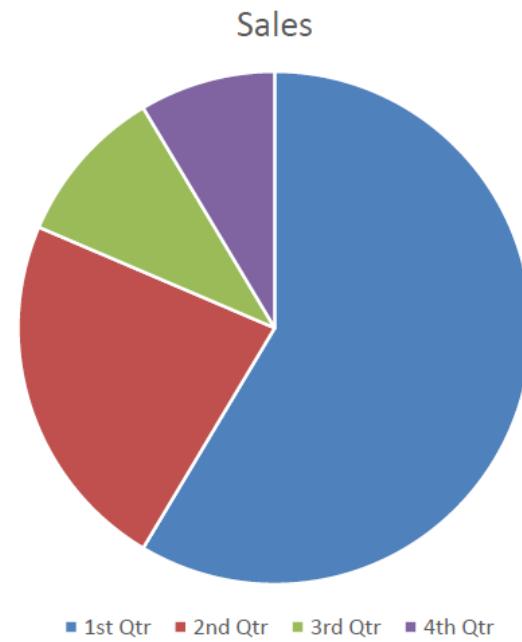
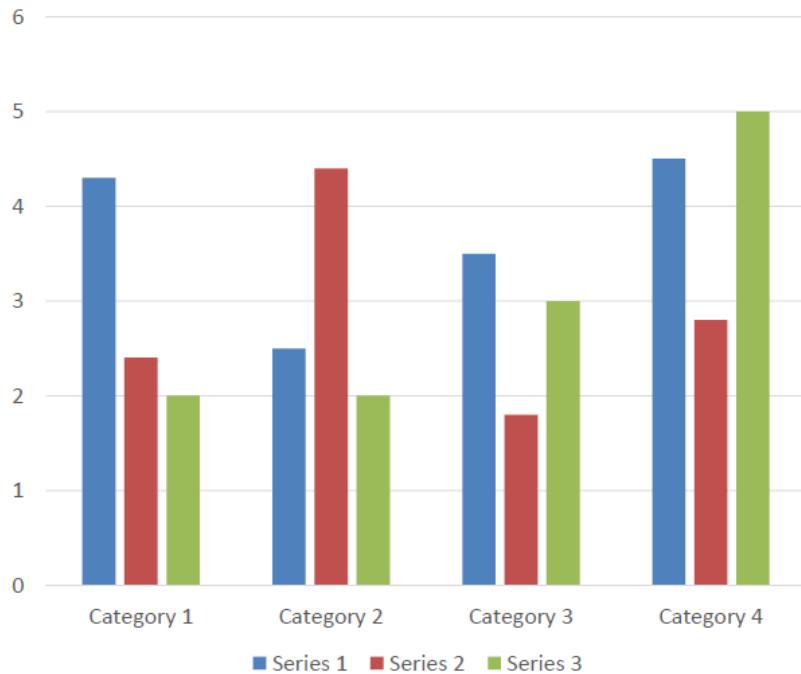
A large, ornate illustration of an open book occupies the left side of the slide. The book is open wide, with its pages fanned out like fireworks or starburst patterns. The pages are a warm gold color, and the lines between them are bright white and yellow, creating a sense of light and energy. The background is a dark, velvety black, dotted with numerous small, glowing particles of various sizes and colors, including white, yellow, and pink. The overall effect is one of magic, knowledge, and the power of stories.

Data Visualization & Storytelling

Panita Thusaranon, Ph.D.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Segment	Country	Product	Discount Band	Units Sold	Manufacturing Price	Sale Price	Gross Sales	Discounts	Sales	COGS	Profit
2	Government	Canada	Carretera	None	1618.5	\$ 3.00	\$ 20.00	\$ 32,370.00	\$ -	\$ 32,370.00	\$ 16,185.00	\$ 16,185.00
3	Government	Germany	Carretera	None	1321	\$ 3.00	\$ 20.00	\$ 26,420.00	\$ -	\$ 26,420.00	\$ 13,210.00	\$ 13,210.00
4	Midmarket	France	Carretera	None	2178	\$ 3.00	\$ 15.00	\$ 32,670.00	\$ -	\$ 32,670.00	\$ 21,780.00	\$ 10,890.00
5	Midmarket	Germany	Carretera	None	888	\$ 3.00	\$ 15.00	\$ 13,320.00	\$ -	\$ 13,320.00	\$ 8,880.00	\$ 4,440.00
6	Midmarket	Mexico	Carretera	None	2470	\$ 3.00	\$ 15.00	\$ 37,050.00	\$ -	\$ 37,050.00	\$ 24,700.00	\$ 12,350.00
7	Government	Germany	Carretera	None	1513	\$ 3.00	\$ 350.00	\$ 529,550.00	\$ -	\$ 529,550.00	\$ 393,380.00	\$ 136,170.00
8	Midmarket	Germany	Montana	None	921	\$ 5.00	\$ 15.00	\$ 13,815.00	\$ -	\$ 13,815.00	\$ 9,210.00	\$ 4,605.00
9	Channel Partners	Canada	Montana	None	2518	\$ 5.00	\$ 12.00	\$ 30,216.00	\$ -	\$ 30,216.00	\$ 7,554.00	\$ 22,662.00
10	Government	France	Montana	None	1899	\$ 5.00	\$ 20.00	\$ 37,980.00	\$ -	\$ 37,980.00	\$ 18,990.00	\$ 18,990.00
11	Channel Partners	Germany	Montana	None	1545	\$ 5.00	\$ 12.00	\$ 18,540.00	\$ -	\$ 18,540.00	\$ 4,635.00	\$ 13,905.00
12	Midmarket	Mexico	Montana	None	2470	\$ 5.00	\$ 15.00	\$ 37,050.00	\$ -	\$ 37,050.00	\$ 24,700.00	\$ 12,350.00
13	Enterprise	Canada	Montana	None	2665.5	\$ 5.00	\$ 125.00	\$ 333,187.50	\$ -	\$ 333,187.50	\$ 319,860.00	\$ 13,327.50
14	Small Business	Mexico	Montana	None	958	\$ 5.00	\$ 300.00	\$ 287,400.00	\$ -	\$ 287,400.00	\$ 239,500.00	\$ 47,900.00
15	Government	Germany	Montana	None	2146	\$ 5.00	\$ 7.00	\$ 15,022.00	\$ -	\$ 15,022.00	\$ 10,730.00	\$ 4,292.00
16	Enterprise	Canada	Montana	None	345	\$ 5.00	\$ 125.00	\$ 43,125.00	\$ -	\$ 43,125.00	\$ 41,400.00	\$ 1,725.00
17	Midmarket	United States of America	Montana	None	615	\$ 5.00	\$ 15.00	\$ 9,225.00	\$ -	\$ 9,225.00	\$ 6,150.00	\$ 3,075.00
18	Government	Canada	Paseo	None	292	\$ 10.00	\$ 20.00	\$ 5,840.00	\$ -	\$ 5,840.00	\$ 2,920.00	\$ 2,920.00
19	Midmarket	Mexico	Paseo	None	974	\$ 10.00	\$ 15.00	\$ 14,610.00	\$ -	\$ 14,610.00	\$ 9,740.00	\$ 4,870.00
20	Channel Partners	Canada	Paseo	None	2518	\$ 10.00	\$ 12.00	\$ 30,216.00	\$ -	\$ 30,216.00	\$ 7,554.00	\$ 22,662.00
21	Government	Germany	Paseo	None	1006	\$ 10.00	\$ 350.00	\$ 352,100.00	\$ -	\$ 352,100.00	\$ 261,560.00	\$ 90,540.00
22	Channel Partners	Germany	Paseo	None	367	\$ 10.00	\$ 12.00	\$ 4,404.00	\$ -	\$ 4,404.00	\$ 1,101.00	\$ 3,303.00
23	Government	Mexico	Paseo	None	883	\$ 10.00	\$ 7.00	\$ 6,181.00	\$ -	\$ 6,181.00	\$ 4,415.00	\$ 1,766.00
24	Midmarket	France	Paseo	None	549	\$ 10.00	\$ 15.00	\$ 8,235.00	\$ -	\$ 8,235.00	\$ 5,490.00	\$ 2,745.00
25	Small Business	Mexico	Paseo	None	788	\$ 10.00	\$ 300.00	\$ 236,400.00	\$ -	\$ 236,400.00	\$ 197,000.00	\$ 39,400.00
26	Midmarket	Mexico	Paseo	None	2472	\$ 10.00	\$ 15.00	\$ 37,080.00	\$ -	\$ 37,080.00	\$ 24,720.00	\$ 12,360.00
27	Government	United States of America	Paseo	None	1143	\$ 10.00	\$ 7.00	\$ 8,001.00	\$ -	\$ 8,001.00	\$ 5,715.00	\$ 2,286.00
28	Government	Canada	Paseo	None	1725	\$ 10.00	\$ 350.00	\$ 603,750.00	\$ -	\$ 603,750.00	\$ 448,500.00	\$ 155,250.00
29	Channel Partners	United States of America	Paseo	None	912	\$ 10.00	\$ 12.00	\$ 10,944.00	\$ -	\$ 10,944.00	\$ 2,736.00	\$ 8,208.00
30	Midmarket	Canada	Paseo	None	2152	\$ 10.00	\$ 15.00	\$ 32,280.00	\$ -	\$ 32,280.00	\$ 21,520.00	\$ 10,760.00
31	Government	Canada	Paseo	None	1817	\$ 10.00	\$ 20.00	\$ 36,340.00	\$ -	\$ 36,340.00	\$ 18,170.00	\$ 18,170.00

Used this before?



Visualization Goals

Communicate : explanatory

- Present data and ideas
- Explain and inform
- Provide evidence and support
- Influence and persuade



Analyze : exploratory

- Explore the data
- Assess a situation
- Determine how to proceed
- Decide what to do

หัวใจสำคัญของการทำ Data Visualization

The importance of context

Understanding WHO, WHAT and HOW



ไซร์คือผู้รับสารของคุณ

สิ่งที่ผู้ส่งสารควรรู้



ผู้รับสารอยากรู้อะไร
(เช่น ผลกำไร-ขาดทุน)



ผู้รับสารมีความรู้ด้านใดบ้างแล้ว
(เช่น การเงิน-บัญชี, คณิตศาสตร์)



ผู้รับสารไม่สนใจเรื่องใด



What? ເຮືອງວະໄຣທ໌ຄຸນອຍາກນຳເສນວ

Prompting action

Here are some action words to help act as thought starters as you determine what you are asking of your audience:

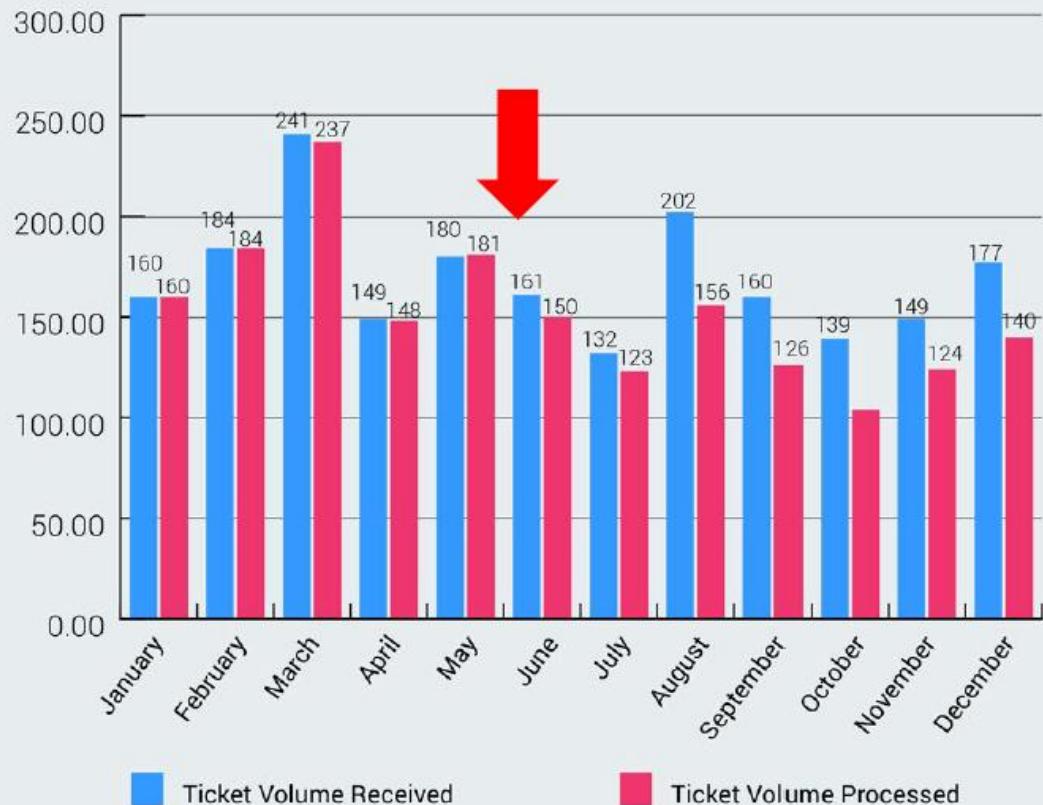
accept | agree | begin | believe | change | collaborate | commence
| create | defend | desire | differentiate | do | empathize |
empower | encourage | engage | establish | examine | facilitate
| familiarize | form | implement | include | influence | invest |
invigorate | know | learn | like | persuade | plan | promote
| pursue | recommend | receive | remember | report | respond |
secure | support | simplify | start | try | understand | validate

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

M24 : fx

	A	B	C	D
1	Ticket Volume Over Time			
2				
3	Month	Volume Received	Volume Processed	% Processed
4	Jan	161	166	103%
5	Feb	185	186	101%
6	Mar	242	238	98%
7	Apr	150	149	99%
8	May	181	182	101%
9	Jun	162	151	93%
10	Jul	133	124	93%
11	Aug	203	167	82%
12	Sep	161	137	85%
13	Oct	140	115	82%
14	Nov	150	135	90%
15	Dec	178	151	85%

TICKET TREND



Before

Background:

This bar chart displays the number of tickets received and processed in a year.

Problem:

จะมีคนลาออกจากตอนสิ้นเดือน May ซึ่งจะทำให้ค่าน้ำที่มีอยู่ไม่เพียงพอเมื่อเก็บยกับปริมาณงานที่ต้องทำ

Please approve the hire of 2 FTEs

to backfill those who quit in the past year

Ticket volume over time



After

If your purpose is to convey a message and move someone to a specific action (in this case, the hire of two new employees), then this is much better.



How?

Data Visualization

แบบไหนที่จะทำให้ผู้รับสาร เข้าใจได้เร็วที่สุด

DATA TYPES

KNOW YOUR DATA

Before understanding visualizations, you must understand the types of data that can be visualized and their relationships to each other. Here are some of the most common you are likely to encounter.



QUANTITATIVE

Data that can be counted or measured; all values are numerical.



DISCRETE

Numerical data that has a finite number of possible values. Example: Number of employees in the office.



CONTINUOUS

Data that is measured and has a value within a range. Example: Rainfall in a year.

CATEGORICAL

Data that can be sorted according to group or category. Example: Types of products sold.

GUIDE TO CHART TYPES

In this section, we'll cover the uses, variations, and best practices for some of the most common data visualizations:

BAR CHART



PIE CHART



LINE CHART



AREA CHART



SCATTER PLOT

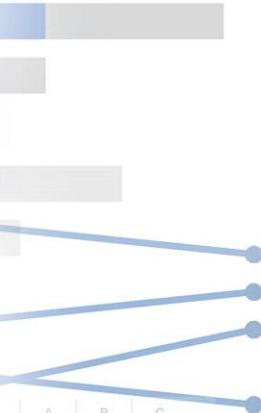
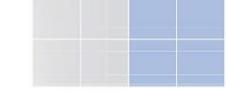


BUBBLE CHART

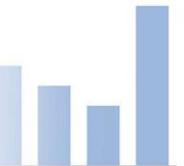


HEAT MAP





	A	B	C
15%	22%	42%	
40%	38%	20%	
35%	17%	34%	
30%	29%	26%	
55%	30%	58%	
11%	25%	49%	



	A	B	C
Category 1	15%	22%	42%
Category 2	40%	38%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%

cole nussbaumer knaflic

storytelling with data

a data
visualization
guide for
business
professionals

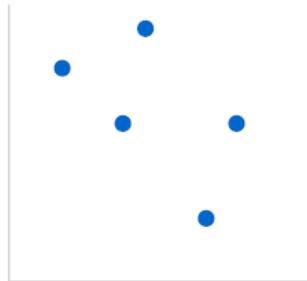


91%

Simple Text

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

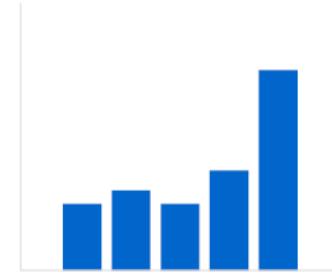
Table



Scatter Plot

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Heatmap



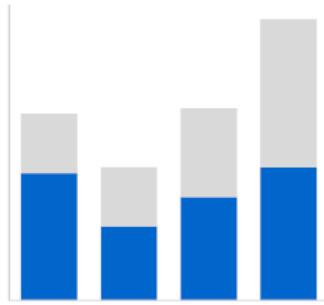
Vertical Bar



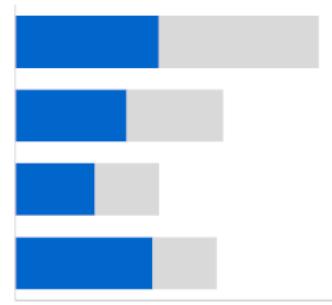
Horizontal Bar



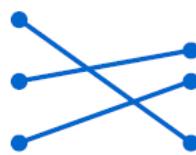
Line



Stacked vertical bar



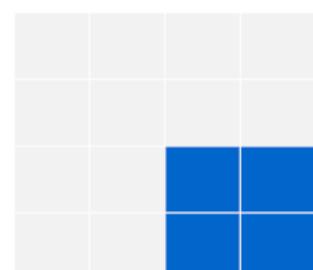
Stacked horizontal bar



Slope graph



Waterfall



Square area

What do you want to tell from your data?

1.Comparison



Bar Chart

Line Chart

Bullet Chart

2.Relationship



Scatter Plot

Map

Bubble Chart

Heat Map

Crosstab/Highlight table

3.Composition



Pie Chart

Tree Map

4.Distribution



Histogram Chart

Box Plot

What do you want to tell from your data?

1. Comparison



Bar Chart

Line Chart

Bullet Chart

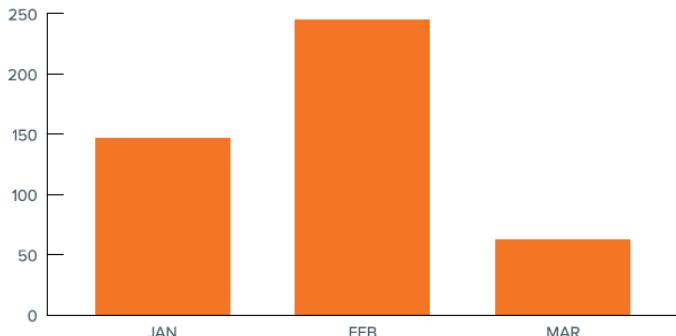
BAR CHART

Bar charts are very versatile. They are best used to show change over time, compare different categories, or compare parts of a whole.

- แสดงการเปรียบเทียบข้อมูลในแต่ละหมวดหมู่
- สามารถแสดงถึงลำดับและขนาดได้ชัดเจน
- แกนควรเริ่มต้นที่เลข 0

VARIATIONS OF BAR CHARTS

PAGE VIEWS, BY MONTH



VERTICAL (COLUMN CHART)

Best used for chronological data (time-series should always run left to right), or when visualizing negative values below the x-axis.

CONTENT PUBLISHED, BY CATEGORY



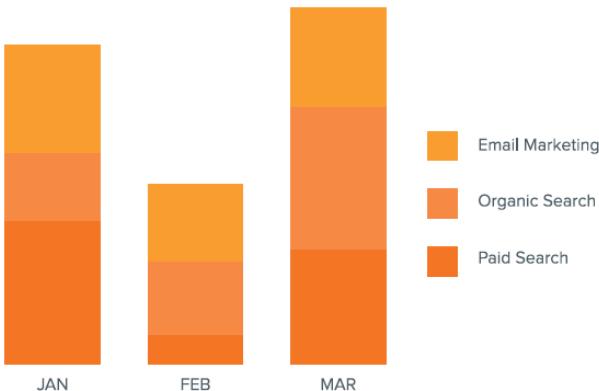
HORIZONTAL

Best used for data with long category labels.

BAR CHART

VARIATIONS OF BAR CHARTS (CONT.)

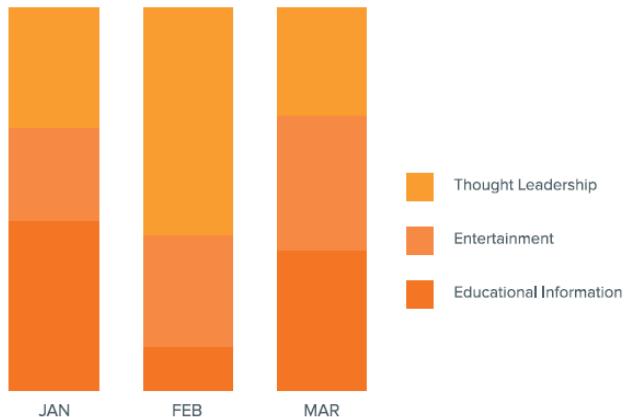
MONTHLY TRAFFIC, BY SOURCE



STACKED

Best used when there is a need to compare multiple part-to-whole relationships. These can use discrete or continuous data, oriented either vertically or horizontally.

PERCENTAGE OF CONTENT PUBLISHED, BY MONTH

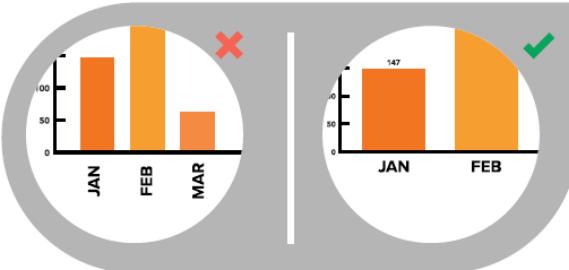


100% STACKED

Best used when the total value of each category is unimportant and percentage distribution of subcategories is the primary message.

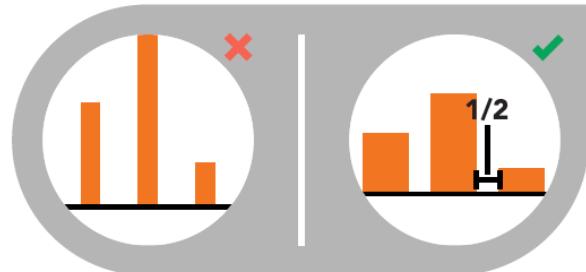
BAR CHART

DESIGN BEST PRACTICES



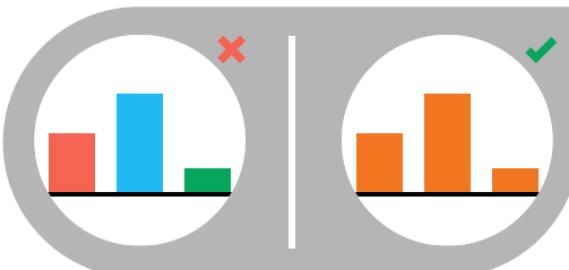
USE HORIZONTAL LABELS

Avoid steep diagonal or vertical type, as it can be difficult to read.



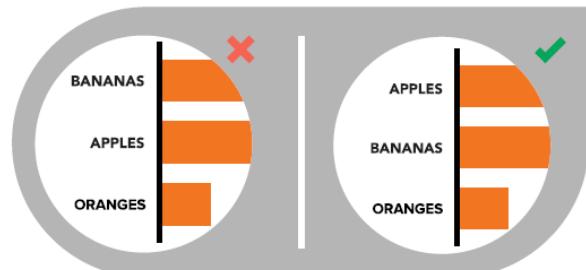
SPACE BARS APPROPRIATELY

Space between bars should be $\frac{1}{2}$ bar width.



START THE Y-AXIS VALUE AT 0

Starting at a value above zero truncates the bars and doesn't accurately reflect the full value.



USE CONSISTENT COLORS

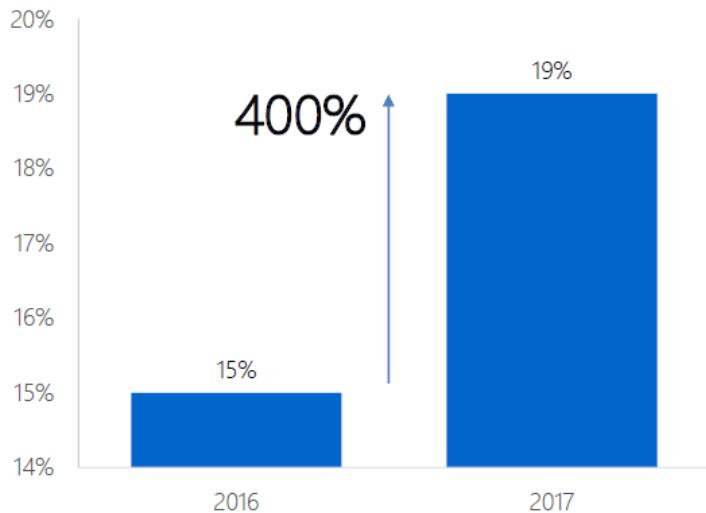
Use one color for bar charts. You may use an accent color to highlight a significant data point.

ORDER DATA APPROPRIATELY

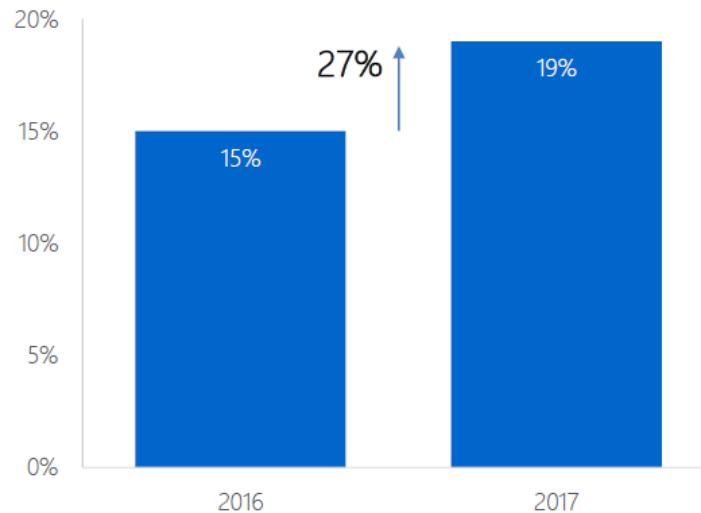
Order categories alphabetically, sequentially, or by value.

