University of Dayton

Charts

CPS 563 – Data Visualization

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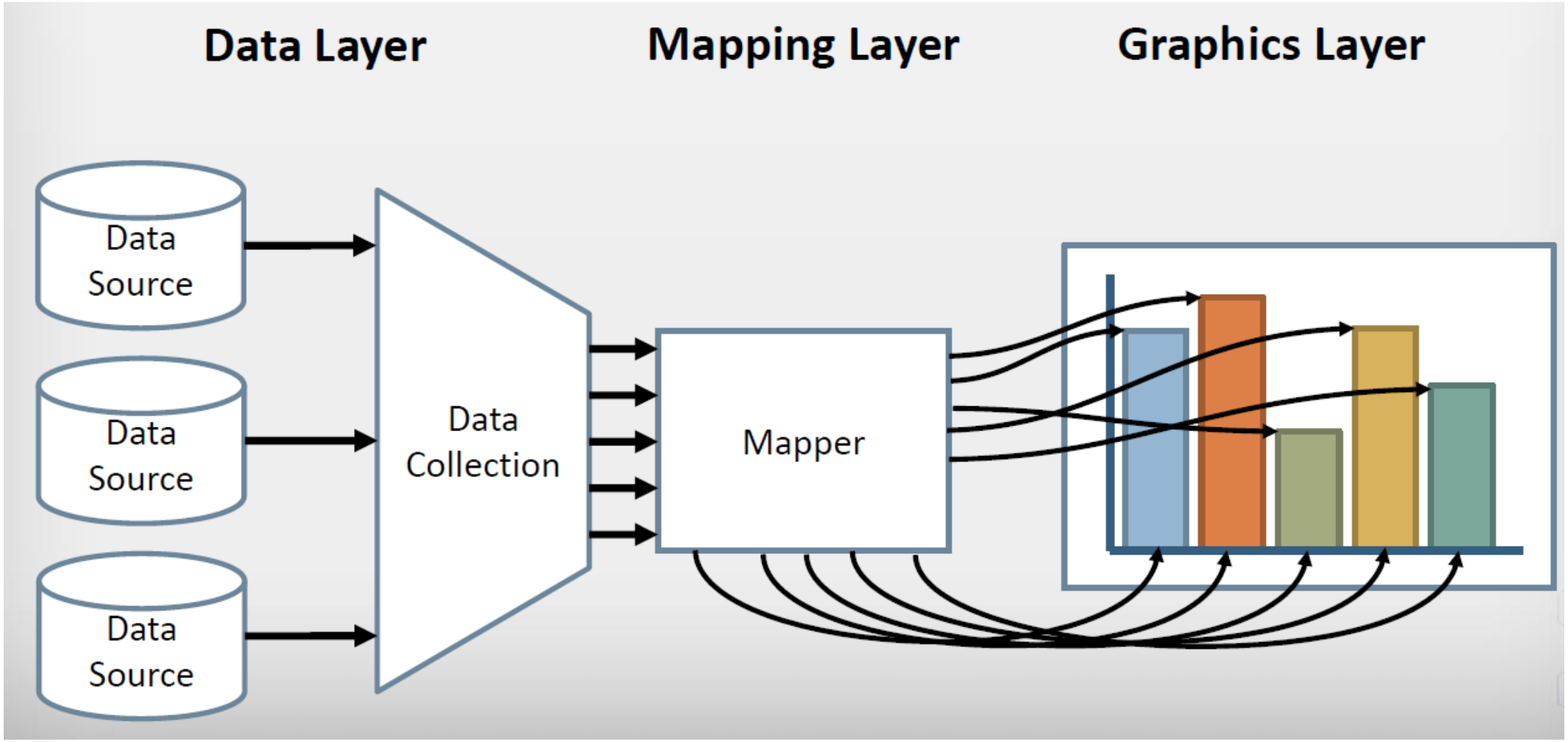
Outline

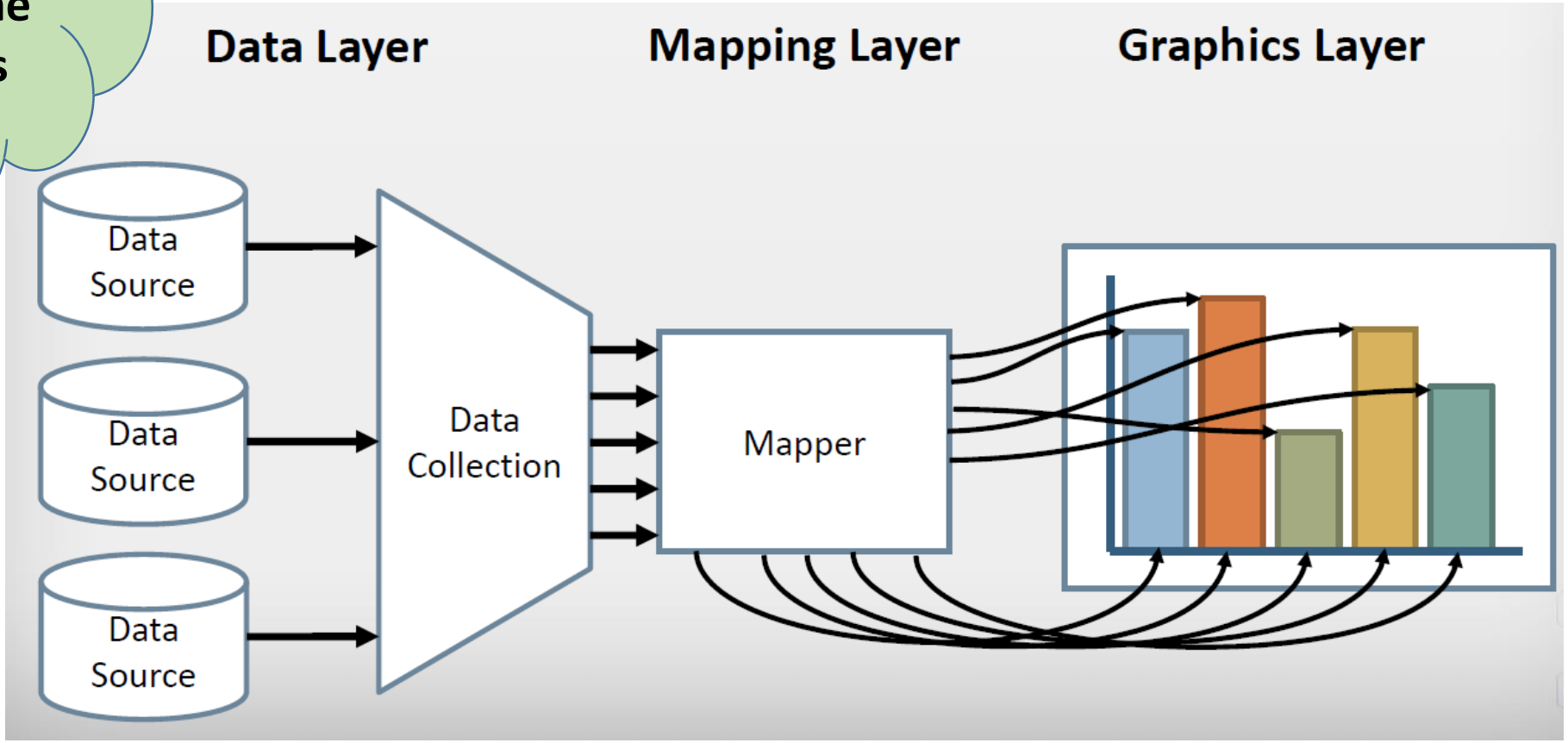
- Data Visualization Process
- Some basic charts
- Stacked charts

Data Visualization Process



- **Data Layer**
  - Locating, obtaining data and importing data in proper format
- **Mapping Layer**
  - Associating appropriate geometry with corresponding data channels
- **Graphics Layer**
  - Conversion of geometry into displayable image

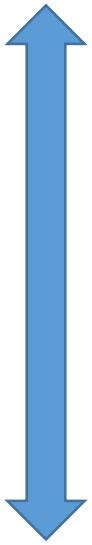
We talked about the data in the previous lecture.



