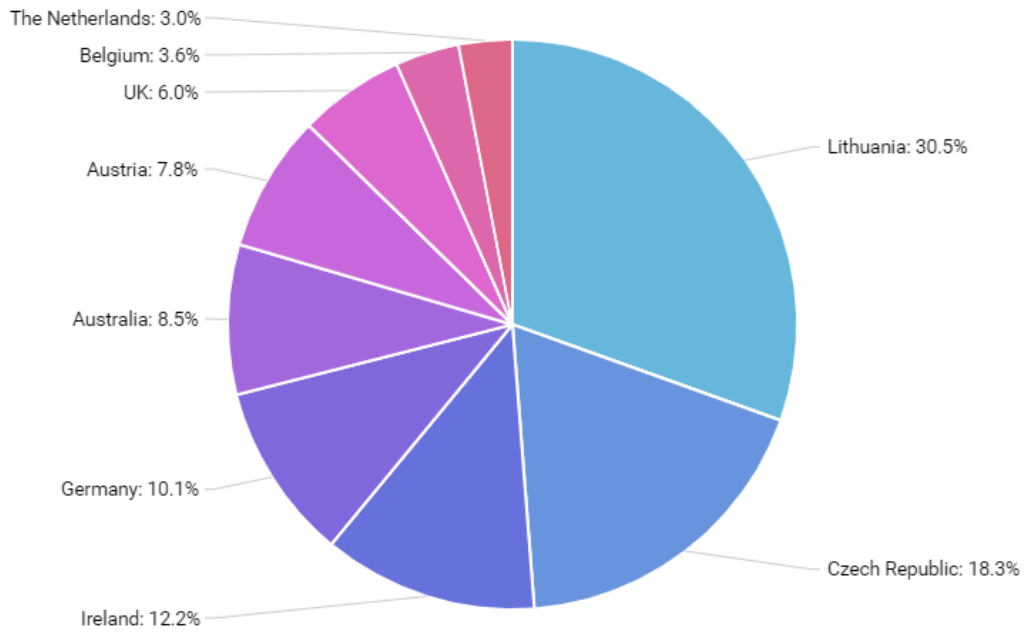
Lengths are Easy to Understand

- People can easily distinguish between two different lengths, e.g., height of bars in bar chart



Angles are Hard to Understand

- Avoid pie charts!
- Angle judgements are inaccurate
- In general, underestimate size of larger angle.



Areas are Hard to Understand

- Avoid area charts
- Area judgements are inaccurate
- In general, underestimate size of larger area

References

- Tufte Books
- Wilke, Fundamentals of Data Visualization
  - https://clauswilke.com/dataviz/
  - Written in R Markdown, you can see R source code for images