Bars: Always use 0 baseline

Non zero baseline

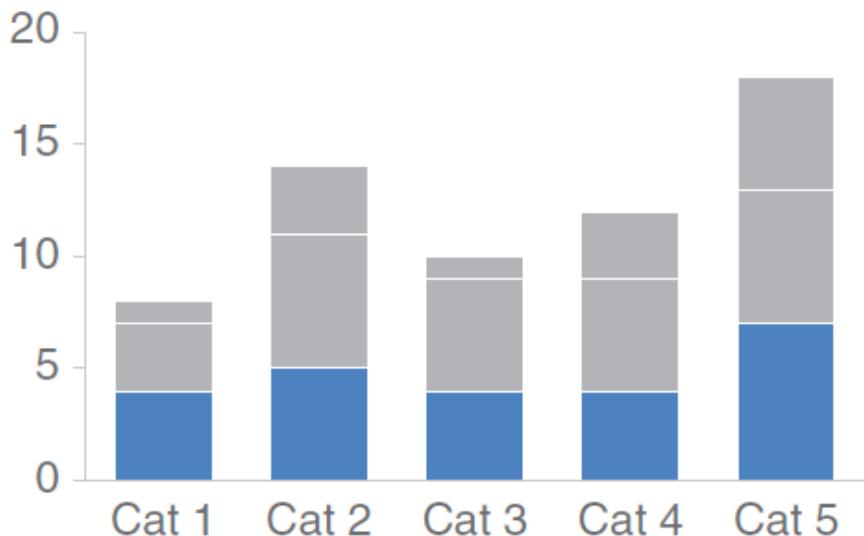


Zero baseline

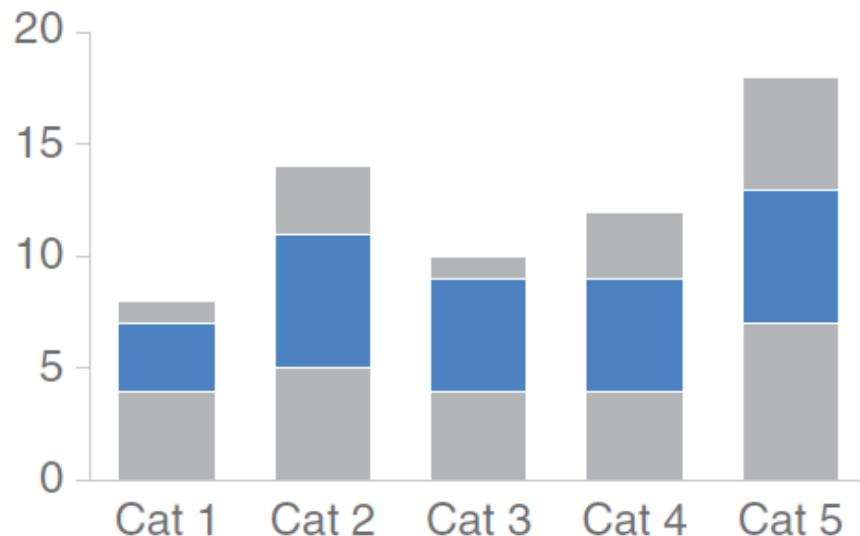


Stacked vertical bar chart

Comparing **these** is easy

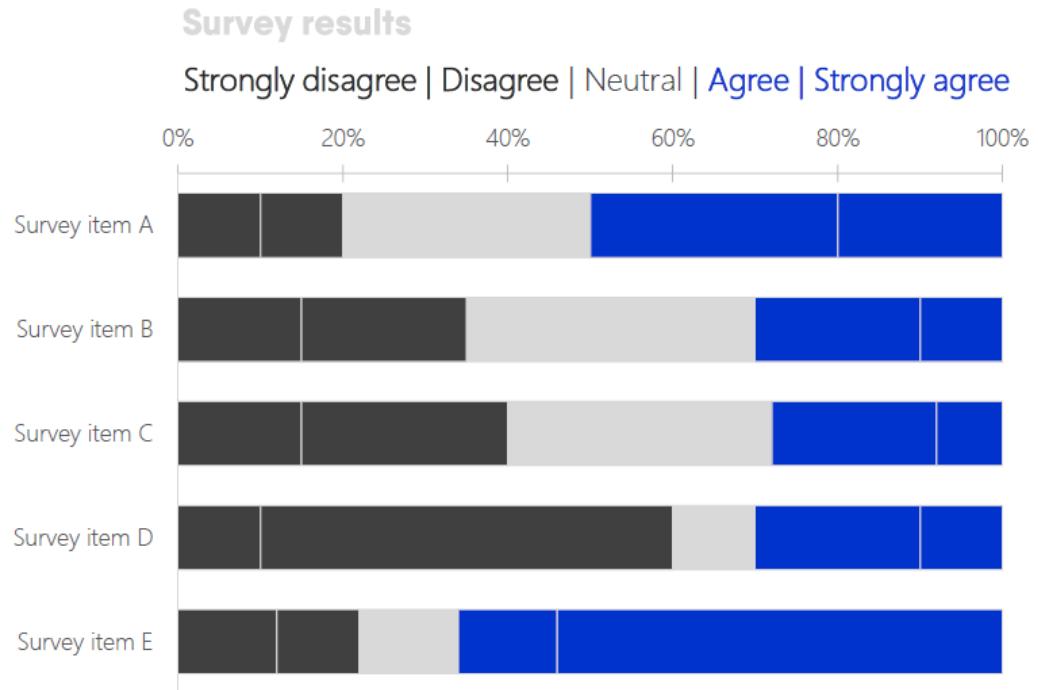


Comparing **these** is hard



Best chart for Likert scale

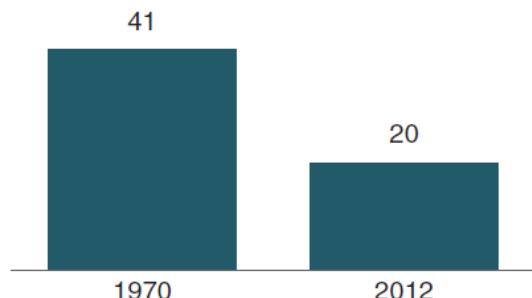
100% stacked bar chart is very useful for survey results



Simple text

Children with a "Traditional" Stay-at- Home Mother

*% of children with a married
stay-at-home mother with a
working husband*



Note: Based on children younger than 18.
Their mothers are categorized based on
employment status in 1970 and 2012.

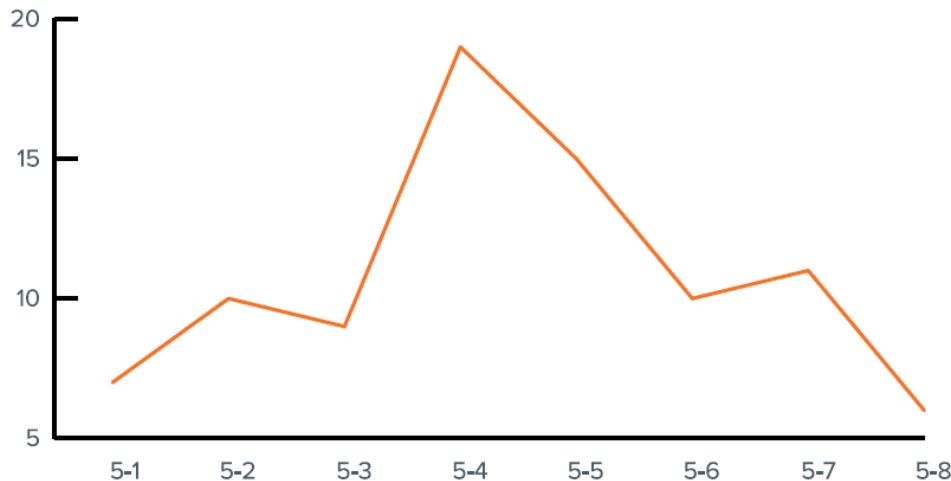
20%

of children had a
traditional stay-at-home mom
in 2012, compared to 41% in 1970

LINE CHART

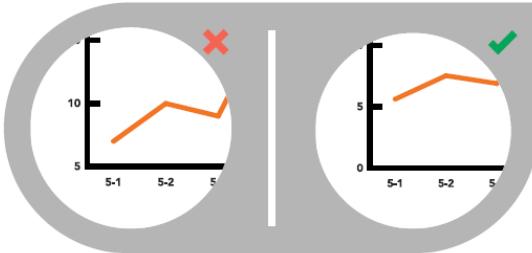
Line charts are used to show time-series relationships with continuous data. They help show trend, acceleration, deceleration, and volatility.

DIRECT MARKETING VIEWS, BY DATE



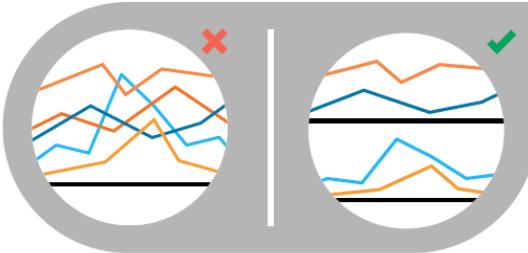
LINE CHART

DESIGN BEST PRACTICES



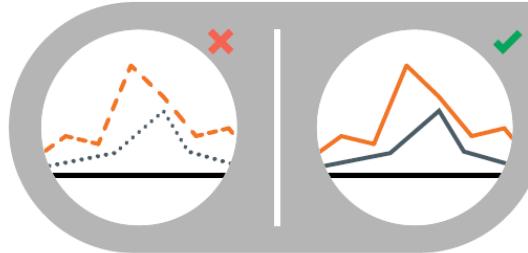
INCLUDE A ZERO BASELINE IF POSSIBLE

Although a line chart does not have to start at a zero baseline, it should be included if possible. If relatively small fluctuations in data are meaningful (e.g., in stock market data), you may truncate the scale to showcase these variances.



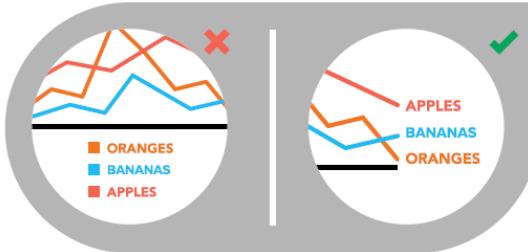
DON'T PLOT MORE THAN 4 LINES

If you need to display more, break them out into separate charts for better comparison.



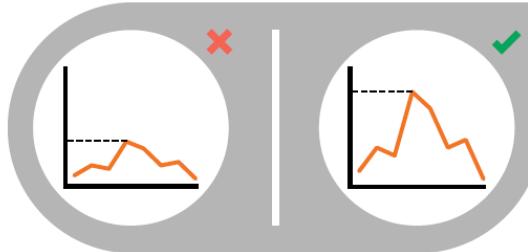
USE SOLID LINES ONLY

Dashed and dotted lines can be distracting.



LABEL THE LINES DIRECTLY

This lets readers quickly identify lines and corresponding labels instead of referencing a legend.



USE THE RIGHT HEIGHT

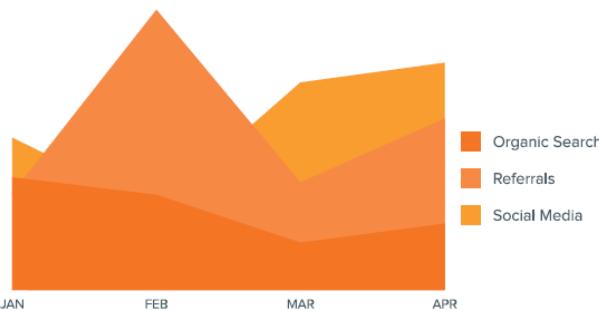
Plot all data points so that the line chart takes up approximately two-thirds of the y-axis' total scale.

AREA CHART

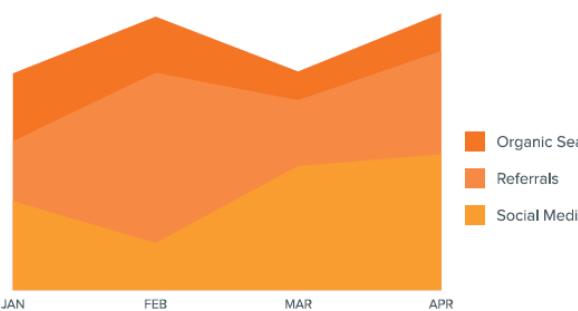
Area charts depict a time-series relationship, but they are different than line charts in that they can represent volume.

VARIATIONS OF AREA CHARTS

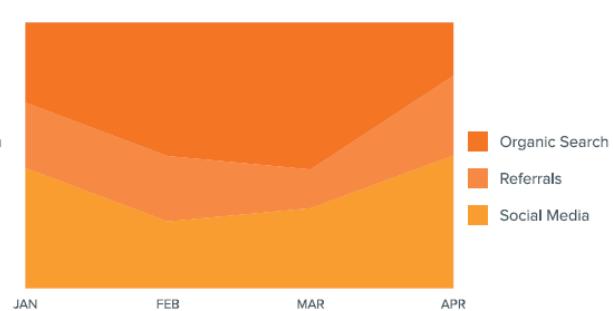
NEW CONTACTS, BY SOURCE



NEW CONTACTS, BY SOURCE



NEW CONTACTS, BY SOURCE



AREA CHART

Best used to show or compare a quantitative progression over time.

STACKED AREA

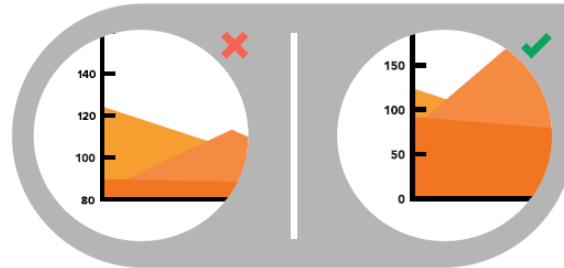
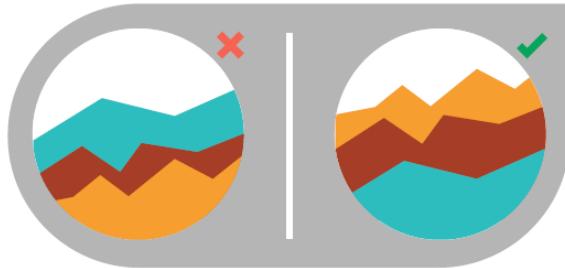
Best used to visualize part-to-whole relationships, helping show how each category contributes to the cumulative total.

100% STACKED AREA

Best used to show distribution of categories as part of a whole, where the cumulative total is unimportant.

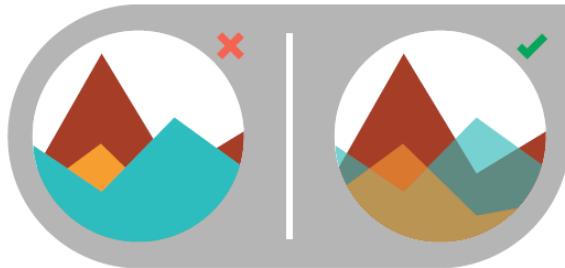
AREA CHART

DESIGN BEST PRACTICES



MAKE IT EASY TO READ

In stacked area charts, arrange data to position categories with highly variable data on the top of the chart and low variability on the bottom.

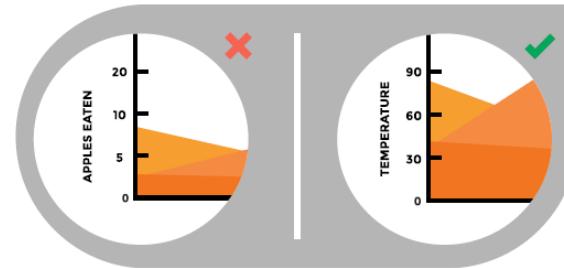


DON'T DISPLAY MORE THAN 4 DATA CATEGORIES

Too many will result in a cluttered visual that is difficult to decipher.

USE TRANSPARENT COLORS

In standard area charts, ensure data isn't obscured in the background by ordering thoughtfully and using transparency.

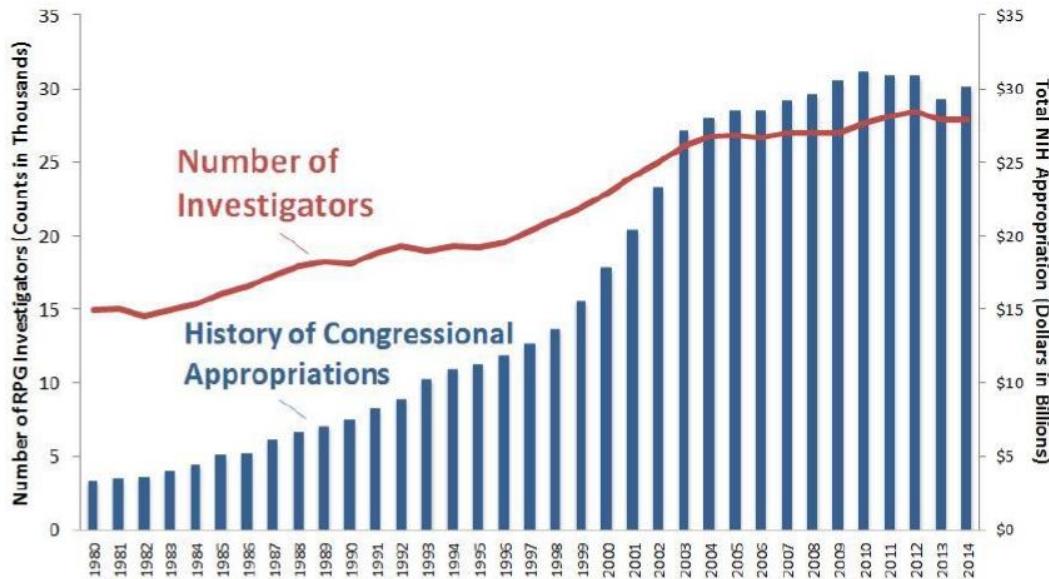


DON'T USE AREA CHARTS TO DISPLAY DISCRETE DATA

The connected lines imply intermediate values, which only exist with continuous data.

Bar Chart + Line Chart

Number of Principal Investigators* Supported on NIH Research Project Grants (RPGs) and History of Congressional Appropriations



NIH Rock Talk Blog: <http://nexus.od.nih.gov/al/category/blog/>

NIH RePORT: http://report.nih.gov/special_reports_and_current_issues/index.aspx

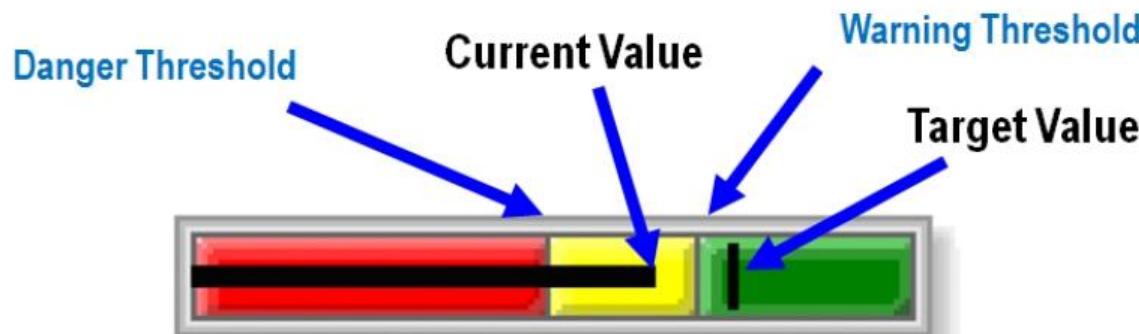
Fiscal Year

* Includes contact and multiple principal investigators. Excludes awards made with American Recovery and Reinvestment Act funds.

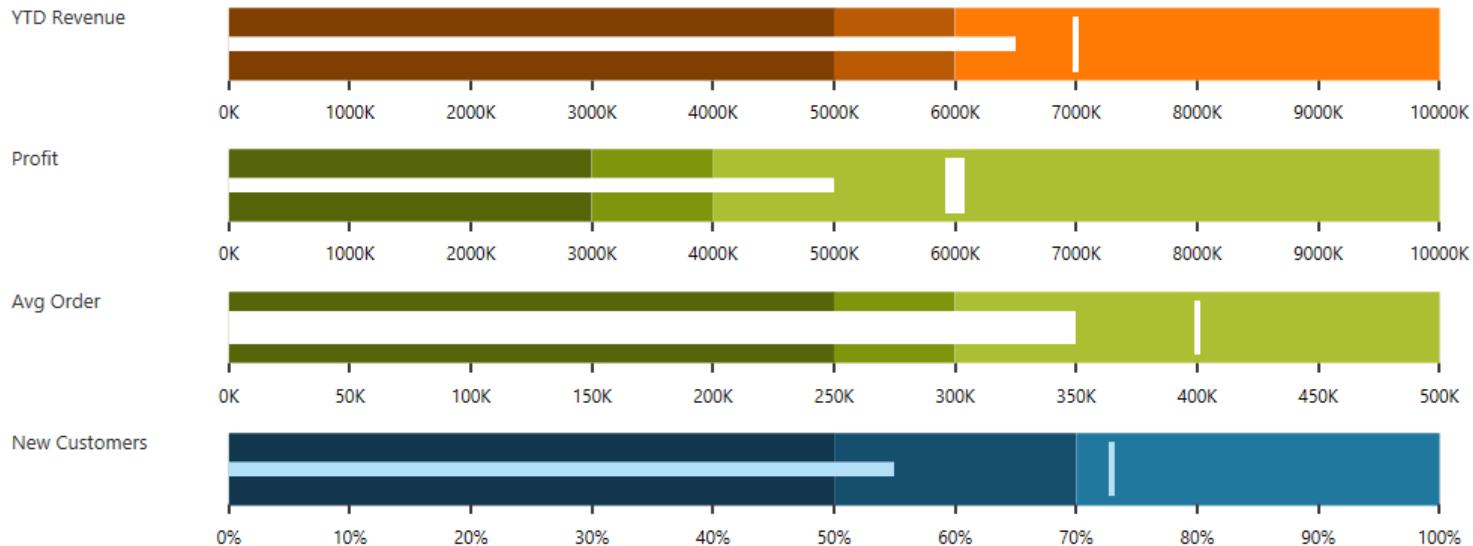
<https://nexus.od.nih.gov/al/2015/06/29/what-are-the-chances-of-getting-funded/>

Bullet Chart

- When to use: Evaluating performance of a metric against a goal
- Possible extension
 - Use color to illustrate achievement thresholds



Bullet Chart

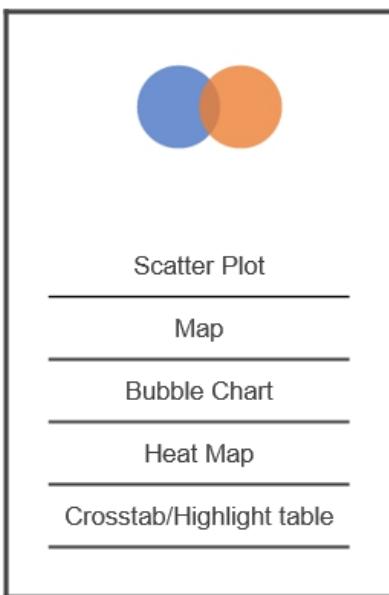


What do you want to tell from your data?

1.Comparison



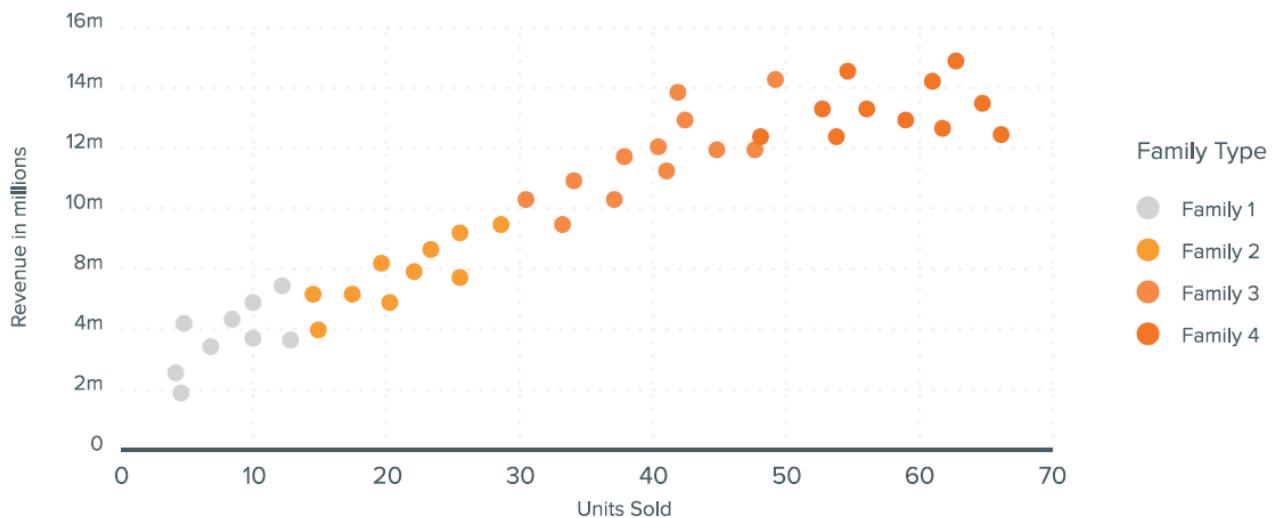
2.Relationship



SCATTER PLOT

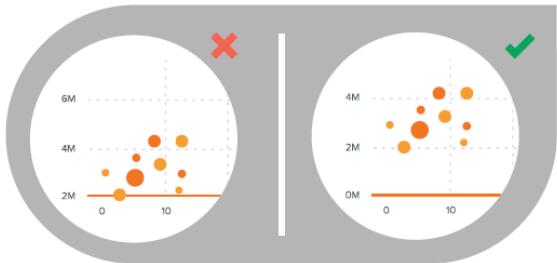
Scatter plots show the relationship between items based on two sets of variables. They are best used to show correlation in a large amount of data.

