

Power BI Advanced Data Visualization and Storytelling

September 2020 release

Prerequisites and Setup Steps

Internet connectivity: You must be connected to the internet

- At minimum, a computer with 2-cores and 4GB RAM running Windows 8 / Windows Server 2008 R2 or later
- Microsoft Power BI Desktop requires Internet Explorer 10 or greater
- Verify if you have 32bit or 64bit operating system to decide if you need to install the 32bit or 64bit applications.
 - Search for computer on your PC, right click properties for your computer
 - You will be able to identify if your operating system is 64 or 32 bit based on "system type" as shown below

Download and install Power BI Desktop: Download and install Microsoft Power BI Desktop from <http://www.microsoft.com/en-us/download/details.aspx?id=45331>. Optionally, you can also install the Power BI Desktop tool from the **Power BI Desktop Install** folder on the flash drive that will be provided on the day of the session. Please choose appropriate 64-bit or 32-bit version depending on your platform. Microsoft Power BI Desktop is available for 32-bit (x86) and 64-bit (x64) platforms

Download Class Files:

https://aka.ms/PBI-adv_vis_Inst

NOTE: This lab is using real anonymized data and is provided by ObviEnce LLC. Visit their site to learn about their services: www.obvience.com. This data is property of ObviEnce LLC and has been shared for the purpose of demonstrating PowerBI functionality with industry sample data. Any uses of this data must include this attribution to ObviEnce LLC.

Following the training

Please fill our survey:

<https://aka.ms/PBIAdvanced>

Select: Advanced Data

Visualization

Agenda (times are approximate and will be fluid with the class)

09:00 AM – 09:30 AM – What is Storytelling with Data

09:30 AM – 10:00 AM – Science Behind Data Visualization

10:00 AM – 10:15 AM – Process Behind Data Visualization

10:15 AM – 11:15 AM – Dashboard and Reports

11:15 AM – 12:00 PM – Lab 01 - 04

12:00 – 12:30 – Break

12:30 PM – 01:00 PM – Custom Visuals

01:00 PM – 01:45 PM – Polishing and Formatting

01:45 PM – 03:00 PM – Lab 05 – 10

03:00 PM – 03:30 PM – Report Authoring – Best Practices

03:30 PM – 04:00 PM – Dashboard Design

COURSE OBJECTIVES

By the end of this course, you gain a better understanding of Storytelling with Data. Specifically you will be able to:

- Understand the need for storytelling with data
- Understand the agile process to creating Power BI data visualizations
- Understand the art behind visualizations
- Gain familiarity with Power BI report layouts and structure
- Understand implications behind choosing the right charts
- Gain familiarity over the use of Power BI custom visuals

