

Data and Visual Channels

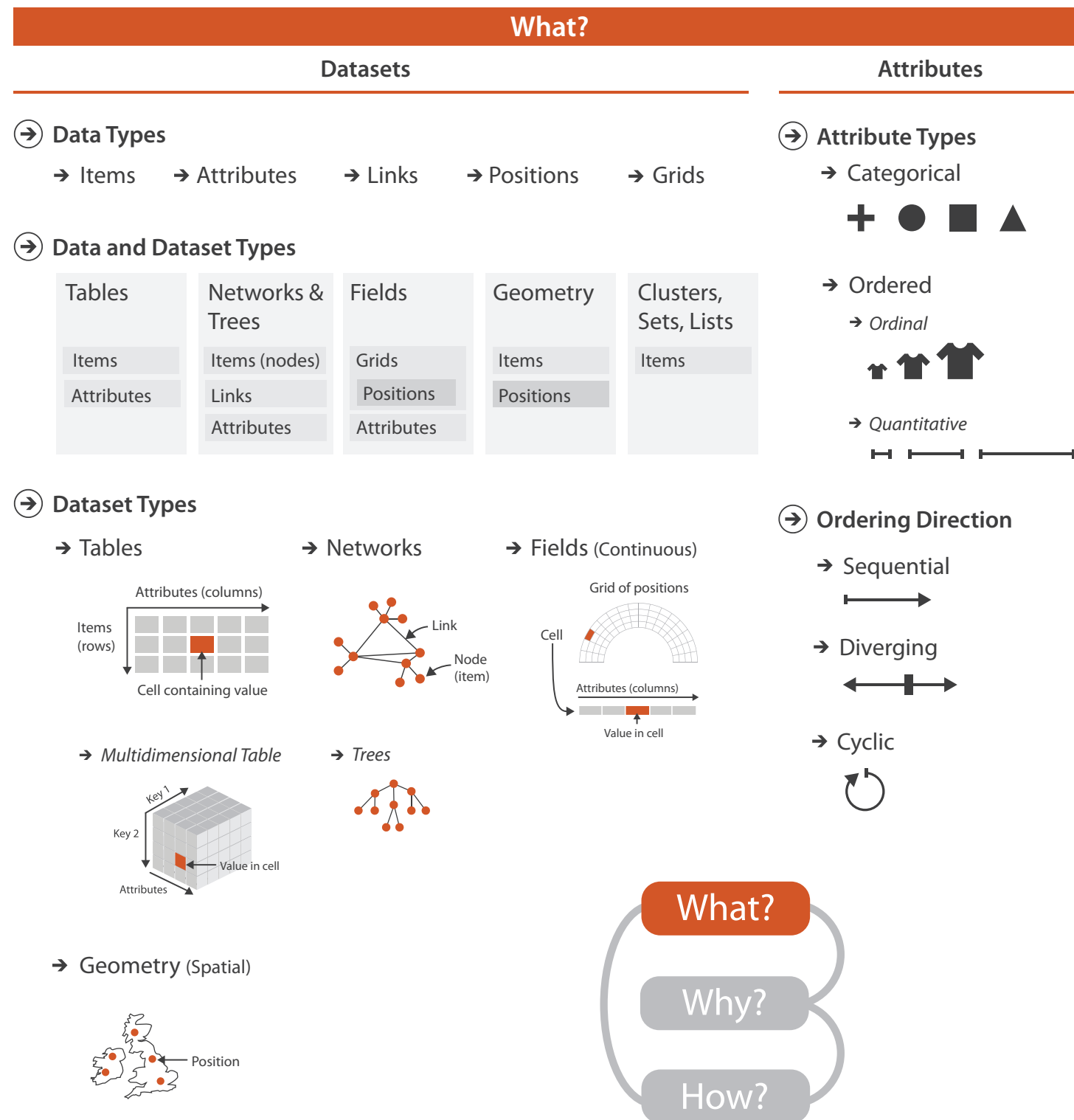
Courtesy of Tamara Munzner

Department of Computer Science

University of British Columbia

<http://www.cs.ubc.ca/~tmm/courses/547-15>

VAD Ch 2: Data Abstraction

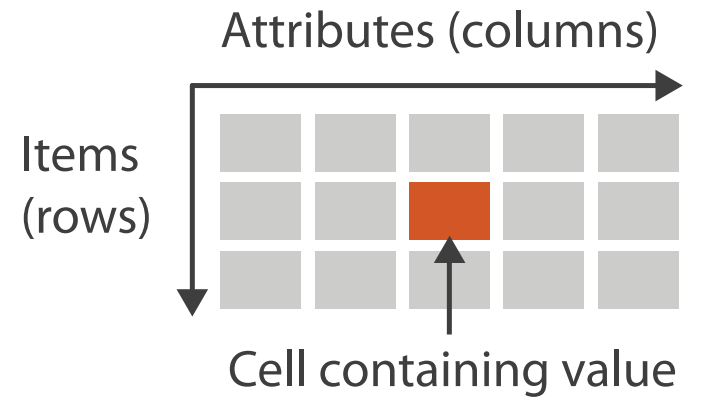


[VAD Fig 2.1]