REVENUE, BY PRODUCT FAMILY



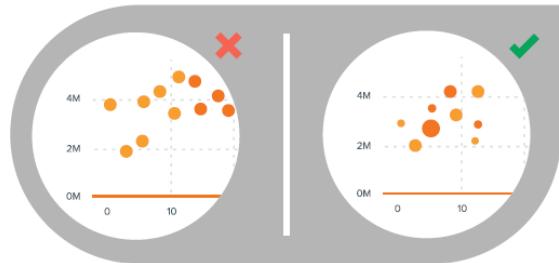
SCATTER PLOT

DESIGN BEST PRACTICES



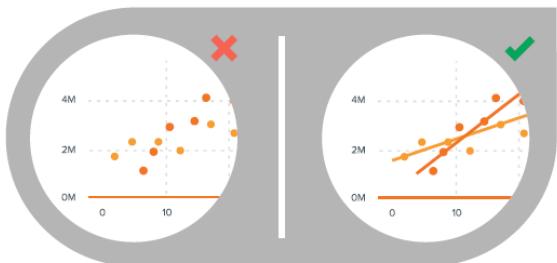
START Y-AXIS VALUE AT 0

Starting the axis above zero truncates the visualization of values.



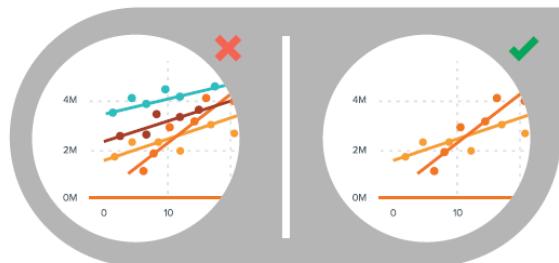
INCLUDE MORE VARIABLES

Use size and dot color to encode additional data variables.



USE TREND LINES

These help draw correlation between the variables to show trends.



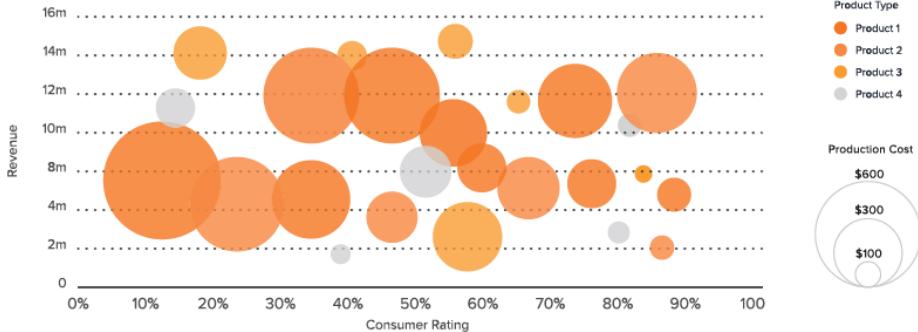
DON'T COMPARE MORE THAN 2 TREND LINES

Too many lines make data difficult to interpret.

BUBBLE CHART

VARIATIONS OF BUBBLE CHARTS

REVENUE VS. RATING



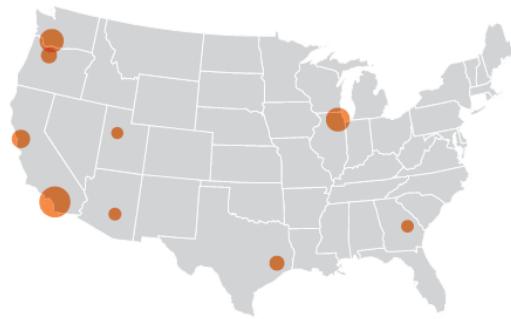
BUBBLE PLOT

This is a scatter plot with bubbles, best used to display an additional variable.

Bubble charts are good for displaying nominal comparisons or ranking relationships.

Bubble Chart គឺជា Scatter Plot ទីម្រាតទៅតាមតុលាការ
សារពន្លកបន្ថែងវារមពេកទៅរាយទំនាក់ទំនងនៃចំណោម។

BIGGEST SALES INCREASE

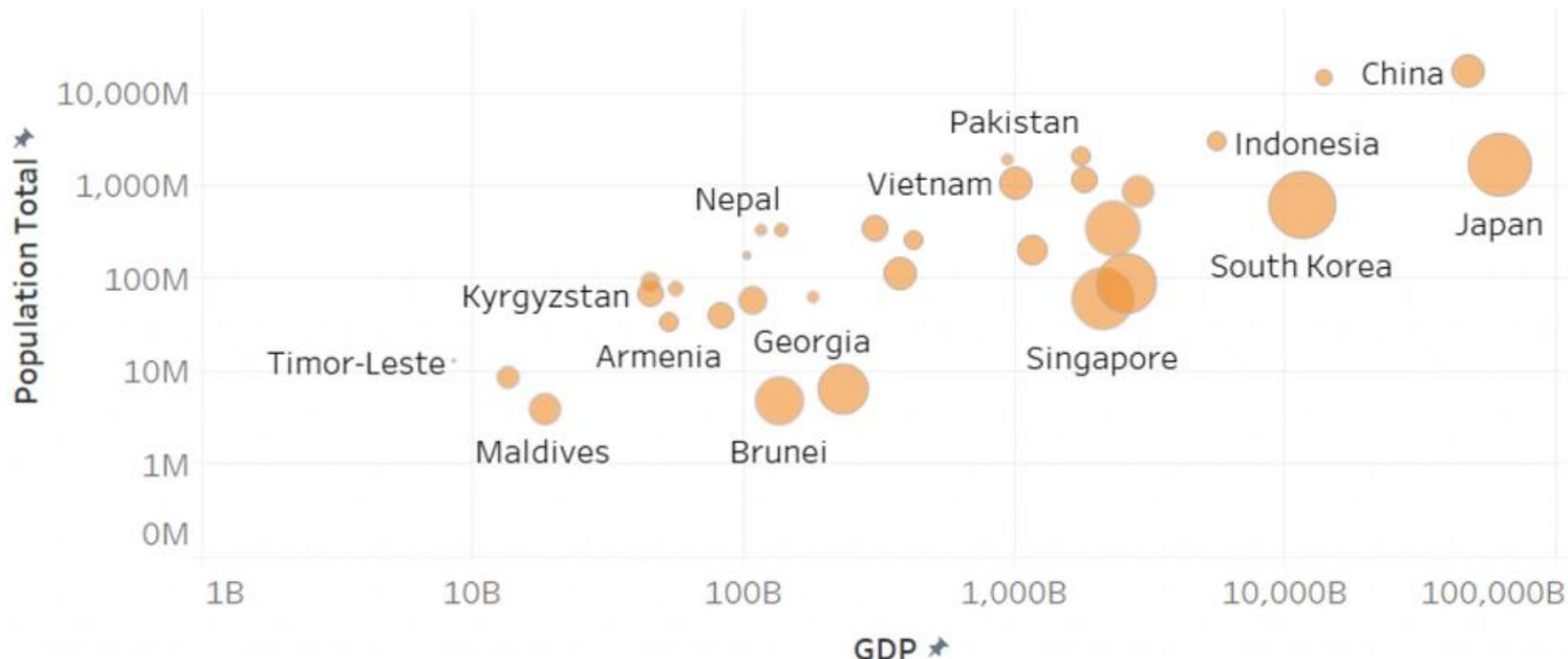


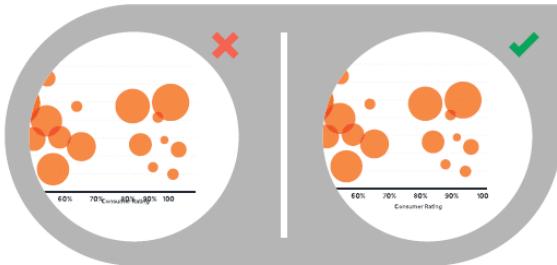
BUBBLE MAP

Best used for visualizing values for specific geographic regions.

BUBBLE CHART

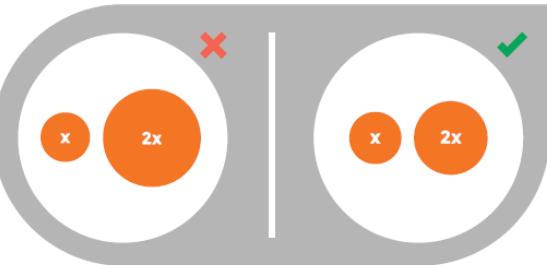
Population, GDP vs Internet Usage (Circle Size)





MAKE SURE LABELS ARE VISIBLE

All labels should be unobstructed and easily identified with the corresponding bubble.



SIZE BUBBLES APPROPRIATELY

Bubbles should be scaled according to area, not diameter.



DON'T USE ODD SHAPES

Avoid adding too much detail or using shapes that are not entirely circular; this can lead to inaccuracies.

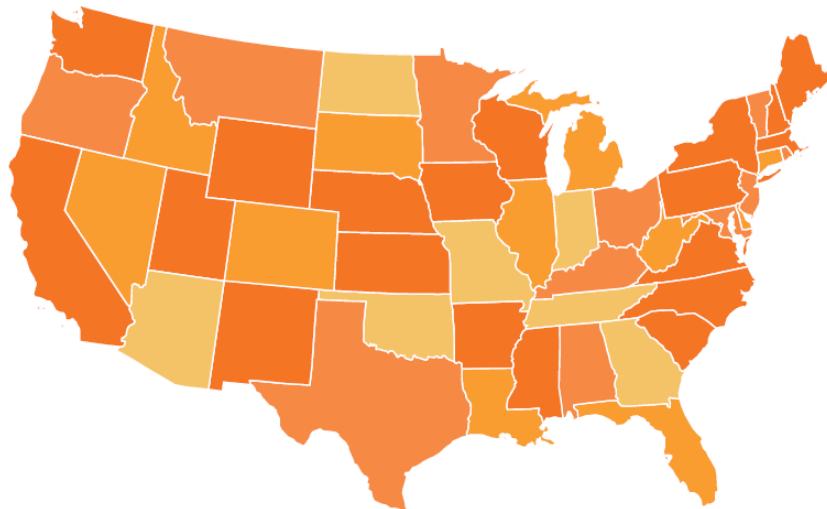
BUBBLE CHART

DESIGN BEST PRACTICES

HEAT MAP

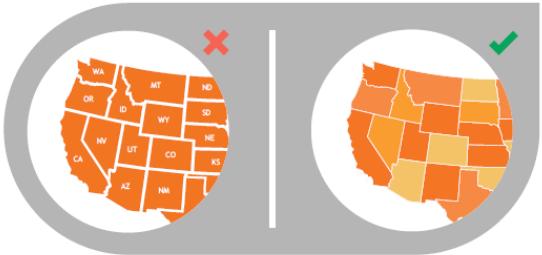
Heat maps display categorical data, using intensity of color to represent values of geographic areas or data tables.

STATES WITH NEW SERVICE CONTRACTS



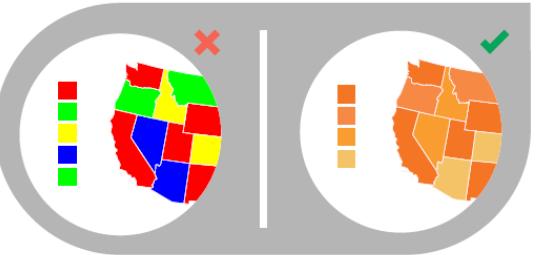
HEAT MAP

DESIGN BEST PRACTICES



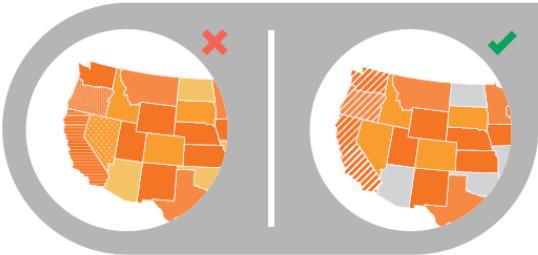
USE A SIMPLE MAP OUTLINE

These lines are meant to frame the data, not distract.



SELECT COLORS APPROPRIATELY

Some colors stand out more than others, giving unnecessary weight to that data. Instead, use a single color with varying shade or a spectrum between two analogous colors to show intensity. Also remember to intuitively code color intensity according to values.



USE PATTERNS SPARINGLY

A pattern overlay that indicates a second variable is acceptable, but using multiple is overwhelming and distracting.

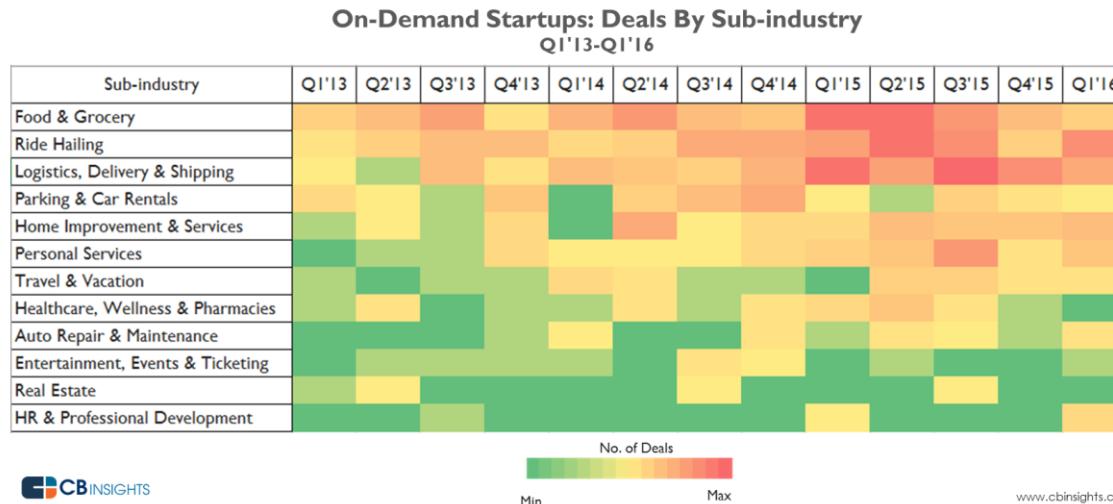


CHOOSE APPROPRIATE DATA RANGES

Select 3-5 numerical ranges that enable fairly even distribution of data between them. Use +/- signs to extend high and low ranges.

Heat Map

- ❑ When to use: Showing the relationship between two factors
- ❑ Possible extension
 - Vary the size of squares
 - Using something other than squares



Crosstab/Highlight table

- ❑ When to use: Providing detailed information on heat maps
- ❑ Possible extension
 - Combine highlight tables with other chart types

SUM(Sales)		\$194,268								\$1,031,341	
Region	Country / Re..	Consumer		Corporate		Home Office		Small Business			
		Furniture	Office Supplies	Furniture	Office Supplies	Furniture	Office Supplies	Furniture	Office Supplies		
AsiaPac	Australia		\$2,677	\$316	\$5,753	\$43,007	\$25,163	\$1,976	\$52,048		
	China	\$327,285	\$153,923	\$520,690	\$284,654	\$292,090	\$198,831	\$207,592	\$177,013		
	India	\$169,824	\$119,982	\$254,423	\$336,395	\$177,964	\$136,734	\$141,475	\$71,999		
	Japan	\$79,342	\$89,044	\$104,936	\$122,644	\$132,382	\$85,140	\$42,223	\$28,308		
EMEA	Germany	\$1,350	\$1,332	\$878	\$1,098	\$38,522	\$27,084	\$9,873	\$232		
	South Africa			\$18,122	\$8,175	\$20,453	\$10,940	\$24	\$4,229		
	United Kingdom	\$768	\$11,250	\$2,836	\$6,798	\$11,143	\$32,098	\$551	\$2,188		
Latam	Argentina	\$73,676	\$20,235	\$84,516	\$116,670	\$148,742	\$65,528	\$40,353	\$93,933		
	Brazil	\$146,501	\$115,550	\$271,880	\$181,832	\$144,187	\$115,890	\$97,058	\$196,796		
	Mexico	\$19,058	\$14,374	\$229,770	\$140,469	\$56,381	\$43,140	\$29,137	\$19,366		
North America	Canada	\$2,100	\$2,734	\$6,538	\$10,231			\$24,142	\$10,287		
	United States ..	\$616,038	\$407,799	\$1,031,341	\$725,000	\$663,557	\$570,220	\$499,786	\$509,639		

Tables

Data should be what stands out, not border

Heavy borders

Group	Metric A	Metric B	Metric C
Group1	\$X.X	Y%	Z.ZZZ
Group2	\$X.X	Y%	Z.ZZZZ
Group3	\$X.X	Y%	Z.ZZZ
Group4	\$X.X	Y%	Z.ZZZ
Group5	\$X.X	Y%	Z.ZZZ

Light borders

Group	Metric A	Metric B	Metric C
Group1	\$X.X	Y%	Z.ZZZZ
Group2	\$X.X	Y%	Z.ZZZZ
Group3	\$X.X	Y%	Z.ZZZZ
Group4	\$X.X	Y%	Z.ZZZZ
Group5	\$X.X	Y%	Z.ZZZZ

Minimal borders

Group	Metric A	Metric B	Metric C
Group1	\$X.X	Y%	Z.ZZZ
Group2	\$X.X	Y%	Z.ZZZ
Group3	\$X.X	Y%	Z.ZZZ
Group4	\$X.X	Y%	Z.ZZZ
Group5	\$X.X	Y%	Z.ZZZ

Tables: Heatmap

Use color saturation to highlight cells, do it easy in Excel

Table

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Heatmap

LOW-HIGH

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

What do you want to tell from your data?

1.Comparison



Bar Chart

Line Chart

Bullet Chart

2.Relationship



Scatter Plot

Map

Bubble Chart

Heat Map

Crosstab/Highlight table

3.Composition

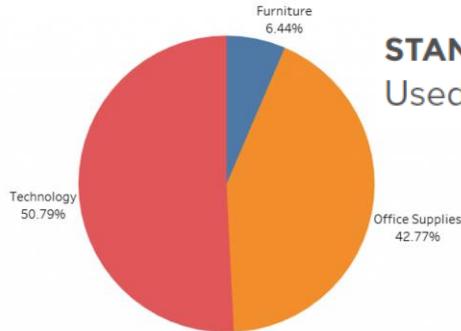


Pie Chart

Tree Map

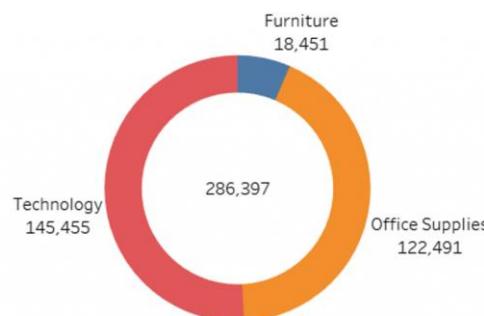
PIE CHART

VARIATIONS OF PIE CHARTS



STANDARD

Used to show part-to-whole relationships.



DONUT

Stylistic variation that enables the inclusion of a total value or design element in the center.

ใช้แสดงส่วนประกอบ หรือแสดงให้เห็นว่า
แต่ละหมวดหมู่มีจำนวนหรือปริมาณที่
เกี่ยวข้องเท่าใด

Note :

- ผลรวมต้องเท่ากับ 100%
- ต้องแสดงตัวเลข
- ไม่ควรใช้ในกรณีที่มีหมวดหมู่มากเกินไป
(ไม่ควรเกิน 5 หมวดหมู่)



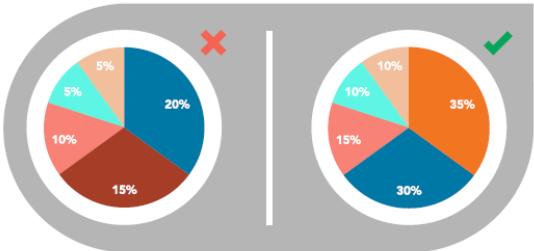
VISUALIZE NO MORE THAN 5 CATEGORIES PER CHART

It is difficult to differentiate between small values; depicting too many slices decreases the impact of the visualization. If needed, you can group smaller values into an “other” or “miscellaneous” category, but make sure it does not hide interesting or significant information.



DON'T USE MULTIPLE PIE CHARTS FOR COMPARISON

Slice sizes are very difficult to compare side-by-side. Use a stacked bar chart instead.



MAKE SURE ALL DATA ADDS UP TO 100%

Verify that values total 100% and that pie slices are sized proportionate to their corresponding value.



ORDER SLICES CORRECTLY

There are two ways to order sections, both of which are meant to aid comprehension:

OPTION 1

Place the largest section at 12 o'clock, going clockwise. Place the second largest section at 12 o'clock, going counterclockwise. The remaining sections can be placed below, continuing counterclockwise.

OPTION 2

Start the largest section at 12 o'clock, going clockwise. Place remaining sections in descending order, going clockwise.

PIE CHART

DESIGN BEST PRACTICES

What do you want to tell from your data?

1.Comparison



Bar Chart

Line Chart

Bullet Chart

2.Relationship



Scatter Plot

Map

Bubble Chart

Heat Map

Crosstab/Highlight table

3.Composition



Pie Chart

Tree Map

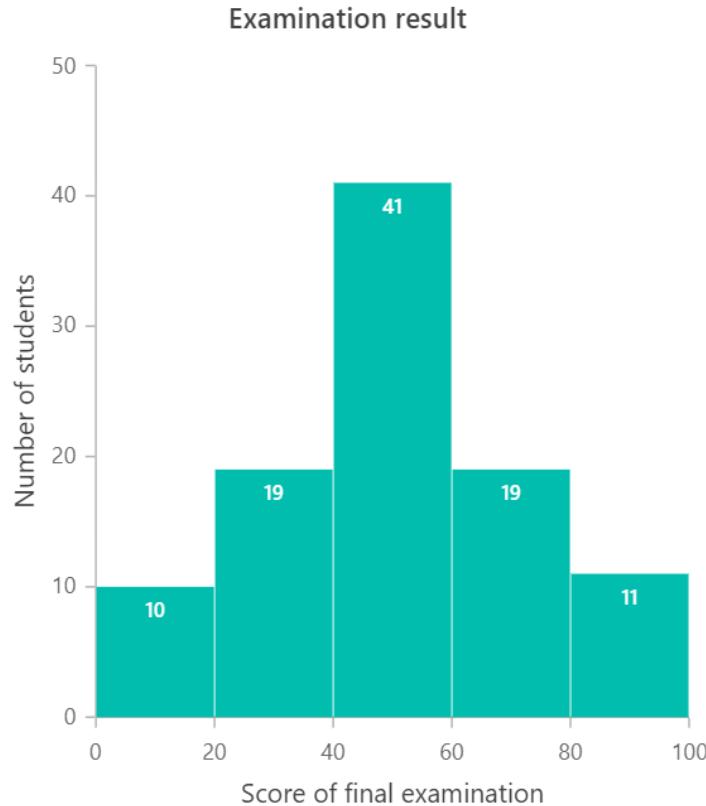
4.Distribution



Histogram Chart

Box Plot

HISTOGRAM CHART



ใช้แสดงการกระจายตัวของข้อมูล

Note :

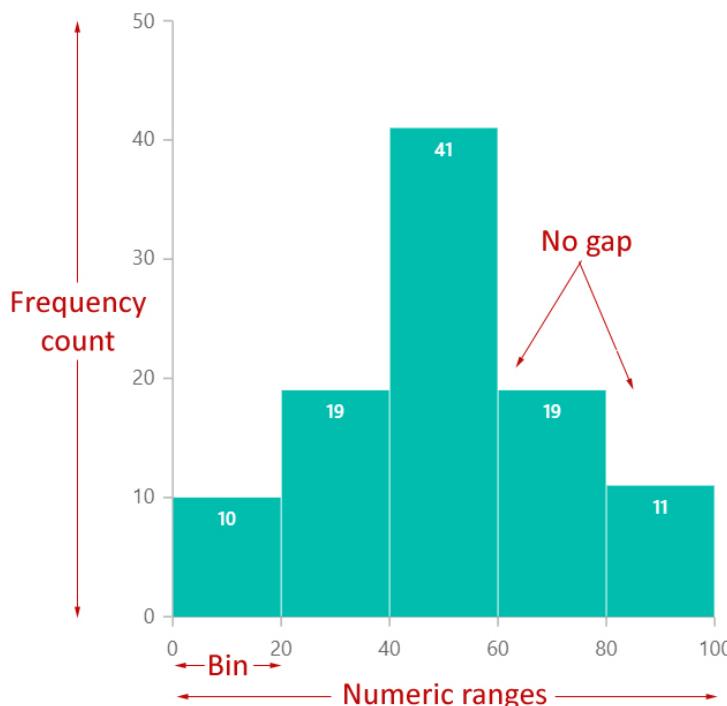
- ควรเลือกจำนวนของแท่ง (Bins) ให้เหมาะสม
- ต้องเข้าใจเรื่องการการกระจายตัวของข้อมูล ก่อนทำการวิเคราะห์
- ข้อมูลในแกน X (X-axis) มีความต่อเนื่อง

Bar chart vs Histogram

Bar Chart

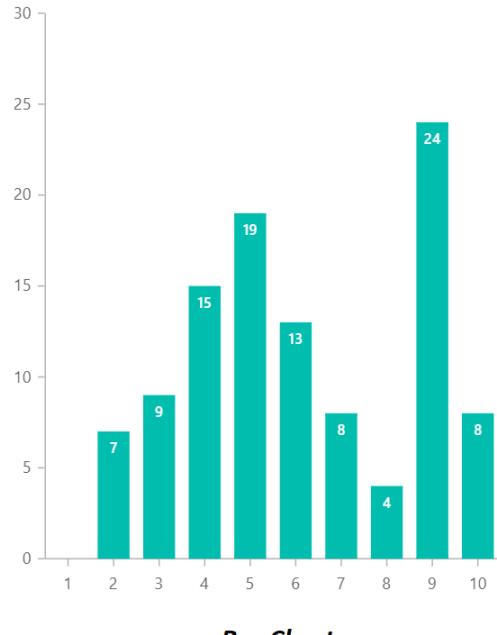


Histogram Chart

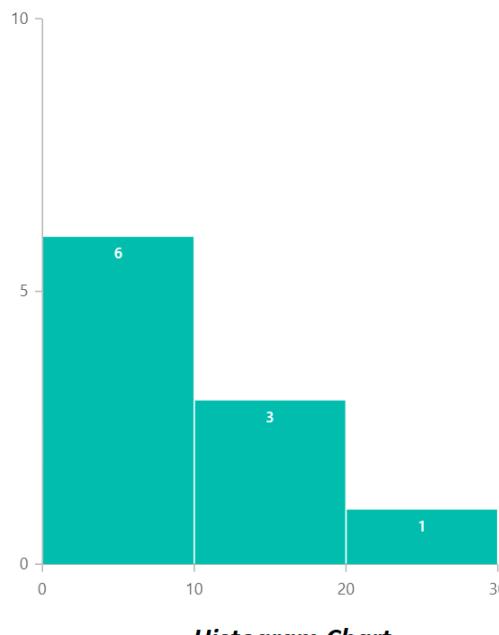


Bar chart vs Histogram

Here, you can see the output in a bar chart and a histogram chart for the same data set **[0, 7, 9, 15, 19, 13, 8, 4, 24, 8]**.



