Statistical Graphics

Jordan Brace

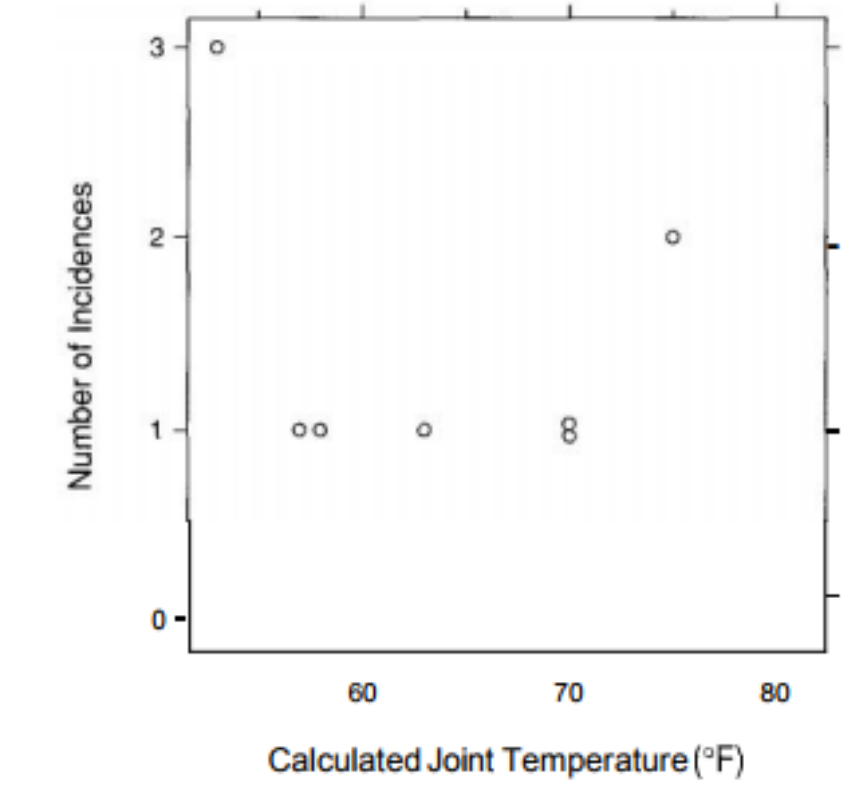
- *“Above all else, show the data”*

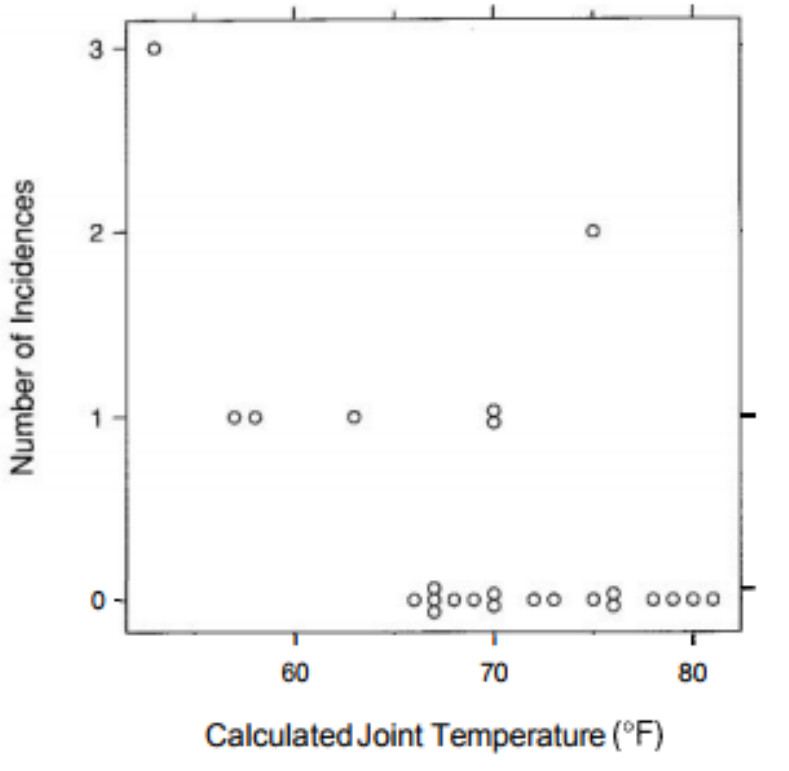
– Edward Tufte

- *“The graph retains the information of the data”*

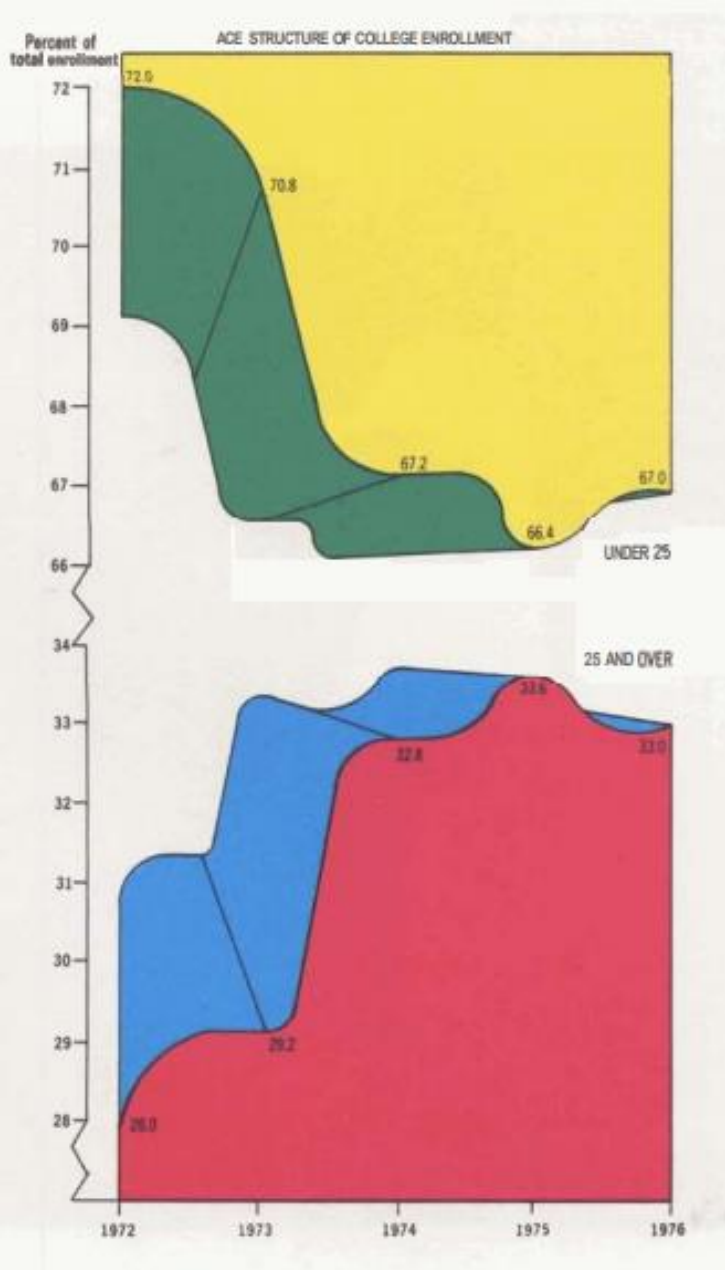
– W. Edwards Deming

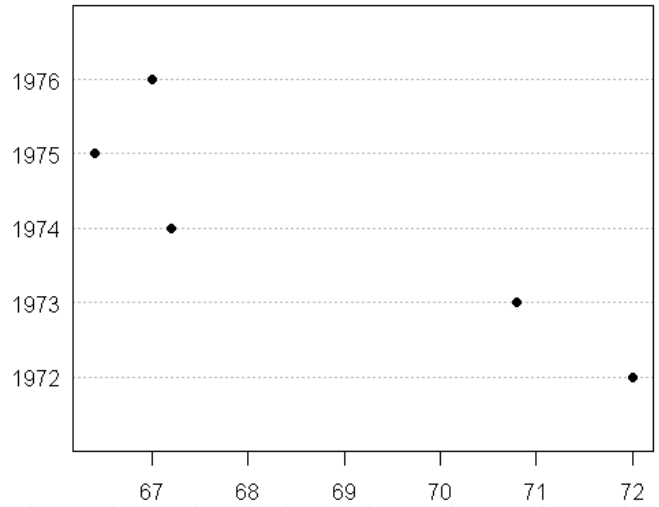
Space Shuttle Challenger O-Rings





College Enrollment by Age



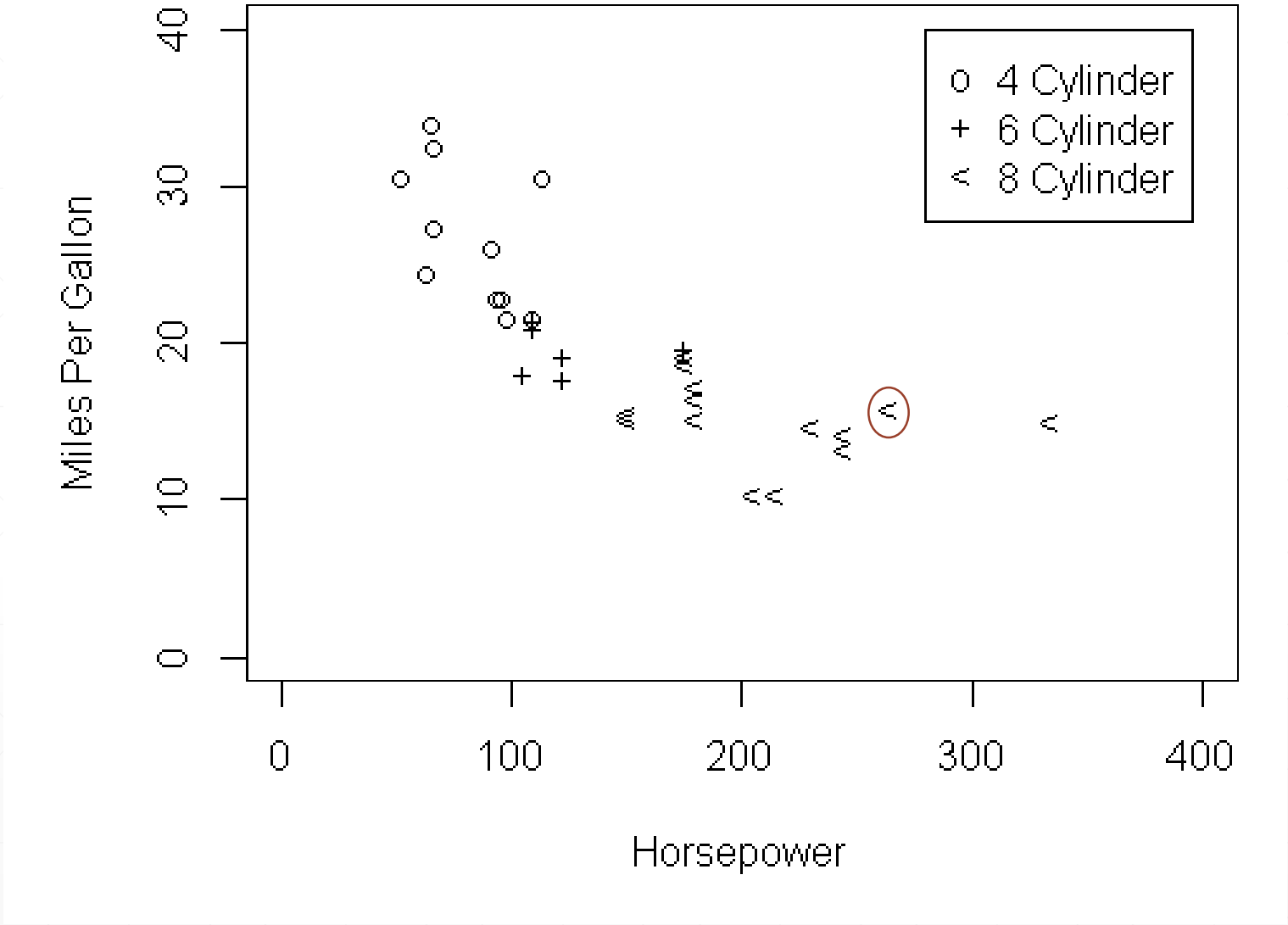


Year	% Under 25
1972	72.0
1973	70.8
1974	67.2
1975	66.4
1976	67.0

Model of Graph Perception

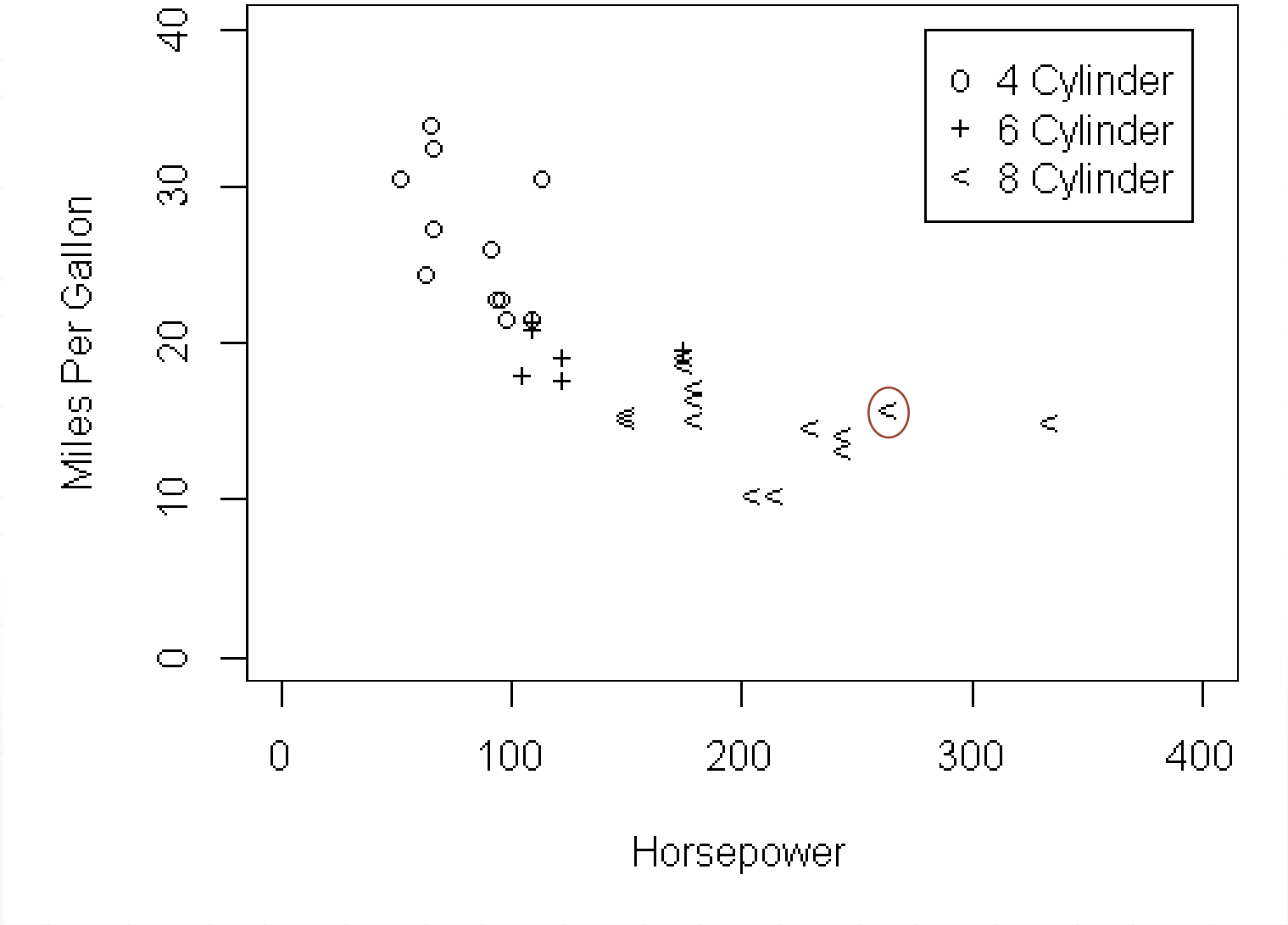
- *Encoding:* process by which a graph is constructed from data.
- *Decoding:* process by which graph is converted back into data by viewer.
  - If visual decoding is not possible, the graph is a failure.

- Two types of information displayed in a graph
  - *Scale information:* The data being communicated to the viewer
  - *Physical information:* Information used to communicate scale information
- *Decoding* is the process of receiving the scale and physical information encoded in the graph.


Miles Per Gallon
0
10
20
30
40
0
100
200
300
400
Horsepower
4 Cylinder
6 Cylinder
8 Cylinder