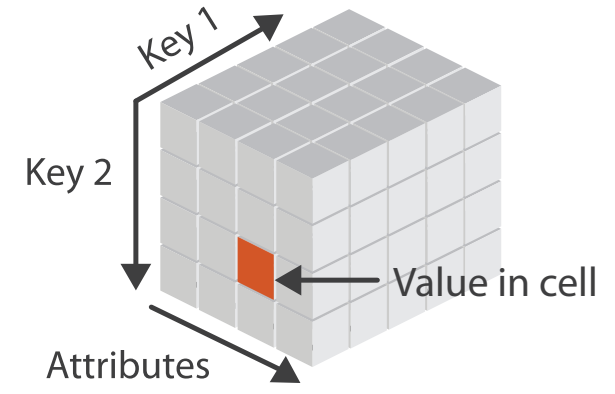
Dataset types

→ Dataset Types

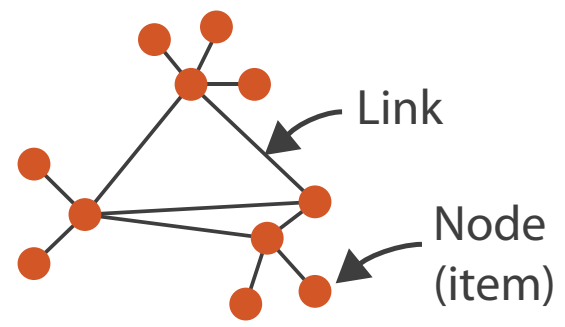
→ Tables



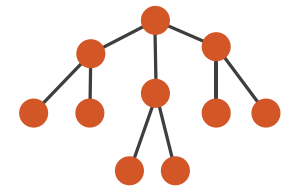
→ *Multidimensional Table*



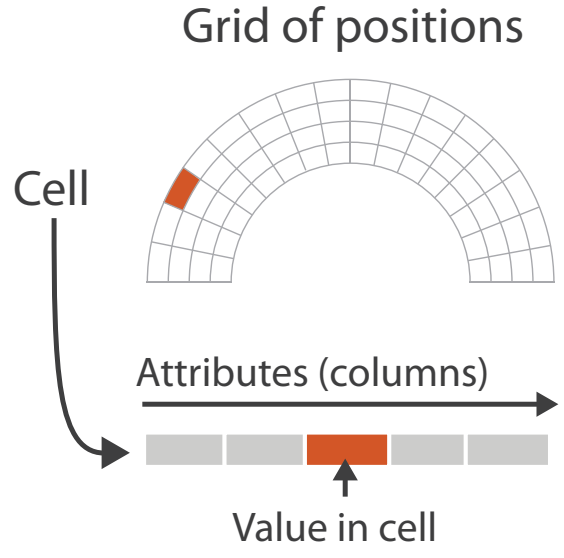
→ Networks



→ Trees



→ Fields (Continuous)

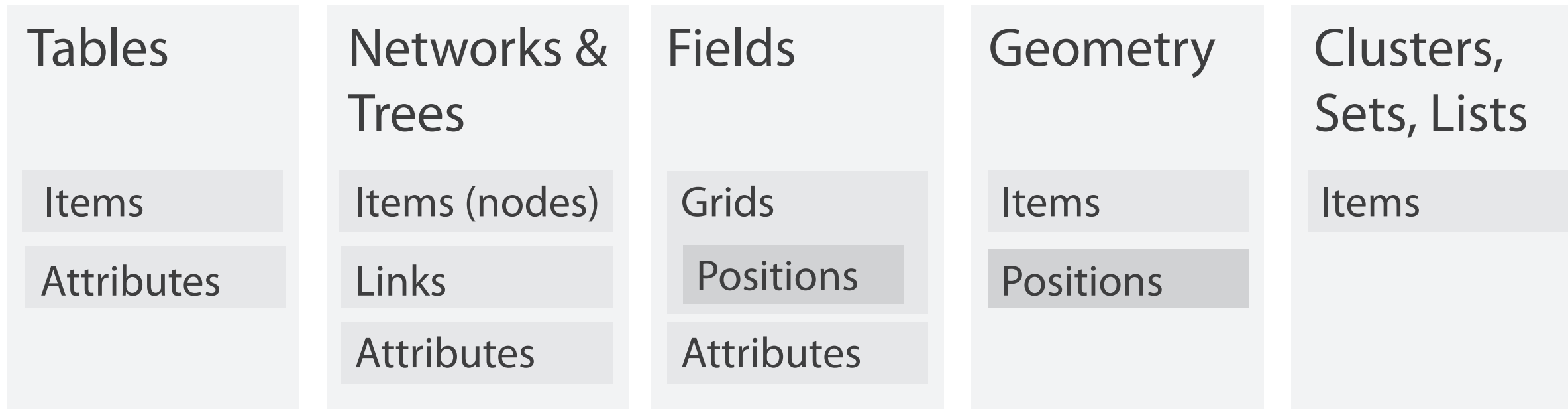


→ Geometry (Spatial)