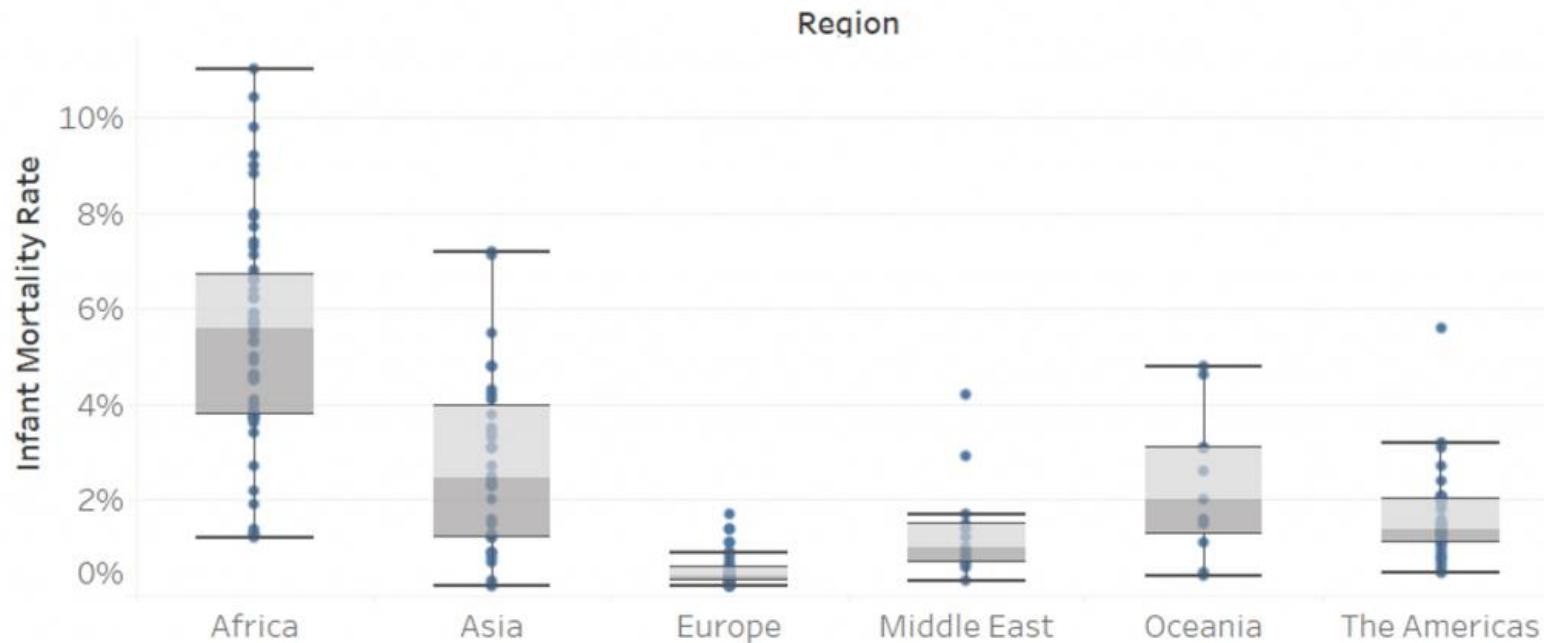
Bar Chart



Histogram Chart

BOXPLOT

Infant Mortality Rate in 2012

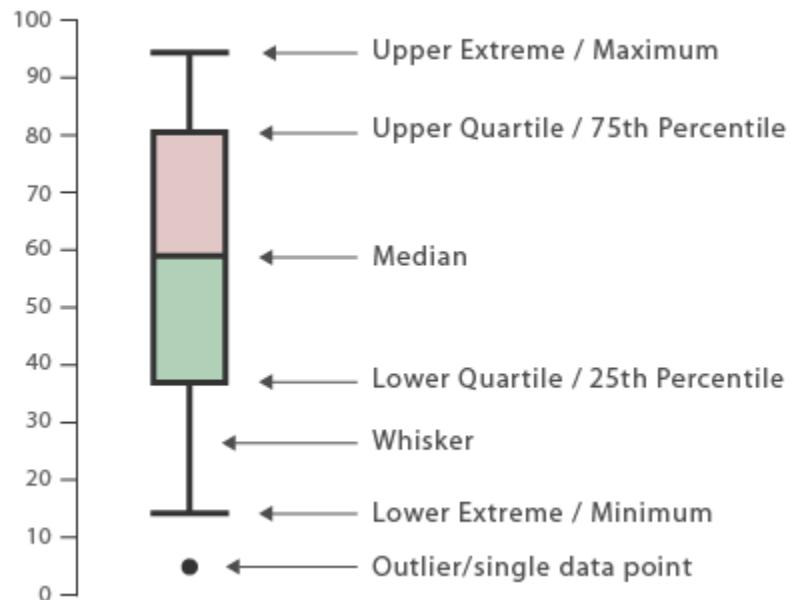


Box Plot

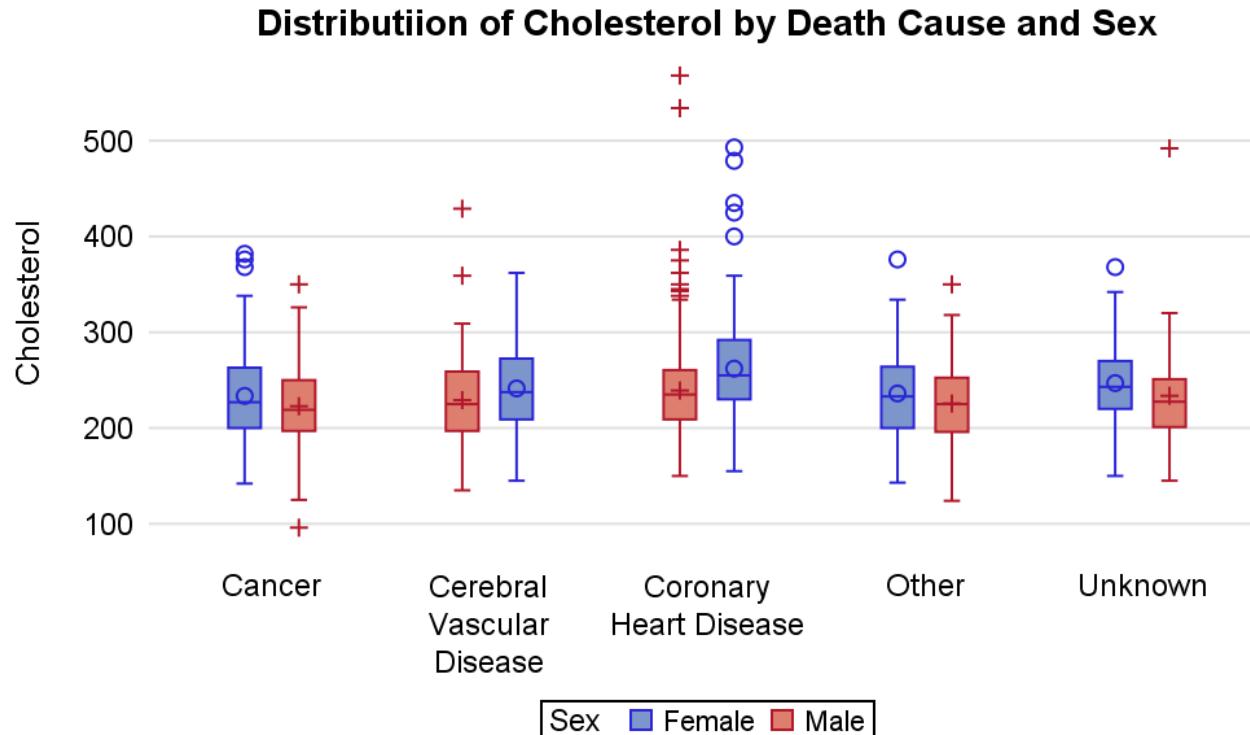
□ When to use: Showing the distribution of a set of data

□ Possible extension

- Hiding the points within the box
- Comparing boxplots across categorical dimensions



Box Plot





Color should be
used strategically

เรามองเห็น
ตัวหนี
ในภาพไหน
ได้ไวและชัดเจน
ที่สุด



Source: The Functional Art by Alberto Cairo

Our visual brains
are attracted by
Difference

เลข 6 มีกี่ตัว

1	6	8	7	2	3	4	6
9	7	2	1	4	6	3	2
1	5	6	8	1	4	2	3
2	6	4	8	7	4	3	1
4	5	7	8	9	8	6	2

Contrast

1	6	8	7	2	3	4	6
9	7	2	1	4	6	3	2
1	5	6	8	1	4	2	3
2	6	4	8	7	4	3	1
4	5	7	8	9	8	6	2



75%

ของการรับรู้ ของมนุษย์เกิดจาก
การมองเห็น



75%
ของการรับรู้ ของมนุษย์เกิดจาก
การมองเห็น

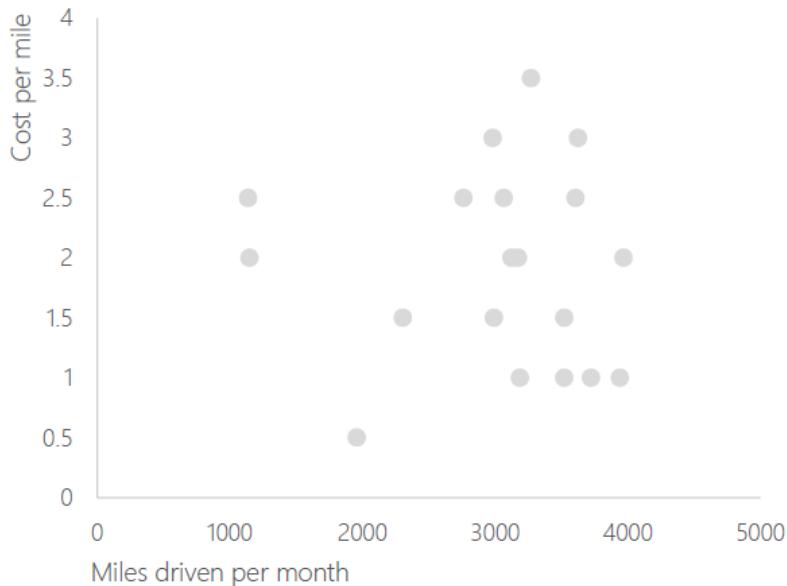
PRODUCT VARIETY



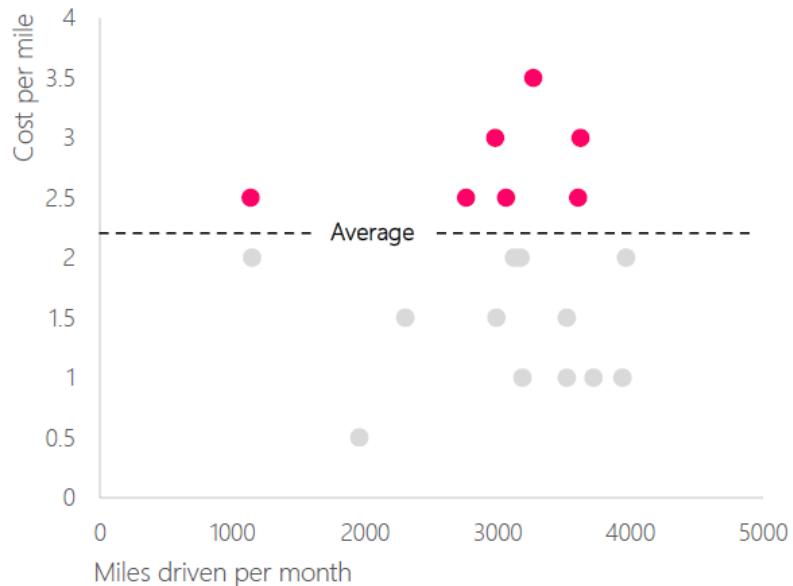
ธรรมชาติการรับรู้ของมนุษย์เรา คือ **การมองเห็น**
ใช้ความแตกต่างของสี เพื่อให้ข้อมูลเด่นชัด
ตัดรายละเอียดให้เหลือน้อยที่สุด เพื่อให้สายตาได้ฟอกับกีจุดสำคัญ

Scatter plot

Cost per mile by miles driven



Cost per mile by miles driven



Lines

Be consistent with the interval of x axis

Single series



Two series



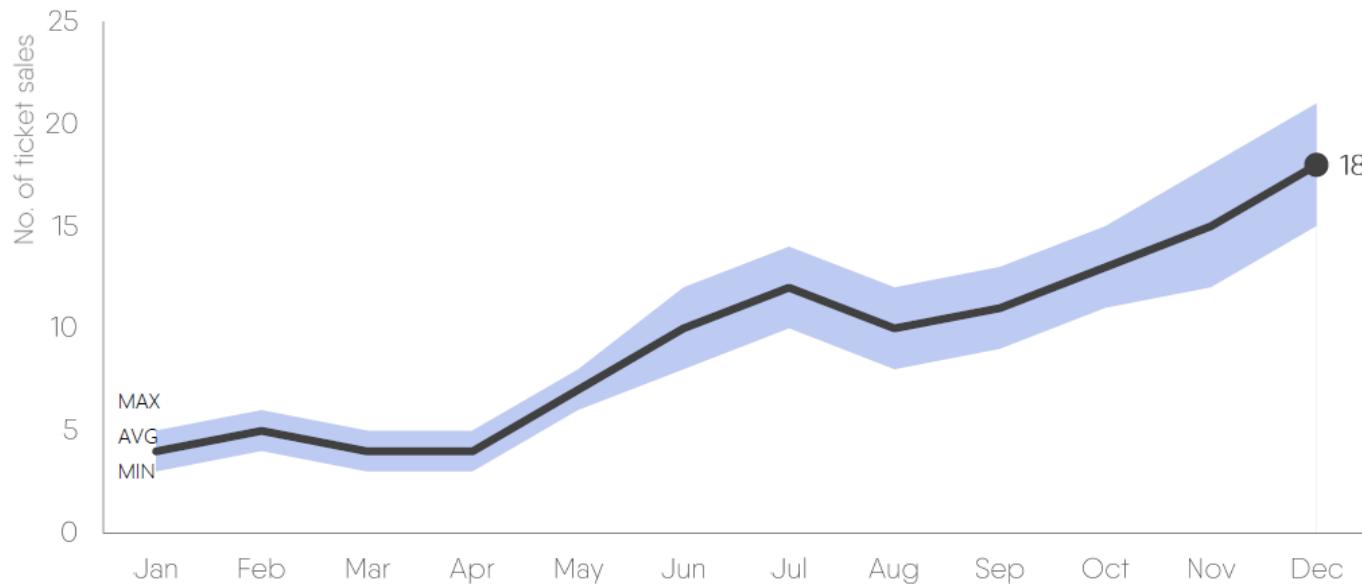
Multiple series



Lines

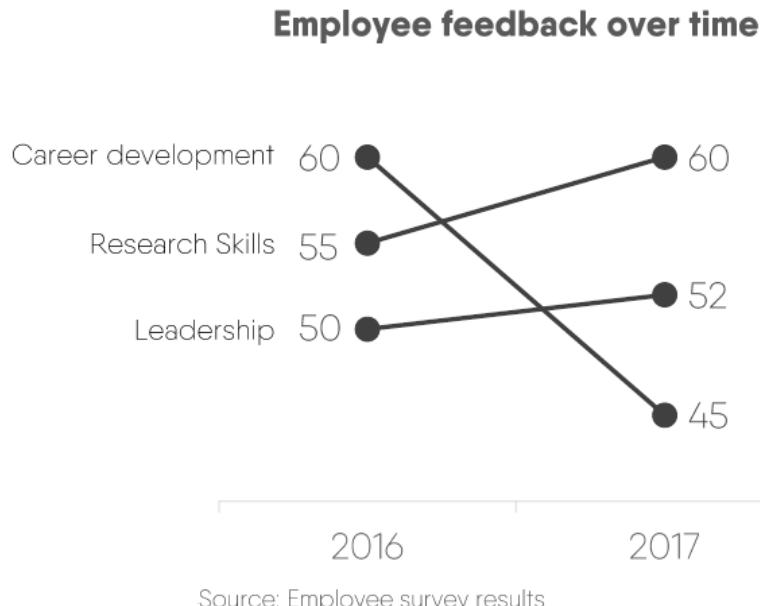
Give a sense of confidence interval

Past 12 months in Y2016

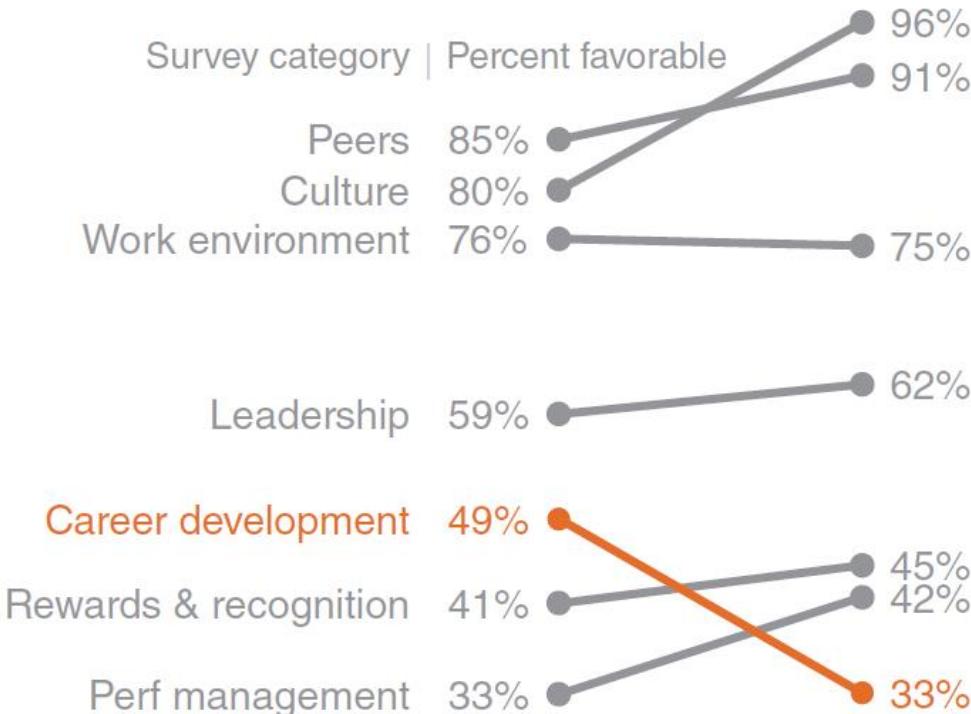


Use combo charts to create confidence interval, COOL!

Slope graph



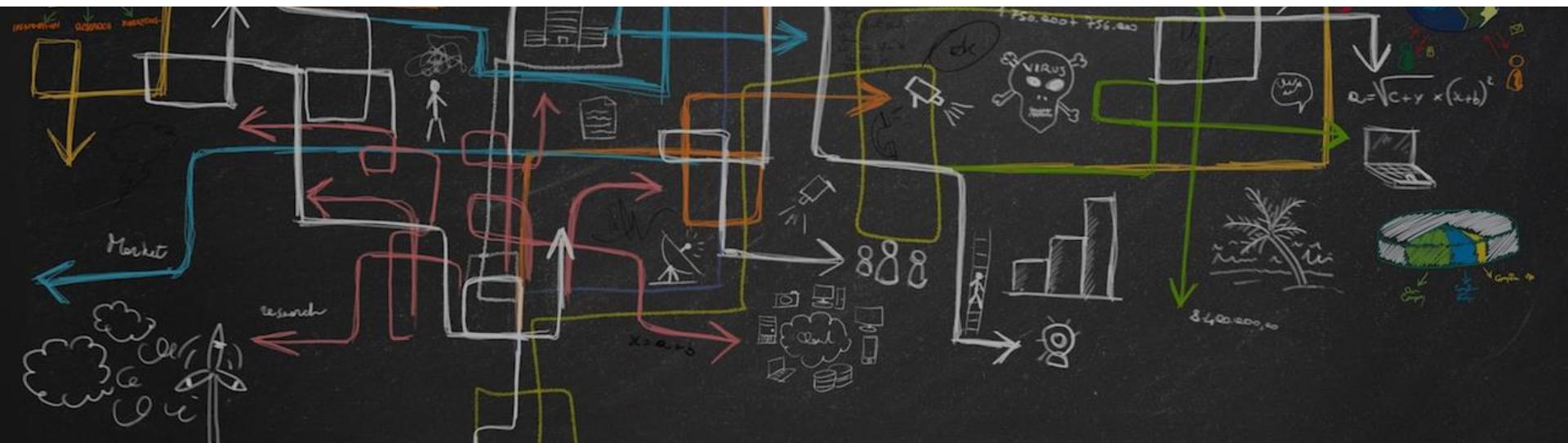
Slope graph



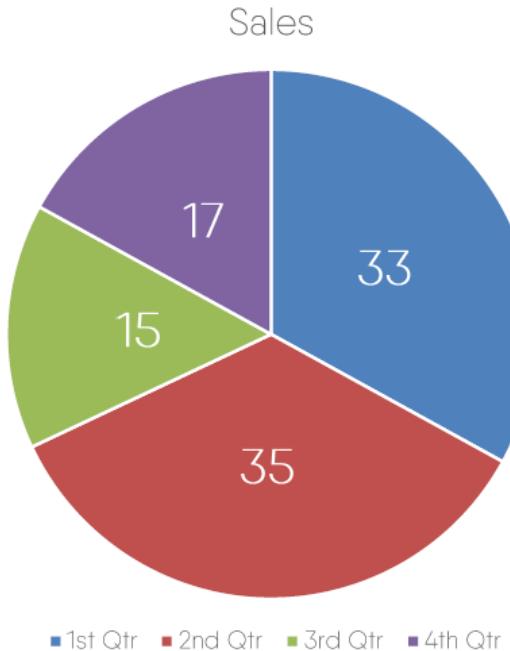
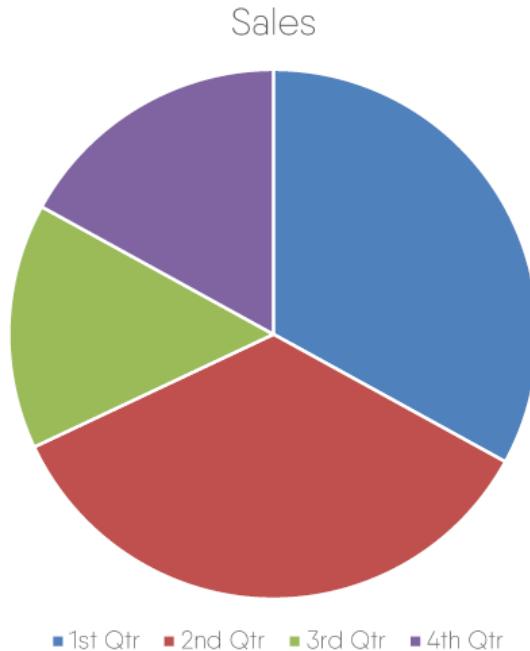


What you should avoid

Pie charts, 3D, and Secondary axis

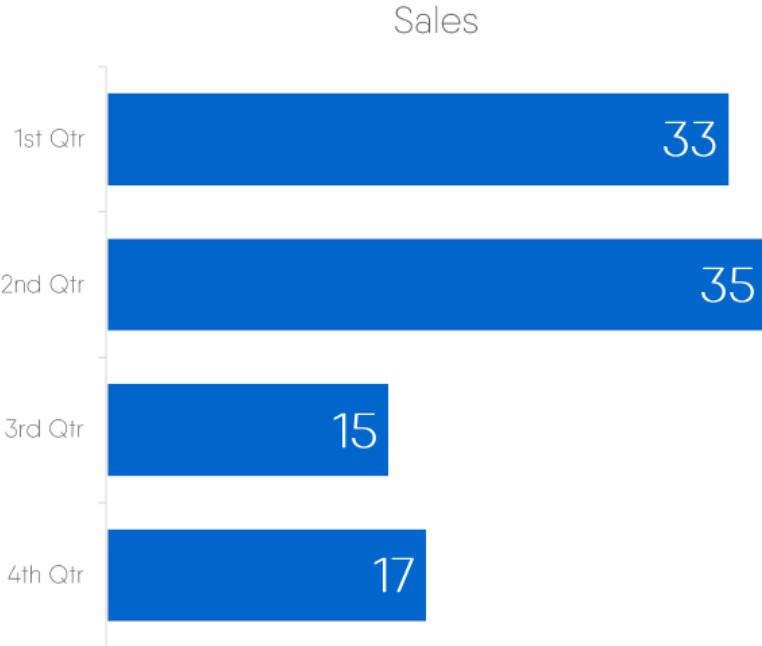


Pie charts are evil



Alternatives to Pies

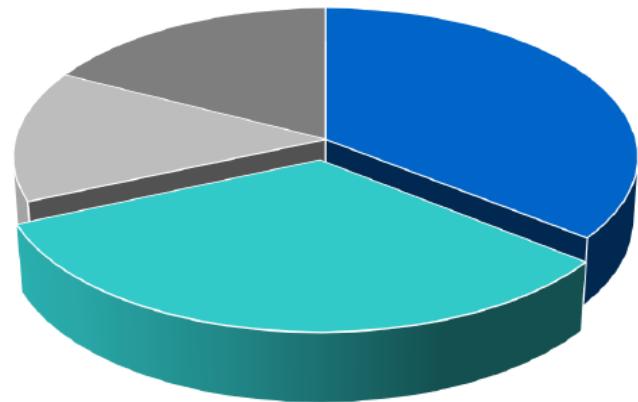
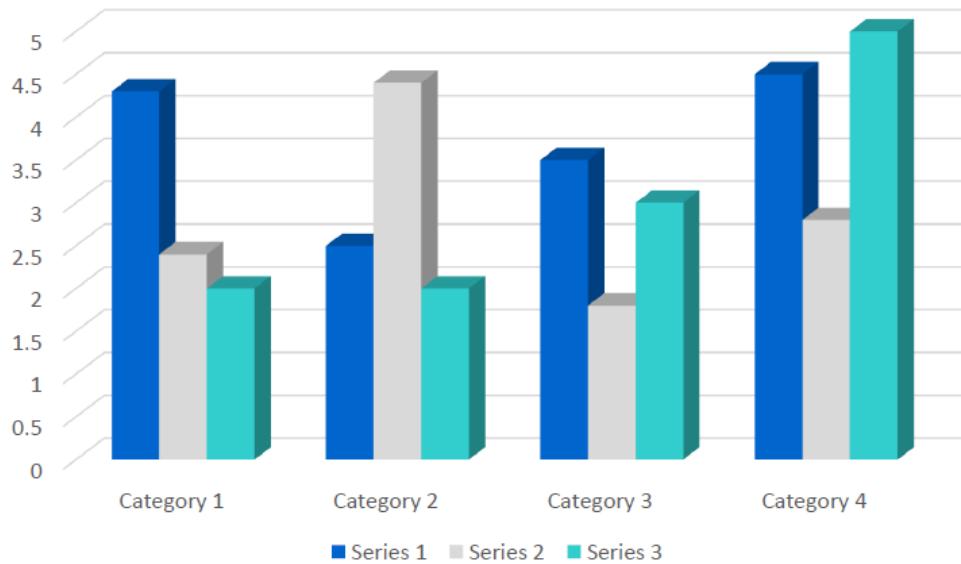
Horizontal bar chart is ideal alternative to all pies