Power BI

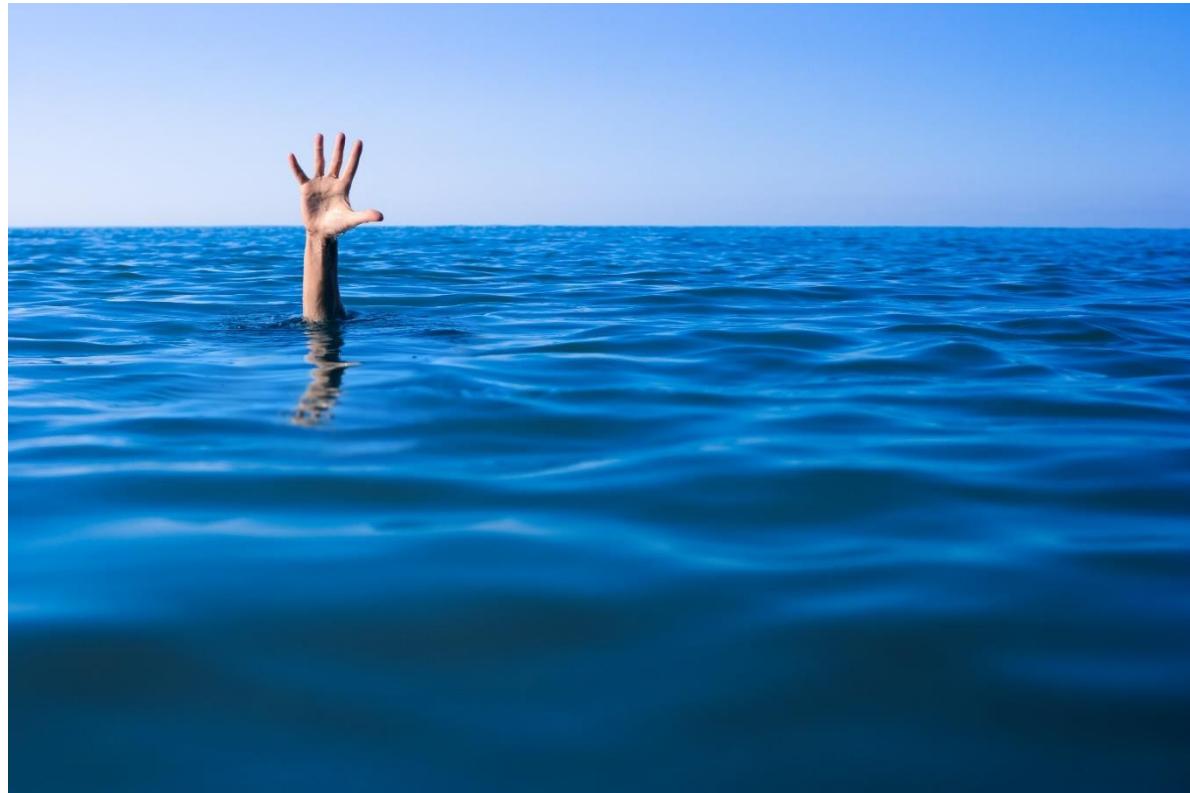
Data Visualization in a Day

What is Story Telling with Data

What is Story Telling with Data