Mapping Quantitative Values

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

Mapping Quantitative Values



Perceptual Accuracy

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

1-D

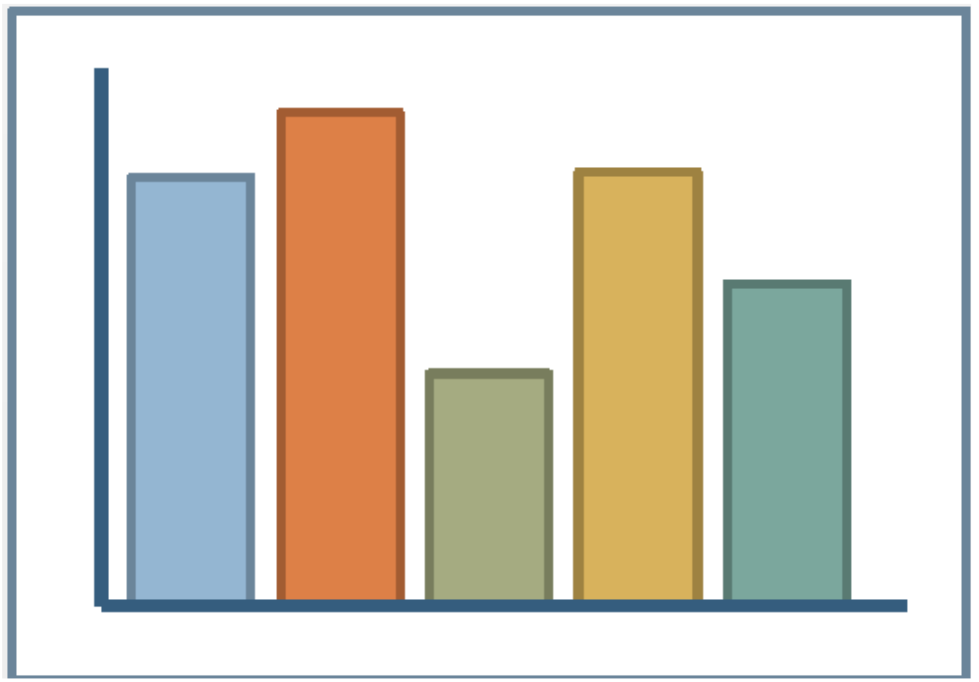
2-D

3-D

Data Types

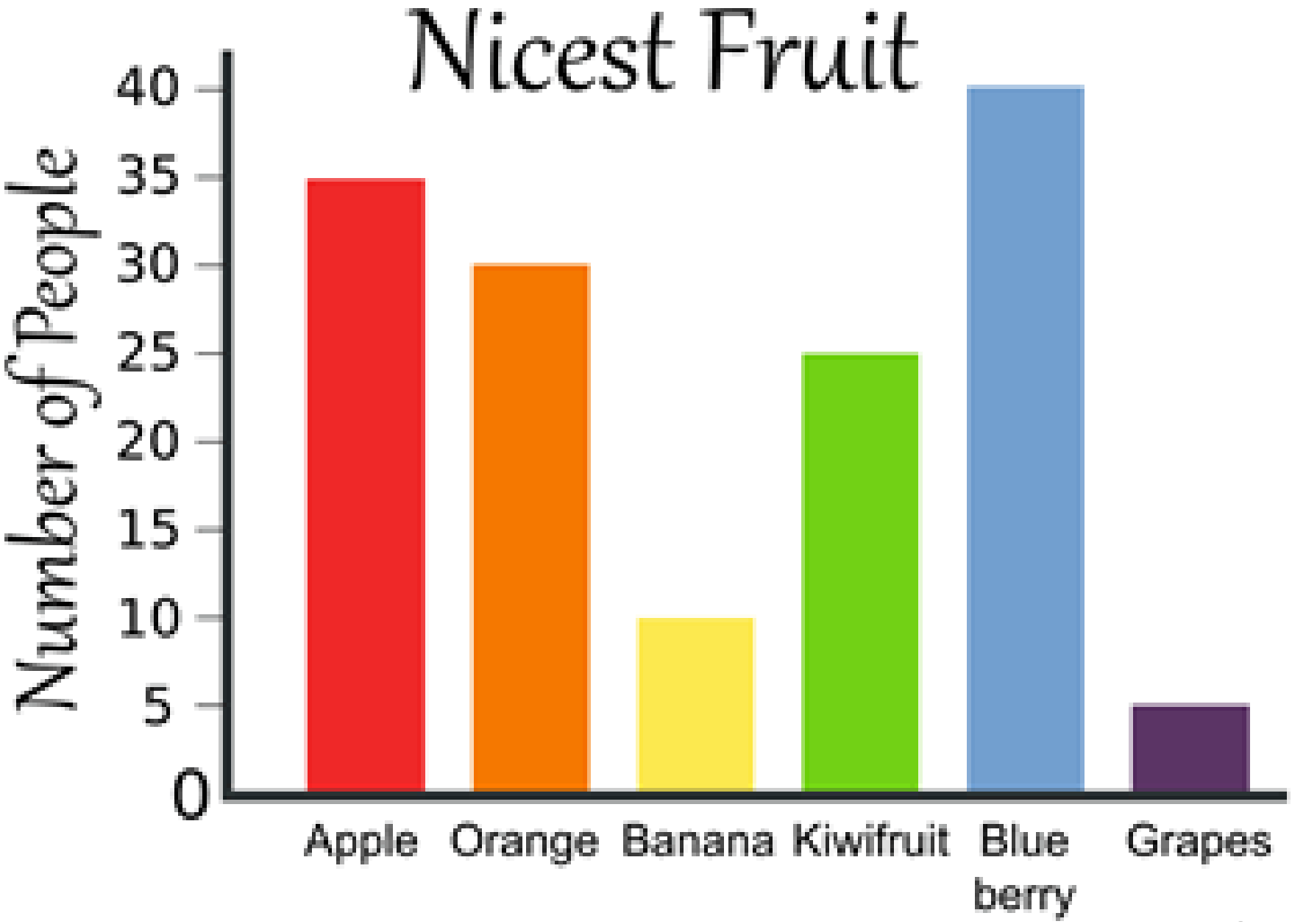
	Discrete (no between values)	**Continuous** (values between)
Ordered (values are comparable)		
Unordered (values not comparable)		

Bar Chart

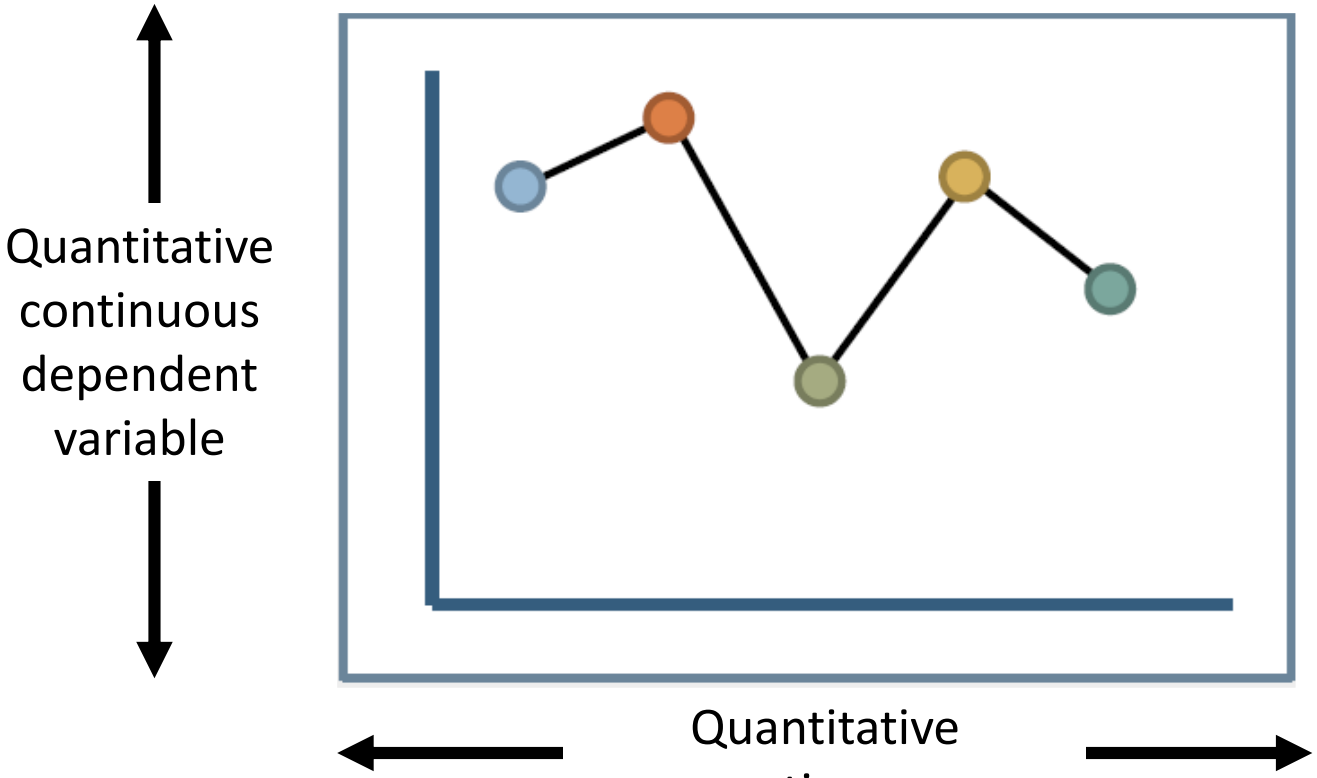


Benefits from both position (top of bar) and length (size of bar)

Example

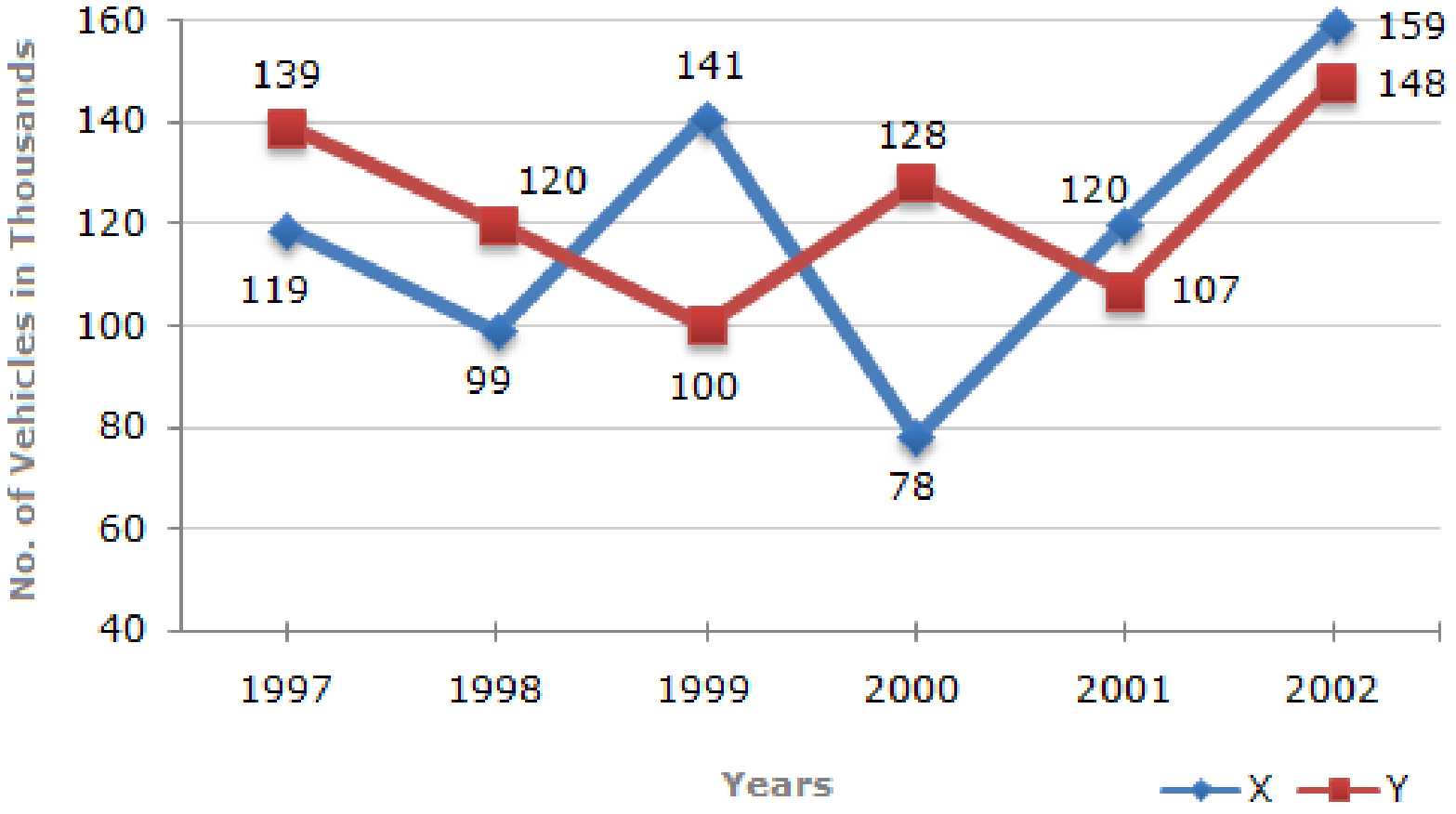

Nicest Fruit
Number of People
0
5
10
15
20
25
30
35
40
Apple
Orange
Banana
Kiwifruit
Blue berry
Grapes