Quarter	Sales
1 st	33
2 nd	35
3 rd	15
4 th	17

Never use 3D

It's difficult to gauge the value on 3D charts

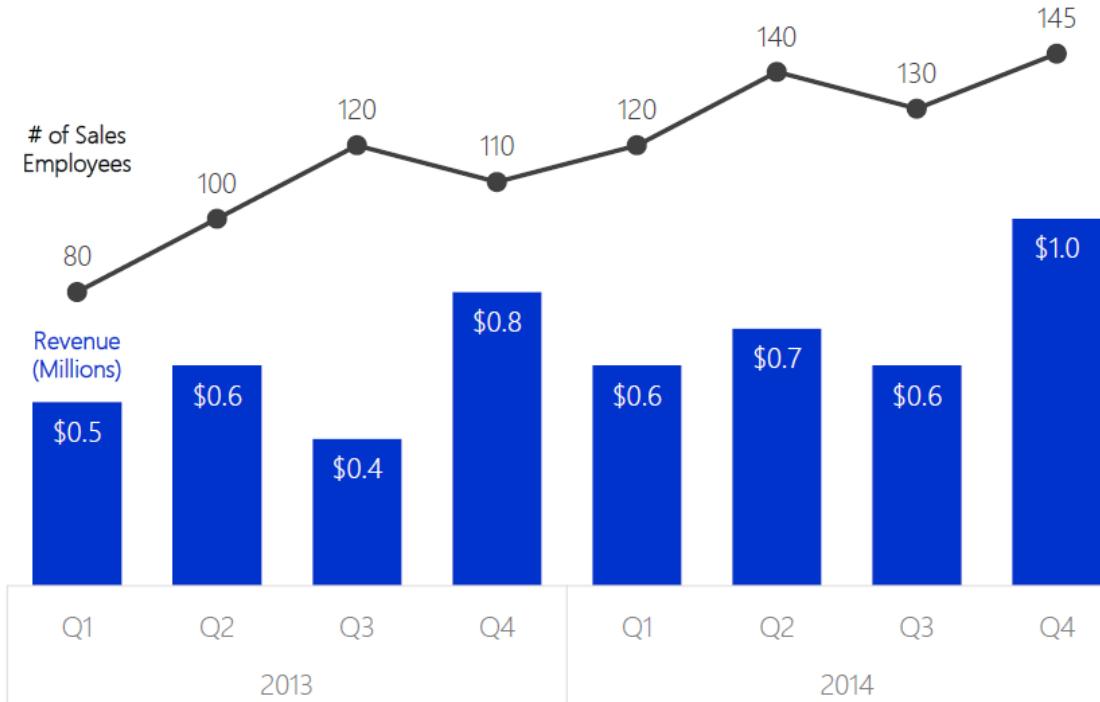


Secondary axis generally not a good idea

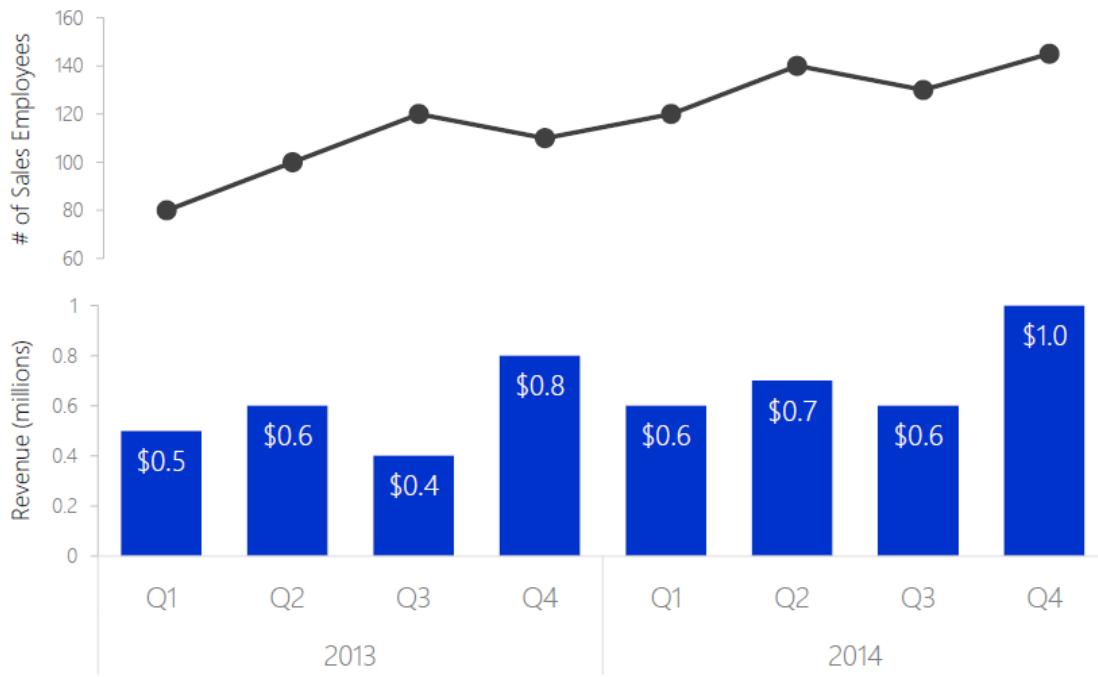
It takes time for audience to understand the chart



2 approaches to
deal with this issue



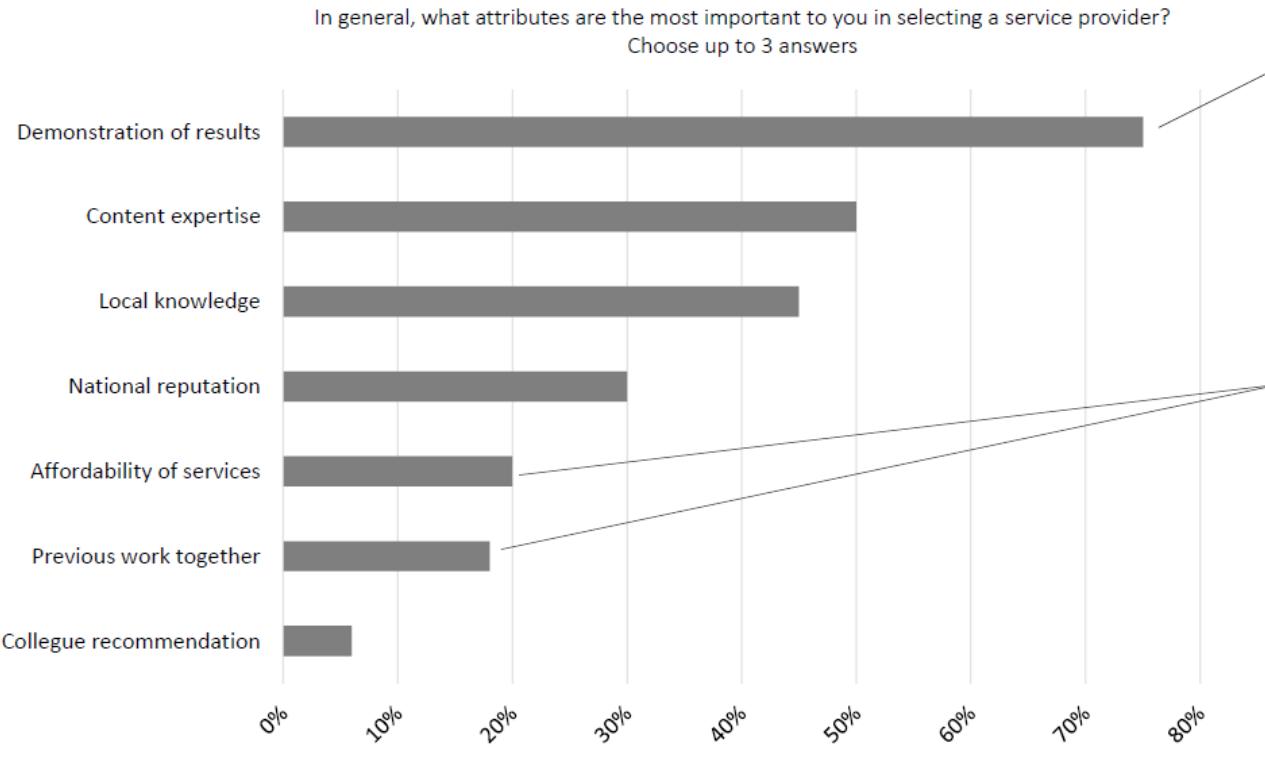
Label
directly



Pull
apart
vertically

BEFORE

Demonstrating effectiveness is most important consideration when selecting a provider



Survey shows that demonstration of results is the single most important dimension when choosing a service provider

Affordability and experience working together previously, which were hypothesized to be very important in decision making process, were both cited less frequently as important attributes.

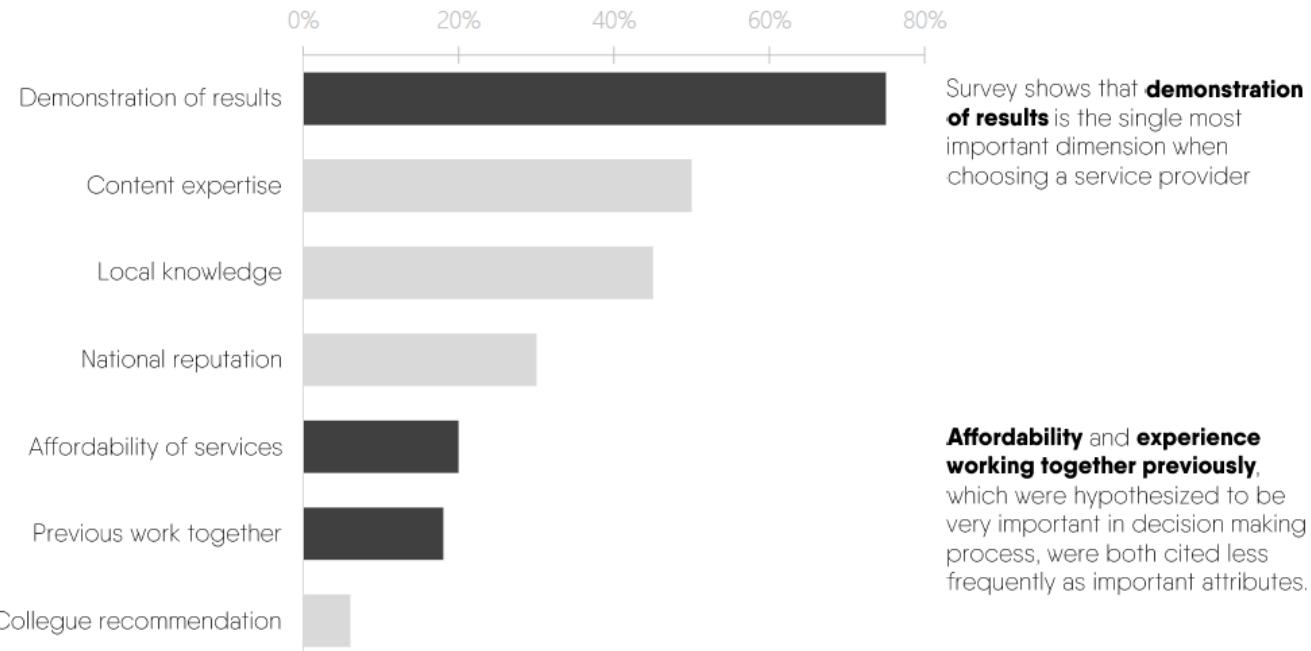
Data source: Storytelling with data by Cole. Page 81.

Source: Storytelling with data

Demonstrating effectiveness is most important consideration when selecting a provider

In general, **what attributes are the most important** to you in selecting a service provider?

Choose up to 3 answers



Survey shows that **demonstration of results** is the single most important dimension when choosing a service provider

Affordability and **experience working together previously**, which were hypothesized to be very important in decision making process, were both cited less frequently as important attributes.

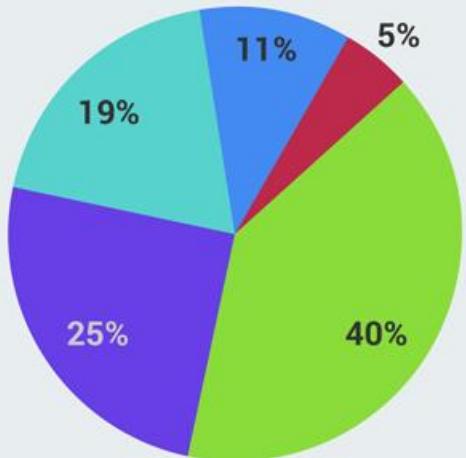
Data source: Storytelling with data by Cole, Page 81.

Source: Storytelling with data

Survey Results

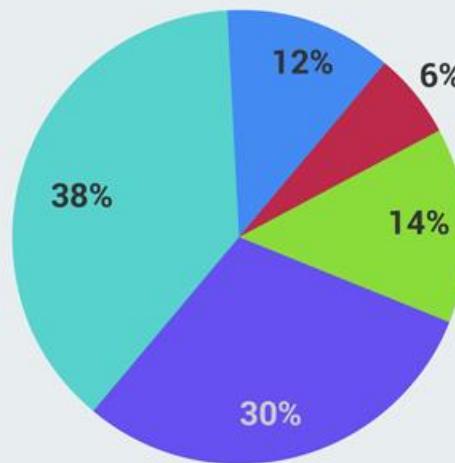
PRE: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



POST: How do you feel about doing science?

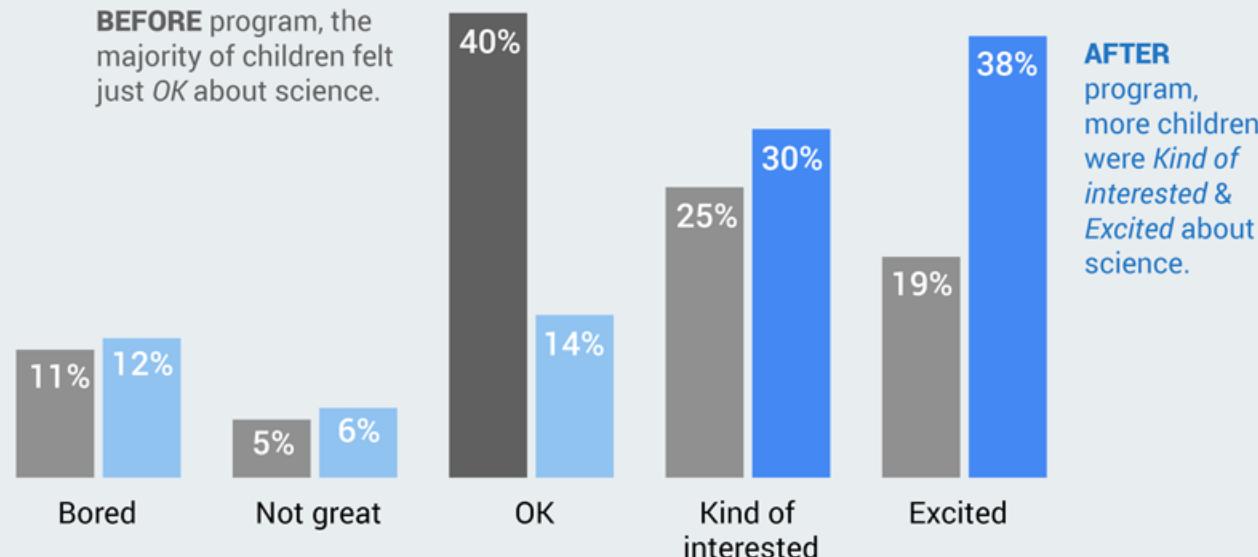
■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



Source: Storytelling With Data by Cole Nussbaumer Knaflic

Pilot program was a success

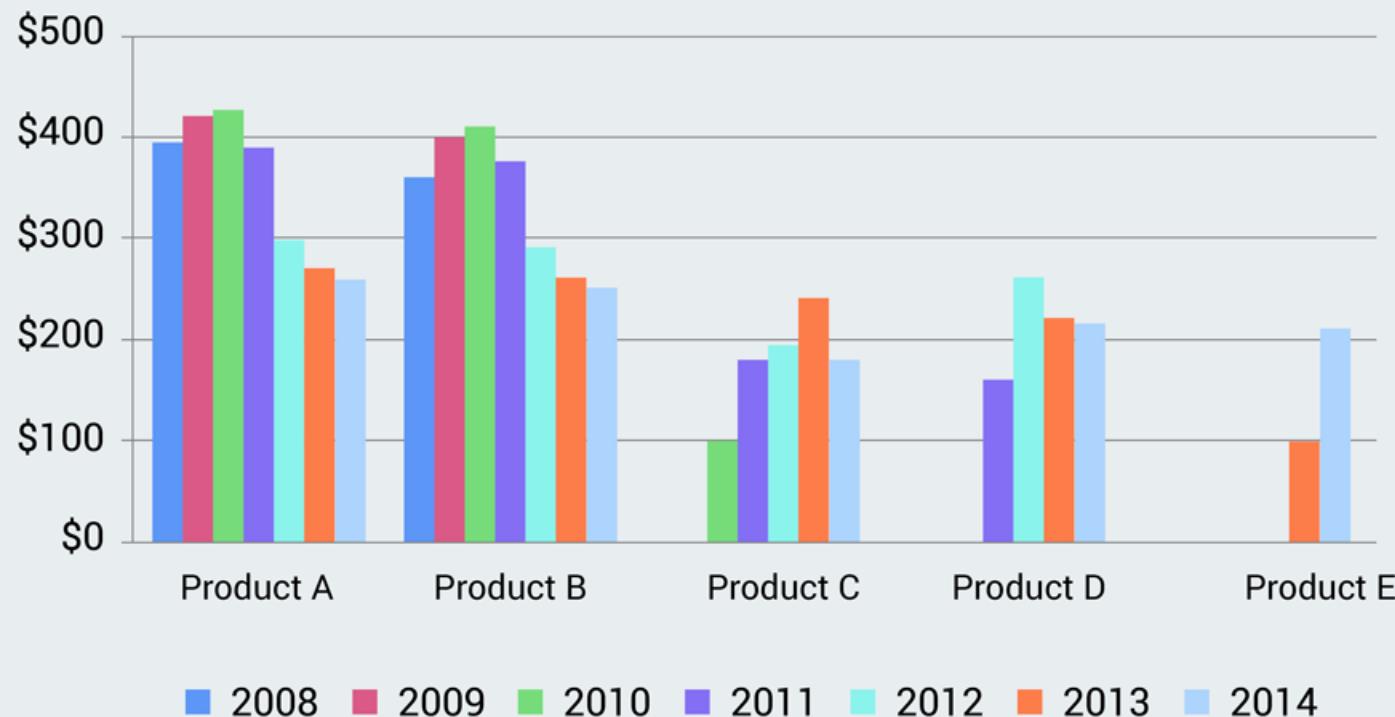
How do you feel about science?



Source: Storytelling With Data by Cole Nussbaumer Knaflic

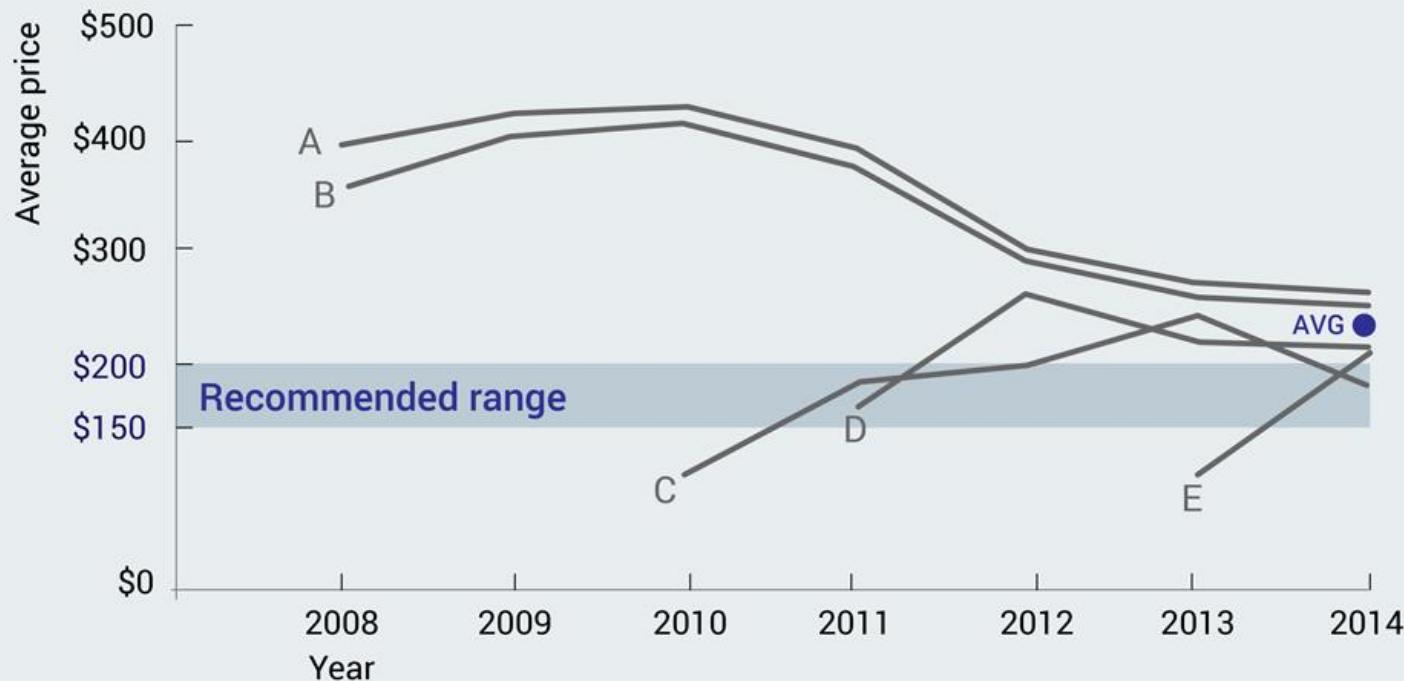
Before

Average Retail Product Price per Year

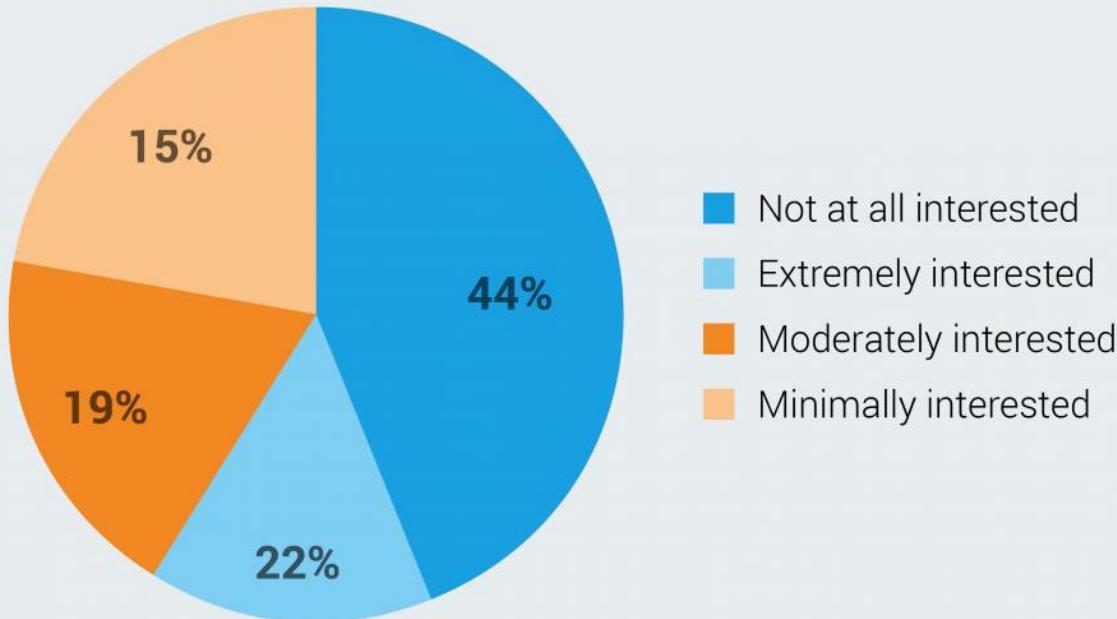


To be competitive, we recommend introducing our product below the \$223 average price point in the **\$150-\$200 range**

Retail price over time by product



HOW INTERESTED ARE YOU IN THIS PRODUCT?



HOW INTERESTED ARE YOU IN THIS PRODUCT?



Source: Good Charts by Harvard Business Review Press

Standard Report vs Ad Hoc Report

Standard Report

- Aim to deliver constant information
- Design for repeated monitoring

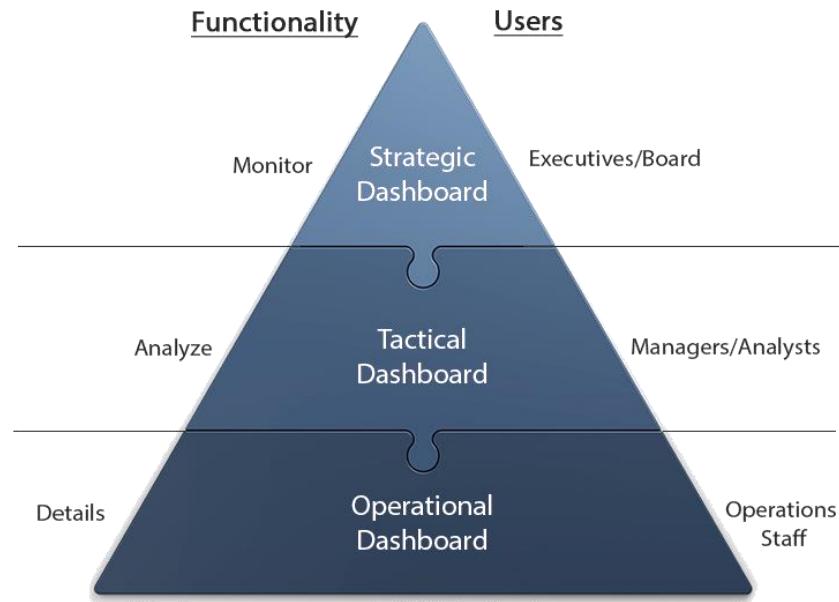


Ad Hoc Report

- Aim to answer specific question
- Design for one time use

Types of Dashboards

- **Operational dashboards** monitor operational processes, events, and activities as they occur (every minute, hour, or day).
- **Tactical dashboards** measure and analyze the performance of departmental activities, processes, and goals.
- **Strategic dashboards** track progress toward achieving strategic objectives in a top down fashion (e.g., a "Balanced Scorecard").