Today's world is filled with Data

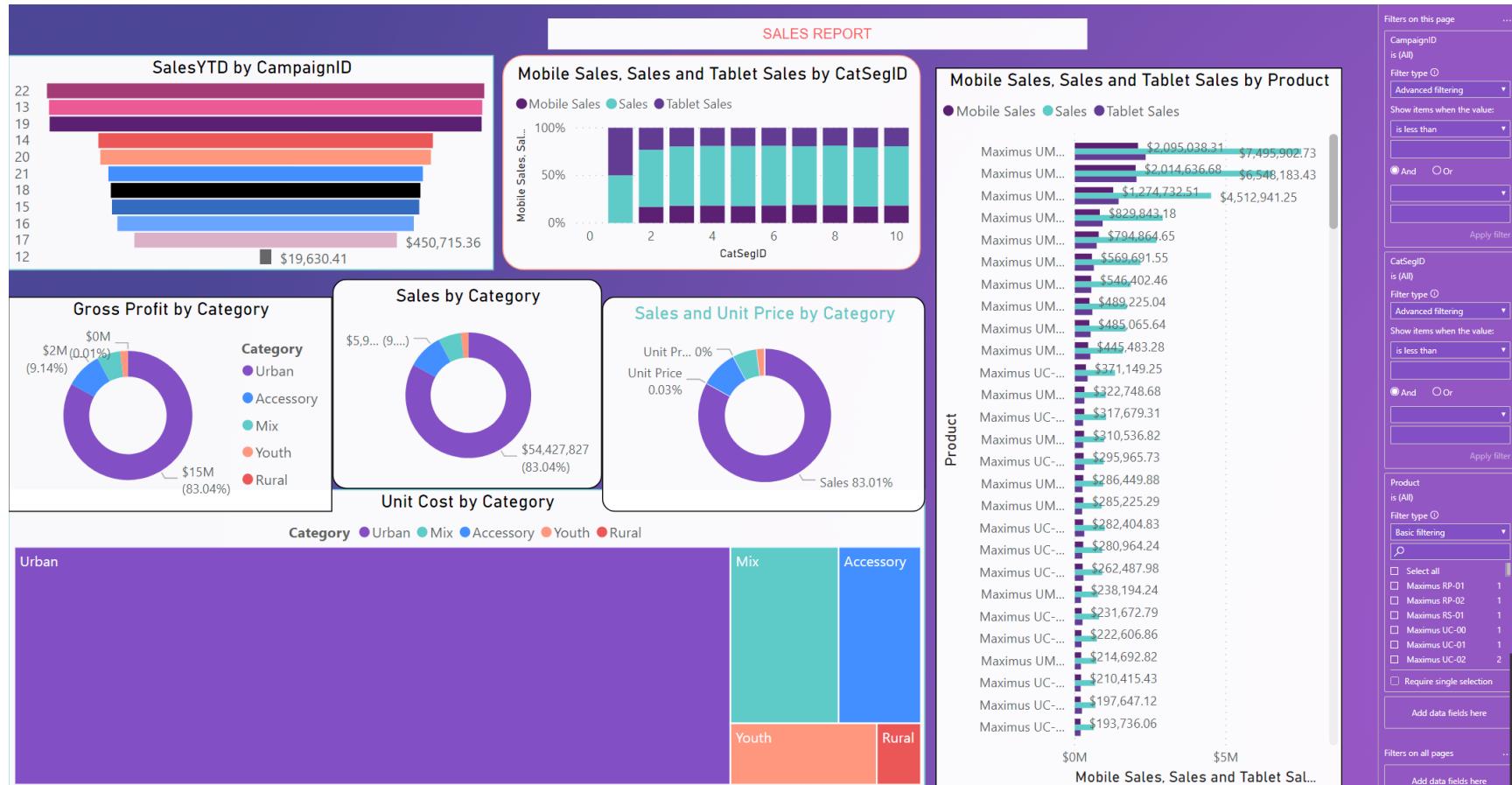
- Volume
- Velocity
- Variety



We are drowning in data!!