Line Chart

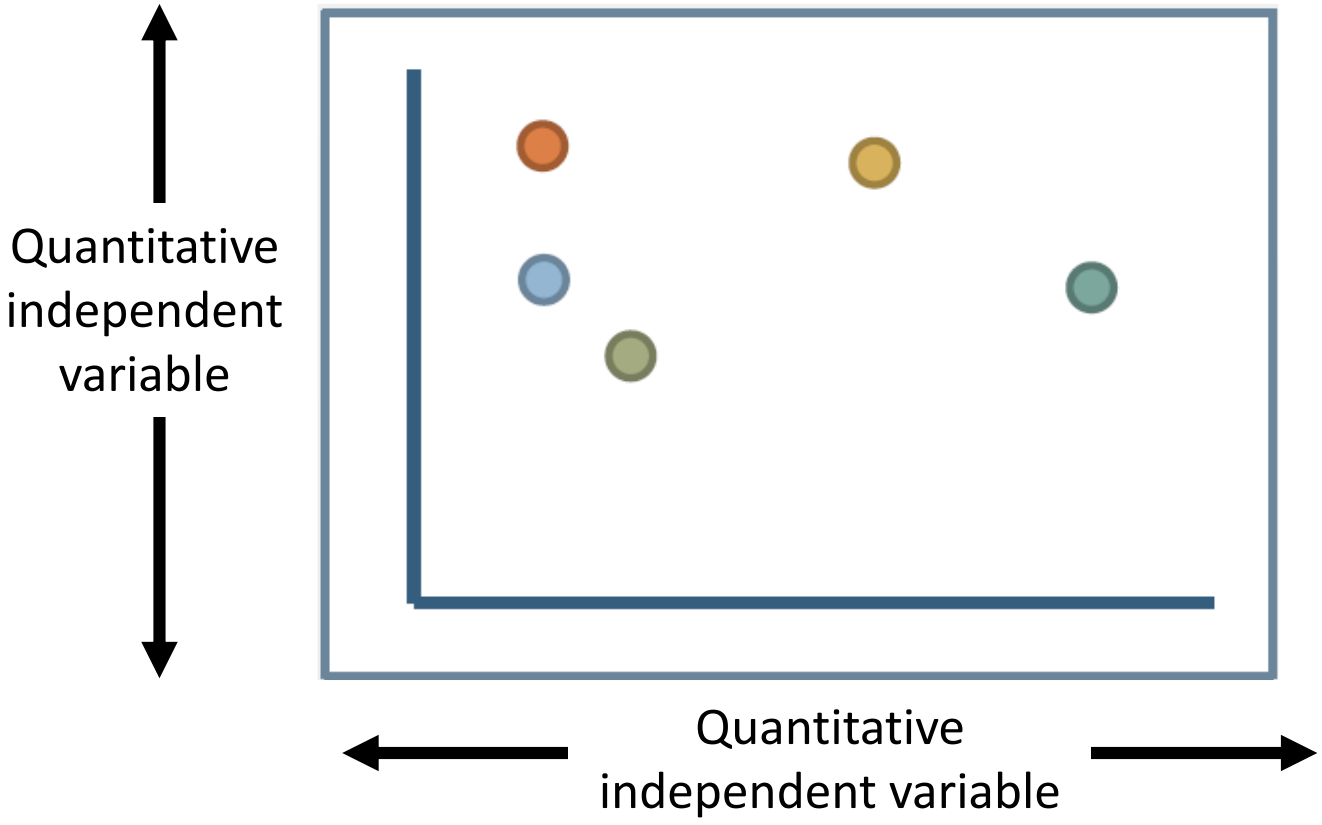


Benefits from position but not length

Example

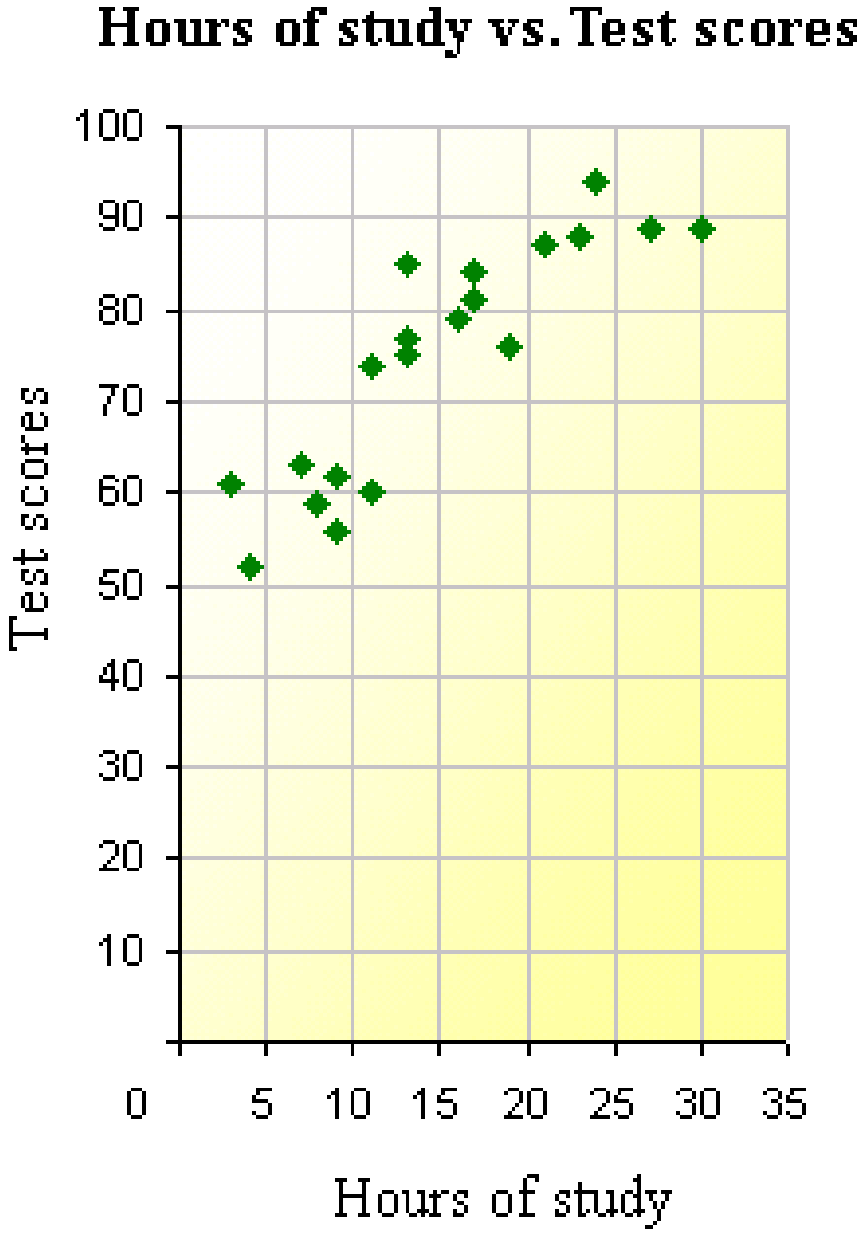

No. of Vehicles in Thousands
160
140
120
100
80
60
40
139
120
99
141
100
128
78
120
107
159
148
119
1997
1998
1999
2000
2001
2002
Years
X
Y

Scatter Plot



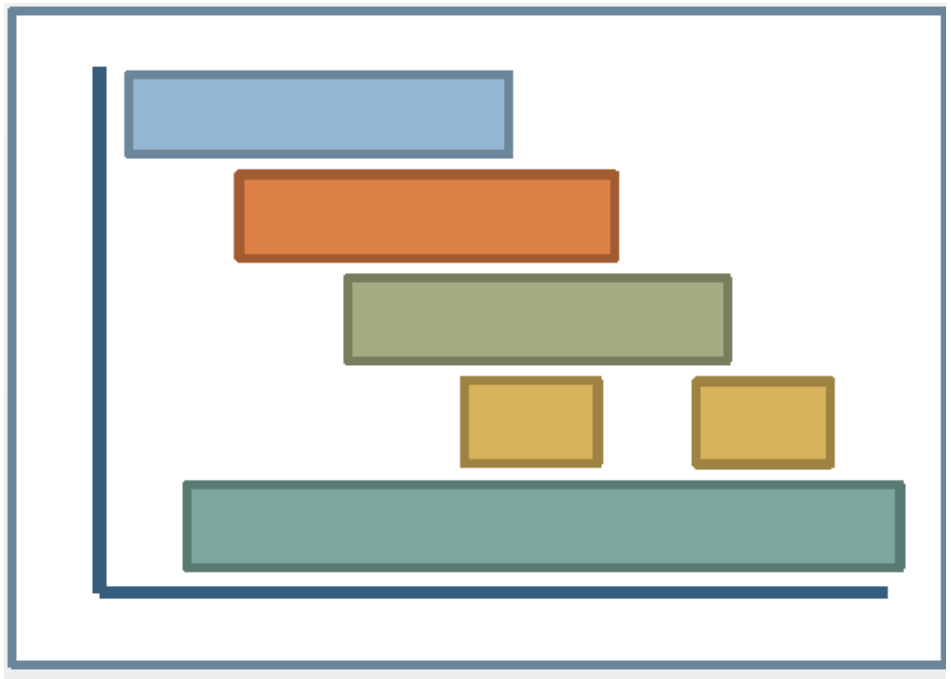
Relies mostly on position, but clusters also yield density

Example


Hours of study vs. Test scores
Test scores
100
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25
30
35
Hours of study

