Data

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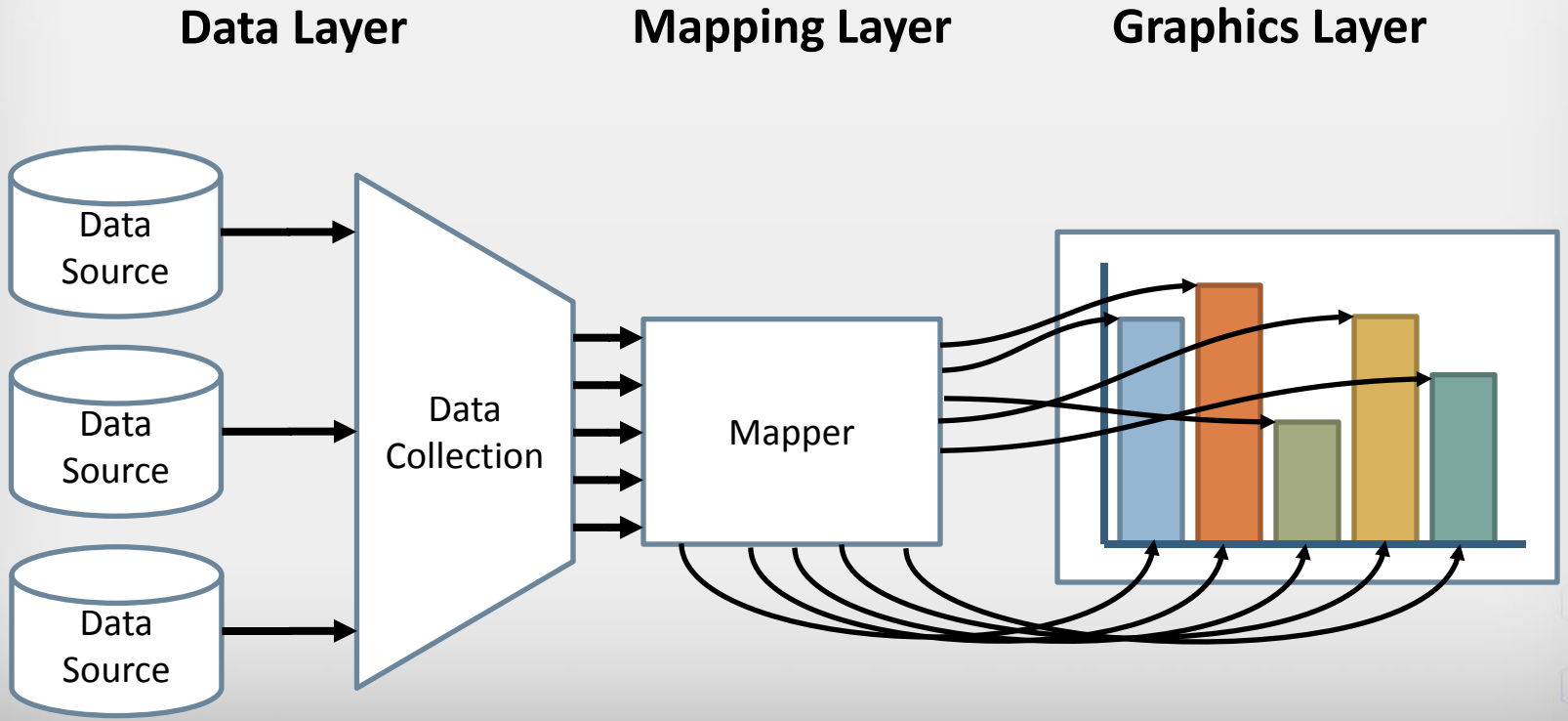
Data Visualization Framework



Data Layer	Mapping Layer	Graphics Layer
• Locating and obtaining data • Importing data in proper format • Relating data for proper correspondence • Data analysis and aggregation	• Associating appropriate geometry with corresponding data channels • Data analysis and algorithms (e.g. contouring)	• Conversion of geometry into displayable image • Decorations • Managing interaction