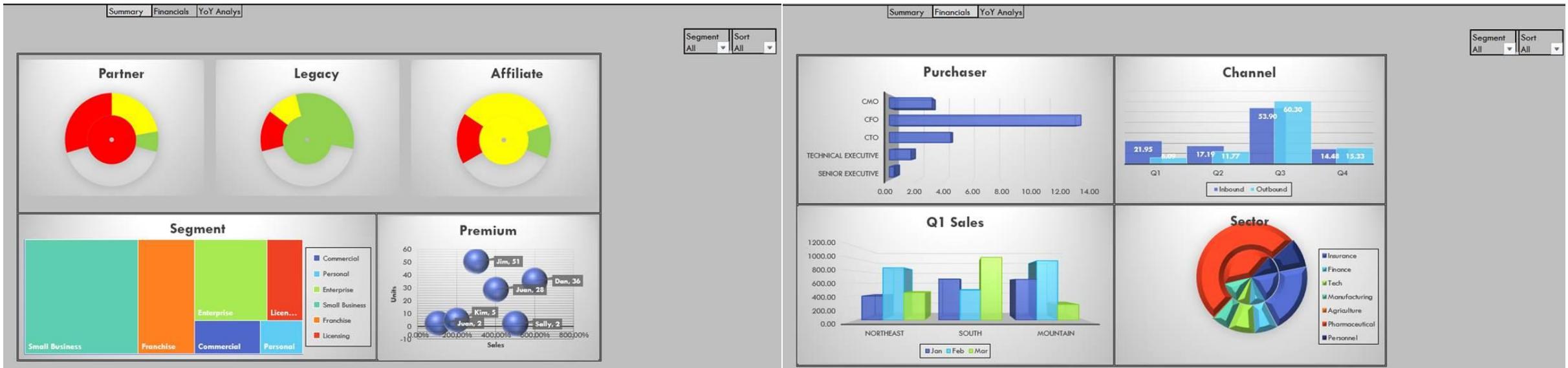
What is Story Telling with Data

We see reports everyday that share a common problem



What is Story Telling with Data

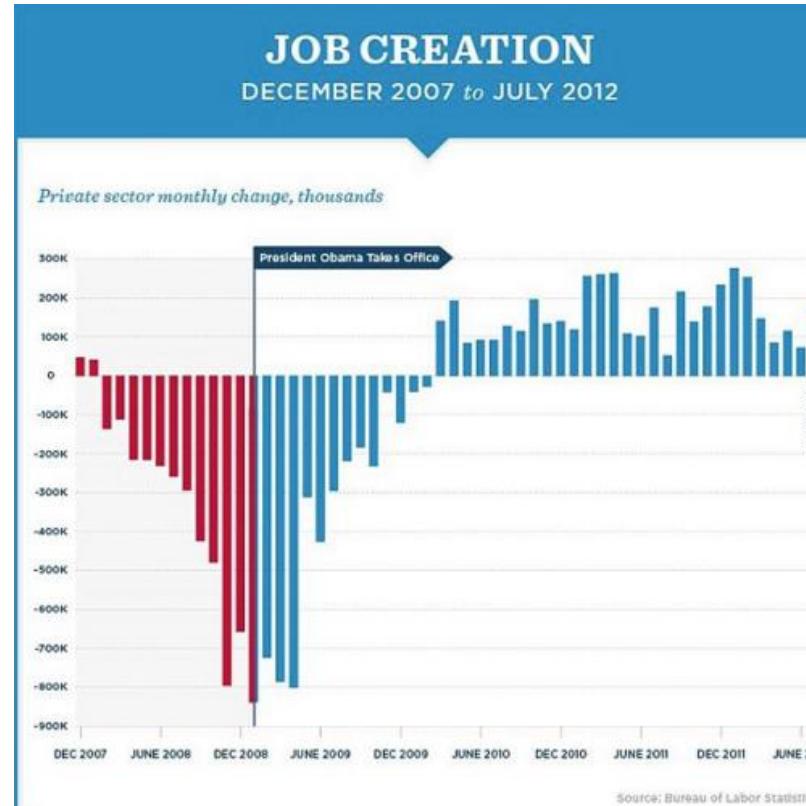
We see reports everyday that all have the same problem



- No story, so the visual does not stick
- 3 D Layering and Drop shadows - Eye sore
- Color scheme, fonts, end up making you look like you are from 1990s
- Use of incorrect charts

What is Story Telling with Data

Are there visuals and reports that tell a great story?



Source: Bureau of Labor Statistics | Nathan Yau

For a visual to work,
they need to tell the
story the author
intended.

What is Story Telling with Data

Are there other ways to tell a great story with data?