Dataset and data types

→ Data and Dataset Types



→ Data Types

→ Items → Attributes → Links → Positions → Grids

→ Dataset Availability

→ Static



→ Dynamic



Attribute types

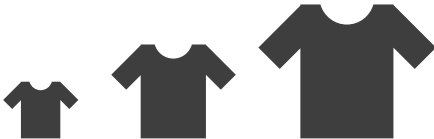
➔ Attribute Types

➔ Categorical

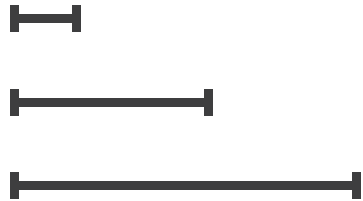


➔ Ordered

➔ *Ordinal*



➔ *Quantitative*



➔ Ordering Direction

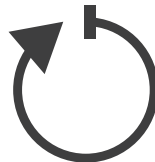
➔ Sequential



➔ Diverging



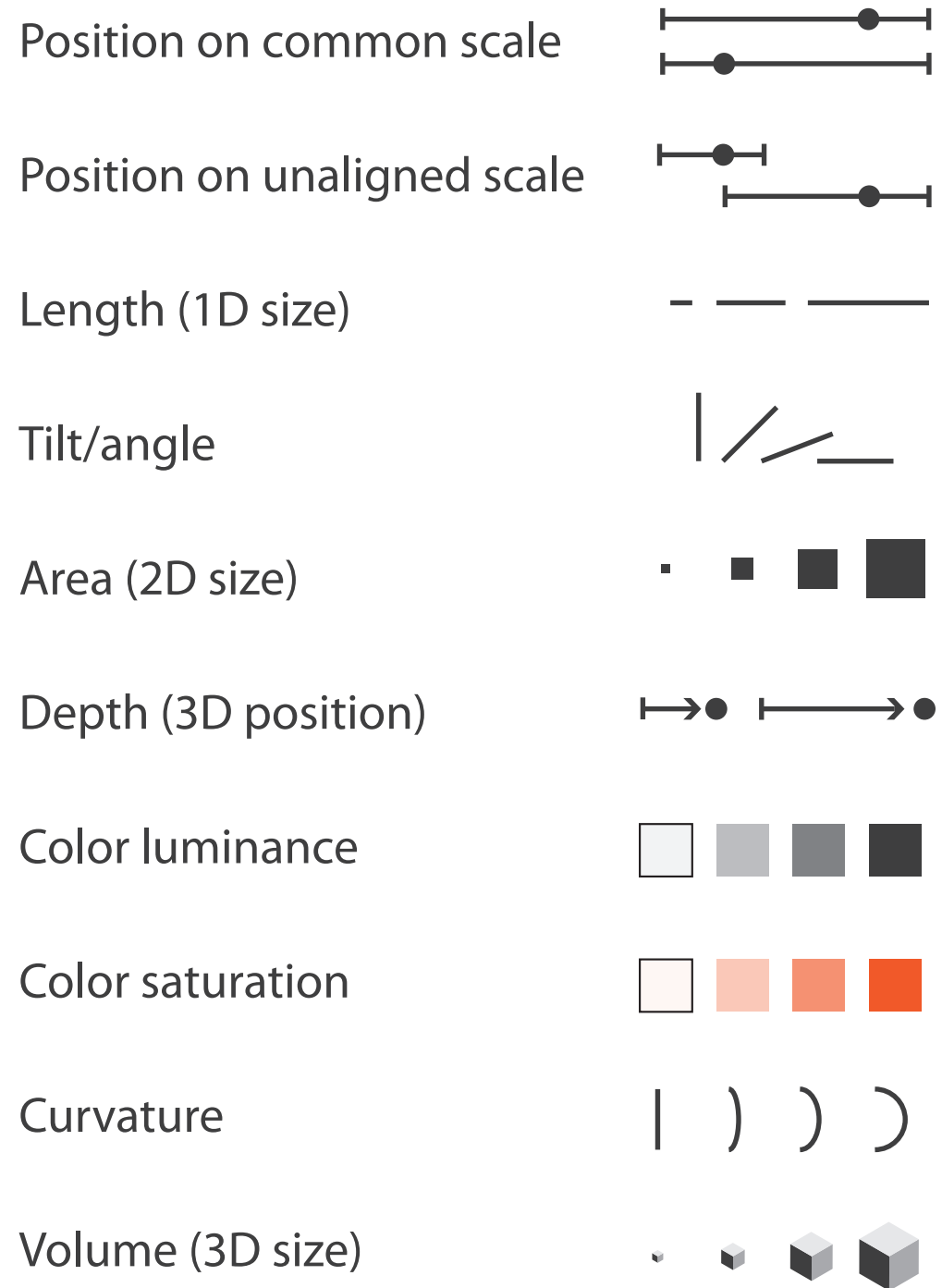
➔ Cyclic



VAD Ch 5: Marks and Channels

Channels: Expressiveness Types and Effectiveness Ranks

➔ Magnitude Channels: Ordered Attributes



➔ Identity Channels: Categorical Attributes



Most

Effectiveness

Least

Same

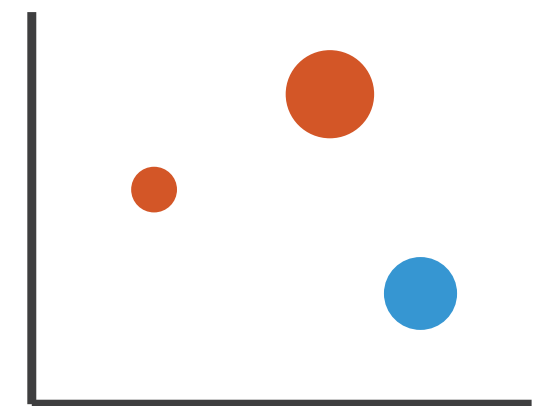
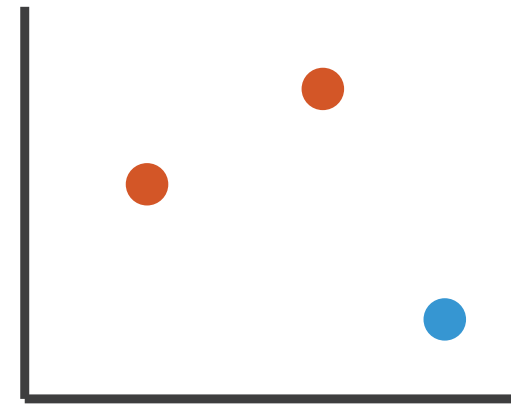
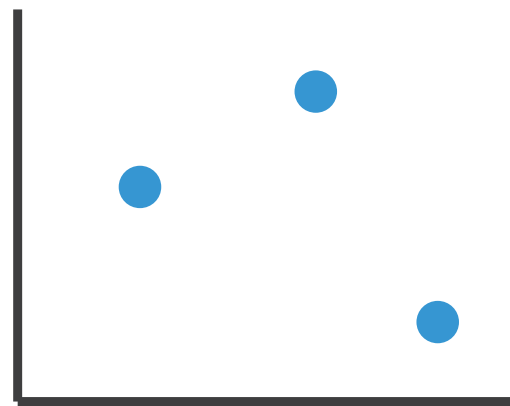
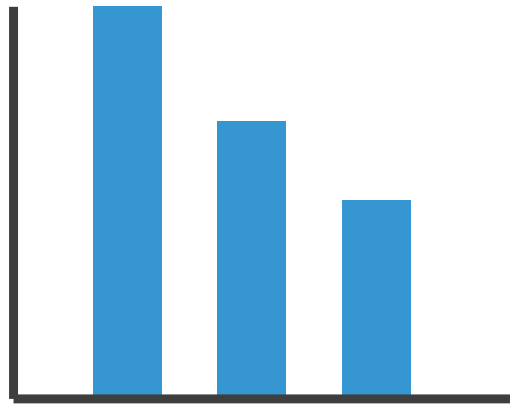
Same

Same

[VAD Fig 5.1]

Encoding visually

- analyze idiom structure



Definitions: Marks and channels