Data Types

	Discrete (no between values)	**Continuous** (values between)
Ordered (values are comparable)	**Ordinal,** e.g. size: S,M,L,XL,… **Quantitative,** e.g. counts: 1,2,3,…	**Fields,** e.g. altitude, temperature
Unordered (values not comparable)	**Nominal,** e.g. shape: ☐○△ **Categories,** e.g. nationality	**Cyclic values,** e.g. directions, hues

Mapping Quantitative Values

- Position
- Length
- Angle/Slope
- Area
- Volume
- Color/Density

CLEVELAND, W. S., AND MCGILL, R. Graphical perception: Theory, experimentation and application to the development of graphical methods. Journal of the American Statistical Association, 79(387) 1984

Mapping Quantitative Values

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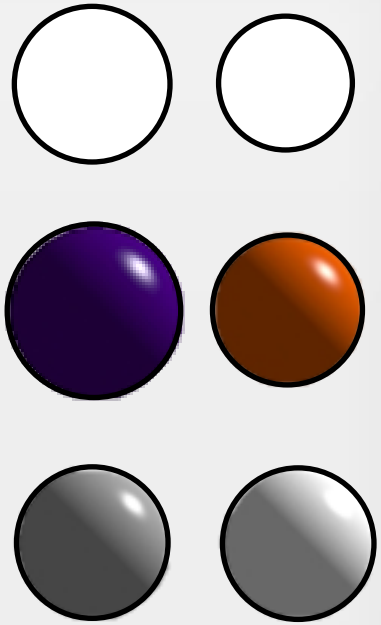

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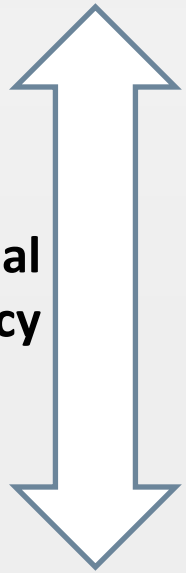

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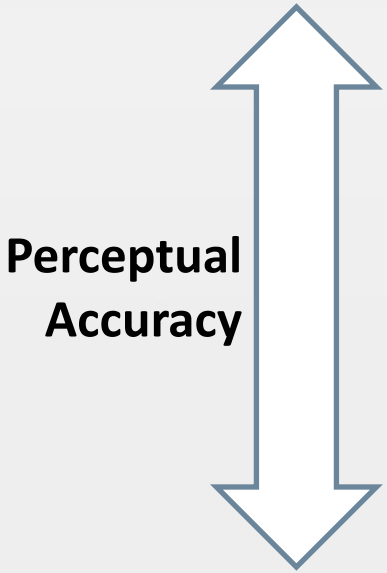

- Position
- Length
- Angle/Slope
- Area
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- Color/Density

1-D

2-D

3-D

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Quantitative

Position

Length

Angle

Slope

Area

Volume

Density

Saturation

Hue

J. Mackinlay, Automating the Design of Graphical Presentations of Relational Information, ACM Transactions on Graphics 5(2), 1986

Quantitative	Ordinal
Position	
Length	
Angle	
Slope	
Area	
Volume	
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Density	
Saturation	Length
Hue	Angle
	Slope
	Area
	Volume

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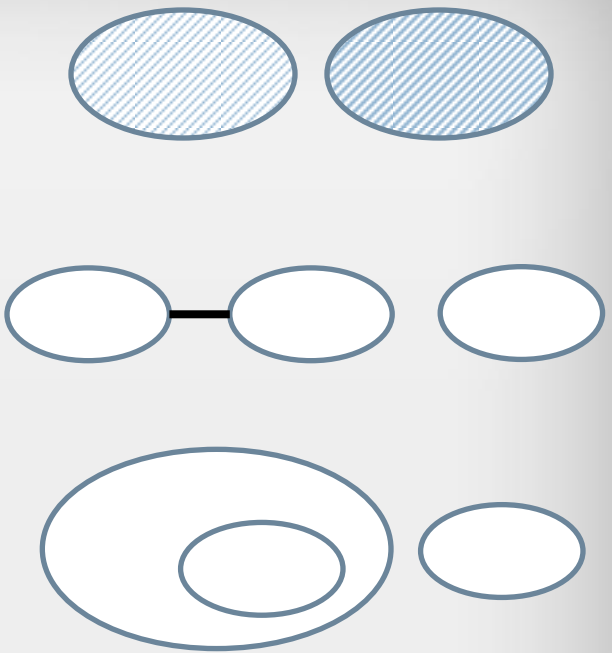
Quantitative	Ordinal
Position	Position
Length	Density
Angle	Saturation
Slope	Hue
Area	**Texture**
Volume	**Connection**
Density	**Containment**
Saturation	Length
Hue	Angle
	Slope
	Area
	Volume