Source: The Gap minder foundation, BBC, Youtube.com

Image Source: <http://img.youtube.com/vi/jbkSRLYSojo/0.jpg>

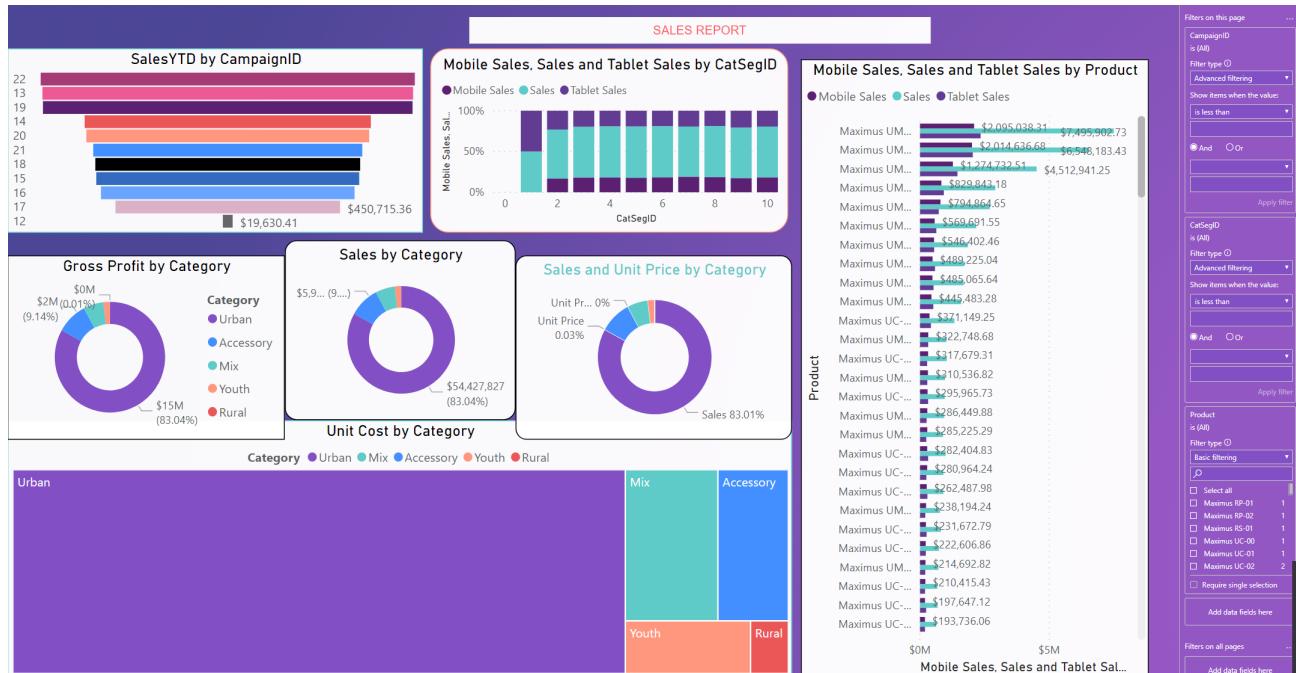
Power BI

Data Visualization in a Day

The Science Behind Data Visualization

The Science Behind Data Visualization

Most Bad or forgettable reports all have the same problems

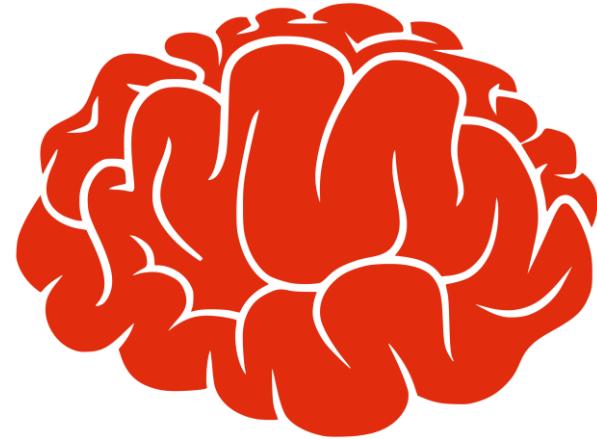


- No context
- Excessive precision
- Incorrect measures
- Incorrectly chosen graph
- Clutter
- Inaccurate encoding of data
- Poor layout
- No or poor highlighting
- Unnecessary pictures
- Bad use of colors

How many of these problems can you spot in the example?