- marks

 - geometric primitives

→ Points



→ Lines



→ Areas



- channels

 - control appearance of marks

→ Position

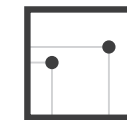
→ Horizontal



→ Vertical



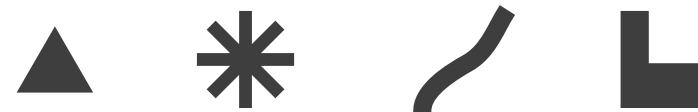
→ Both



→ Color



→ Shape



→ Tilt



→ Size

→ Length



→ Area

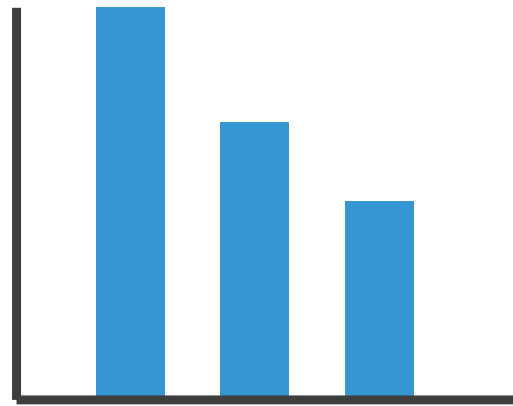


→ Volume



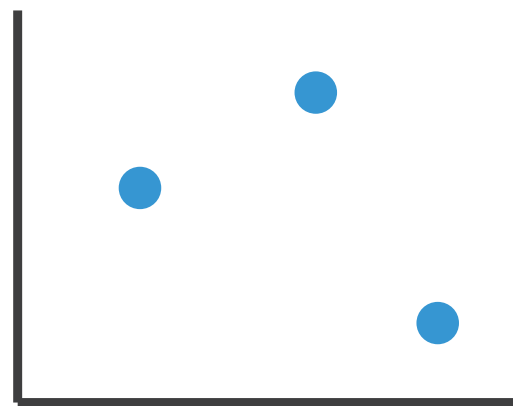
Encoding visually with marks and channels

- analyze idiom structure
 - as combination of marks and channels



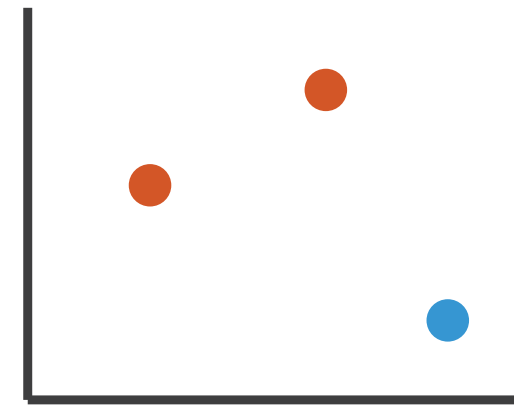
1:
vertical position

mark: line



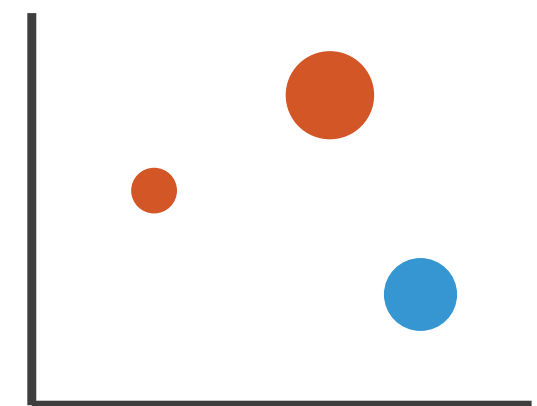
2:
vertical position
horizontal position

mark: point



3:
vertical position
horizontal position
color hue

mark: point



4:
vertical position
horizontal position
color hue
size (area)

mark: point

Channels

Position on common scale



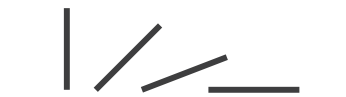
Position on unaligned scale



Length (1D size)