Operational Dashboard

Operational Sales Dashboard

Klipfolio

Performance Today

\$219,830
Revenue 

\$40,177
Profit 

27
Sales 

15
Customers 

Sales Today

Rep	Customer	Revenue	Profit	Profit Margin
Valerie Soshal	Red Hot Wireless	\$10,360	\$684	 6.60%
Katya Vartan	Wowe	\$13,080	\$852	 6.51%
Chris Closer	SteamWhistle	\$25,680	\$1,292	 5.03%
Ashraf Bentley	Okay Corp.	\$39,890	\$3,791	 9.50%
Mychelle Masters	Humidify	\$75,000	\$22,500	 30.00%
Scotty Skills	Vespa	\$44,870	\$9,253	 20.62%
Jon Walker	Boulder Energy	\$10,950	\$1,805	 16.48%

Accounts in Arrears/Block Future Sales

Company	Age of AR
Cars123	10
Ekin	22
AdsRUs	65
ABC123	72
Corp24	13

Lead Funnel



Daily Profit/Target



Monthly Profit/Target



Profit/Revenue Trend This Quarter



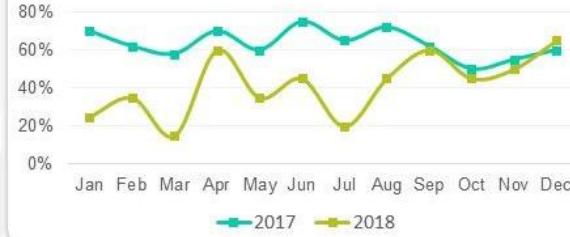
Tactical Dashboard

Revenue 2018



Gross profit margin | 2017 vs 2018

▲ **70.2% in 2018**
... Compared to 60% in 2017

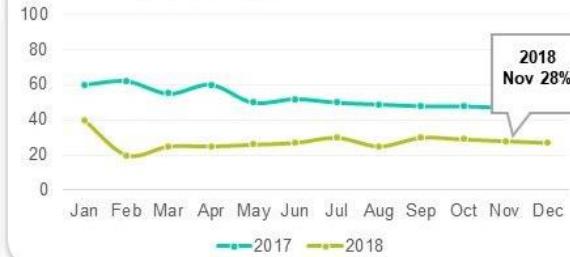


Dept-to-Equity

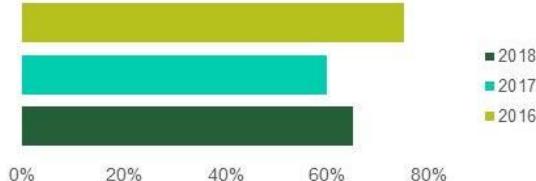


Net profit margin | 2018 vs 2017

▼ **14.8% in 2018**
... Compared to 46% in 2017

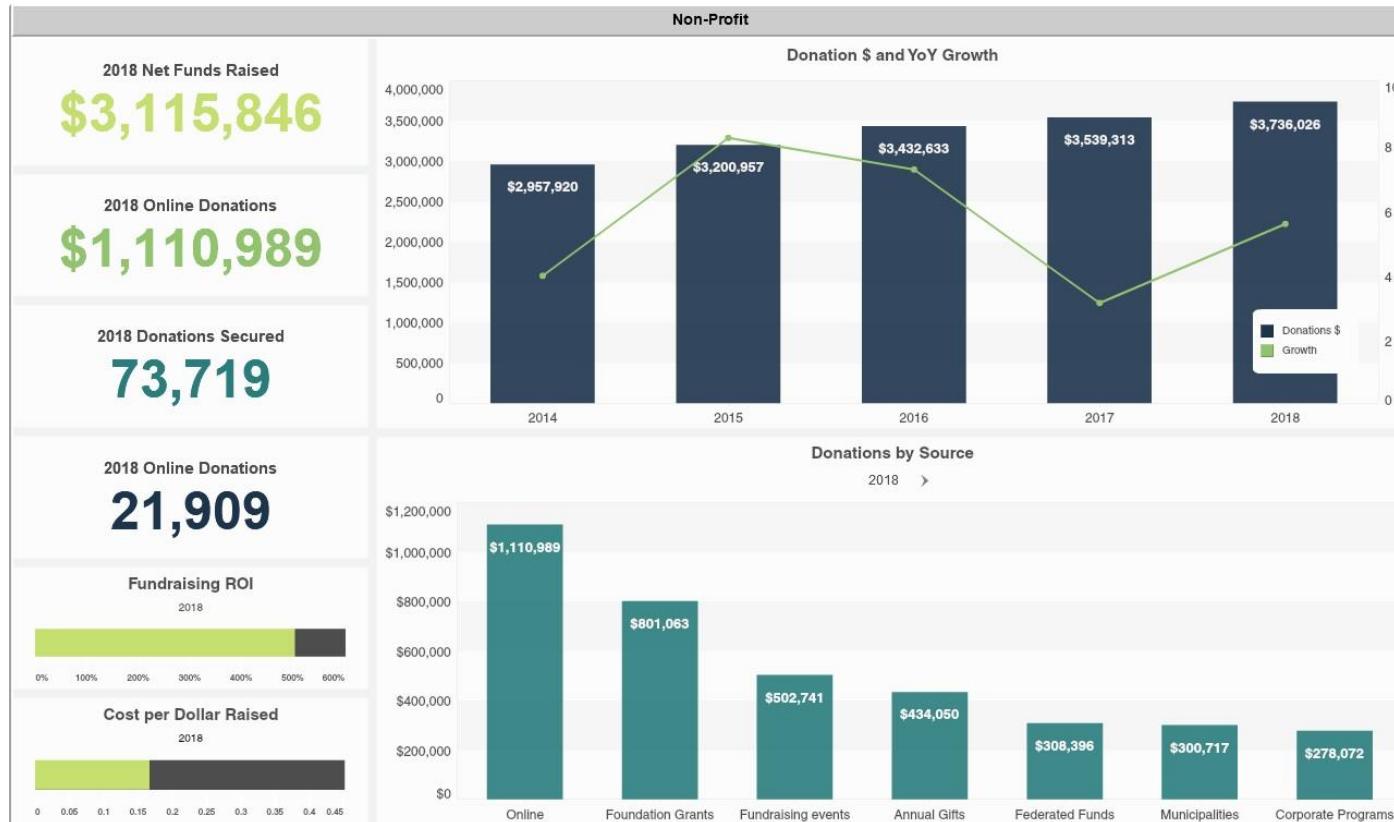


Return on Equity 2016-2018



This graph/chart is linked to excel, and changes automatically based on data. Just left click on it and select "Edit Data".

Strategic Dashboard



Data Visualization with Power BI Desktop



Power BI

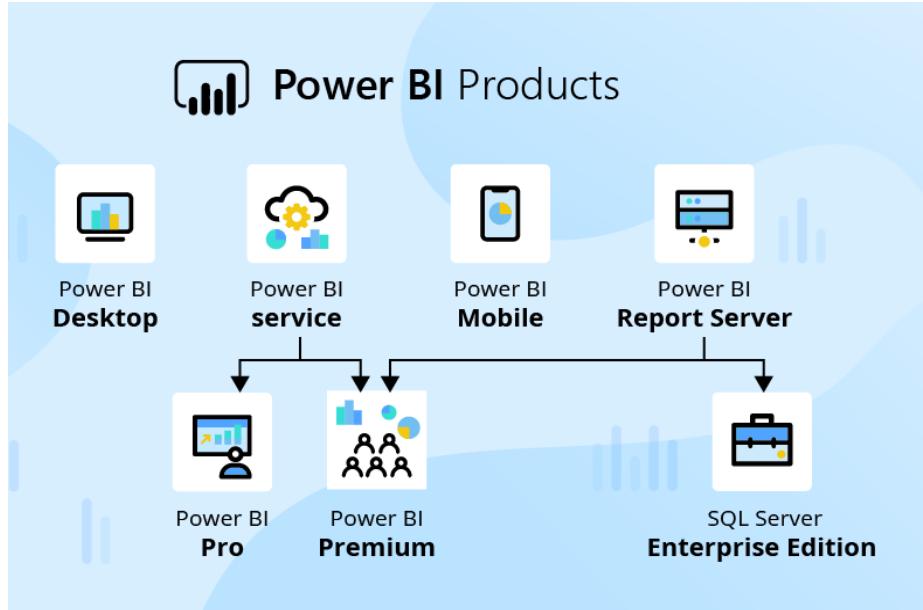
- Power BI เป็นหนึ่งในโปรแกรมตระกูล Microsoft ที่มีความสามารถในการจัดการข้อมูลเชิงวิเคราะห์ด้วยหลักการ Data Visualization กล่าวคือ การเปลี่ยนฐานข้อมูลให้อยู่ในรูปแบบของรายงานและกราฟต่างๆ ซึ่งเรียกว่า Report & Dashboard
- สามารถเชื่อมต่อแหล่งข้อมูลหลายๆ แหล่ง ให้เป็นข้อมูลเชิงลึกที่สอดคล้องกัน
- แสดงข้อมูล และโต้ตอบ รวมถึงสามารถแชร์ข้อมูลได้



Power BI

Power BI ประกอบด้วย

- แอปพลิเคชันสำหรับเครื่องเดสก์ท็อป Windows ที่เรียกว่า **Power BI Desktop**
- บริการ SaaS (Software as a Service) แบบออนไลน์ที่เรียกว่า **Power BI Service**
- แอปพลิเคชันสำหรับอุปกรณ์เคลื่อนที่ **Power BI Mobile** สำหรับอุปกรณ์ Windows, iOS และ Android



Power BI

ลำดับการใช้บริการของ Power BI

- **Power BI Desktop** เป็นเครื่องมือที่ทำหน้าที่สร้าง Report โดยเป็นโปรแกรมพรีไม่ต้องมี License หรือ Account ของ Microsoft
- ถ้าต้องการดู Report ออนไลน์บน Cloud ซึ่งก็คือ **Power BI Service** รวมทั้งการแชร์ให้กับบุคคลอื่น และดู Report & Dashboard ผ่าน Power BI Mobile จะต้องมี License



Power BI Desktop

- Power BI Desktop เป็นเครื่องมือในการจัดการกับข้อมูลทั้งจัดระเบียบ, คำนวณ, ปรับแต่งอัตโนมัติ และยังเป็นเครื่องมือในการสร้างรายงาน มีความสามารถในการรวมประสานข้อมูลจากหลายแหล่ง ทั้ง ฐานข้อมูล, ไฟล์ต่าง ๆ ทั้ง Excel, Text File และข้อมูลจากเว็บไซต์
- ลำดับการทำงานทั่วไปใน Power BI เริ่มจากการเชื่อมต่อกับแหล่งข้อมูล และ สร้างรายงานใน Power BI Desktop จากนั้นจึงเผยแพร่รายงานนั้นจาก Power BI Desktop ไปยัง Power BI Service และแชร์เพื่อให้ผู้อื่นที่ใช้บริการ ของ Power BI และอุปกรณ์เคลื่อนที่ สามารถดู และโต้ตอบกับรายงานได้



Power BI Desktop

Power BI Service

- Power BI Service เป็นบริการที่สามารถเข้ามาดู Report & Dashboard แบบออนไลน์ผ่านระบบ Internet จากที่ได้ก็ได้ แต่ต้องมี License ของ Microsoft โดยหลังจากที่สร้างรายงานและแดชบอร์ดแล้ว สามารถแชร์ให้เพื่อนร่วมงานที่ใช้บริการของ Power BI และอุปกรณ์เคลื่อนที่ สามารถดูและโต้ตอบได้ นอกจากนี้ยังสามารถสร้างพื้นที่ทำงานร่วมกับเพื่อนร่วมงาน บนรายงานและแดชบอร์ดได้



Power BI Mobile

- Power BI Mobile เป็นบริการที่สามารถเข้ามาดู Report & Dashboard ด้วยอุปกรณ์เคลื่อนที่สามารถติดต่อ埠ได้ สามารถใช้ได้ทั้งระบบปฏิบัติการ Windows, iOS และ Android โดยต้องใช้ Account ของ Microsoft ในการลงทะเบียนใช้งาน



Power BI

- Power BI จะมีสิทธิการใช้งานอยู่ 3 แบบ คือ

- Power BI Free
- Power BI Pro
- Power BI Premium

Power BI Pro	Power BI Premium
Per user	Per user
\$9.99 Per user/month	\$20 Per user/month ²
<p>License individual users with modern, self-service analytics to visualize data with live dashboards and reports, and share insights across your organization.</p> <ul style="list-style-type: none">• Power BI Pro is included in Microsoft 365 E5.	<p>License individual users to accelerate access to insights with advanced AI, unlock self-service prep for big data, and simplify data management and access at enterprise scale.</p> <ul style="list-style-type: none">• Includes all the features available with Power BI Pro.• Requires a Power BI Pro license for publishing content into Power BI Premium capacity.• Enable autoscale with your Azure subscription to automatically scale Power BI Premium capacity.

Power BI Free

- Power BI Free is included in all Office 365 Plans, and you can sign up for Power BI Free any time you like.
- This free version is surprisingly functional. It allows you to connect to hundreds of data sources (no limit/restriction other than the amount of data you pull in), clean and prepare your data, and build visualizations (no limit). All of the types of visualization options in Power BI Pro are available in Power BI free.

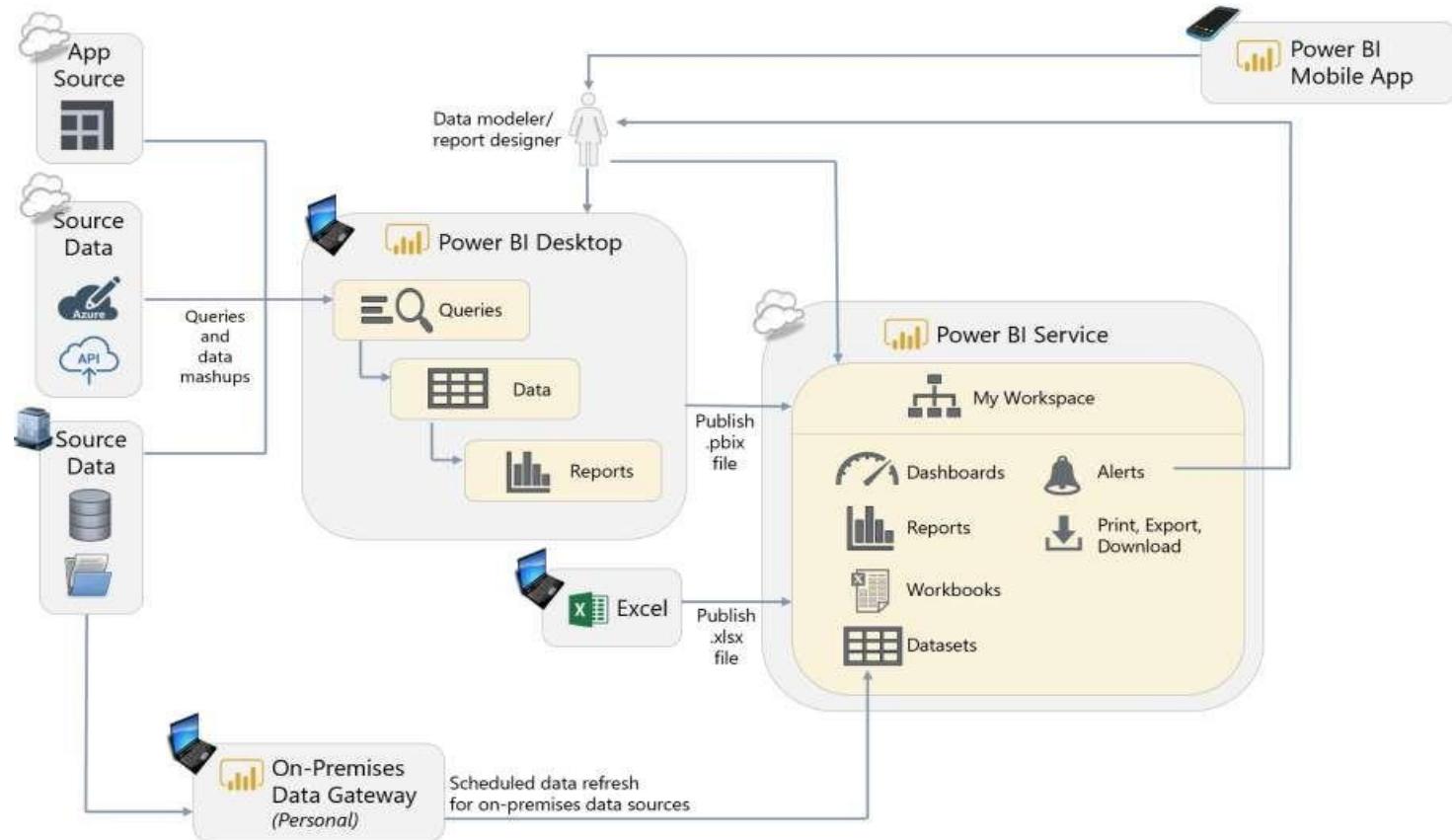
Power BI Pro

- On-Premise Data Gateways
- More Data Storage
- Better Data Refreshes
- Sharing and Collaboration

Power BI Premium

- Power BI Premium is not a type of user license. Think of it as an upgrade to your entire company's capabilities.
- Organizations with Power BI Premium have a super-powered server running their Power BI environment; this allows them to surpass some limits.

Personal Power BI

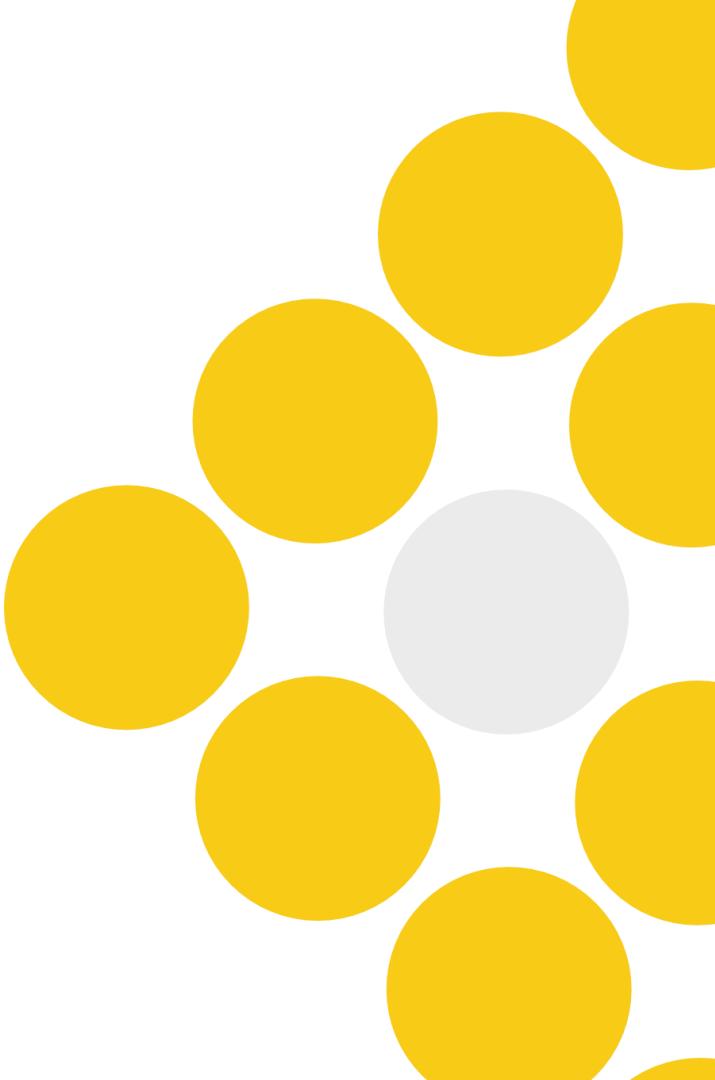
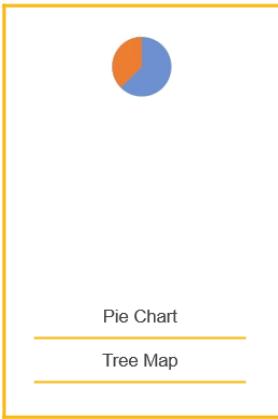


Workshop 1

1.Comparison



3.Composition



Workshop 1

- คลิก Get data > Excel > SuperStore.xlsx

The screenshot shows the Microsoft Power BI Navigator interface. On the left, the 'Home' tab is selected in the ribbon. Under 'Common data sources', the 'Excel workbook' option is highlighted with a red box. In the center, the 'Navigator' pane displays a tree view of the 'Sample - Superstore.xlsx' file, which contains three datasets: 'Orders', 'People', and 'Returns', all of which are checked. To the right, the 'Orders' dataset is previewed in a table format. The table has columns: Row ID, Order ID, Order Date, Ship Date, Customer ID, and Customer Name. The first few rows of data are visible. At the bottom right of the preview area, there are three buttons: 'Load' (highlighted with a red box), 'Transform Data', and 'Cancel'.

Row ID	Order ID	Order Date	Ship Date	Customer ID	Customer Name
1	CA-2016-152156	08/11/2016	11/11/2016	CG-12520	Claire
2	CA-2016-152156	08/11/2016	11/11/2016	CG-12520	Claire
3	CA-2016-138688	12/06/2016	16/06/2016	DV-13045	Darrin
4	US-2015-108966	11/10/2015	18/10/2015	SO-20335	Sean O.
5	US-2015-108966	11/10/2015	18/10/2015	SO-20335	Sean O.
21	CA-2014-143336	27/08/2014	01/09/2014	ZD-21925	Zuschu
22	CA-2016-137330	09/12/2016	13/12/2016	KB-16585	Ken Bla
23	CA-2016-137330	09/12/2016	13/12/2016	KB-16585	Ken Bla

Workshop 1

Visualizations > Data

Build visual

The screenshot shows the Power BI Data view. On the left, there's a sidebar with 'Visualizations' and 'Data' tabs. Under 'Data', there's a search bar and a list of data fields categorized by table. A red box highlights the 'People' and 'Returns' sections.

- Orders
 - Category
 - City
 - Customer ID
 - Customer Name
 - \sum Discount
 - Order Date
 - Order ID
 - \sum Postal Code
 - Product ID
 - Product Name
 - \sum Profit
 - \sum Quantity
 - Region
 - \sum Row ID
 - \sum Sales
 - Segment
 - Ship Date
 - State
 - Sub-Category
- People
 - Column1
 - Column2
- Returns
 - Column1
 - Column2

Values

Add data fields here

Drill through

Cross-report Off

Keep all filters On

Add drill-through fields here

- ในเมนู Home > คลิก Transform data



Transform
data

Workshop 1

เปลี่ยนชนิดของข้อมูลให้ถูกต้อง

The screenshot shows the Microsoft Power Query Editor interface. The ribbon at the top has tabs for File, Home, Transform, Add Column, View, Tools, and Help. The Home tab is selected. Below the ribbon is a toolbar with various icons for file operations like Close & Apply, New, Recent, Enter Data, Data source settings, Manage Parameters, Refresh Preview, Advanced Editor, and Manage. The main area displays a table with columns: Row ID, Order ID, Order Date, Ship Date, and Customer ID. A red box highlights the 'Data Type' dropdown in the ribbon, which is currently set to 'Text'. To the right of the table is a 'Query Settings' pane. It contains sections for 'PROPERTIES' (Name: Orders, All Properties) and 'APPLIED STEPS' (Source, Navigation, Promoted Headers, Changed Type). The 'Changed Type' step is highlighted with a grey background.

Row ID	Order ID	Order Date	Ship Date	Customer ID
1	CA-2016-152156	08/11/2016	11/11/2016	CG-12520
2	CA-2016-152156	08/11/2016	11/11/2016	CG-12520
3	CA-2016-138688	12/06/2016	16/06/2016	DV-13045
4	US-2015-108966	11/10/2015	18/10/2015	SO-20335
5	US-2015-108966	11/10/2015	18/10/2015	SO-20335
6	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
7	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
8	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
9	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
10	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
11	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
12	CA-2014-115812	09/06/2014	14/06/2014	BH-11710
13	CA-2017-114412	15/04/2017	20/04/2017	AA-10480

Workshop 1

Untitled - Power Query Editor

File Home Transform Add Column View Tools Help

Close & Apply New Source Recent Sources Enter Data Data source settings Manage Parameters Refresh Preview Advanced Editor Properties Manage Manage Sort A Z Z A Split Column Group By Replace Values Data Type: Text Use First Row as Headers

Queries [3]

Orders

People

Returns

= Table.TransformColumnTypes(People_Sheet,{{"Column1", type text}, {"Column2", type text}})

	Column1	Column2
1	Person	Region
2	Anna Andreadi	West
3	Chuck Magee	East
4	Kelly Williams	Central
5	Cassandra Brandow	South

Workshop 1: เปรียบเทียบยอดขายสินค้า

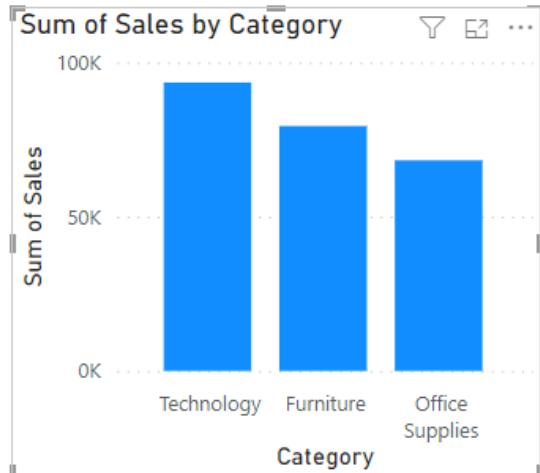
The screenshot shows a Power BI interface with a visualization on the left and a Data pane on the right.

Visualizations: A single bar chart titled "Sum of Sales" is displayed. The Y-axis is labeled "Sum of Sales" and has ticks at 0.0M, 0.1M, and 0.2M. The X-axis is labeled "Add data fields here". A single blue bar reaches approximately 0.2M on the Y-axis.