Model of Graph Perception

- Decoding physical information is *pattern perception*
  - *Detection:* recognition of a geometric aspect of graph that encodes a physical value
  - *Assembly:* visual grouping of detected elements
  - *Estimation:* discrimination, ranking, ratioing.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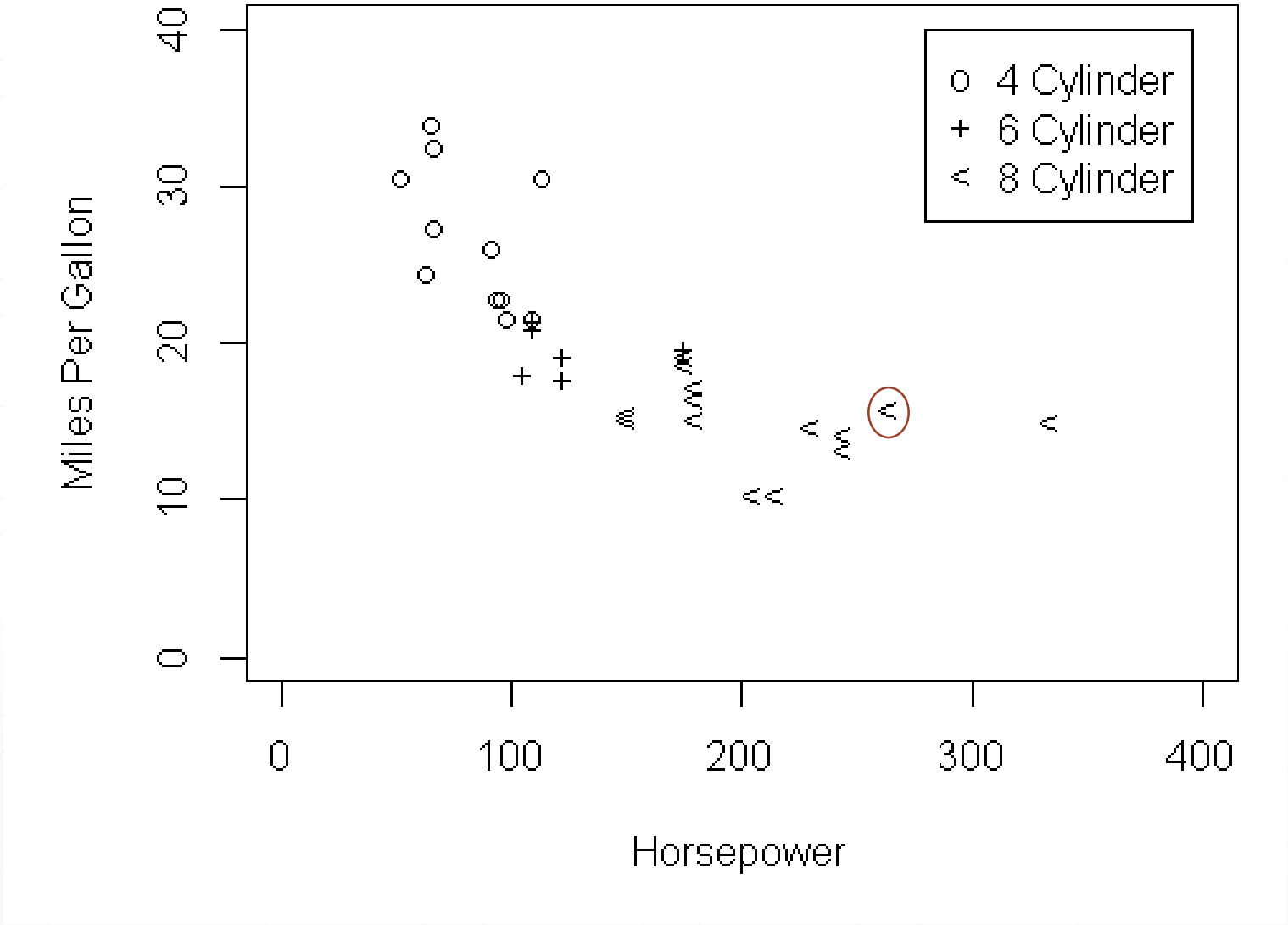
Model of Graph Perception

- Decoding scale information is *table look-up*
  - *Scanning* from point to axis
  - *Interpolate* value based on tick lines
  - *Matching:* decoding scale information presented in other elements of the graph than axes, such as legend.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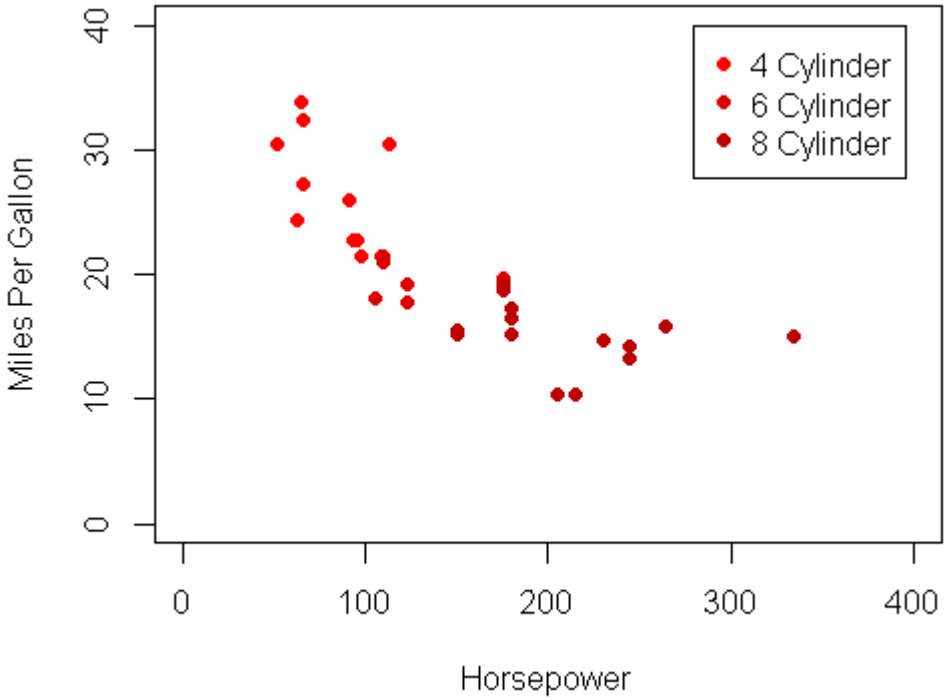
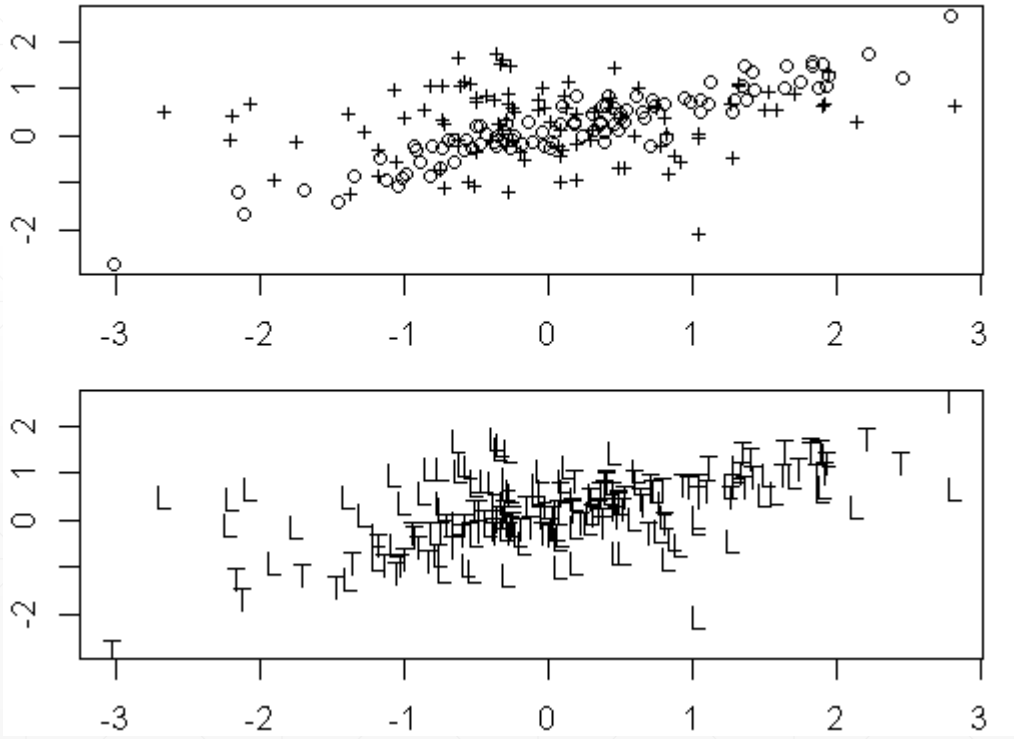
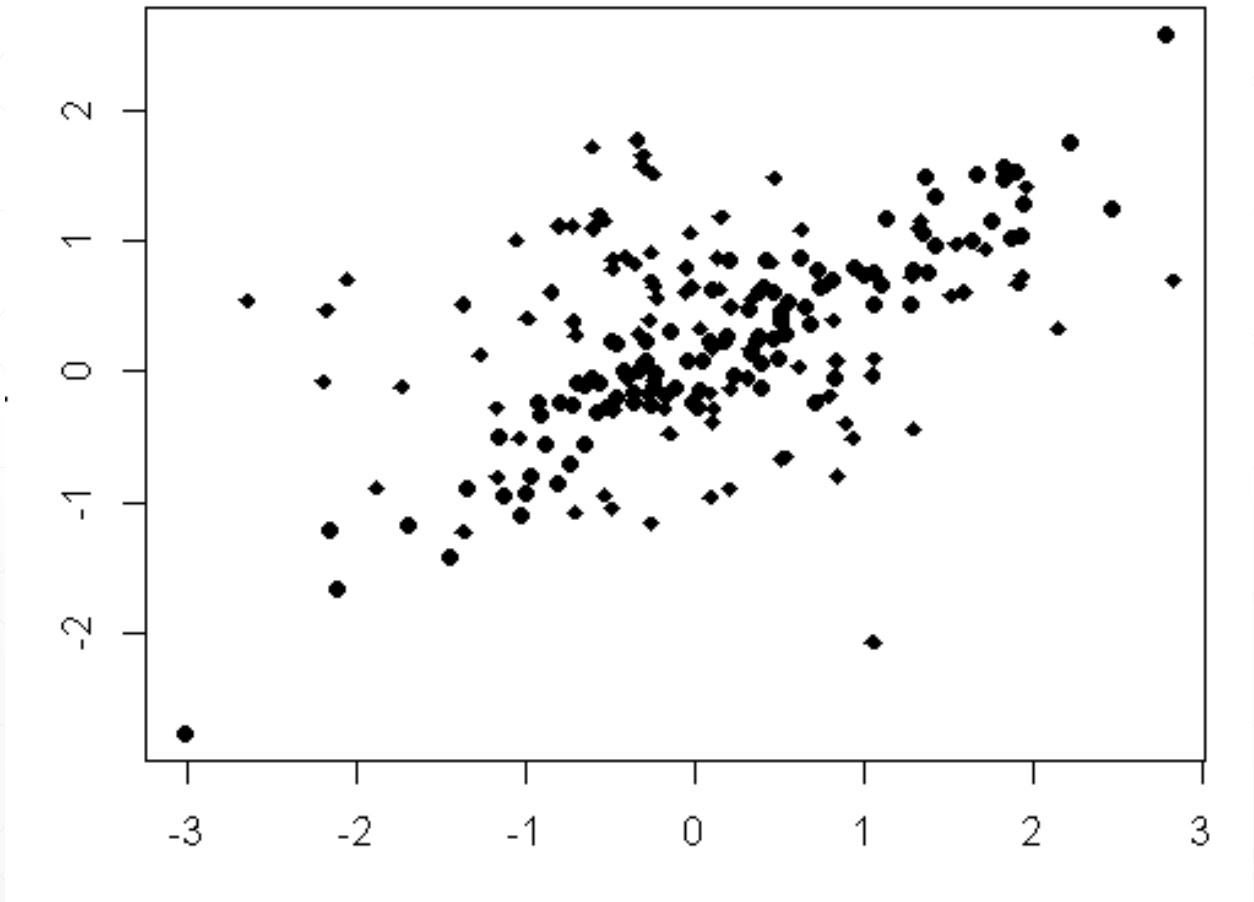
Applying the Model of Graph Perception