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Position	Position	
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Angle	Saturation	Texture
Slope	Hue	Connection
Area	Texture	Containment
Volume	Connection	Density
Density	Containment	Saturation
Saturation	Length	
Hue	Angle	
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Slope	Hue	Connection
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Density	Containment	Saturation
Saturation	Length	
Hue	Angle	
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Length	Density	Hue
Angle	Saturation	Texture
Slope	Hue	Connection
Area	Texture	Containment
Volume	Connection	Density
Density	Containment	Saturation
Saturation	Length	
Hue	Angle	Length
	Slope	Angle
	Area	Slope
	Volume	Area
		Volume

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Quantitative	Ordinal	Nominal
Position	Position	Position
Length	Density	Hue
Angle	Saturation	Texture
Slope	Hue	Connection
Area	Texture	Containment
Volume	Connection	Density
Density	Containment	Saturation
Saturation	Length	Shape
Hue	Angle	Length
	Slope	Angle
	Area	Slope
	Volume	Area
		Volume

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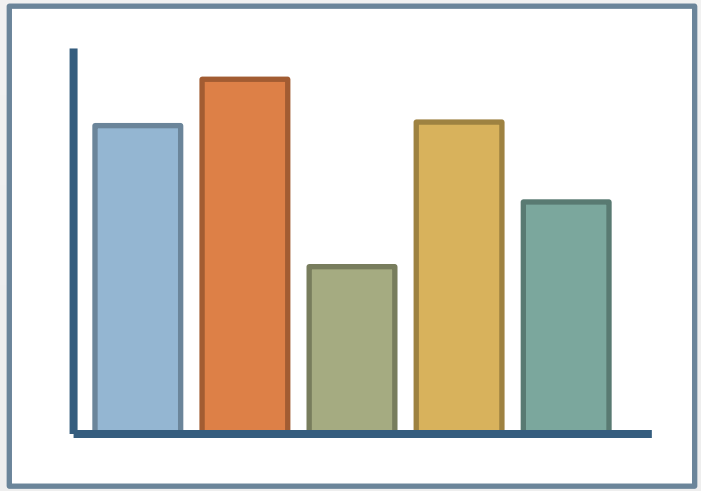
Bar Chart

Quantitative dependent variable

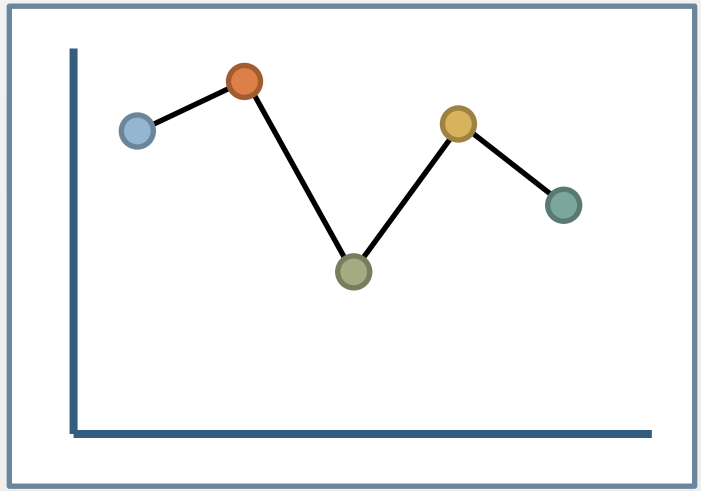


Discrete/nominal independent variable

Benefits from both position (top of bar) and length (size of bar)