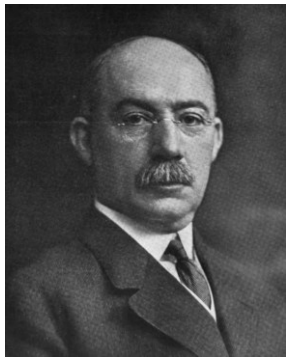
Gantt Chart

Discrete/
nominal
independent
variable



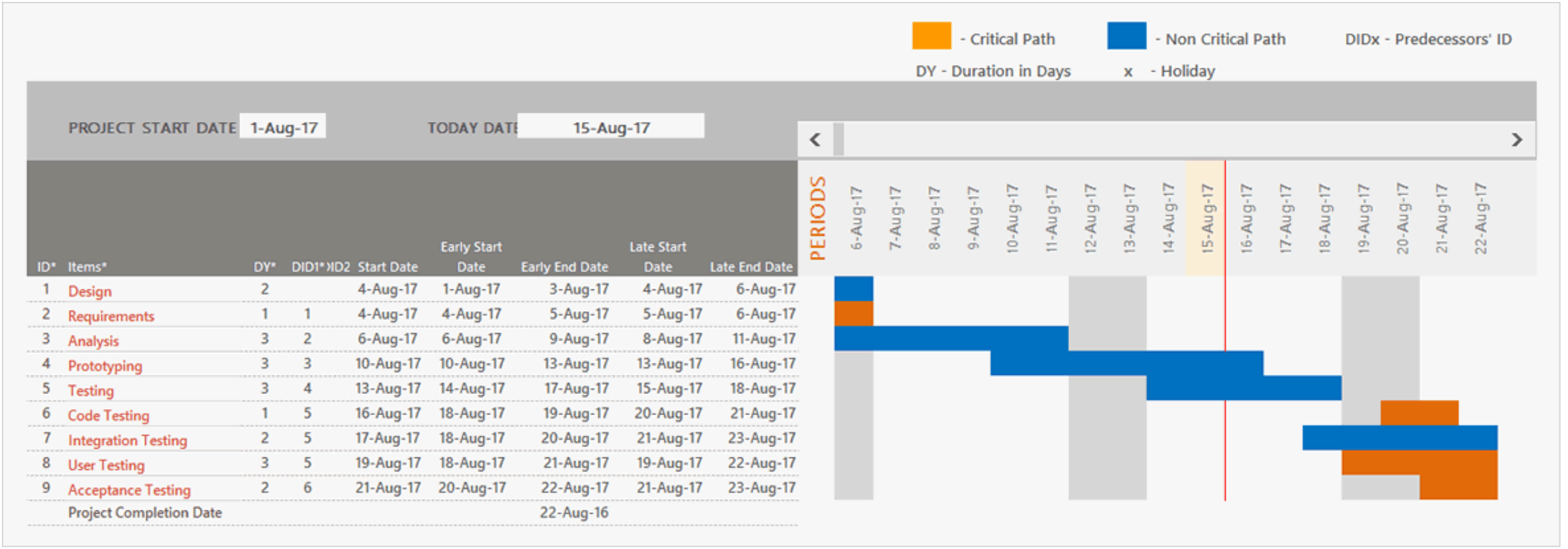
Quantitative
independent variable

Benefits from both
position and length



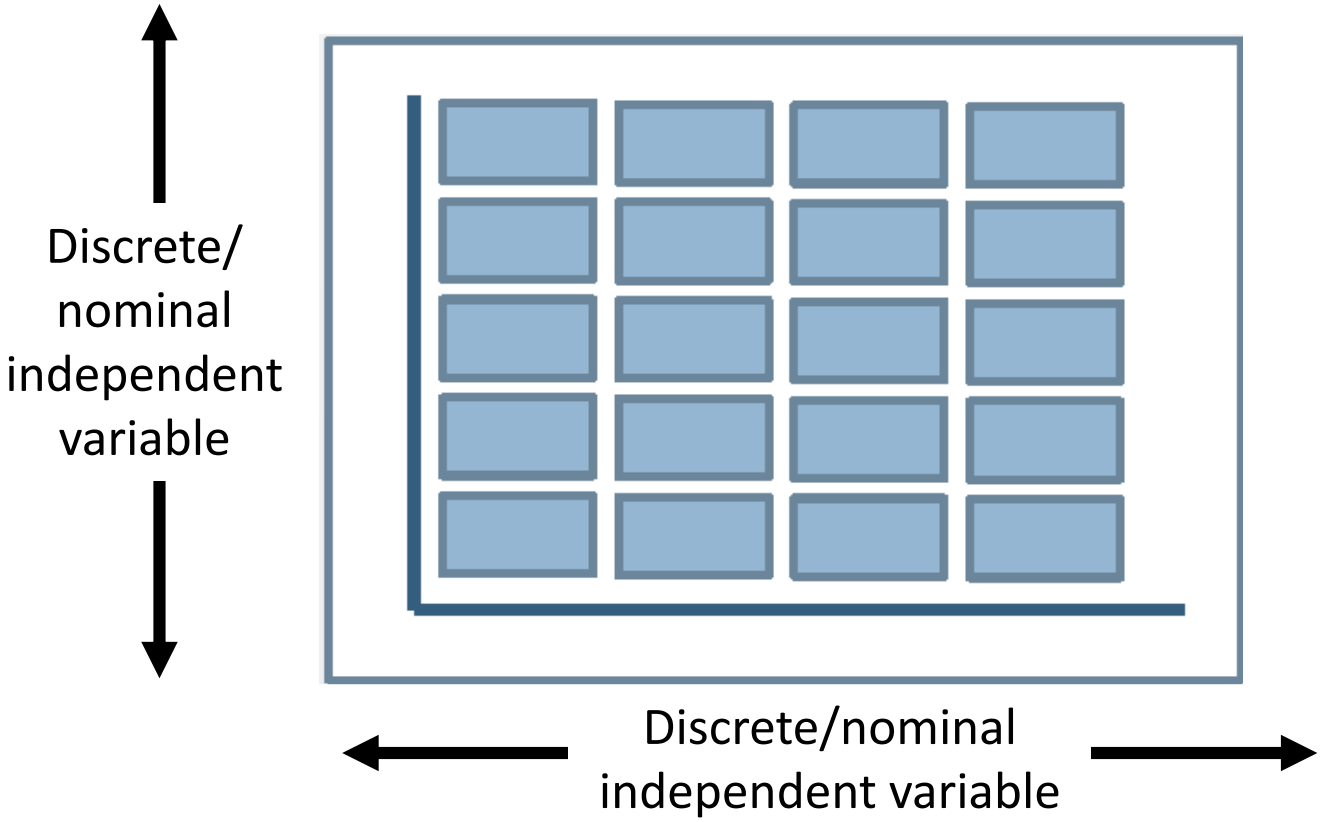
Henry Laurence Gantt

Example



ID*	Items*	DY*	DID1*	DID2	Start Date	Early Start Date	Early End Date	Late Start Date	Late End Date
1	Design	2			4-Aug-17	1-Aug-17	3-Aug-17	4-Aug-17	6-Aug-17
2	Requirements	1	1		4-Aug-17	4-Aug-17	5-Aug-17	5-Aug-17	6-Aug-17
3	Analysis	3	2		6-Aug-17	6-Aug-17	9-Aug-17	8-Aug-17	11-Aug-17
4	Prototyping	3	3		10-Aug-17	10-Aug-17	13-Aug-17	13-Aug-17	16-Aug-17
5	Testing	3	4		13-Aug-17	14-Aug-17	17-Aug-17	15-Aug-17	18-Aug-17
6	Code Testing	1	5		16-Aug-17	18-Aug-17	19-Aug-17	20-Aug-17	21-Aug-17
7	Integration Testing	2	5		17-Aug-17	18-Aug-17	20-Aug-17	21-Aug-17	23-Aug-17
8	User Testing	3	5		19-Aug-17	18-Aug-17	21-Aug-17	19-Aug-17	22-Aug-17
9	Acceptance Testing	2	6		21-Aug-17	20-Aug-17	22-Aug-17	21-Aug-17	23-Aug-17
	Project Completion Date						22-Aug-16		