- Color and Texture

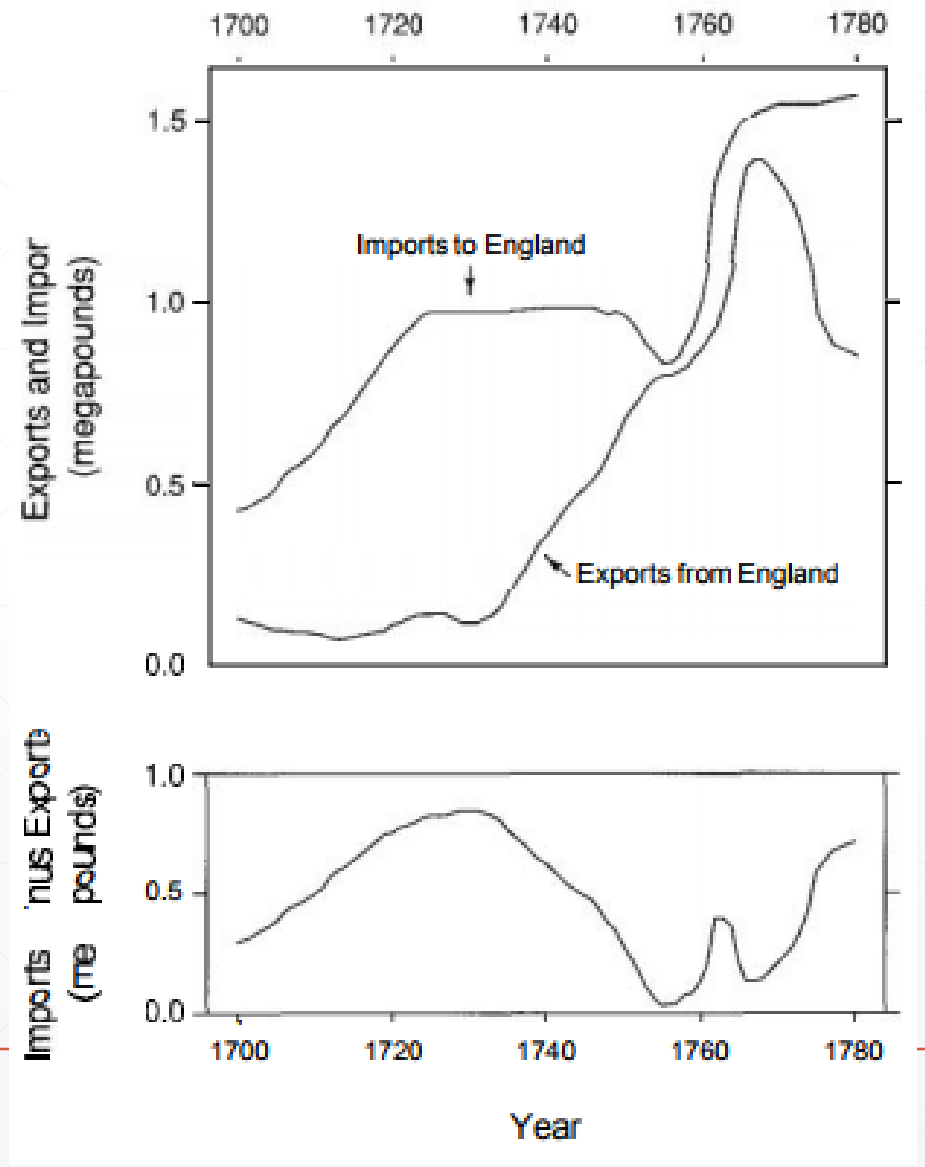




Applying the Model of Graph Perception



Applying the Model of Graph Perception



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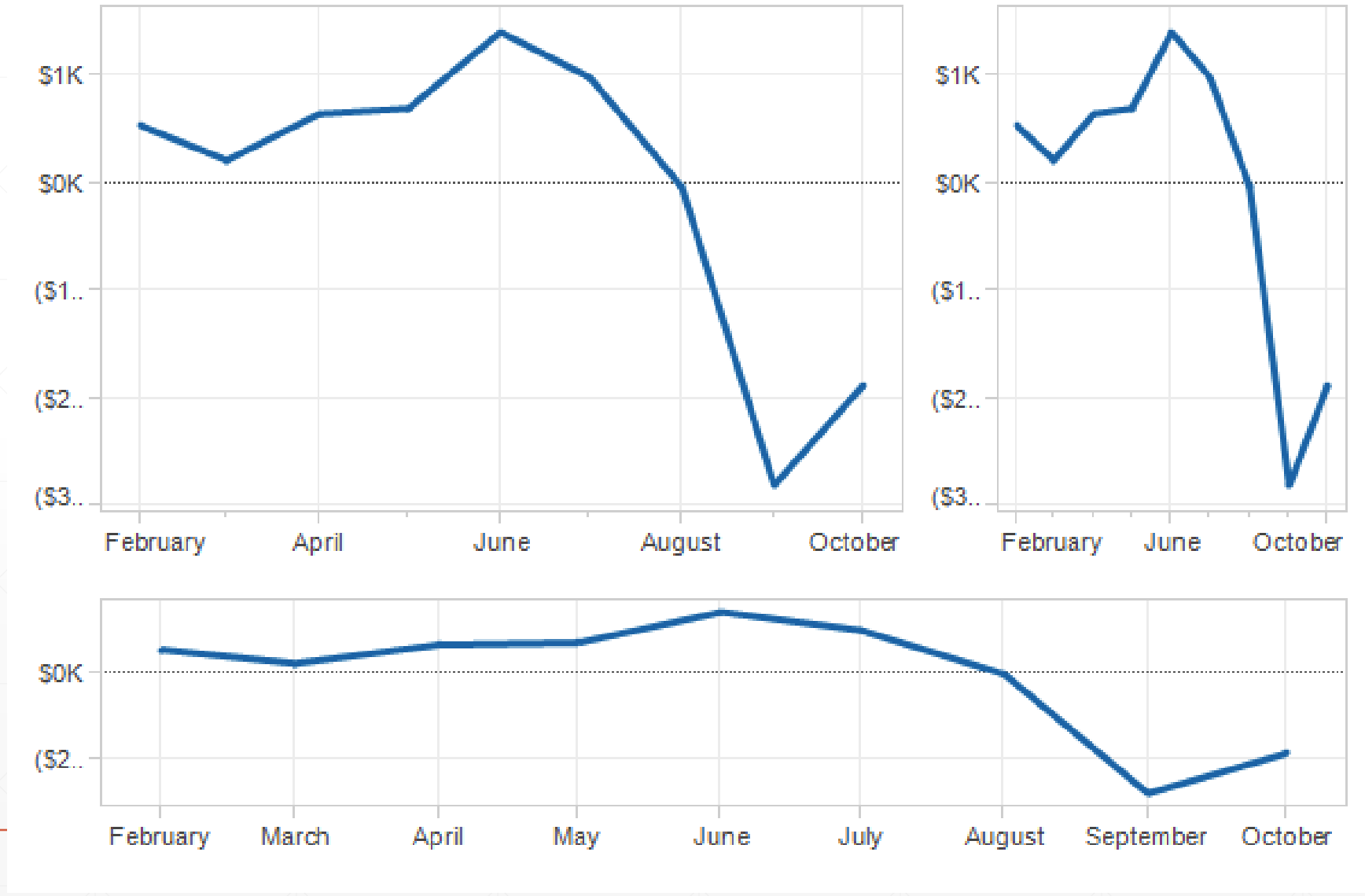