Tilt/angle



Area (2D size)



Depth (3D position)



Color luminance



Color saturation



Curvature



Volume (3D size)



Same

Same

Spatial region



Color hue



Motion

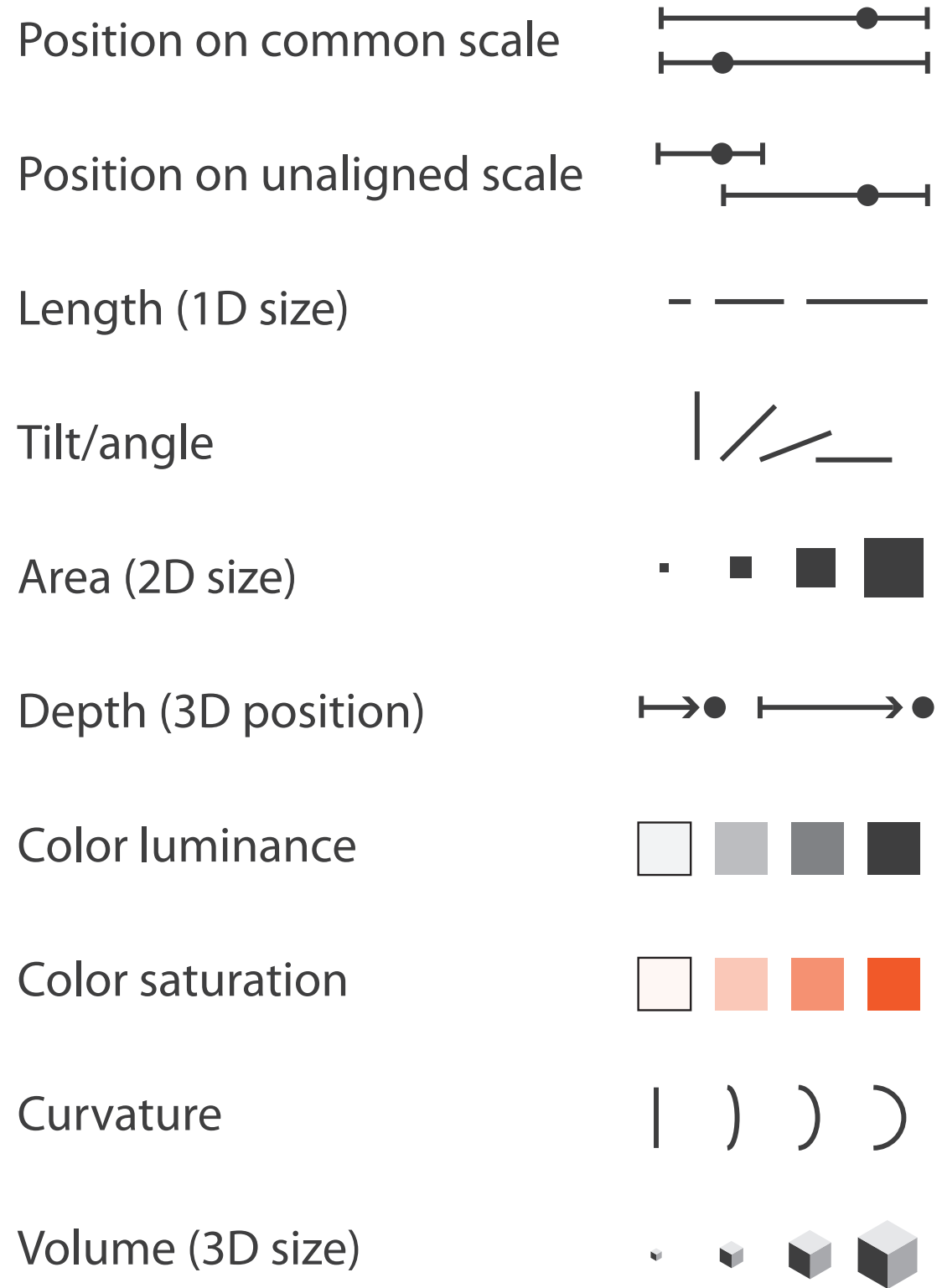


Shape



Channels: Rankings

➔ Magnitude Channels: Ordered Attributes