Science Behind Data Visualization

To build great visualizations you have to understand Cognitive science



Visual memory system takes up 70% of all sensors in brain

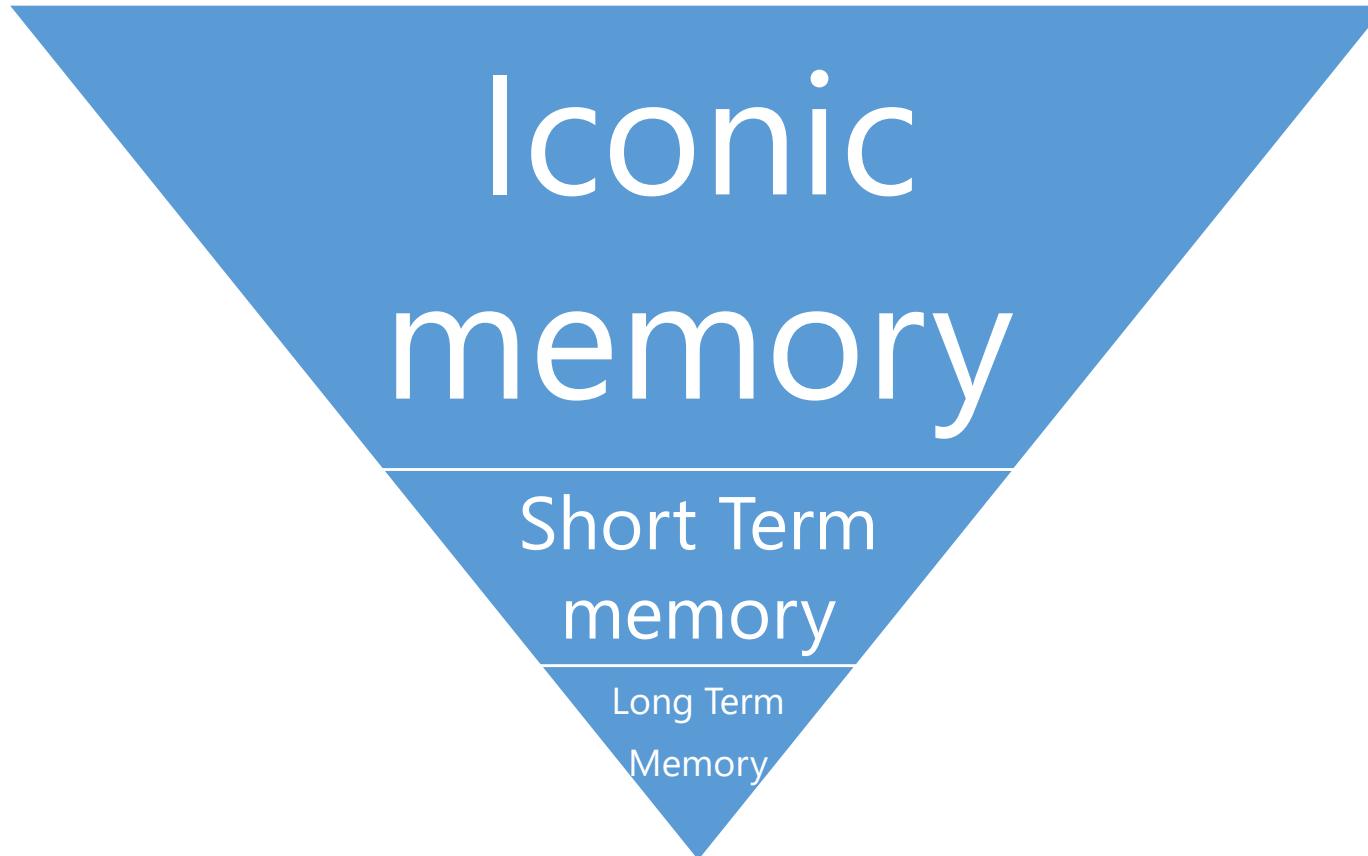
Iconic memory

Short Term
memory

Long Term
memory

Science Behind Data Visualization

How does information pass from one part of memory to another



Iconic Memory

Iconic Memory



Iconic
memory



Short Term
memory

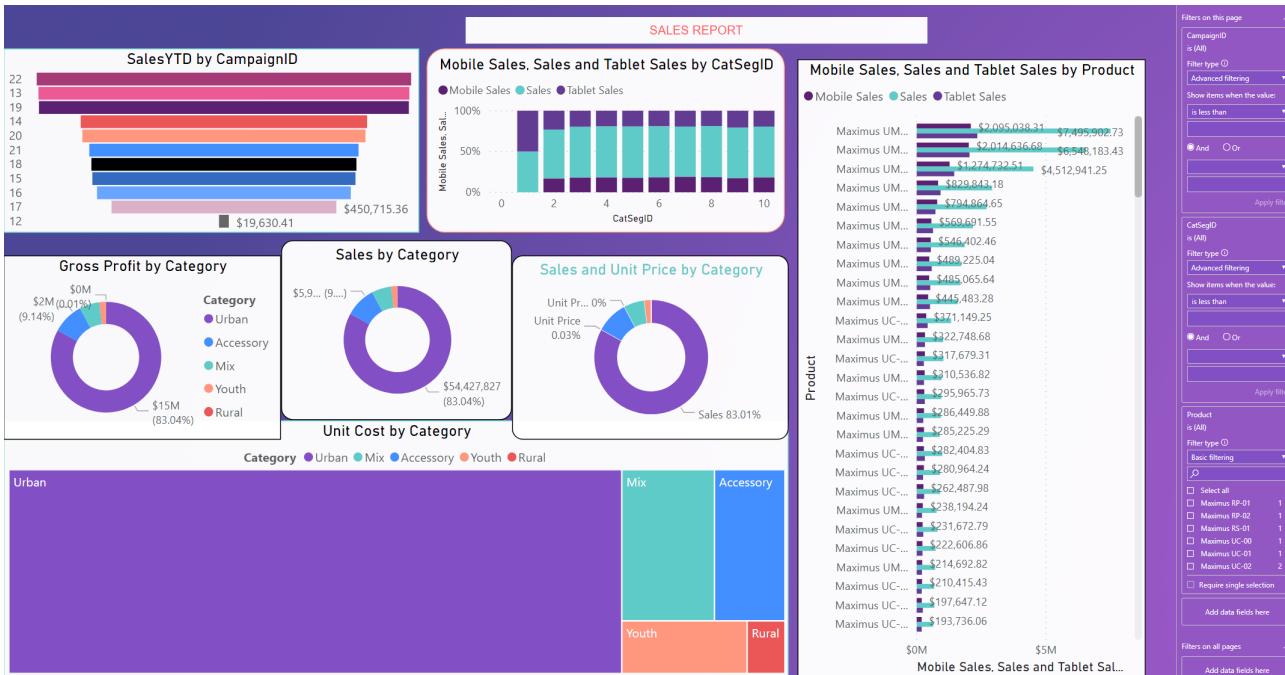


Long Term
Memory