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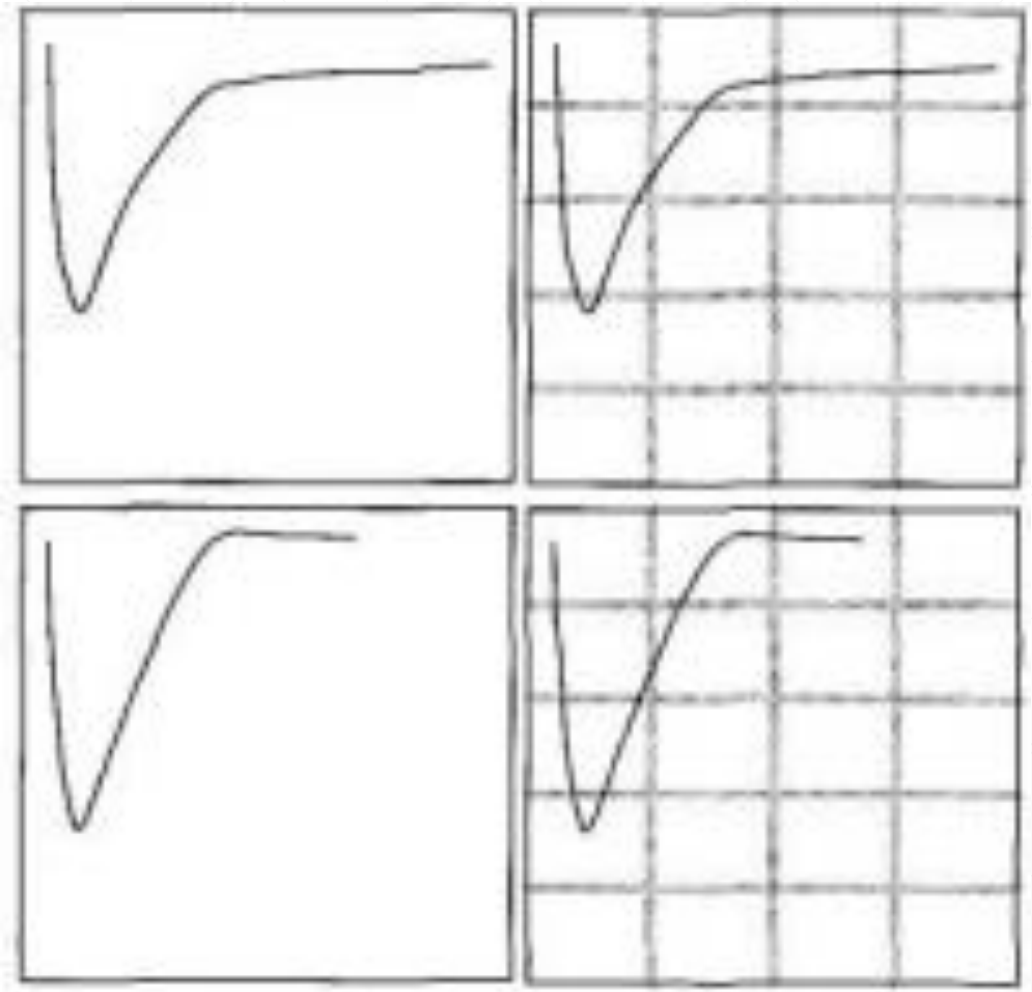

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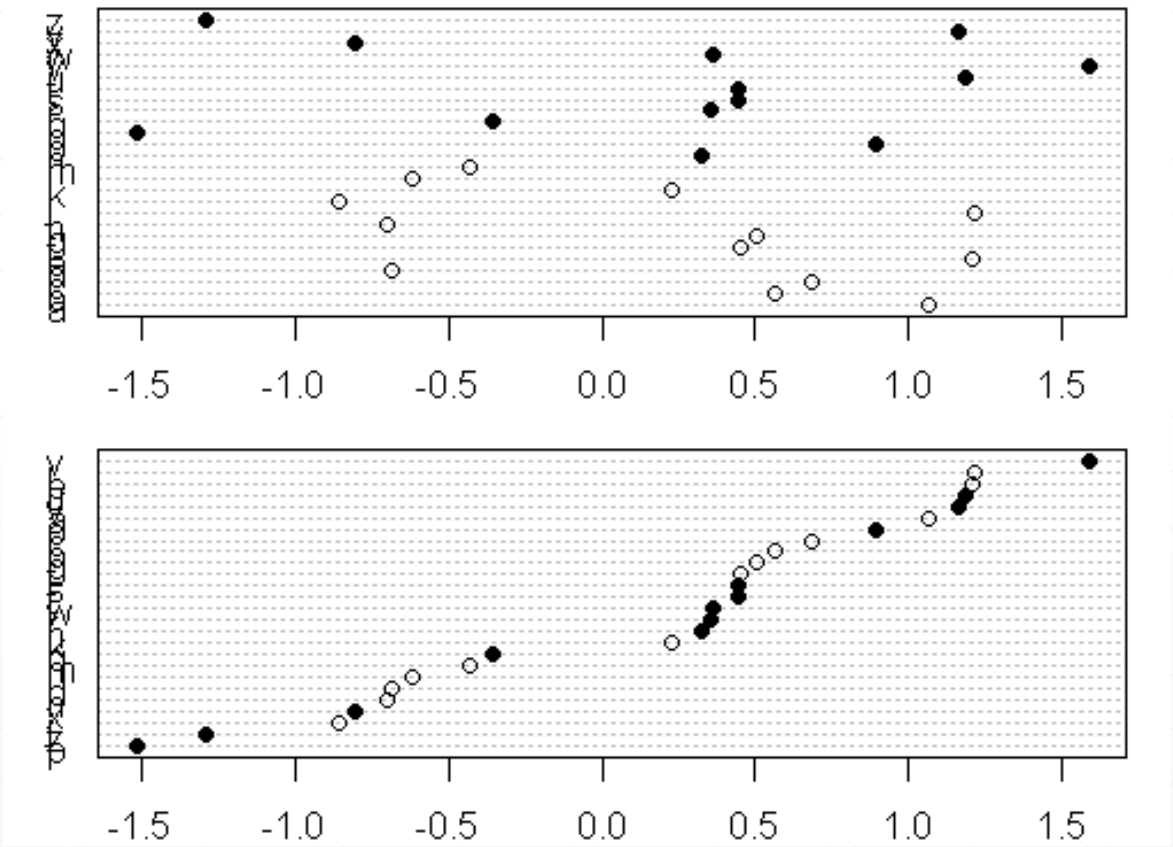

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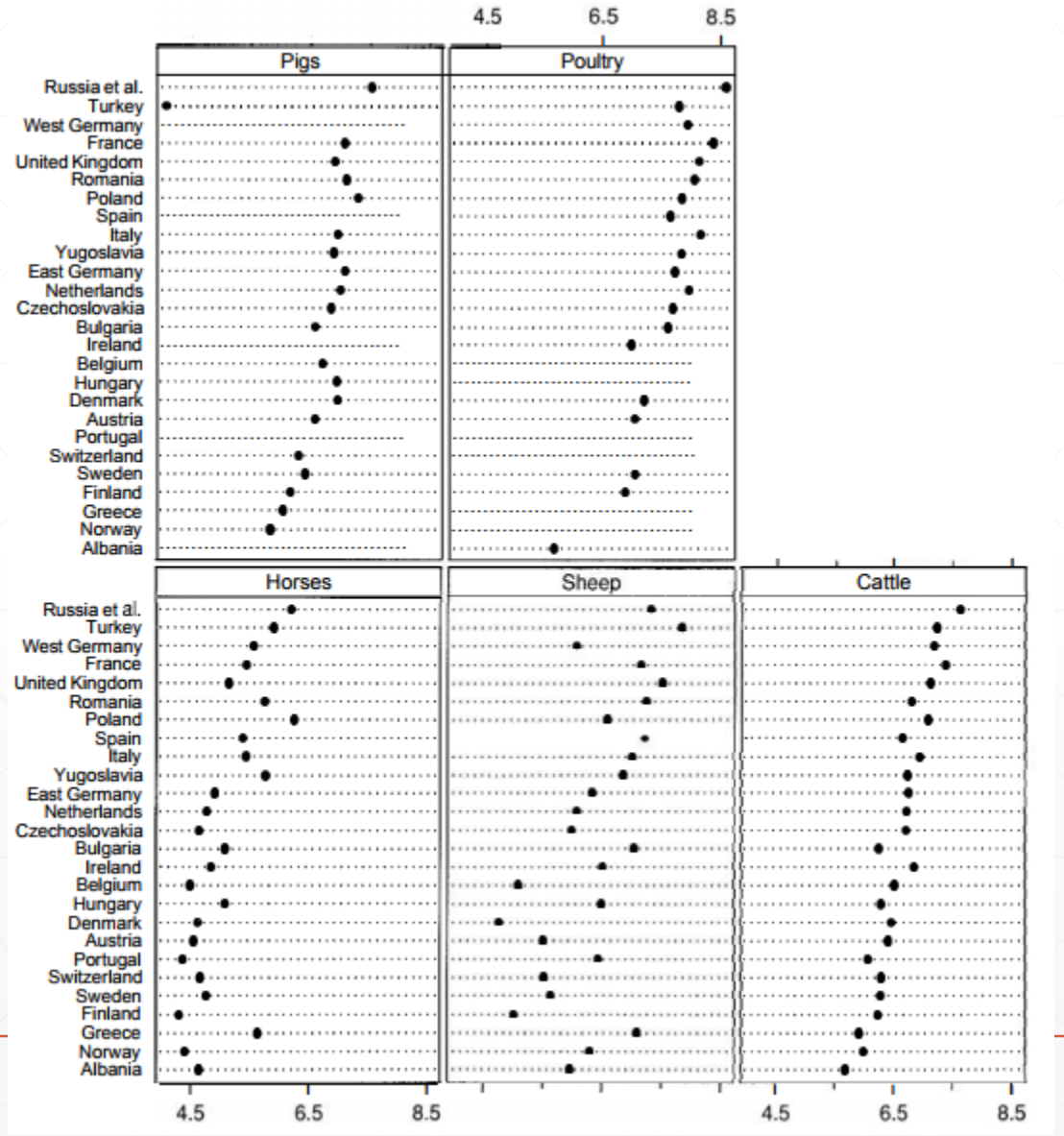