Table

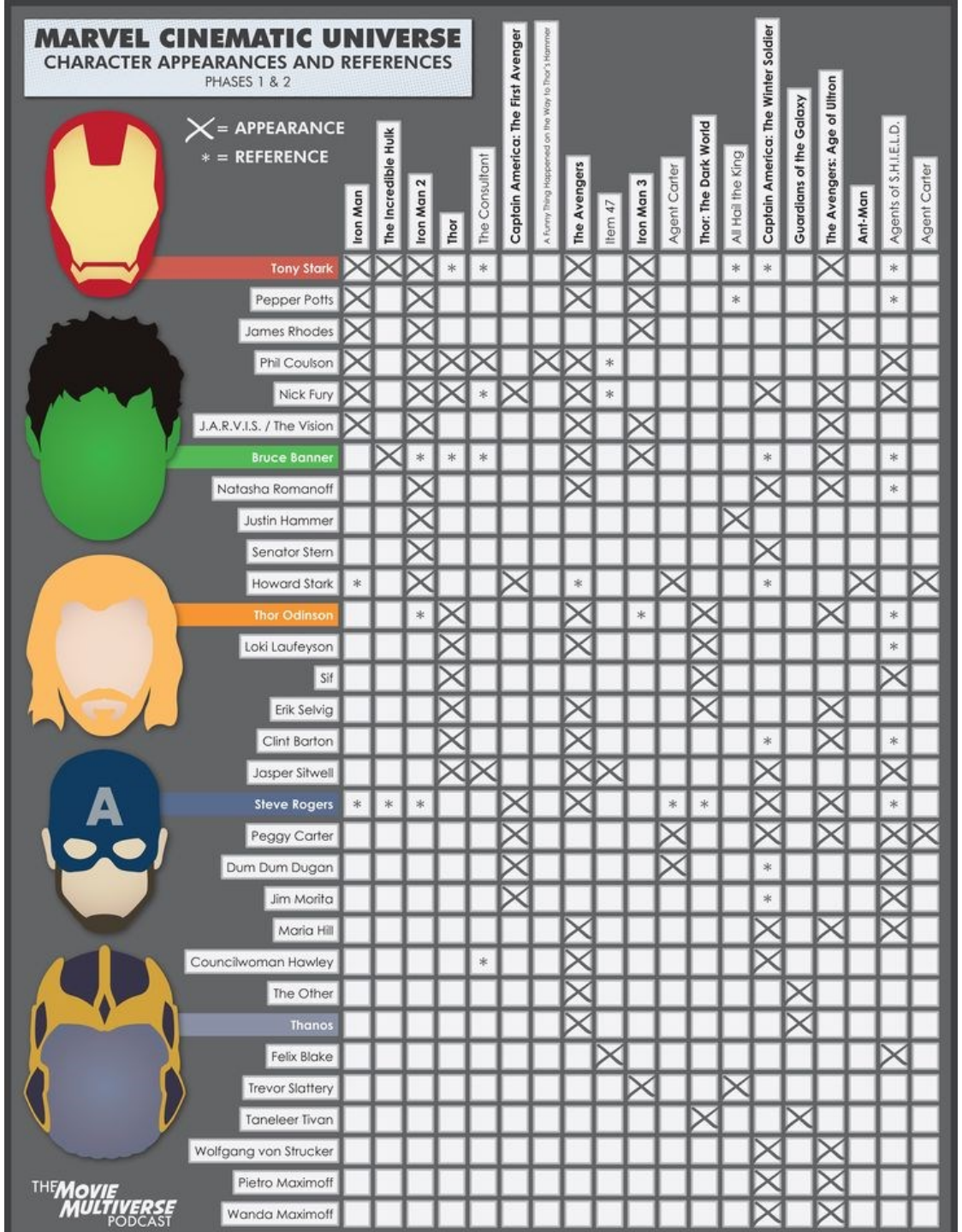


Benefits from position only

Example

X	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

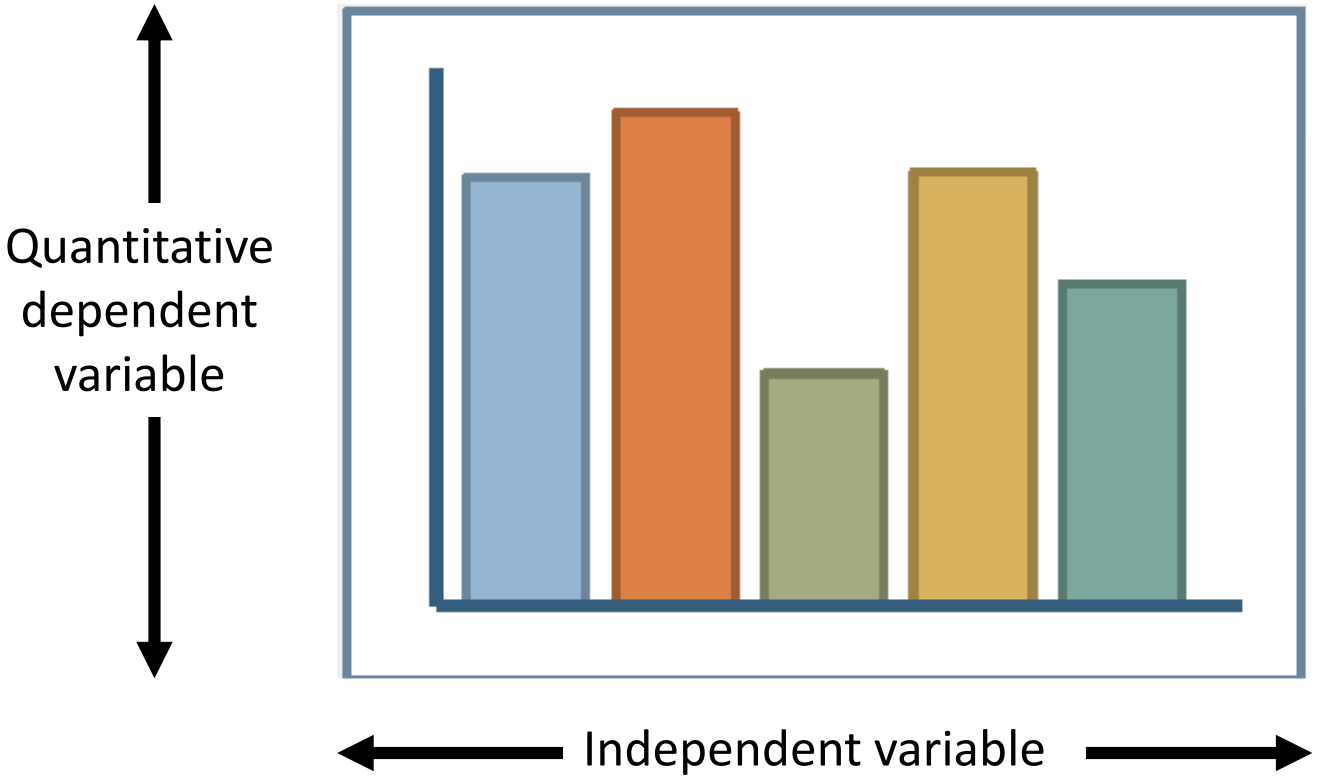
Example


MARVEL CINEMATIC UNIVERSE
CHARACTER APPEARANCES AND REFERENCES
PHASES 1 & 2
= APPEARANCE
* = REFERENCE
Iron Man
The Incredible Hulk
Iron Man 2
Thor
The Consultant
Captain America: The First Avenger
A Funny Thing Happened on the Way to Thor's Hammer
The Avengers
Item 47
Iron Man 3
Agent Carter
Thor: The Dark World
All Hail the King
Captain America: The Winter Soldier
Guardians of the Galaxy
The Avengers: Age of Ultron
Ant-Man
Agents of S.H.I.E.L.D.
Agent Carter
Tony Stark
Pepper Potts
James Rhodes
Phil Coulson
Nick Fury
J.A.R.V.I.S. / The Vision
Bruce Banner
Natasha Romanoff
Justin Hammer
Senator Stern
Howard Stark
Thor Odinson
Loki Laufeyson
Sif
Erik Selvig
Clint Barton
Jasper Sitwell
Steve Rogers
Peggy Carter
Dum Dum Dugan
Jim Morita
Maria Hill
Councilwoman Hawley
The Other
Thanos
Felix Blake
Trevor Slattery
Taneleer Tivan
Wolfgang von Strucker
Pietro Maximoff
Wanda Maximoff
THE MOVIE MULTIVERSE PODCAST

When to use?

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

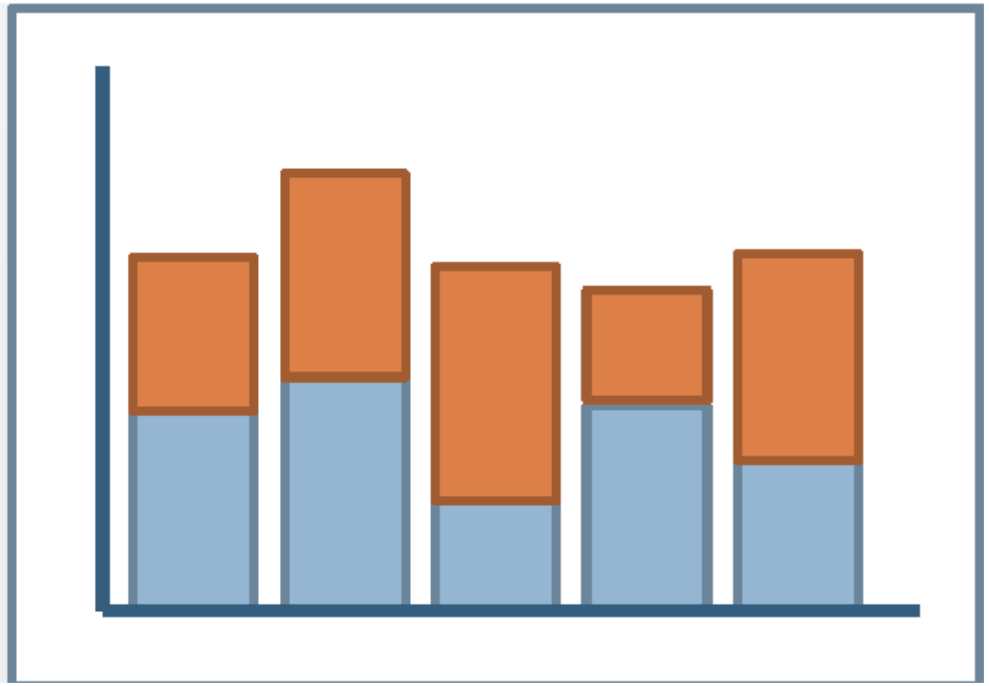
Stacked Chart: Bar Chart Revisit



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

Stacked Bar Chart

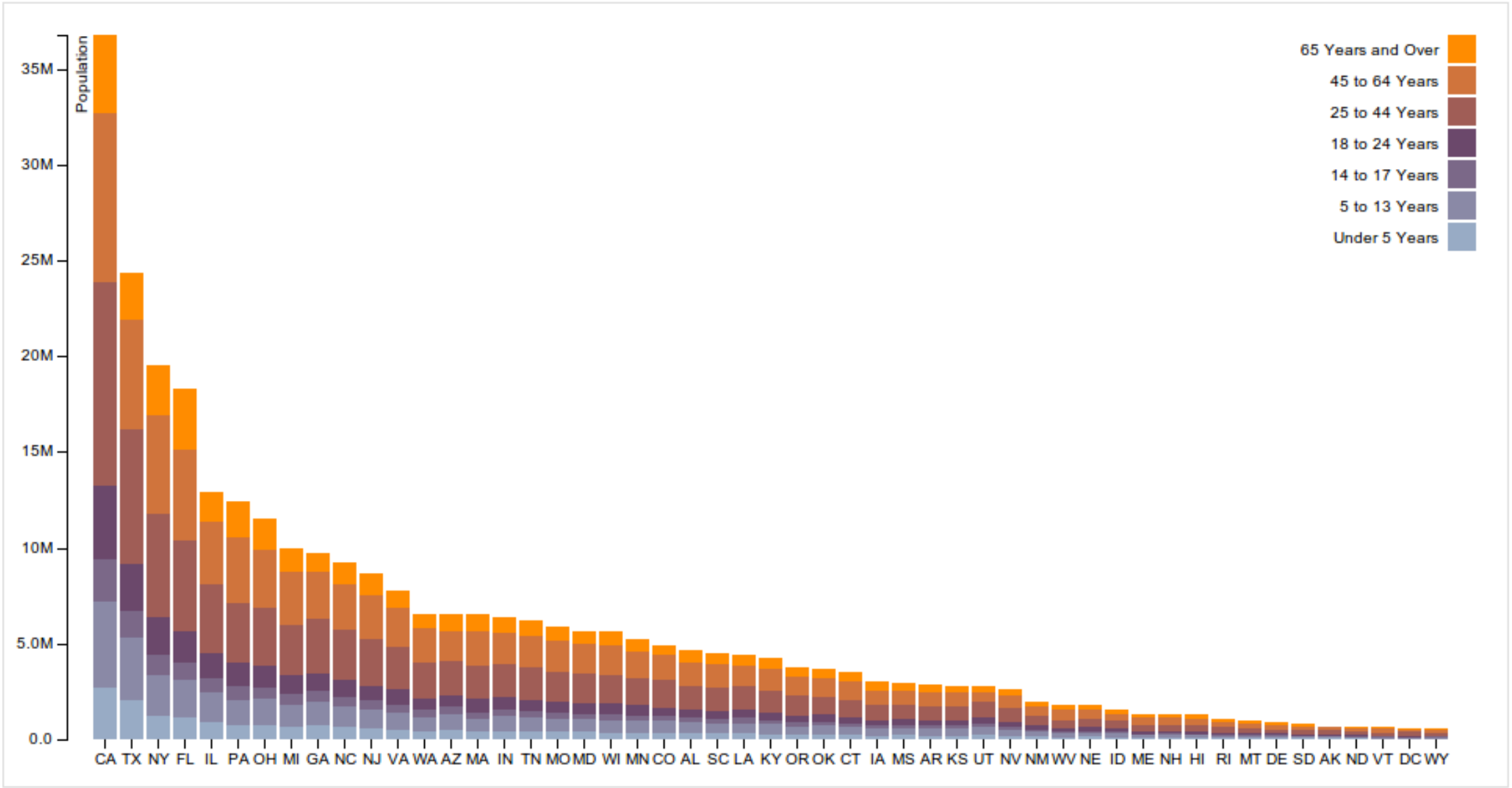
Two or more (accumulating) quantitative dependent variables