Line Chart

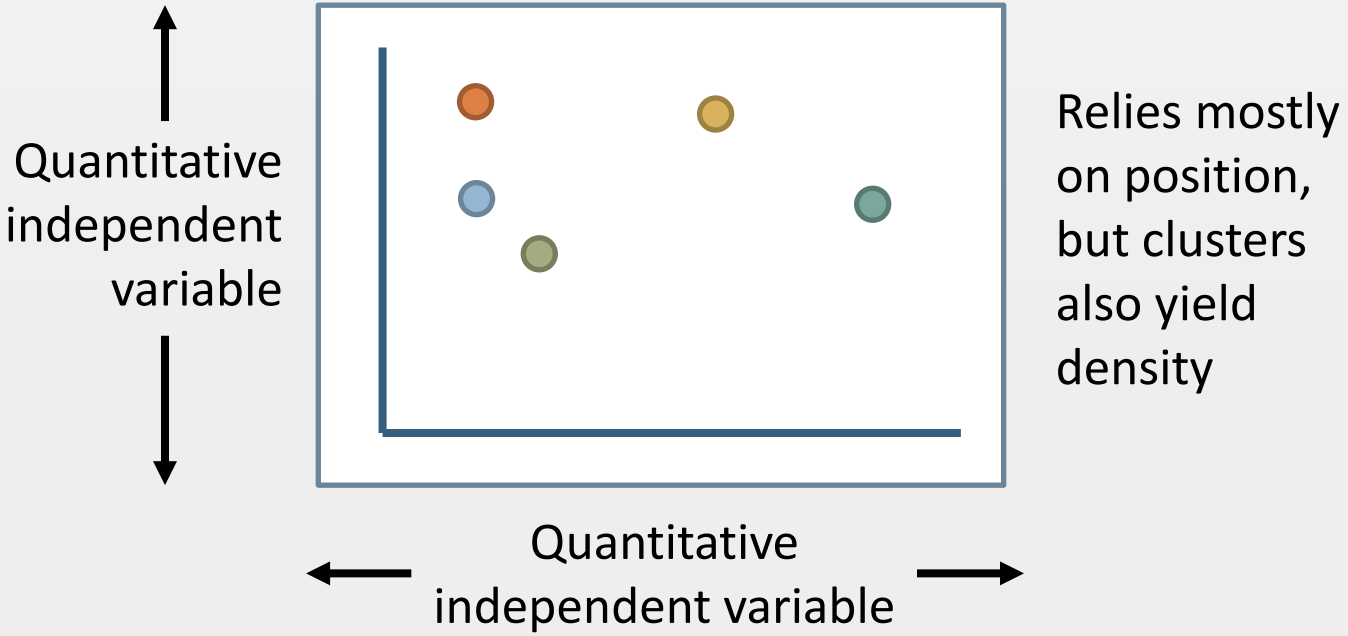
Quantitative continuous dependent variable



Quantitative continuous independent variable

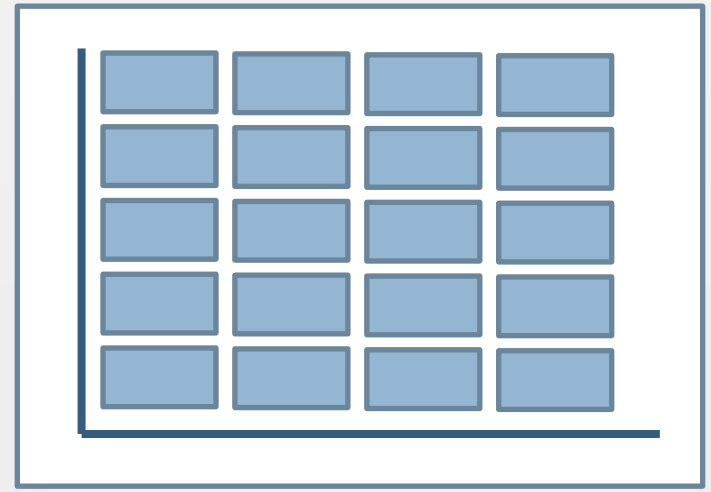
Benefits from position but not length

Scatter Plot



Relies mostly on position, but clusters also yield density

Table



Discrete/nominal independent variable

Discrete/nominal independent variable

Benefits from position only

(notice the lateral inhibition flashing?)

What to Use?

Dep.	Quantitative Continuous	Bar	Line
	Quantitative Discrete	Bar	Bar
Ind.	Quantitative Continuous	Gantt	Scatter
	Nominal or Q. Discrete	Table	Gantt
		Nominal or Q. Discrete	Quantitative Continuous
		Independent	