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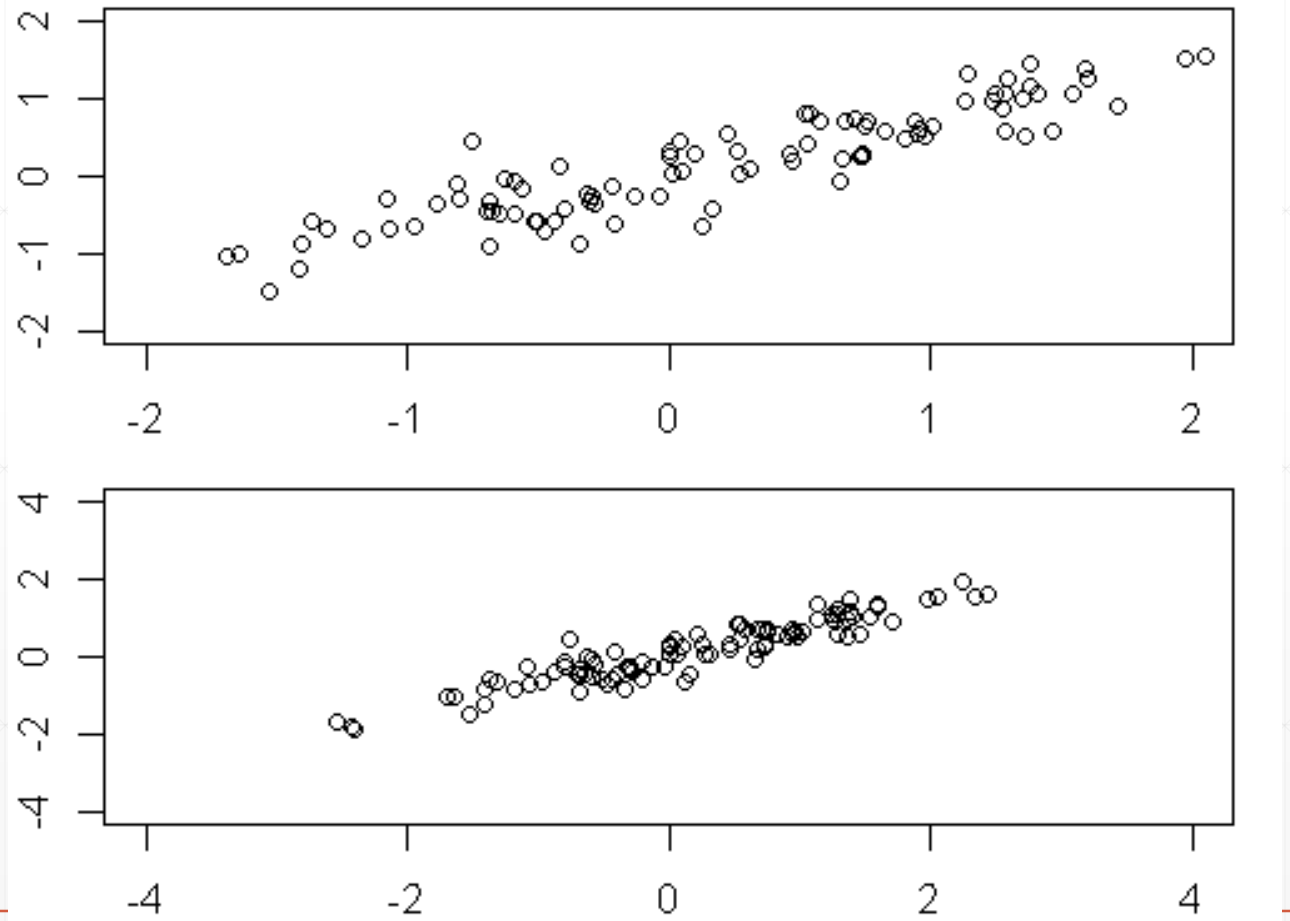


Tufte's Recommendations

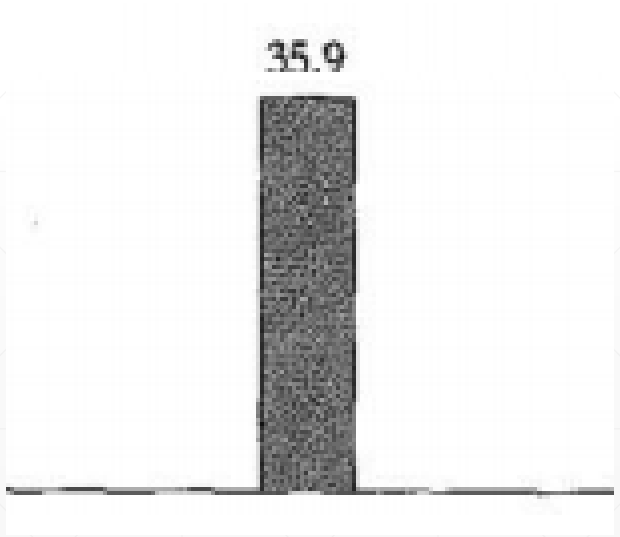
$$\text{Data-ink ratio} = \frac{\text{data-ink}}{\text{total ink used to print the graphic}}$$

$$= \text{proportion of a graphic's ink devoted to the non-redundant display of data-information}$$

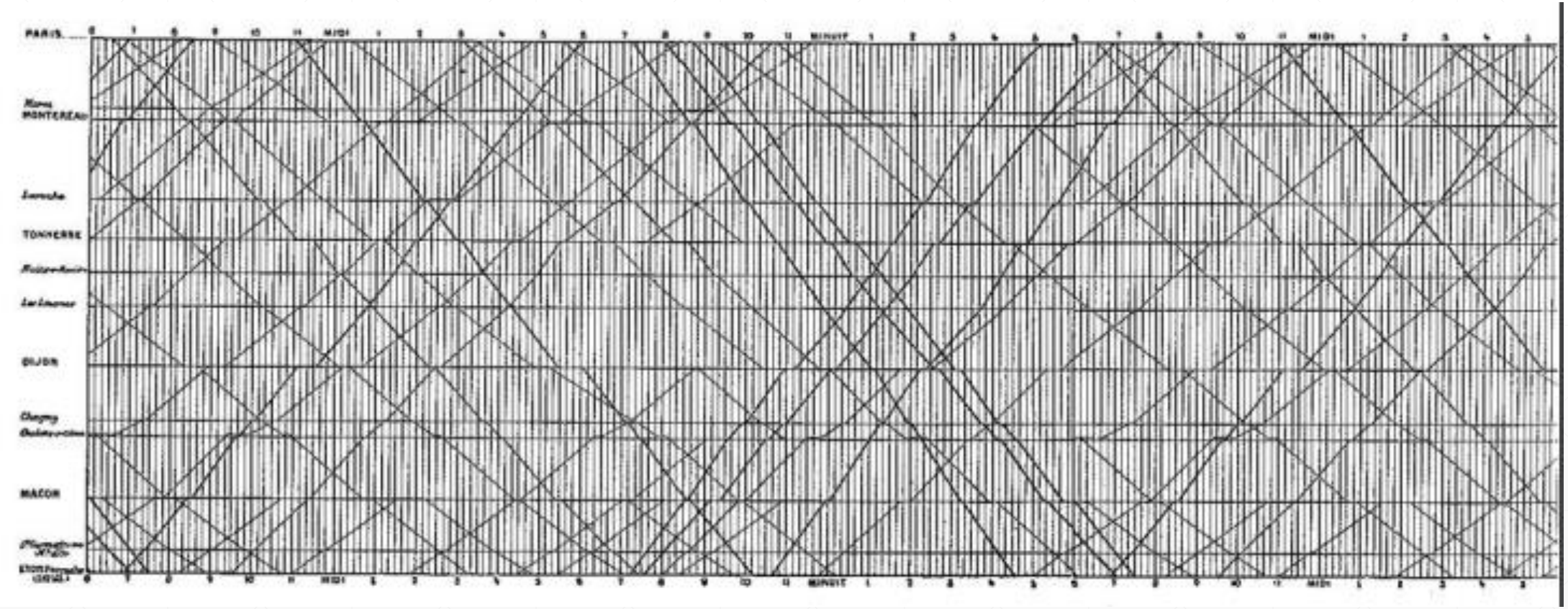
$$= 1.0 - \text{proportion of a graphic that can be erased without loss of data-information.}$$

