

Two objectives of effective graphs:

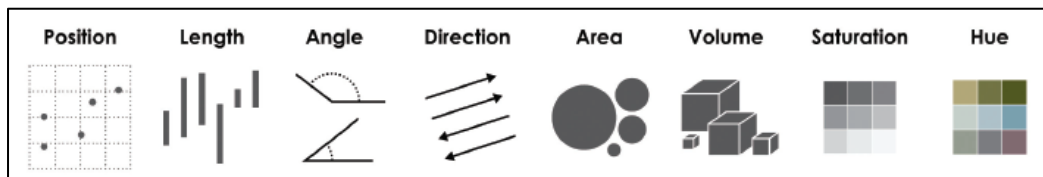
1. Grab & direct attention (iconic memory)
2. Reduce processing demands (working memory)

Graph components:

1. Geoms:
 - points, lines, boxes, bars, etc.
2. Pre-attentive attributes:
 - position, color, shape, curvature, etc.
3. Non-data ink:
 - scales, grid lines, legend, labels, etc.
4. No chart junk!

Cleveland's pattern recognition hierarchy:

1. Position on a common scale (*best*)
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. Color hue (*worst*)



Cleveland's three visual operations of pattern perception:

1. Estimation:
 - Discrimination $X \neq Y$
 - Ranking $X > Y$
 - Ratioing X / Y
2. Assembly:
 - The grouping of graphical elements
 - Prägnanz: We strongly prefer to interpret stimuli as regular, simple, and orderly
3. Detection:
 - Recognizing that a geometric object encodes a physical value
 - Above all else, show the data

10 lessons from research on visual perception:

1. Do not remove chart junk
2. Don't make 3D plots*
3. Don't lie
4. Don't use pie charts for proportions*
5. Don't stack bars*
6. Do rotate and sort categorical axes*
7. Do eliminate legends & directly label geoms*
8. Don't use pattern fills
9. Don't use red & green together
10. Do consider tables for small data sets

*most of the time