➔ Identity Channels: Categorical Attributes

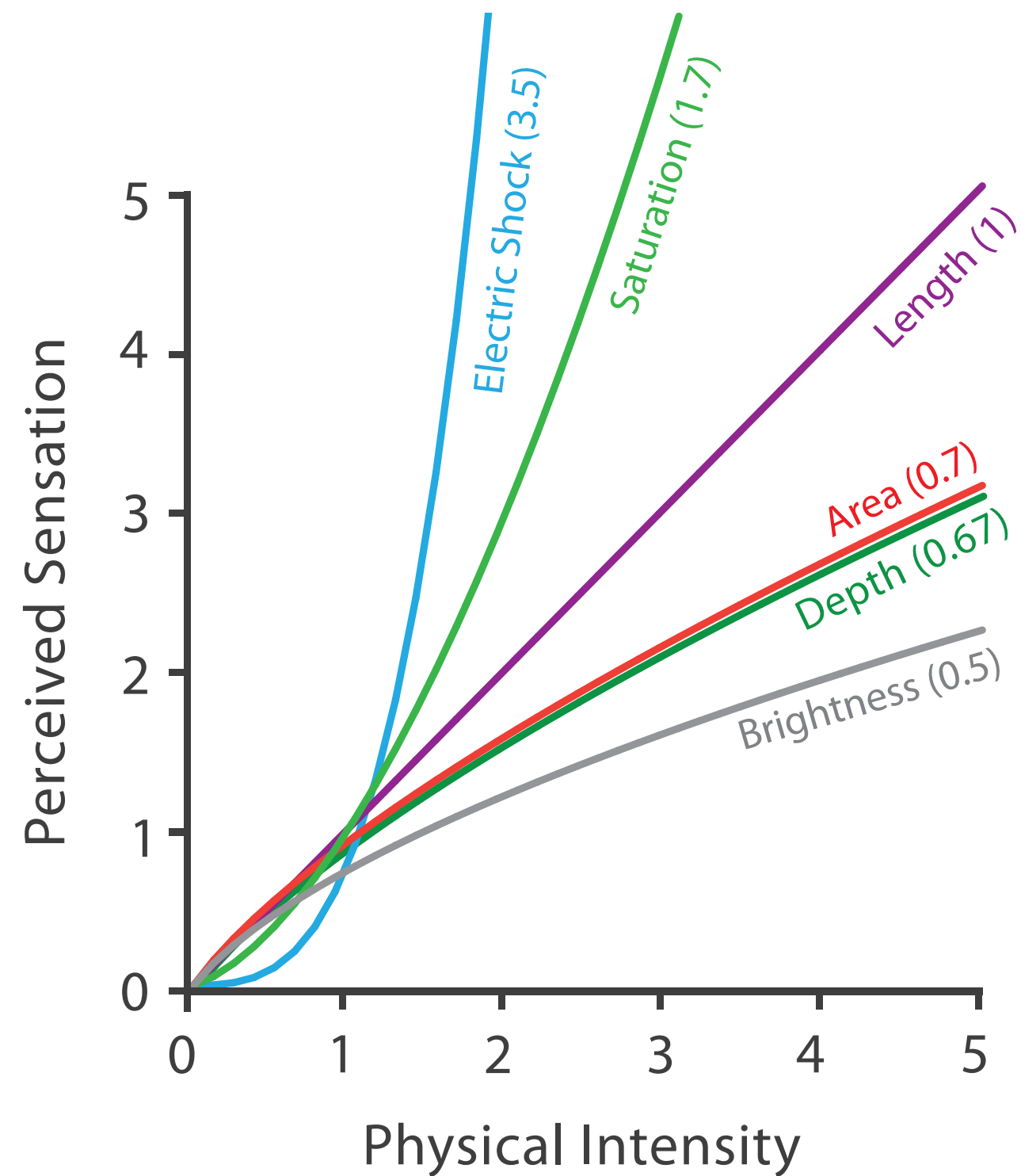


Best
Effectiveness
Least

- effectiveness principle
 - encode most important attributes with highest ranked channels
- expressiveness principle
 - match channel and data characteristics