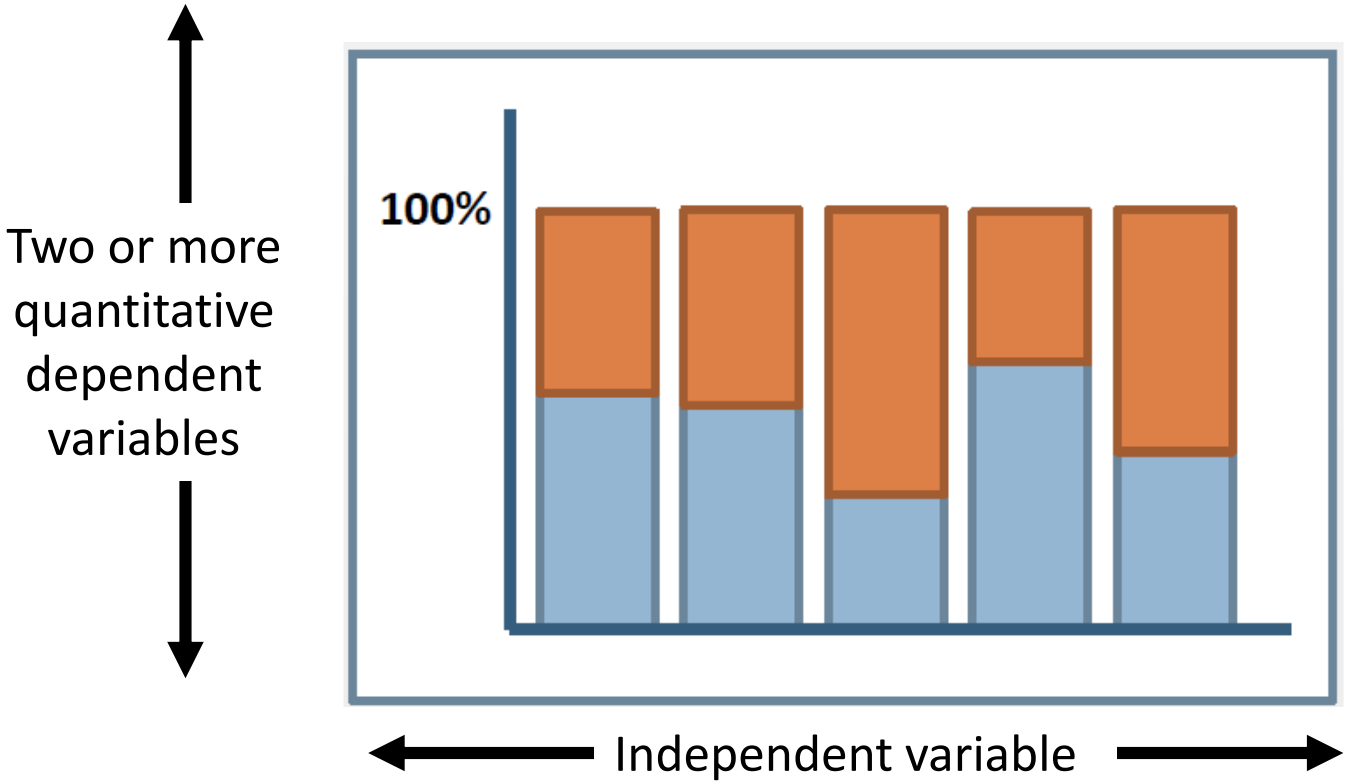
Independent variable

Central limit theorem → as more bars are added, sums will vary less

Example

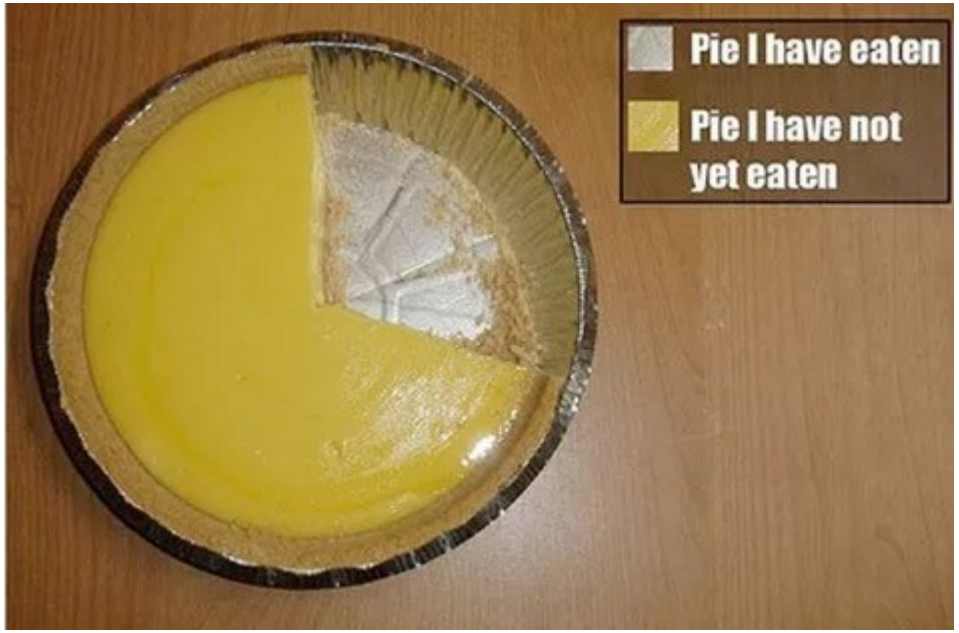

Population
35M
30M
25M
20M
15M
10M
5.0M
0.0
65 Years and Over
45 to 64 Years
25 to 44 Years
18 to 24 Years
14 to 17 Years
5 to 13 Years
Under 5 Years
CA TX NY FL IL PA OH MI GA NC NJ VA WA AZ MA IN TN MO MD WI MN CO AL SC LA KY OR OK CT IA MS AR KS UT NV NM WV NE ID ME NH HI RI MT DE SD AK ND VT DC WY

Relative Stacked Bar Chart

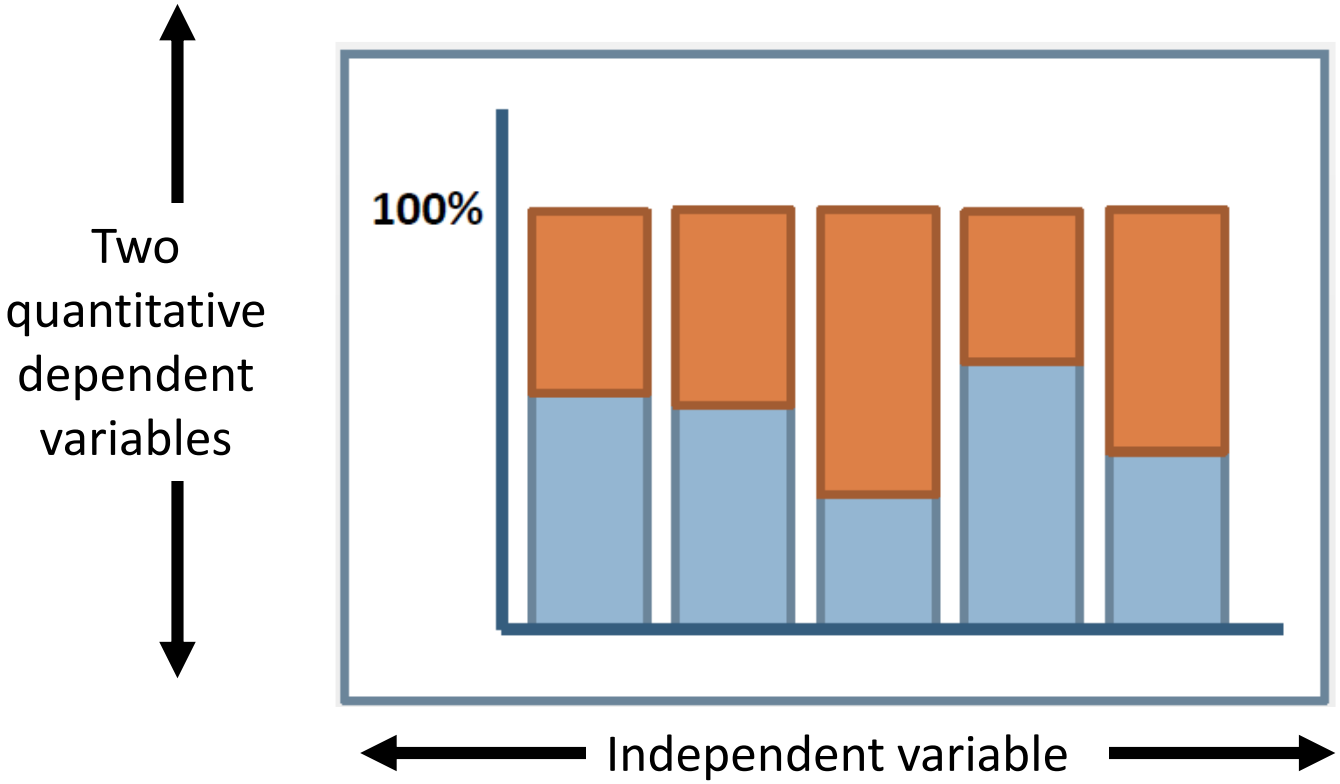


Pie Chart

- Used to indicate relative portions of a quantitative dependent variable of a single dimension
- Maps **percentage** of total to **angle** of wedge arc