Data pane:

- Filters:** A section with icons for filters, build visual, and search.
- Visualizations:** A grid of icons representing different visualization types.
- X-axis:** A section labeled "Add data fields here".
- Y-axis:** A section labeled "Sum of Sales" with a dropdown arrow.
- Legend:** A section labeled "Add data fields here".
- Small multiples:** A section labeled "Add data fields here".
- Toolips:** A section labeled "Add data fields here".
- Data:** A list of fields under the "Orders" category:
 - Category
 - City
 - Customer ID
 - Customer Name
 - \sum Discount
 - Order Date (highlighted with a red circle containing the number 1)
 - Order ID
 - \sum Postal Code
 - Product ID
 - Product Name
 - \sum Profit
 - \sum Quantity
 - Region
 - \sum Row ID
 - \sum Sales (highlighted with a red circle containing the number 1)
 - Segment
 - Ship Date
 - State
 - Sub-Category

Workshop 1: เปรียบเทียบยอดขายสินค้า



Visualizations Data

Build visual

Filters

Search

Orders

Category

City

Customer ID

Customer Name

Σ Discount

Order Date

Order ID

Postal Code

Product ID

Product Name

Σ Profit

Σ Quantity

Region

Σ Row ID

Σ Sales

Segment

Ship Date

State

Sub-Category

2

X-axis: Category

Y-axis: Sum of Sales

Legend: Add data fields here

Small multiples: Add data fields here

Tooltips

The screenshot shows the Power BI 'Build visual' interface. On the left, a bar chart titled 'Sum of Sales by Category' displays sales for three categories: Technology (~90K), Furniture (~80K), and Office Supplies (~60K). On the right, the 'Data' pane lists various dimensions and measures from the 'Orders' table. A red arrow points from the 'Category' field in the 'X-axis' section of the visualization pane to the 'Category' field in the 'Data' pane, which has a yellow circle with the number '2' over it, indicating a relationship or step in the process.

241.13K

Sum of Sales

241.13

Average of Sales

8.16K

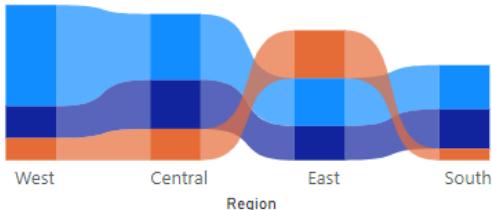
Max of Sales

1.08

Min of Sales

Sum of Sales by Region and Segment

Segment ● Consumer ● Corporate ● Home Office



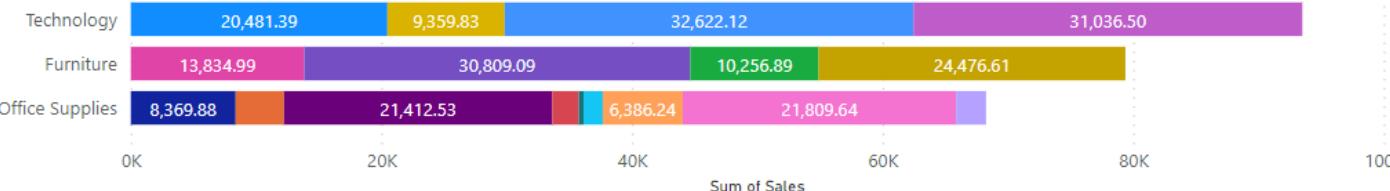
Sum of Sales and Sum of Quantity by Month

● Sum of Sales ● Sum of Quantity

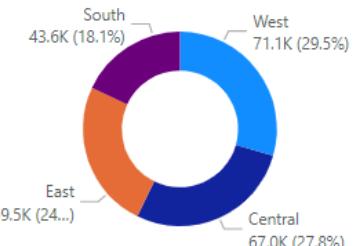


Sum of Sales by Category and Sub-Category

● Accessories ● Appliances ● Art ● Binders ● Bookcases ● Chairs ● Copiers ● Envelopes ● Fasteners ● Furnishings ● Labels ● Machines ● Paper ● Phones ● Storage ● Supplies ● Tables



Sum of Sales by Region



Sum of Sales and Sum of Profit by Year and Month

● Sum of Sales ● Sum of Profit



	Calculated Column	Measure
การทำงานกับข้อมูล	แคลคูล่าในตาราง (Current Row)	ตารางข้อมูลและคอลัมน์ (Table or Column as Aggregate)
ค่าที่จัดเก็บในตาราง	ค่าที่ได้จากการประมวลผลในคอลัมน์	สูตร (ไม่เก็บผลลัพธ์)
การ Filter ข้อมูล	ได้	ไม่ได้
การประมวลผล	เมื่อเข้าถึงข้อมูลและคอลัมน์	เมื่อต้องการแสดงค่า
การประมวลผลใหม่	เมื่อสูตรที่ใช้มีการเปลี่ยนแปลง และเรียกใช้คอลัมน์	มีการเรียกใช้สูตรมาแสดงข้อมูล
ประสิทธิภาพ	สูง - ประมวลผลครั้งแรก ในครั้งต่อ ๆ ไป เมื่อเรียกคอลัมน์มาแสดงผล จะแสดงค่าได้เร็ว	ต่ำ - ประมวลผลทุกครั้งที่มีการเรียกข้อมูลมาแสดงผล
รูปแบบของข้อมูลที่เหมาะสม	<ul style="list-style-type: none"> ■ ข้อมูลปริมาณมาก ■ ข้อมูลไม่มีการเปลี่ยนแปลงบ่อย ๆ ■ การหาค่าเฉลี่ยแบบ (Row) 	<ul style="list-style-type: none"> ■ ข้อมูลปริมาณน้อย ■ ข้อมูลที่มีการเปลี่ยนแปลงบ่อย ๆ หรือการแสดงผลแบบเรียลไทม์ ■ การหาค่าแบบผลรวม (Aggregate)

Workshop 1: Measure

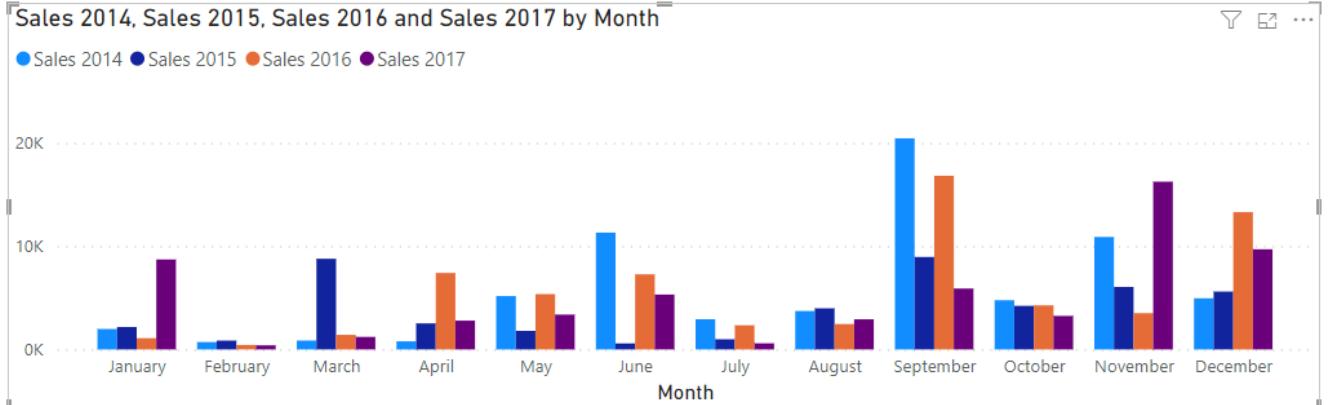
- คลิกขวาที่ตาราง Orders เลือก New measure
- สร้าง Measure ด้วยกัน 4 ตัว ดังนี้

```
Sales 2014 = CALCULATE(SUM(Orders[Sales]), FILTER(Orders, Orders[Order Date].[Year]=2014))
```

```
Sales 2015 = CALCULATE(SUM(Orders[Sales]), FILTER(Orders, Orders[Order Date].[Year]=2015))
```

```
Sales 2016 = CALCULATE(SUM(Orders[Sales]), FILTER(Orders, Orders[Order Date].[Year]=2016))
```

```
Sales 2017 = CALCULATE(SUM(Orders[Sales]), FILTER(Orders, Orders[Order Date].[Year]=2017))
```



Visualizations Data

Build visual

Filters

Orders

- AvgSalesAmt
- Category
- City
- Country
- Customer ID
- Customer Name
- Discount
- LastOrderDate
- Order Date
- Date Hierarchy
- Year
- Quarter
- Month
- Day
- Order ID
- OrderCount
- Postal Code
- Product ID
- Product ID (clusters)
- Product Name
- Profit
- Quantity
- Region
- Row ID
- Sales
- Sales 2014
- Sales 2015
- Sales 2016
- Sales 2017

X-axis

Order Date

Month

Y-axis

Sales 2014

Sales 2015

Sales 2016

Sales 2017

Legend

Add data fields here

Small multiples

Add data fields here

Tooltips

Add data fields here

Drill through

Cross-report

Keep all filters

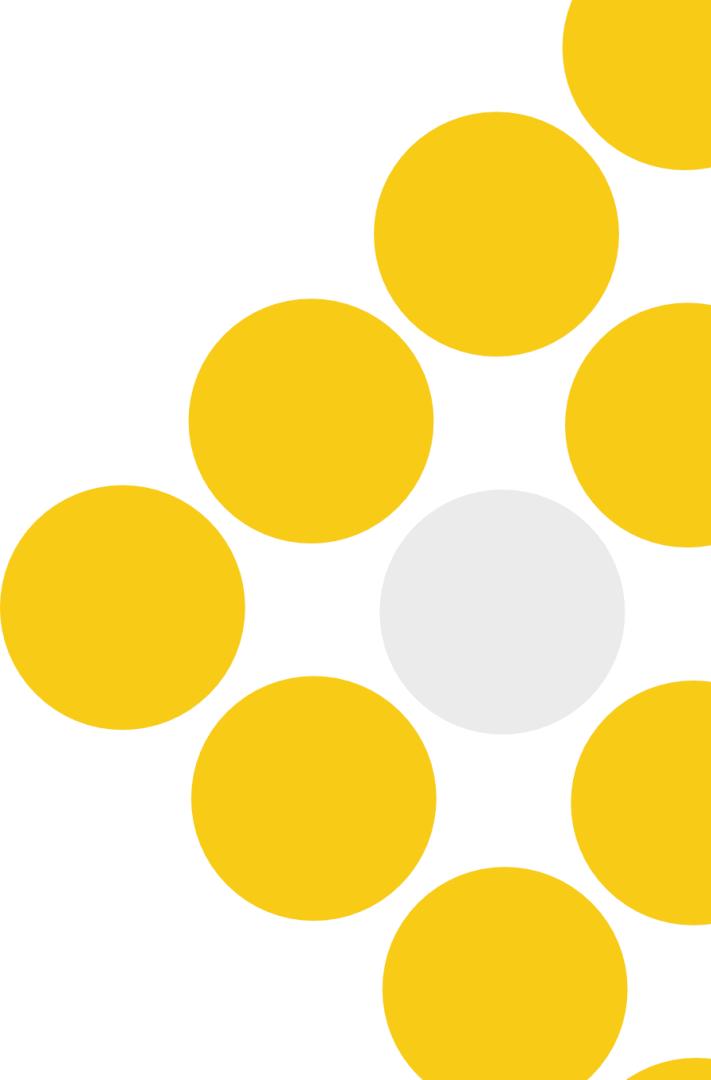
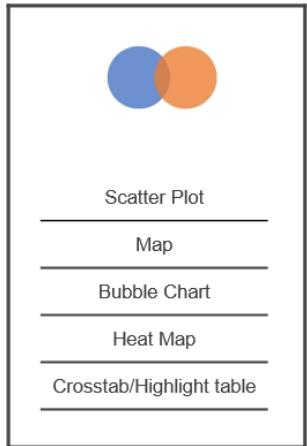
- ที่หน้าต่าง Visualizations คลิกเลือก Clustered Column Chart

ที่ Fields Tool

- Axis > เลือกฟิลด์ Date (Date Hierarchy)
- Values > เลือกฟิลด์ Sale2014, Sale2015, Sale2016 และ Sale 2017

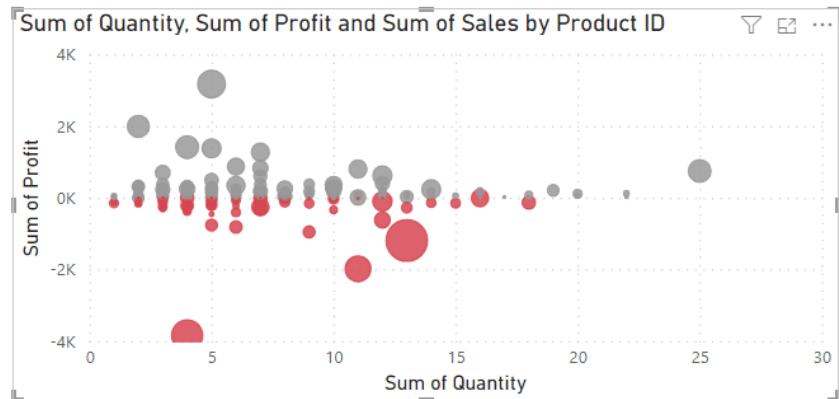
Workshop 2

2.Relationship



Workshop 2 :

แสดงความสัมพันธ์ระหว่างกำไรและจำนวนสินค้าที่ขายได้ของสินค้าแต่ละตัว เพื่อวิเคราะห์ความสามารถในการสร้างผลกำไรของผลิตภัณฑ์ (Product Profitability Analysis)



Visualizations

Build visual

Filters

Data

Search

Orders

- AvgSalesAmt
- Category
- City
- Country
- Customer ID
- Customer Name
- Discount
- LastOrderDate

Order Date

- Order ID
- OrderCount
- Postal Code
- Product ID
- Product ID (clusters)
- Product Name
- Profit
- Quantity
- Region
- Row ID
- Sales

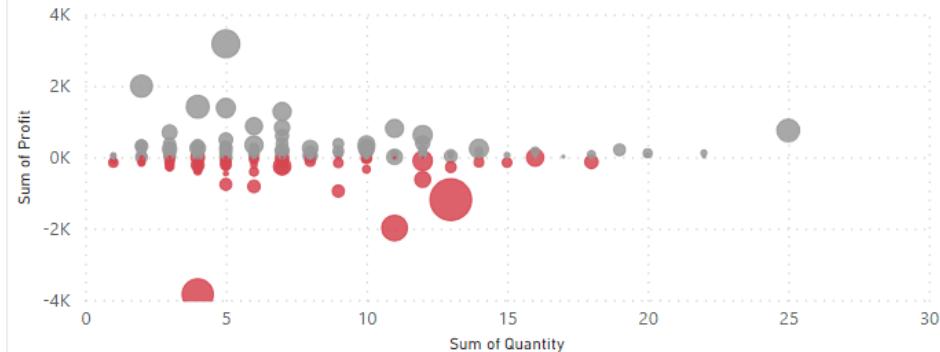
Sales 2014

Sales 2015

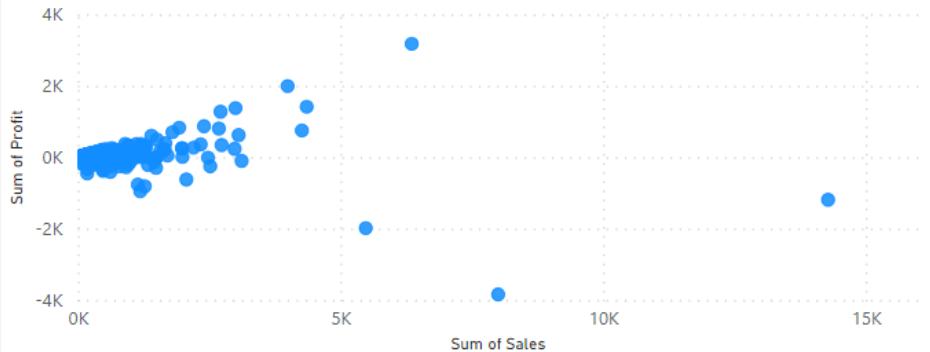
Sales 2016

Sales 2017

Sum of Quantity, Sum of Profit and Sum of Sales by Product ID

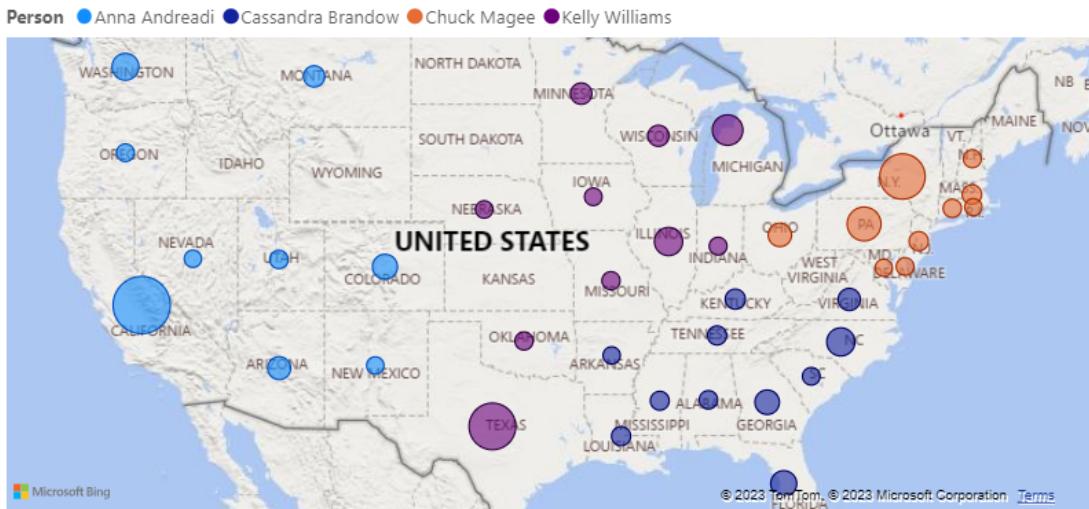


Sum of Sales and Sum of Profit by Product ID



Sub-Category	Central	East	South	West	Total
Accessories	4,375.45	2,901.49	3,104.85	10,099.61	20,481.39
Appliances	3,782.60	1,640.42	1,783.94	1,162.92	8,369.88
Art	565.00	1,496.27	364.36	1,432.45	3,858.08
Binders	1,115.33	8,066.63	9,993.17	2,237.40	21,412.53
Bookcases	3,212.85	8,201.54	261.96	2,158.64	13,834.99
Chairs	9,601.26	6,020.01	7,447.01	7,740.82	30,809.09
Copiers				9,359.83	9,359.83
Envelopes	348.07	1,080.08	590.51	90.67	2,109.33
Fasteners	98.11	183.36	10.74	89.44	381.66
Furnishings	1,650.85	4,012.20	1,069.34	3,524.51	10,256.89
Labels	287.67	507.61	586.08	152.97	1,534.34
Machines	18,144.36	6,212.30	8,265.46		32,622.12
Paper	1,113.12	2,341.60	535.07	2,396.45	6,386.24
Phones	11,453.34	4,761.17	4,507.86	10,314.13	31,036.50
Storage	6,387.31	7,019.56	1,275.72	7,127.04	21,809.64
Supplies	246.53	809.26	1,007.06	328.80	2,391.65
Tables	4,628.00	4,238.14	2,760.83	12,849.64	24,476.61
Total	67,009.85	59,491.64	43,563.96	71,065.32	241,130.77

Sum of Sales by State and Person

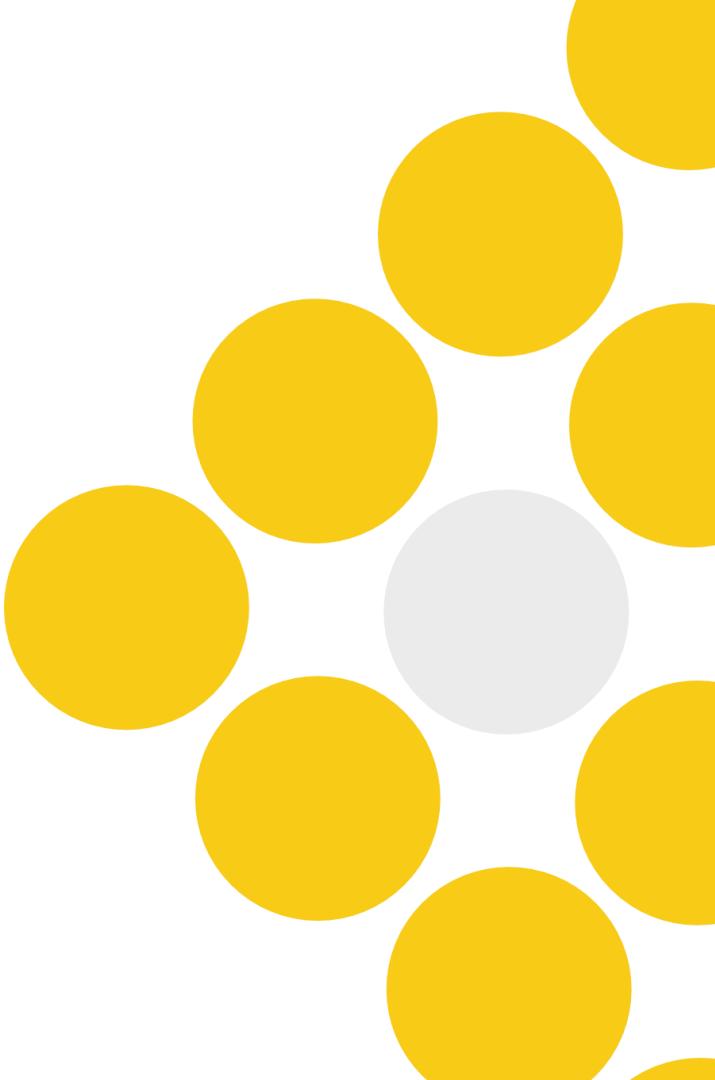


Microsoft Bing

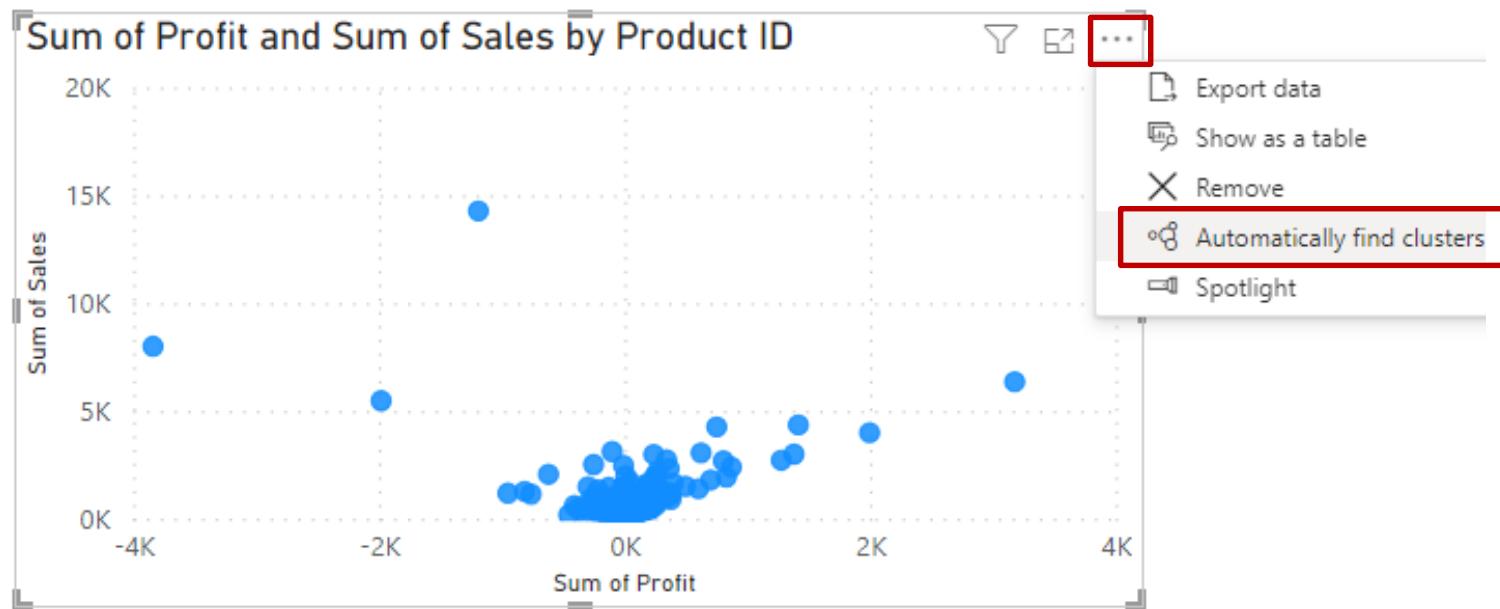
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Workshop 3

- Clustering



Workshop 3-1



Workshop 3-1

Clusters

Name *

Product ID (clusters)