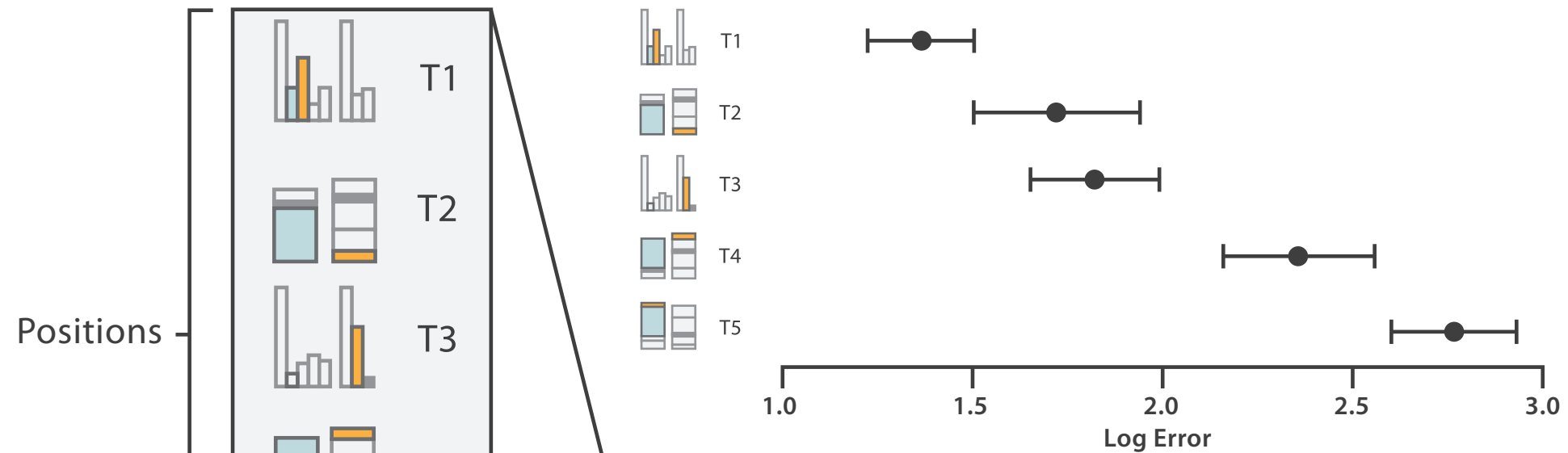
Accuracy: Fundamental Theory

Steven's Psychophysical Power Law: $S = I^N$

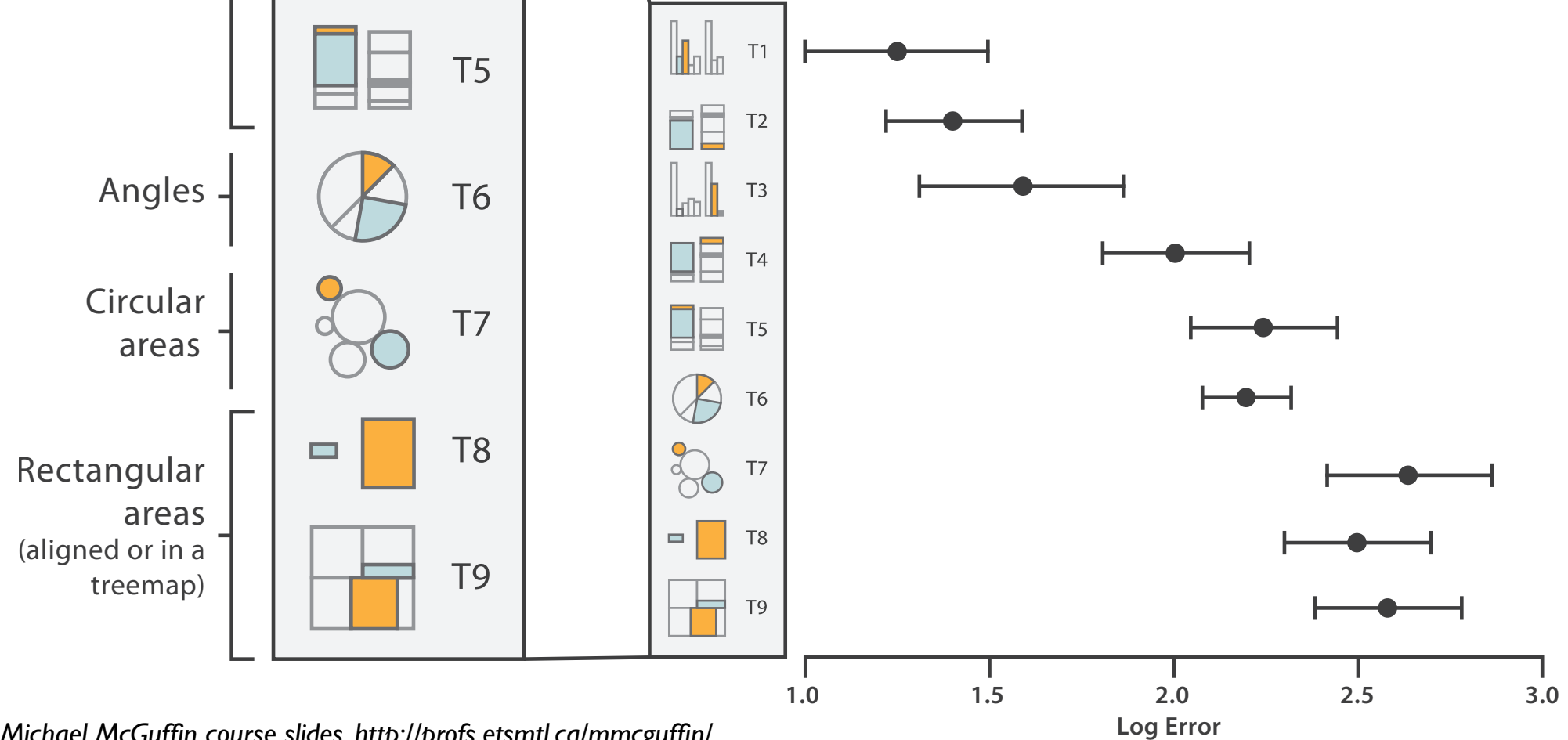


Accuracy: Vis experiments

Cleveland & McGill's Results



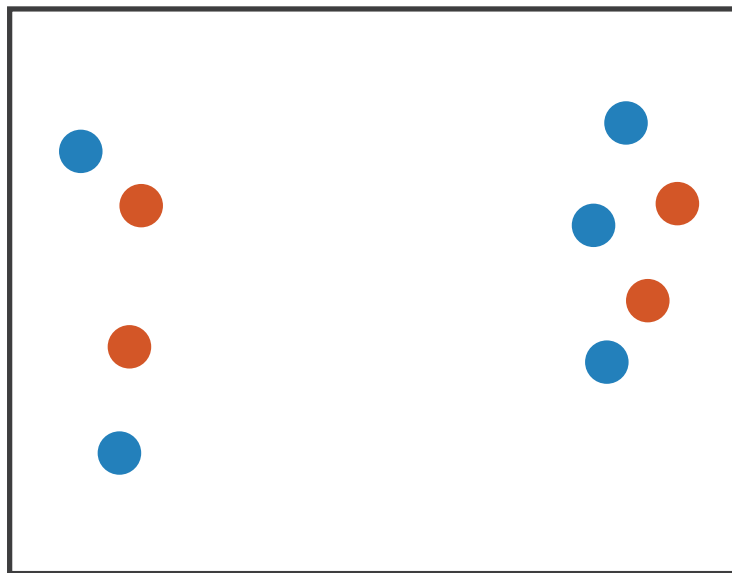
Crowdsourced Results



[Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design. Heer and Bostock. Proc ACM Conf. Human Factors in Computing Systems (CHI) 2010, p. 203–212.]