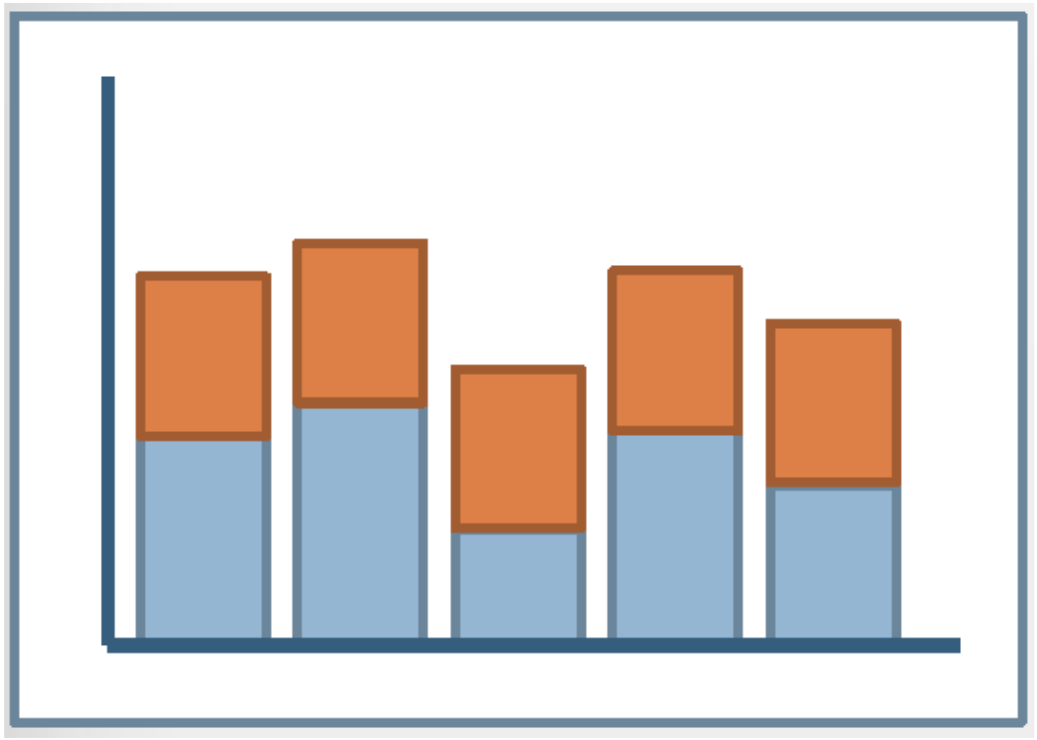
Relative Stacked Bar Chart

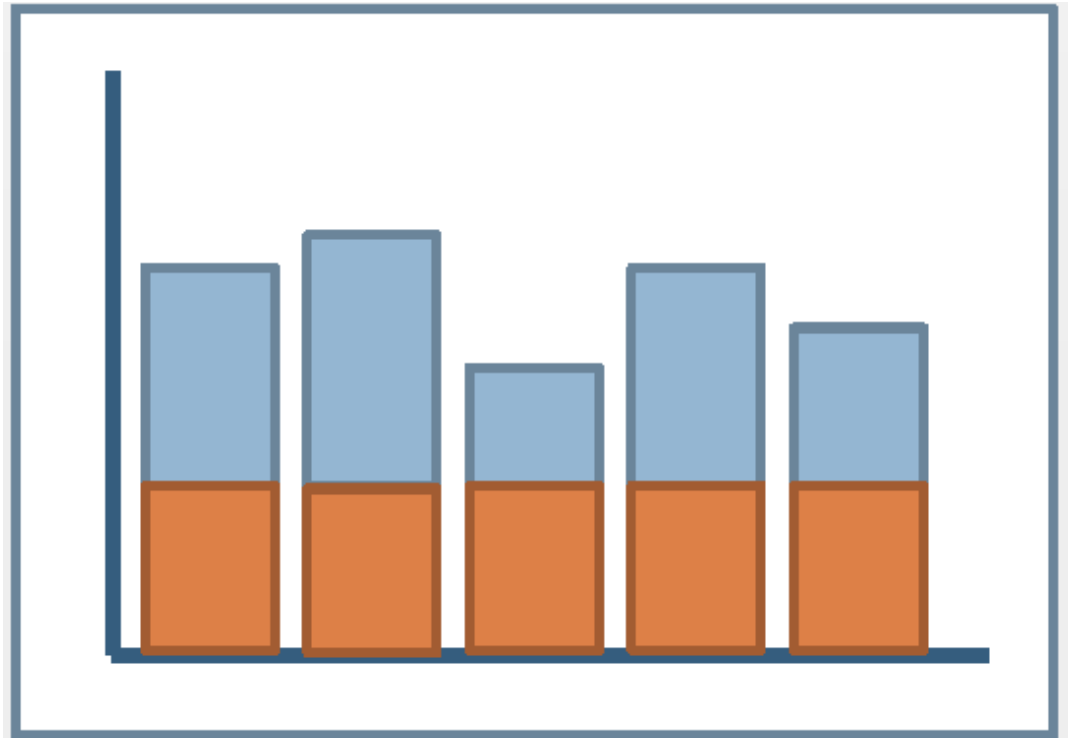


Two variables: Position and Length

Stacking Order Matters

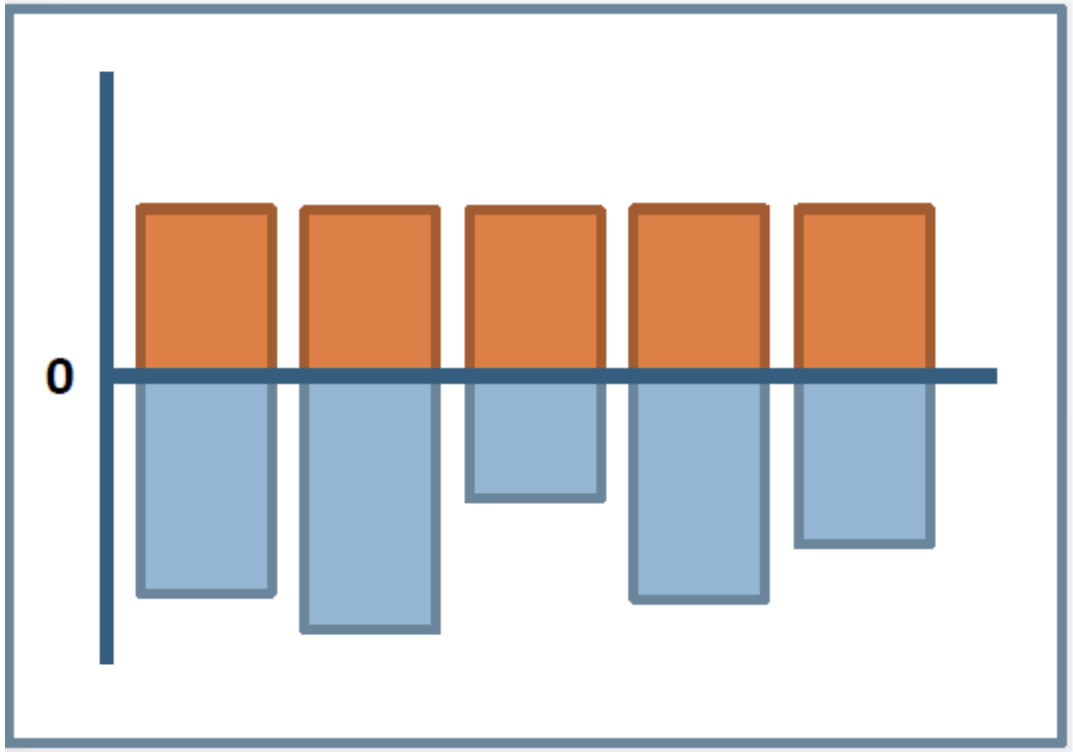
Two variables: Position > Length

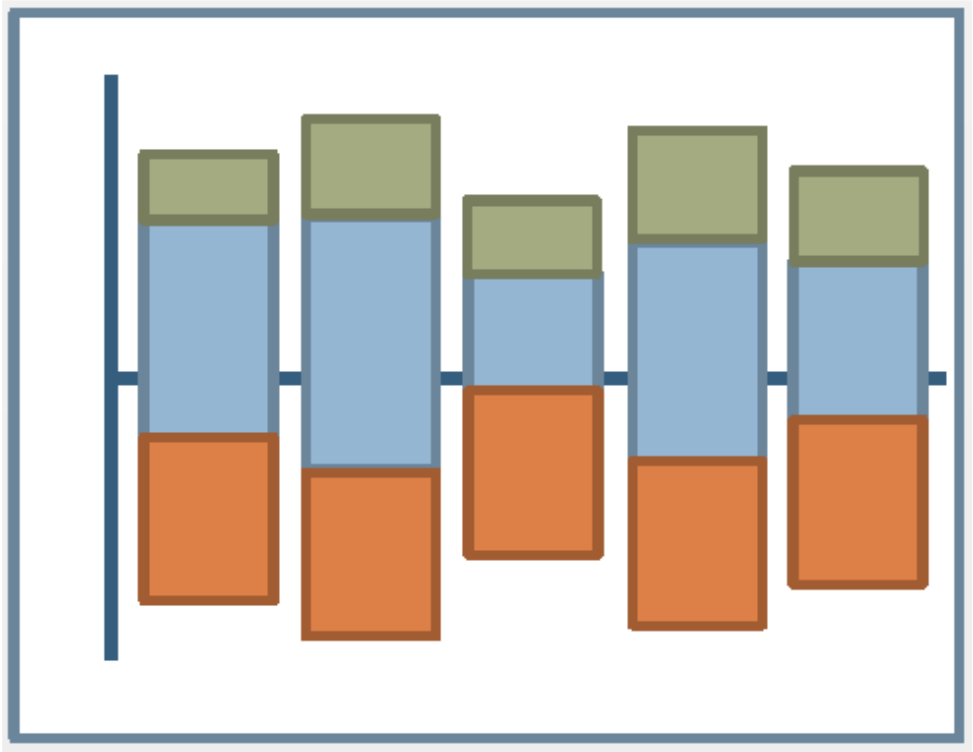




Variance of lower stack elements influences perception of upper stack elements

Diverging Stacked Bar Charts

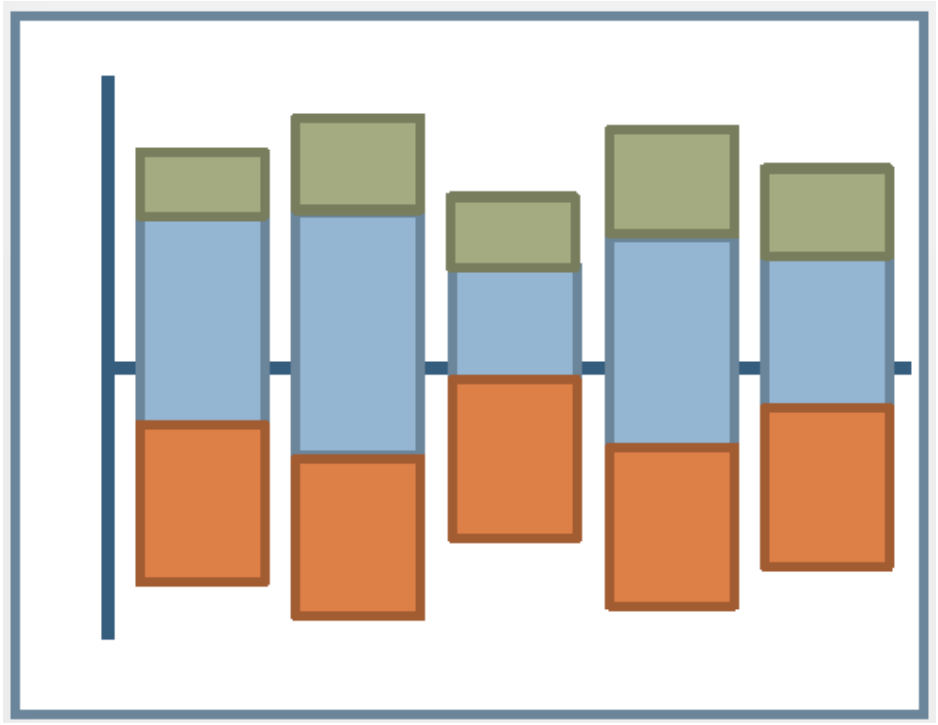


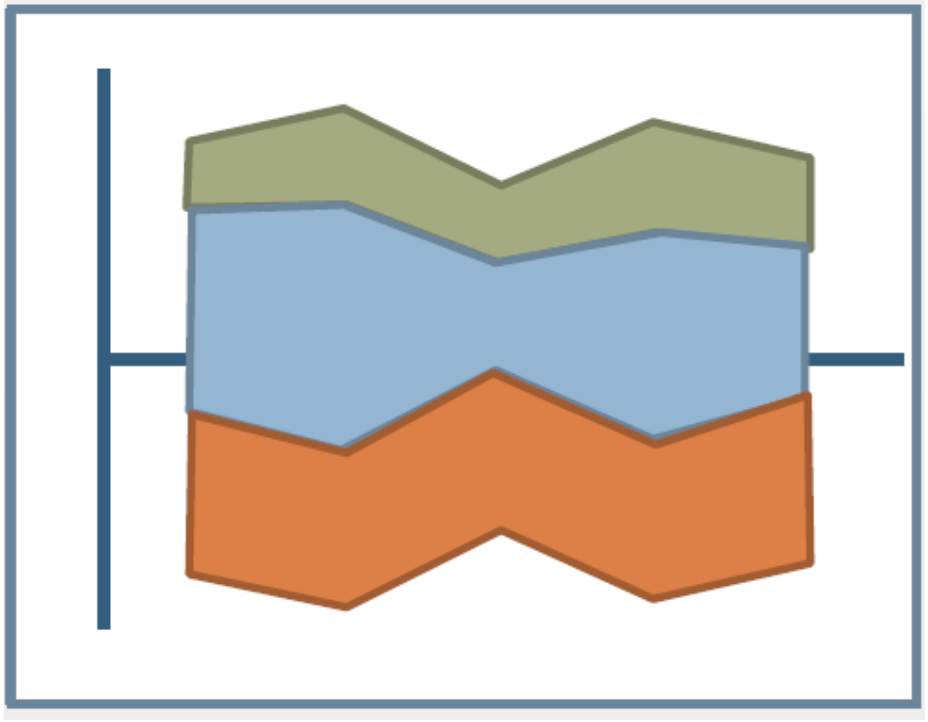


- Benefits from pos. & length
- Only works for two variables
- Negative connotation for lower bars