Tufte’s Recommendations

- Erasing principles
  - Erase non-data ink, within reason
  - Erase redundant ink, within reason



Tufte’s Recommendations



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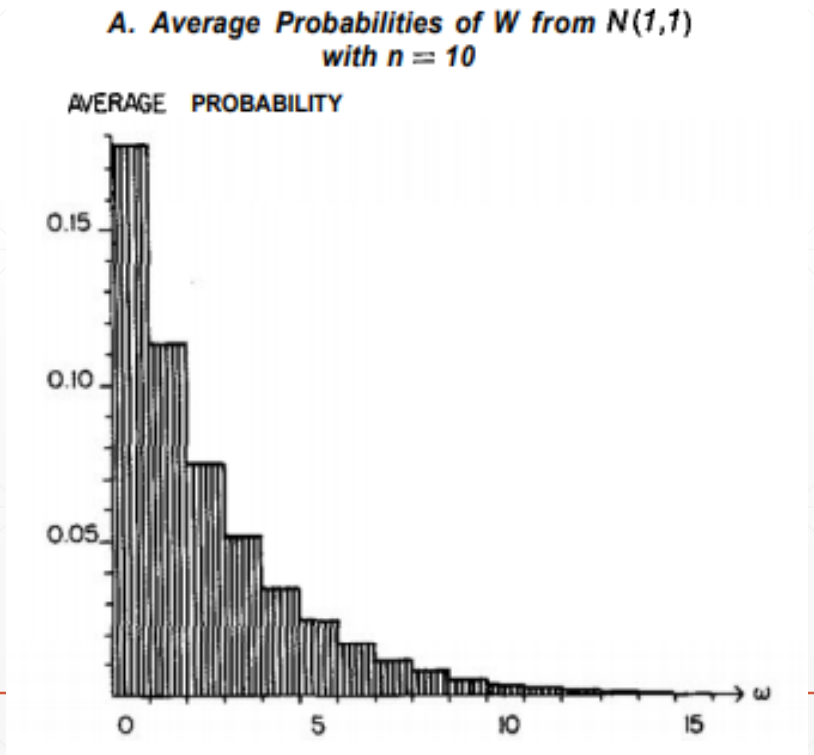

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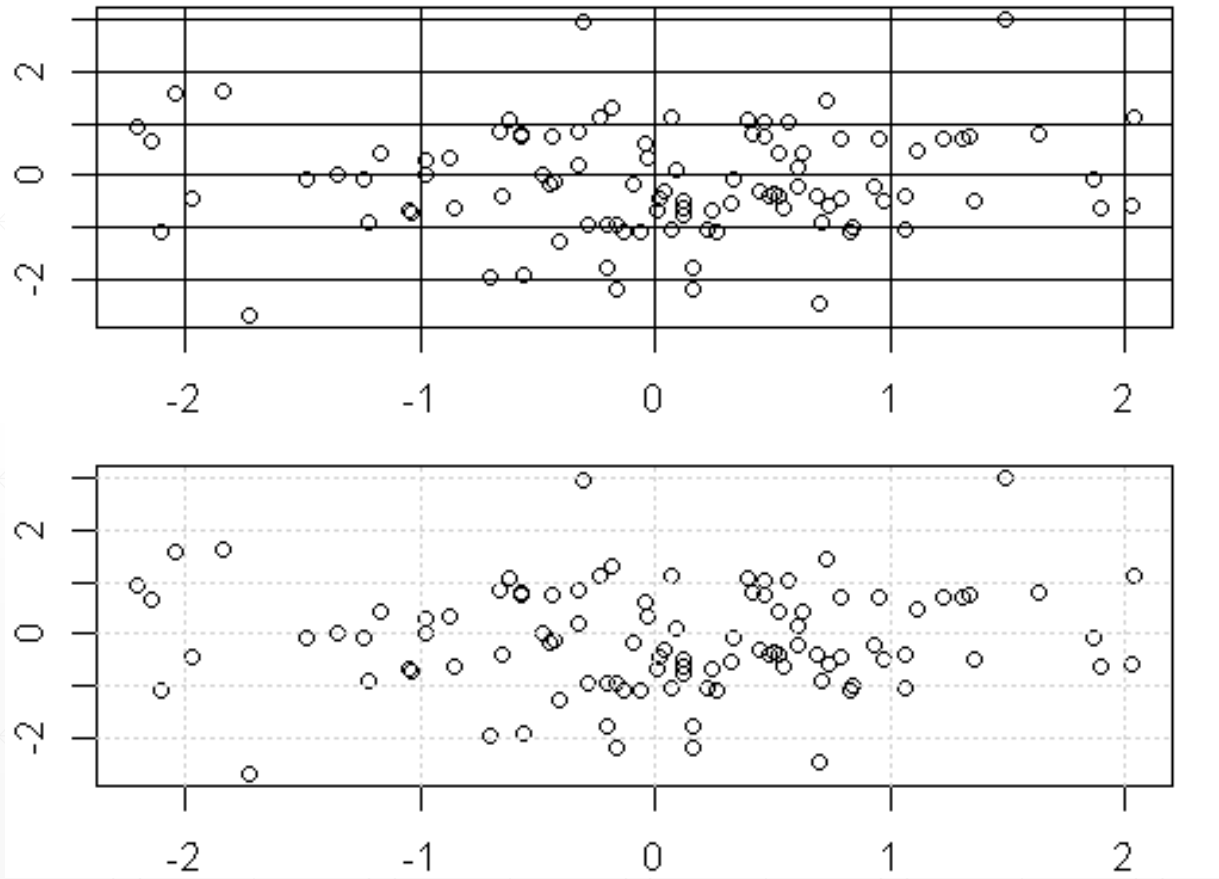