Separability vs. Integrality

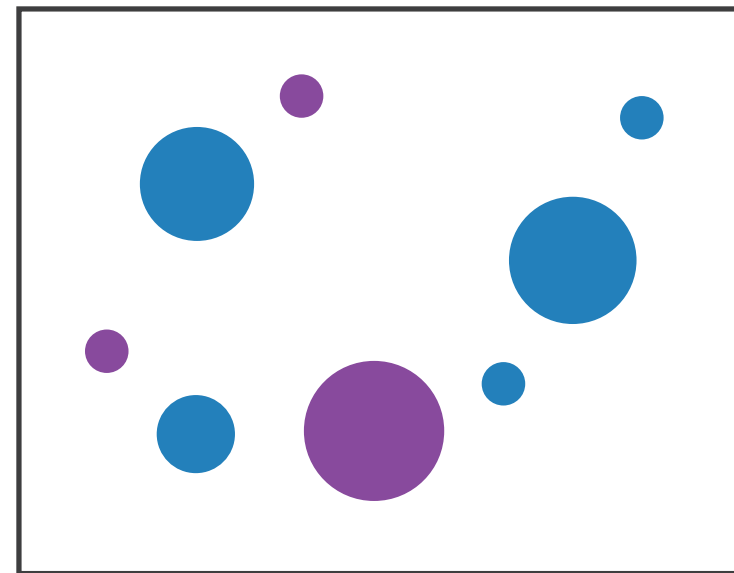
Position
+ Hue (Color)



Fully separable

2 groups each

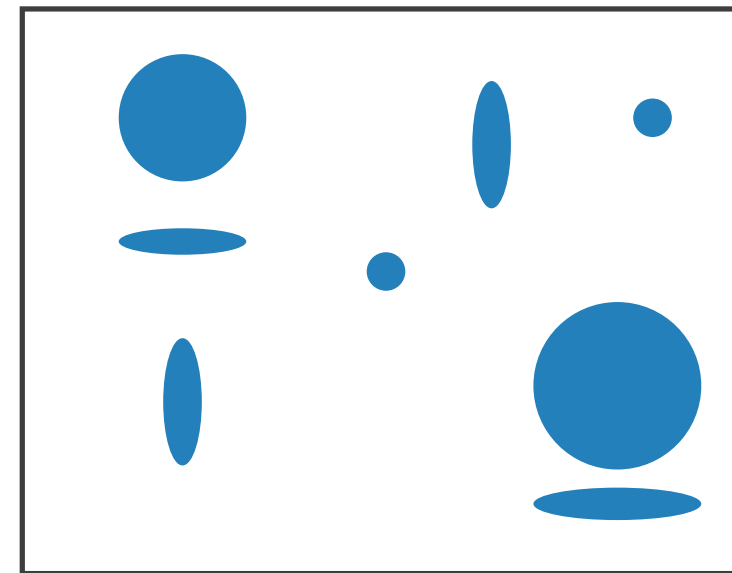
Size
+ Hue (Color)



Some interference

2 groups each

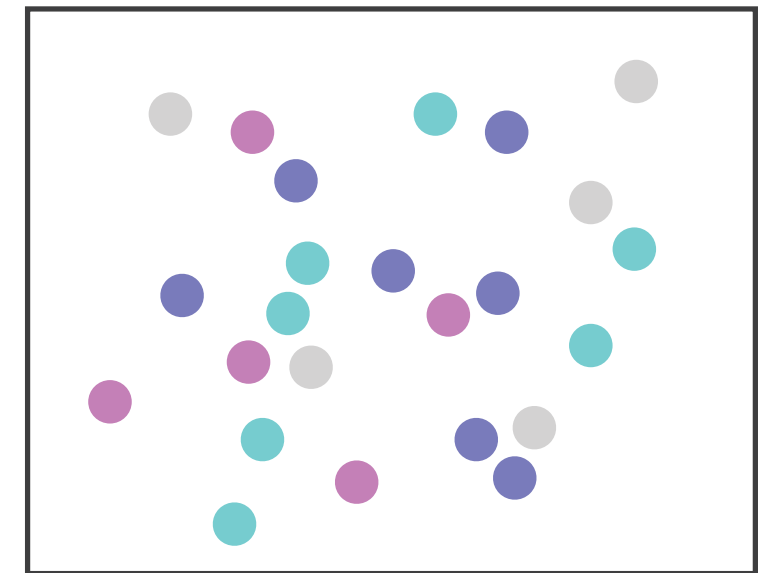
Width
+ Height



Some/significant
interference

3 groups total:
integral area

Red
+ Green



Major interference

4 groups total:
integral hue