- Only indicates length
- Works for many variables

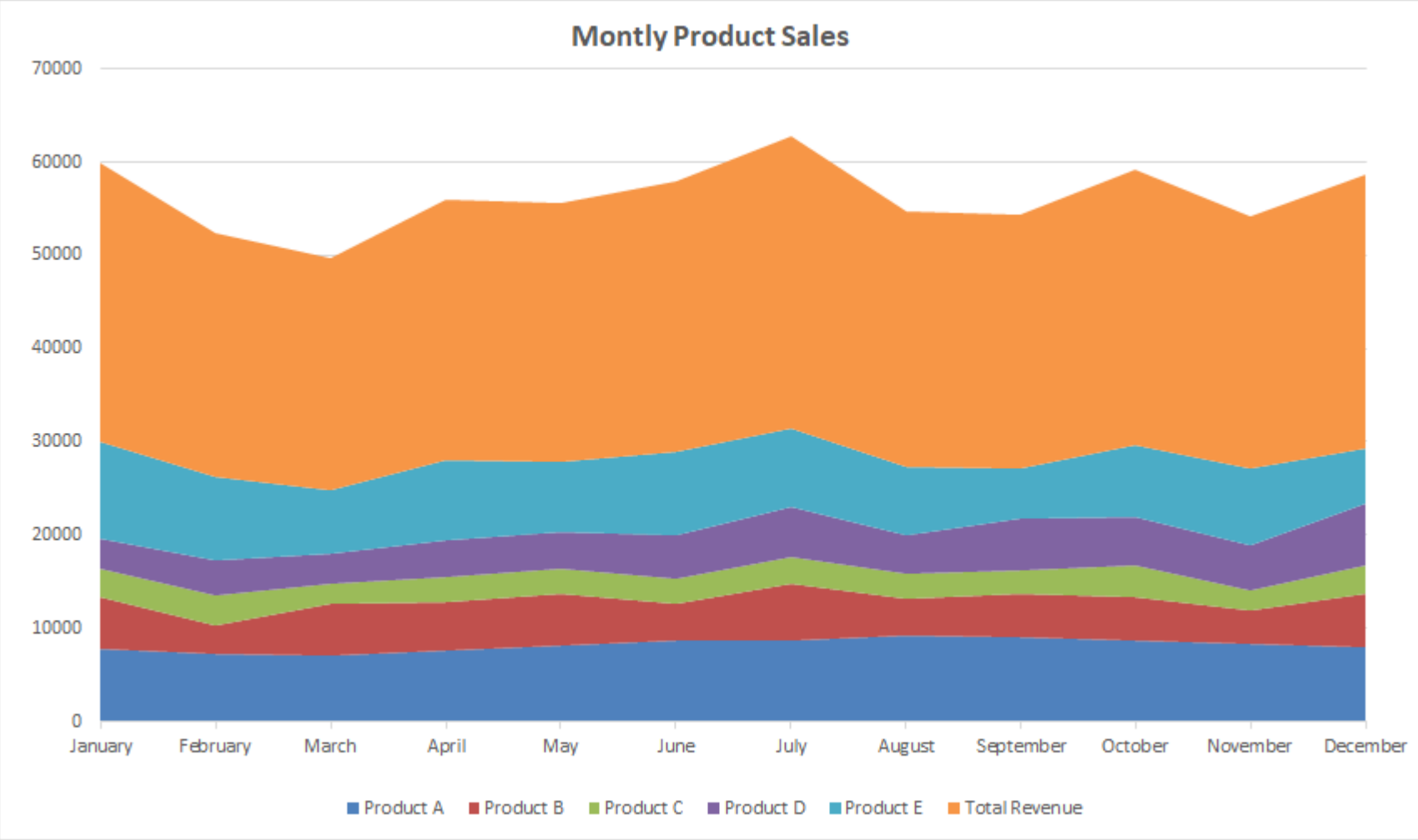
Stacked Bar Charts vs. Stacked Line Charts





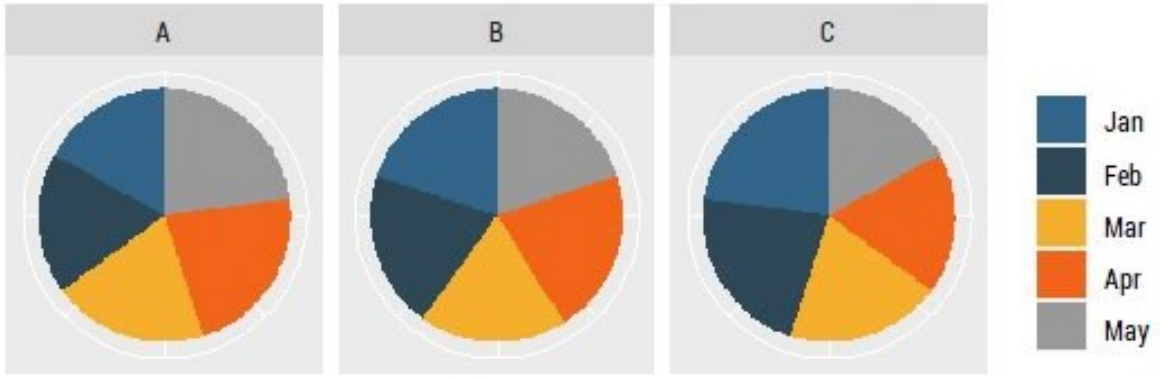
Appropriate for continuous data over a continuous independent variable
Can smooth regions using curves instead of line segments

Stacked Line Charts: Example

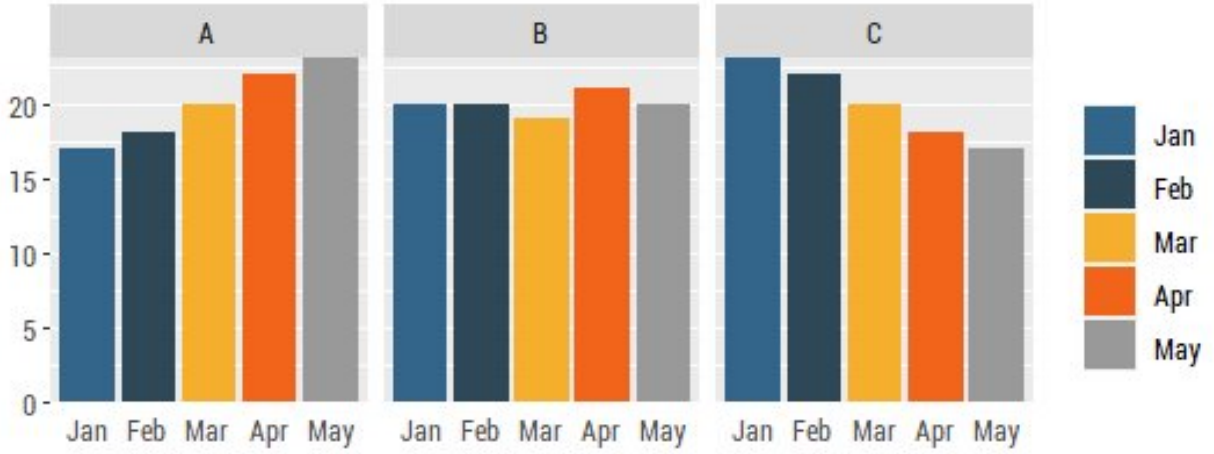


Beware of Pie Chart

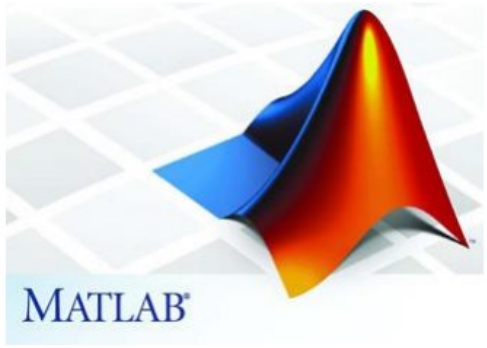
Pie Chart of monthly export

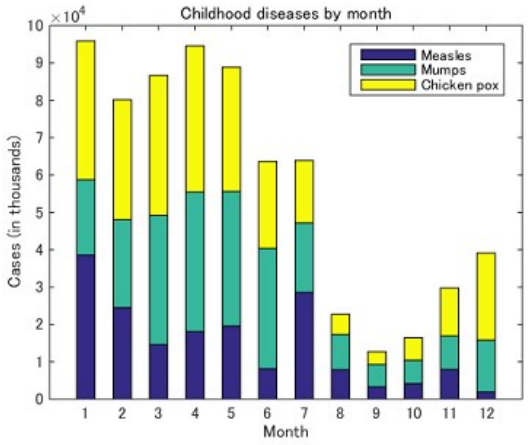


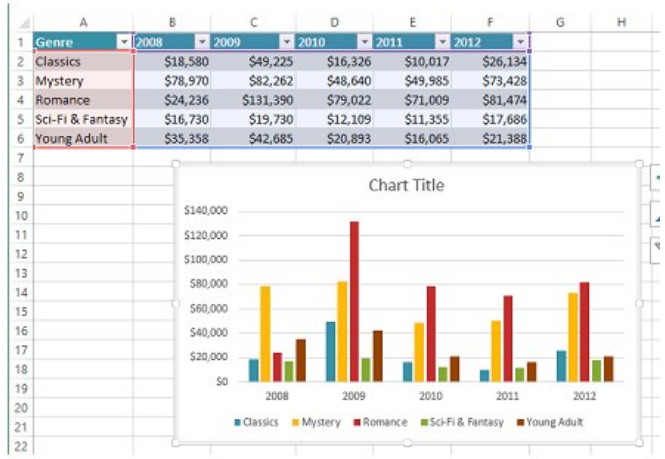
Bar Chart of monthly export

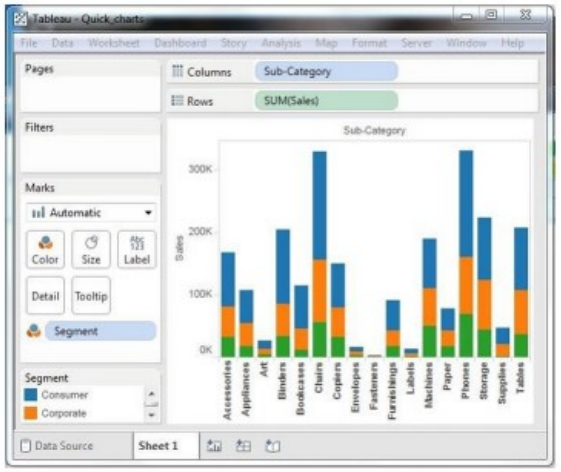


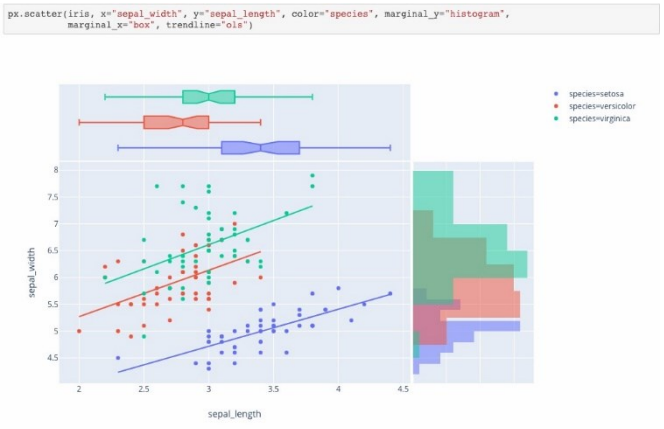
Which tools can we use to plot charts?











Next class

- Please install Excel – Microsoft Office

Q&A