Field

Product ID

Description

Clusters for Product ID

Number of clusters

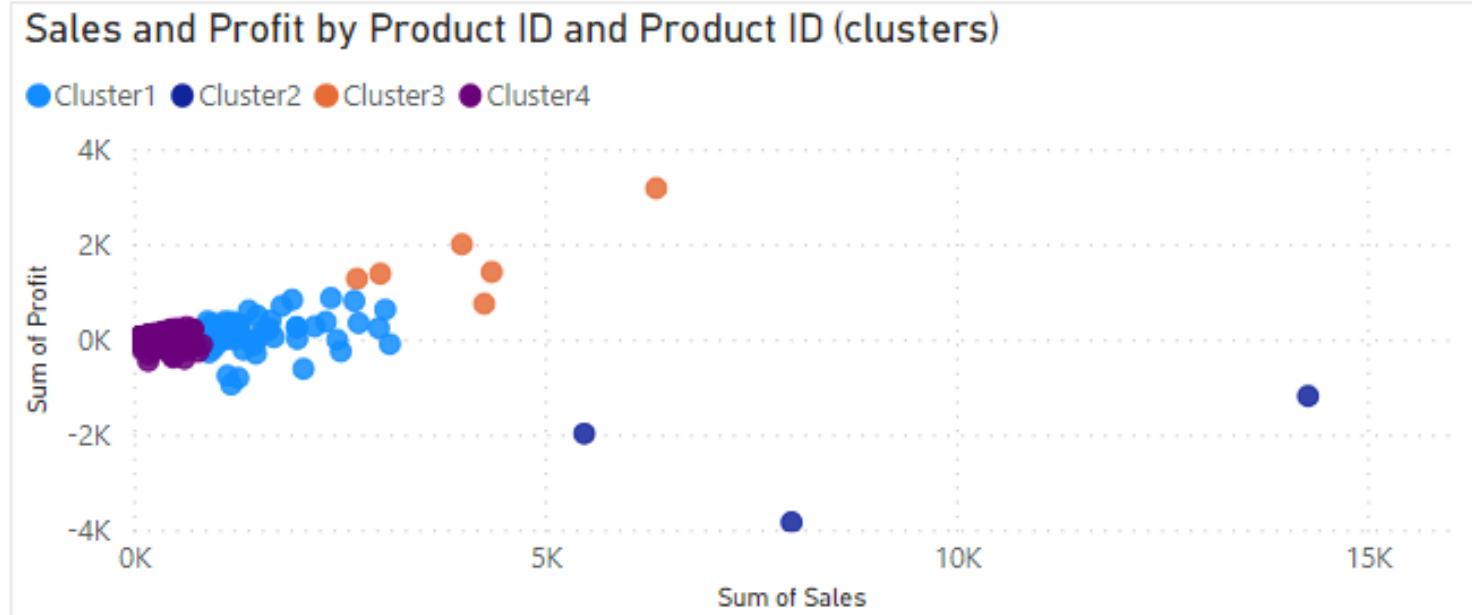
Auto

กำหนดจำนวนกลุ่มที่ต้องการ

OK Cancel

Workshop 3-1

- จะได้ผลลัพธ์ของการจัดกลุ่ม



Workshop 3-2: จัดกลุ่มลูกค้า

- คลิกขวาที่ตาราง Orders เลือก New measure
- สร้าง Measure ด้วยกัน 4 ตัว ดังนี้

TotalSalesAmt = SUM(Orders[Sales])

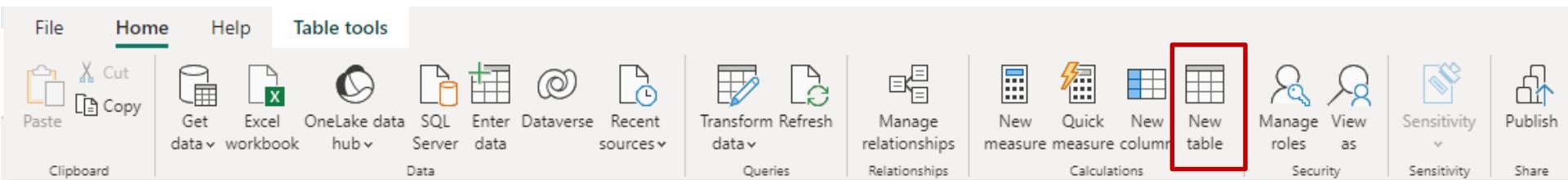
OrderCount = COUNTROWS(Orders)

LastOrderDate = MAX(Orders[Order Date])

AvgSalesAmt = DIVIDE([TotalSalesAmt], Orders[OrderCount])

Workshop 3-2: สร้างตาราง Customer

- เลือกเมนูมอง Data > คลิก New table



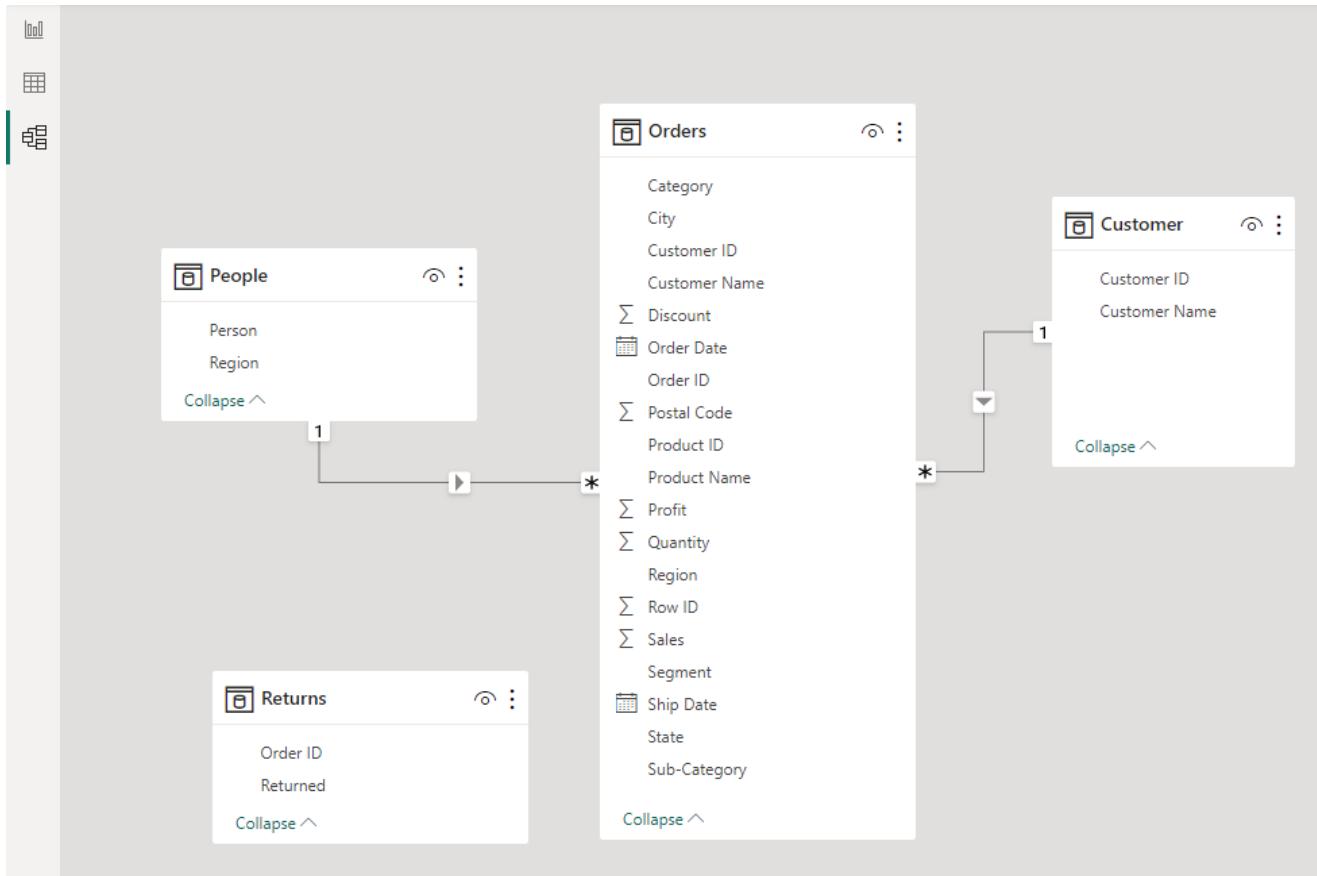
Row ID	Order ID	Order Date	Ship Date	Customer ID	Customer Name	Segment	City	State	Postal Code
3	CA-2016-138688	Sunday, June 12, 2016	Thursday, June 16, 2016	DV-13045	Darrin Van Huff	Corporate	Los Angeles	California	90036
6	CA-2014-115812	Monday, June 9, 2014	Saturday, June 14, 2014	BH-11710	Brosina Hoffman	Consumer	Los Angeles	California	90032
7	CA-2014-115812	Monday, June 9, 2014	Saturday, June 14, 2014	BH-11710	Brosina Hoffman	Consumer	Los Angeles	California	90032

- เขียน DAX เพื่อสร้างตาราง ดังนี้

```
Customer = all(orders[customer ID], Orders[Customer Name])
```

Workshop 3-2: New table

- สร้าง Relationship



Workshop 3-2: Calculated Column

- คลิกขวาที่ตาราง Customer เลือก New column
- เขียน DAX เพื่อสร้าง column ด้วยกัน 4 ตัว ดังนี้

```
CustLastOrderDate = [LastOrderDate]
```

```
CustOrderCount = [OrderCount]
```

```
CustTotalSalesAmt = [TotalSalesAmt]
```

```
CustAvgSalesAmt = [AvgSalesAmt]
```

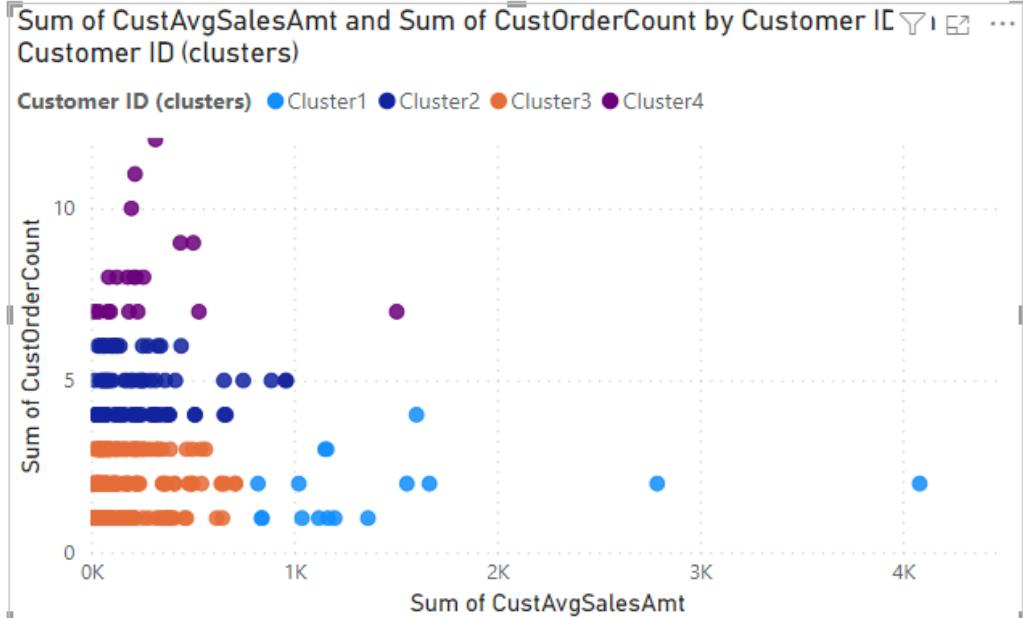
The screenshot shows the Power BI Data View interface. At the top, there is a formula bar with the following code:

```
Customer = all(orders[customer ID], Orders[Customer Name])
```

Below the formula bar is a table with the following data:

Customer ID	Customer Name	CustLastOrderDate	CustOrderCount	CustTotalSalesAmt	CustAvgSalesAmt
BH-11710	Brosina Hoffman	6/9/2014	7	3714.304	530.614857142857
RA-19885	Ruben Ausman	11/5/2017	2	237.87	118.935
KM-16720	Kunst Miller	11/24/2015	4	266.294	66.5735
DN-13690	Duane Noonan	10/12/2014	2	36.29	18.145

Workshop 3-2



Visualizations

Build visual

Filters

Customer

- Σ CustAvgSalesAmt
- Σ CustLastOrderDate
- Customer ID
- Customer ID (clusters)
- Customer Name
- CustOrderCount
- CustTotalSalesAmt

Orders

- AvgSalesAmt
- Category
- Country
- Customer ID
- Customer Name
- Σ Discount
- LastOrderDate

Data

Search

Values

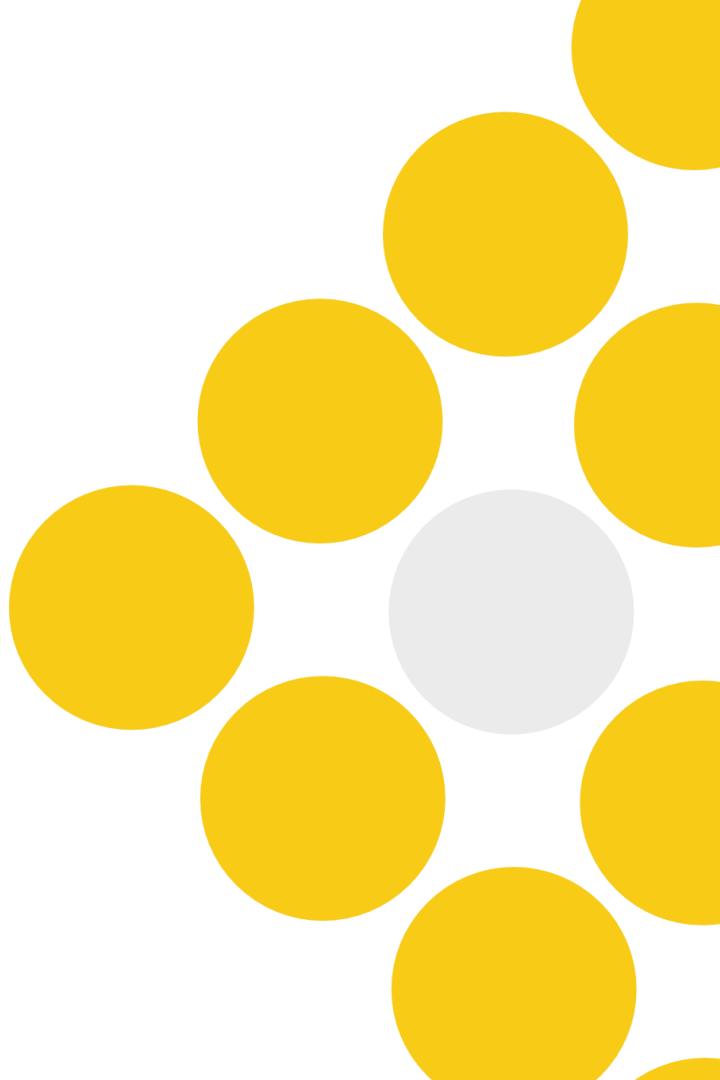
X Axis

Y Axis

Legend

Workshop 4

- การตรวจจับข้อมูลที่ผิดปกติ
(Analytics Anomaly Detection)



Workshop 4:

Anomaly Detection เป็นเครื่องมือในการตรวจจับข้อมูลที่ผิดปกติ

ข้อดี

- มีคำอธิบายสำหรับสิ่งผิดปกติ เพื่อช่วยในการวิเคราะห์สาเหตุที่แท้จริง

ข้อจำกัด

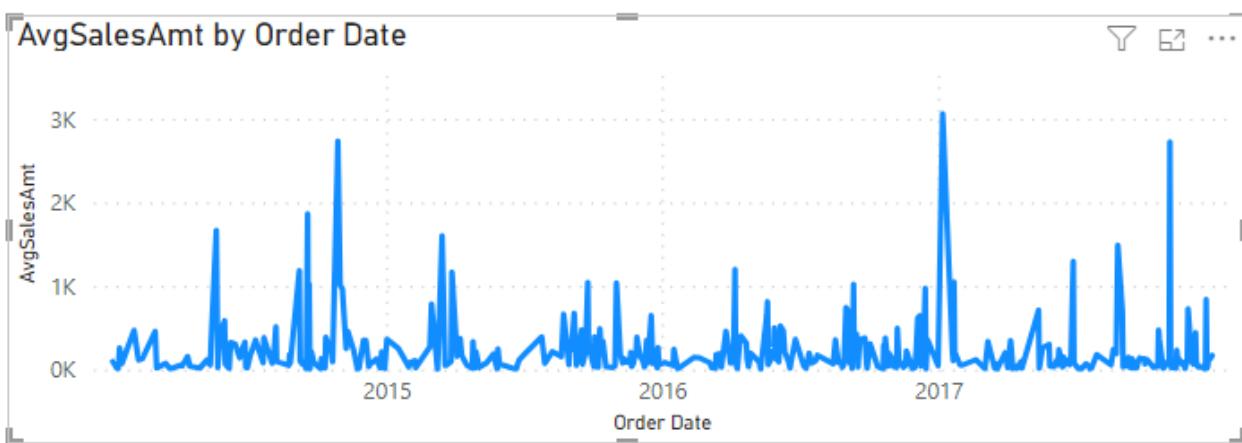
- รองรับการตรวจหาสิ่งผิดปกติสำหรับ Line Chart ที่มีข้อมูลอนุกรมเวลาในเขตข้อมูลแกนเท่านั้น
- ไม่รองรับการตรวจหาสิ่งผิดปกติที่มีคำอธิบายแผนภูมิ ค่าหลายค่า หรือค่ารองใน Line Chart
- การตรวจหาสิ่งผิดปกติต้องการจุดข้อมูลอย่างน้อย 12 จุดขึ้นไป
- เส้นพยากรณ์/ต่อสุด/สูงสุด/เฉลี่ย/มัธยฐาน/เปอร์เซ็นต์ไทล์ ใช้ไม่ได้กับการตรวจหาสิ่งผิดปกติ
- ไม่รองรับ Direct Query ผ่านแหล่งข้อมูล SAP, Power BI Report Server, การเชื่อมต่อแบบ Live Connection ไปยัง Azure Analysis Services และ SQL Server Analysis Services
- ไม่รองรับการเจาะลึกเพื่อไปยังระดับถัดไปในลำดับชั้น (Hierarchy)

Workshop 4:

- ที่หน้าต่าง Visualizations คลิกเลือก Line chart

ที่ Fields Tool

- X-Axis > เลือก Order Date จากตาราง Orders
- Y-Axis > เลือก AvgSalesAmt จากตาราง Orders



X-axis

Order Date

Y-axis

AvgSalesAmt

Secondary y-axis

Add data fields here

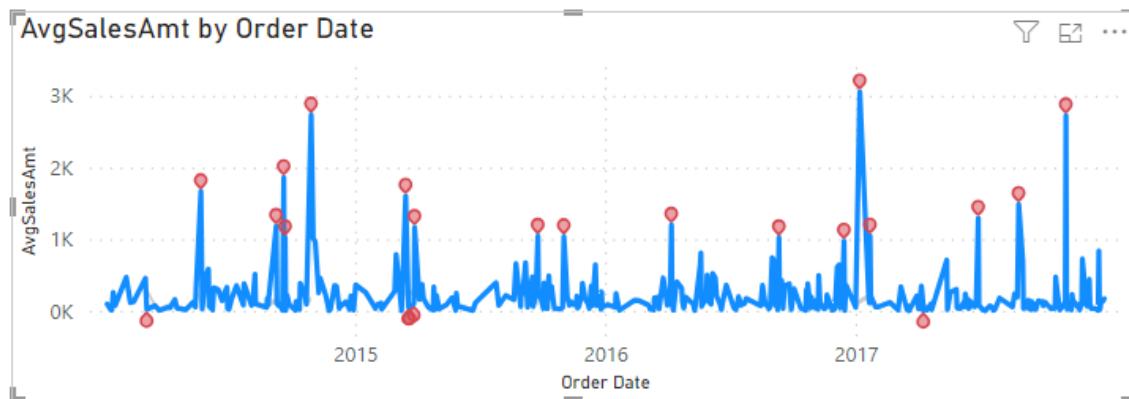
Legend

Add data fields here

Workshop 4:

ที่ Analytic Tool

- เลือกเปิด (On) เมนู Find anomalies



Visualizations >>

Analytics

Search

Find anomalies

Options

Sensitivity: 75 %

Explain by: +Add data

Anomaly

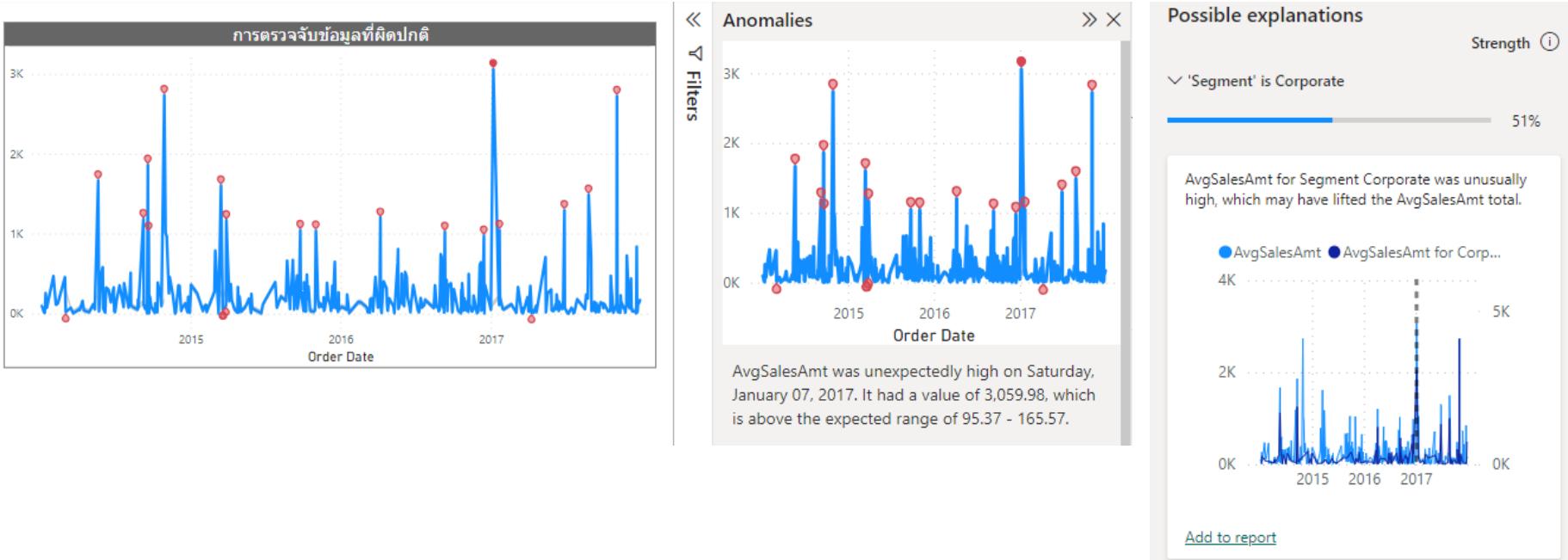
Color: Red

Marker: Circle

Size: 3

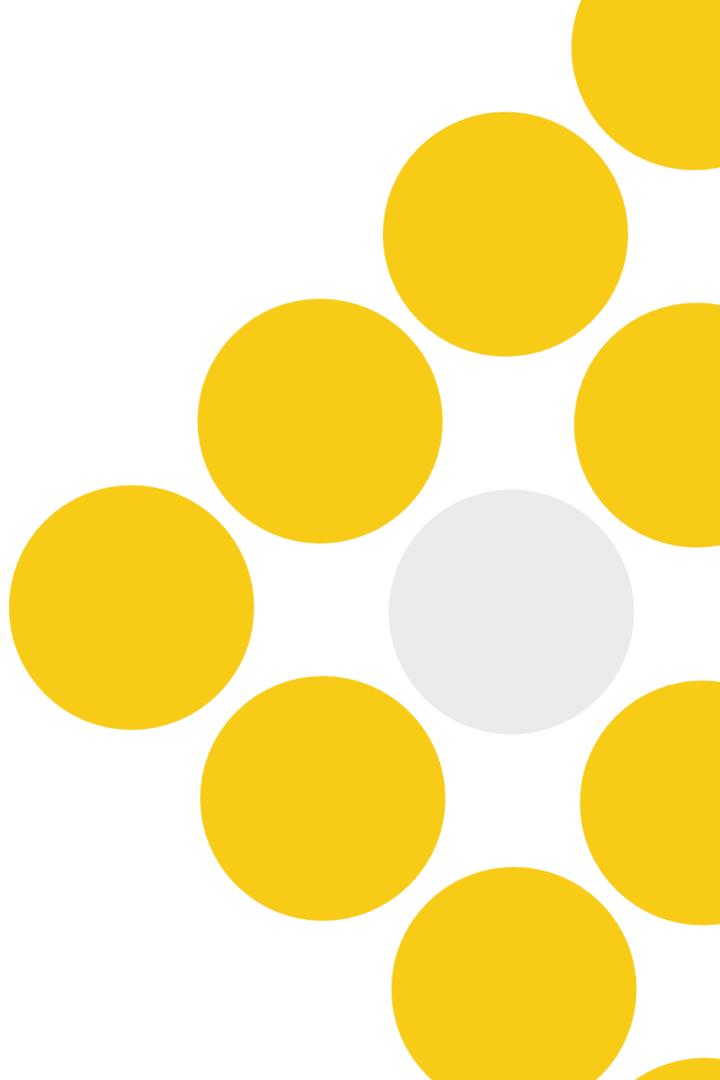
Workshop 4:

- เมื่อคลิกที่เครื่องหมาย Anomaly detection จะปรากฏหน้าต่างที่อธิบายสิ่งผิดปกติของข้อมูล
- ถ้าสามารถตรวจสอบปัจจัยที่เกี่ยวข้องกับสิ่งผิดปกติได้ จะแสดงผลอยู่ในส่วนของ Possible explanations

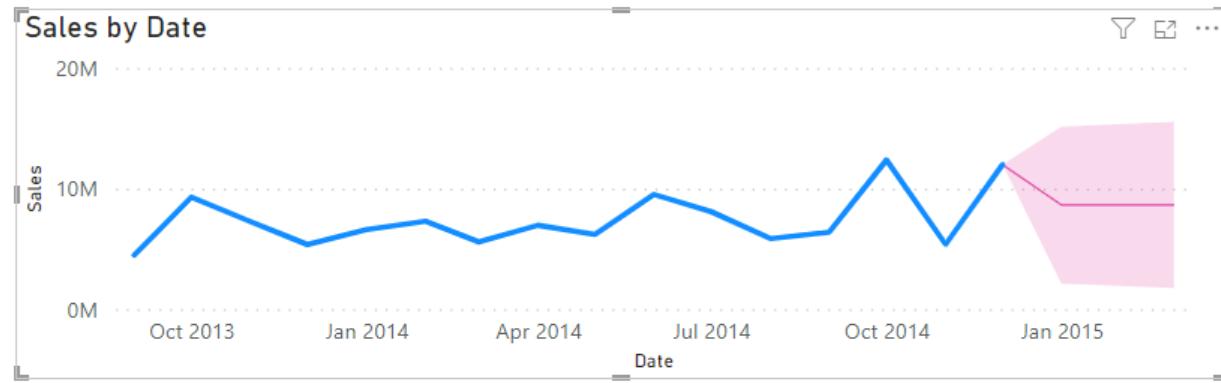


Workshop 5

- การพยากรณ์ข้อมูลเบื้องต้น
(Forecasting)



Workshop 5



Forecast

Options

Units: Months

Forecast length: 3

Ignore the last: 0

Seasonality: Auto Points

Confidence interval: 99%

Apply

Forecast line

Color: Magenta

Style: Solid

Transparency: 80 %

Confidence band

Style: Fill

- ที่หน้าต่าง Visualizations คลิกเลือก Line chart

ที่ Fields Tool

- X-Axis > เลือก Date
- Y-Axis > เลือก Sales