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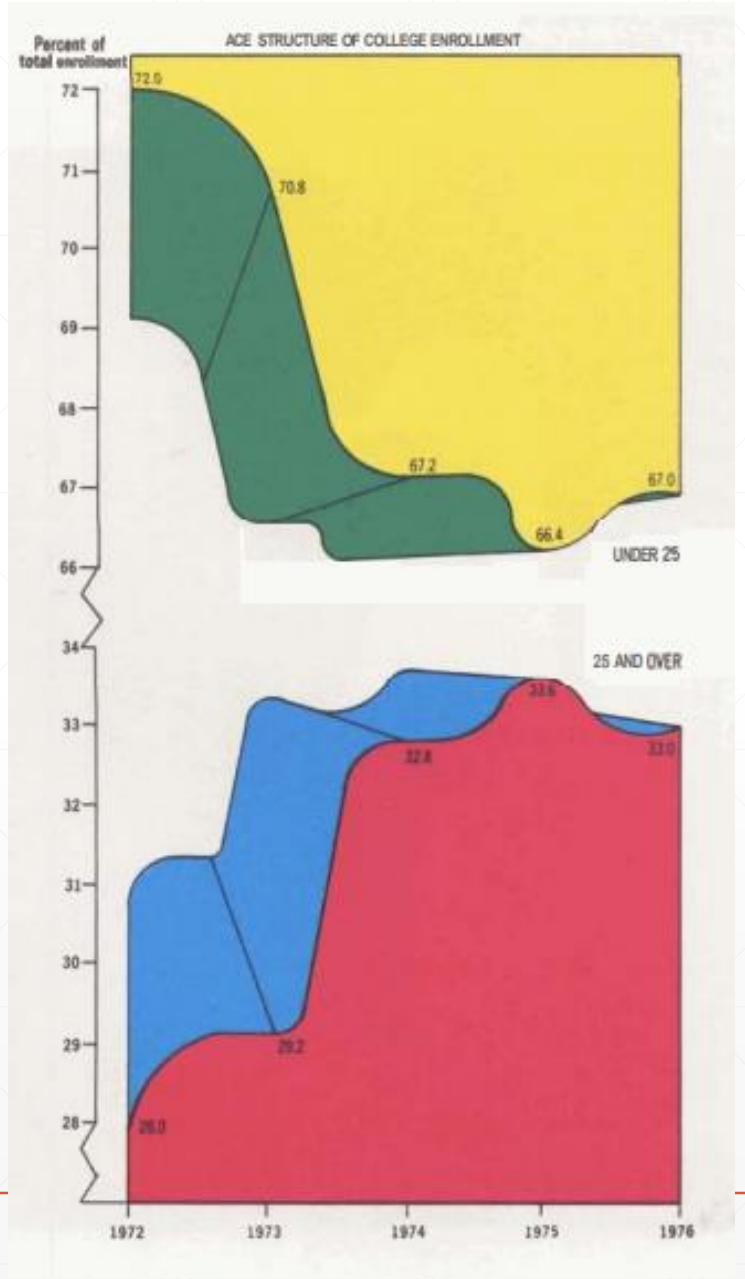
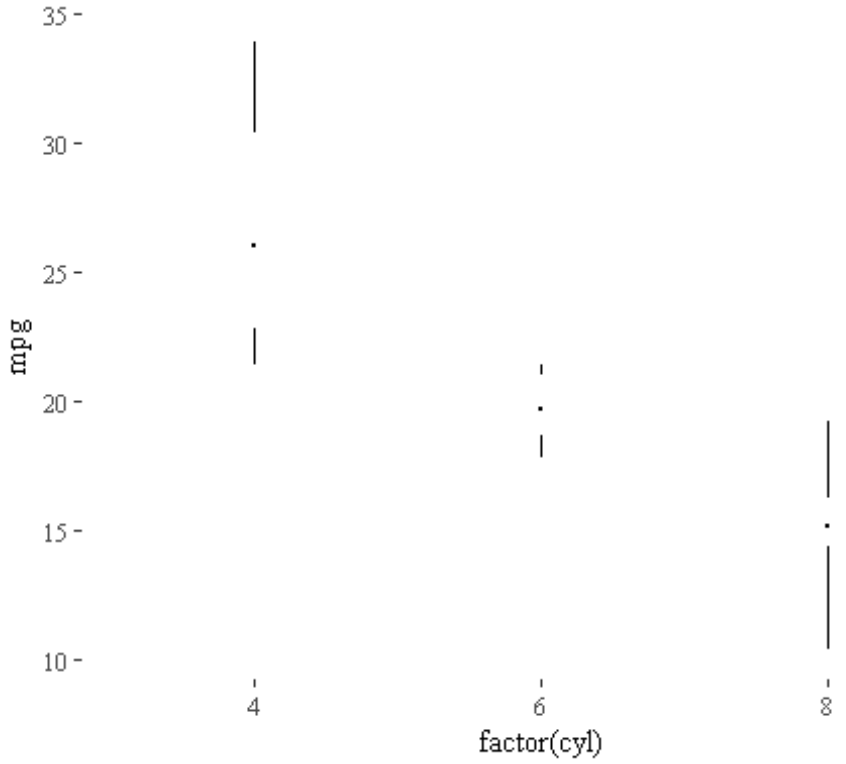
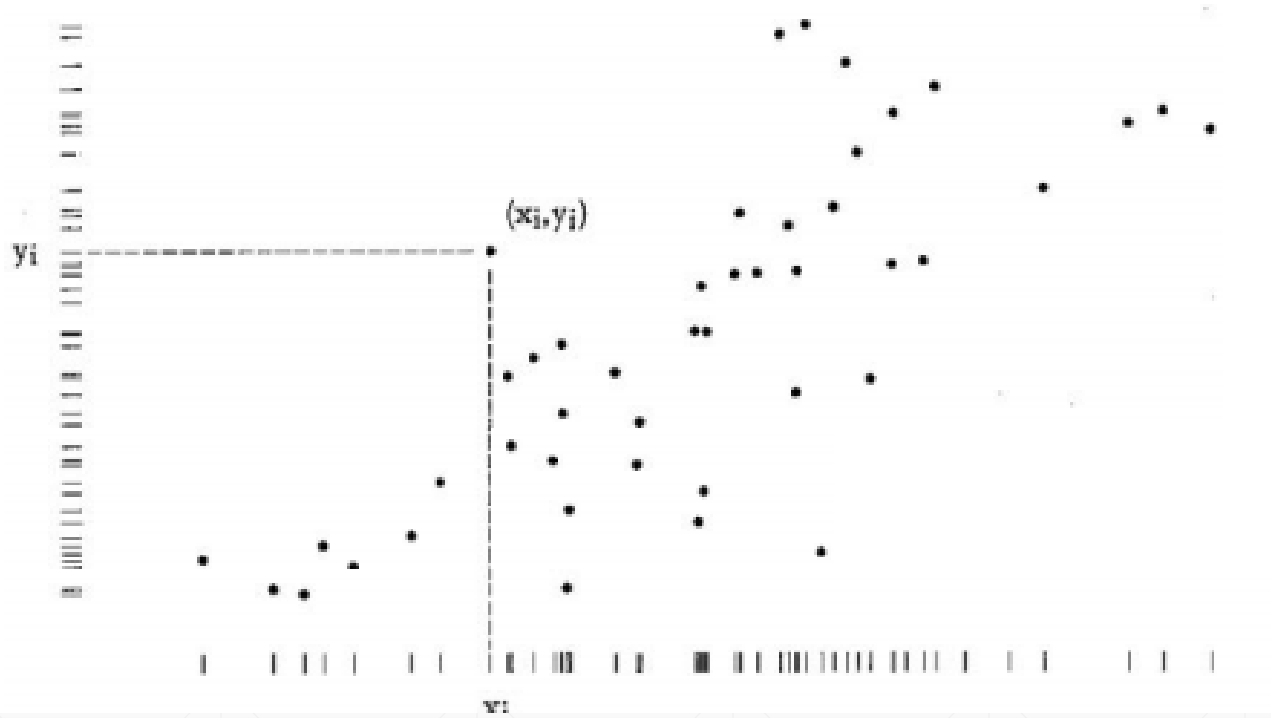


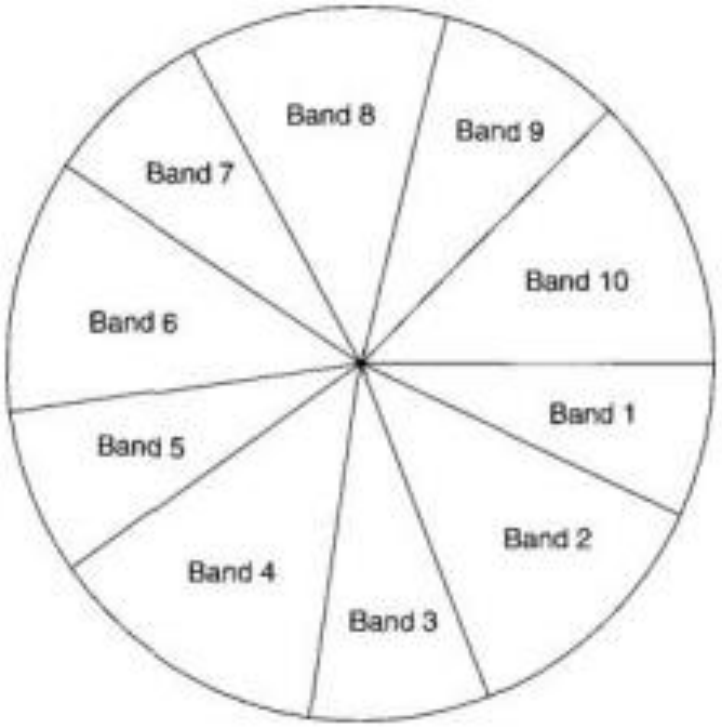
Tufte’s Graphics

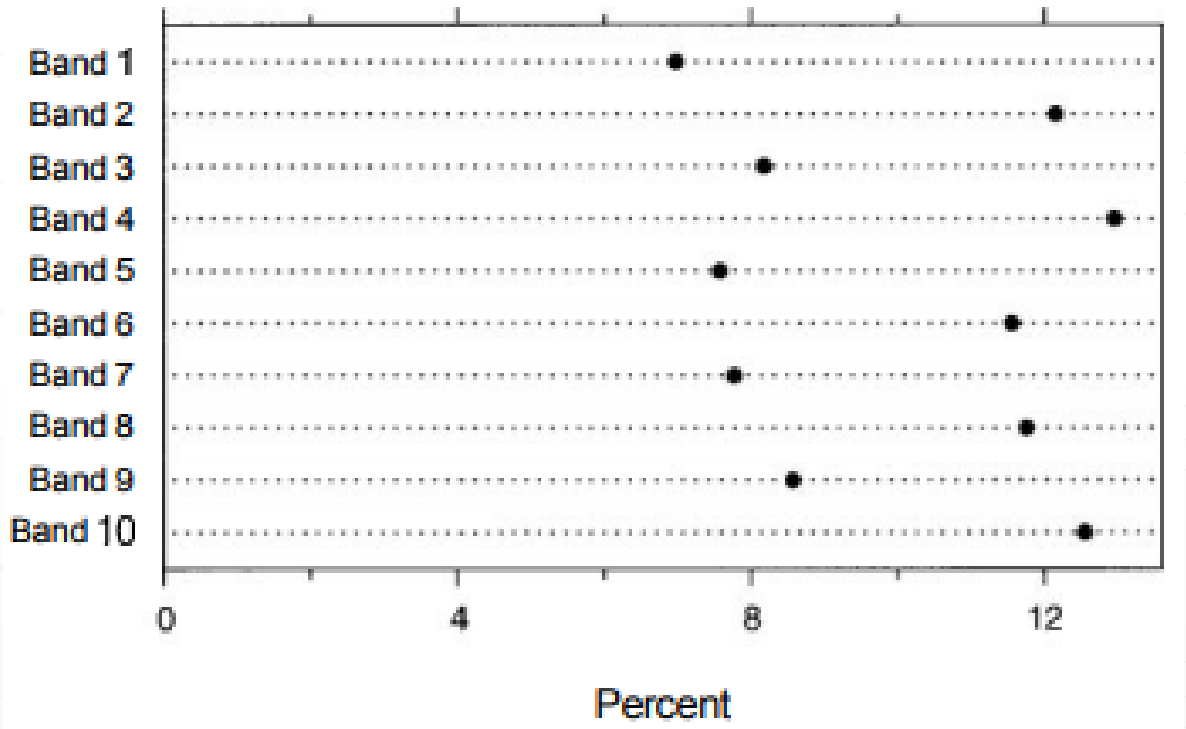




Pop Charts

- Pie Charts





Pop Charts

- Divided bar graphs