- Can take large volume of data
- Lasts only a fraction of a second
- 99% of information discarded unless useful
- Only “interesting data” is passed to Short Term Memory

Iconic Memory

Spark the Iconic Memory – Mute the background noise

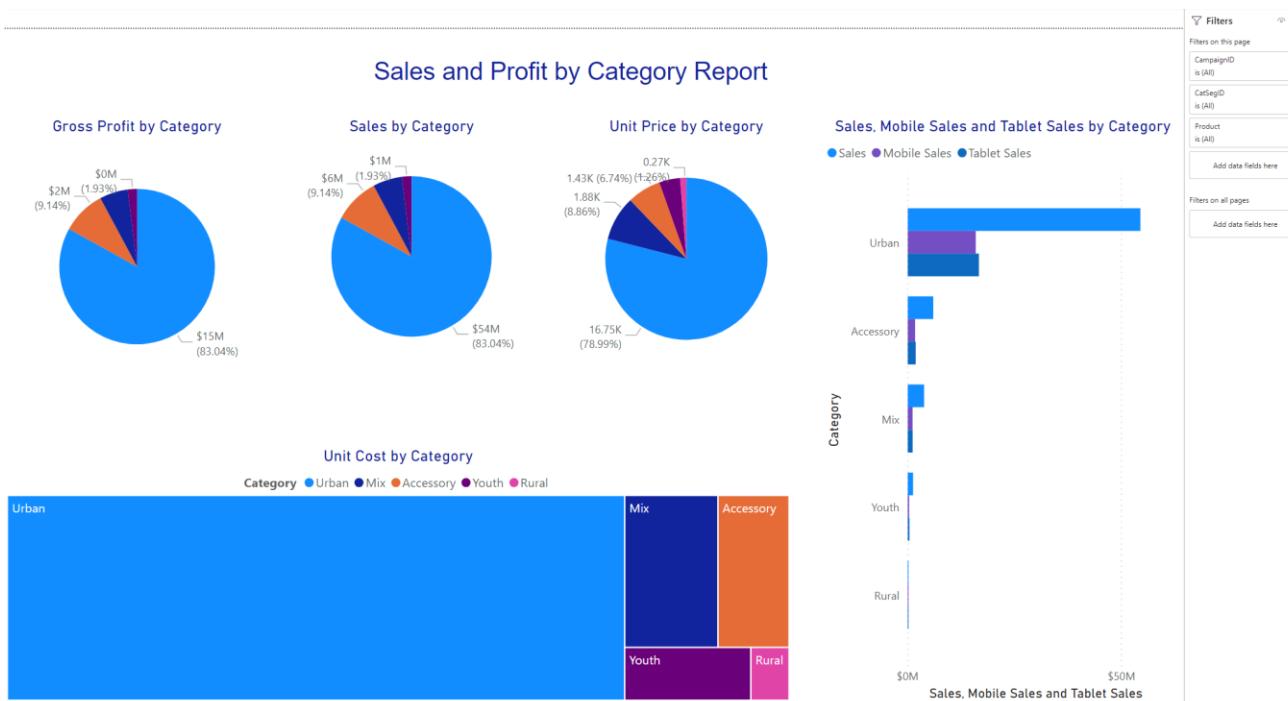


Things that can distract

- Bright colors all over the report
- Thick borders every where
- Grid lines
- Too much precision with numbers
- No highlights

Iconic Memory

Spark the Iconic Memory – Mute the background noise



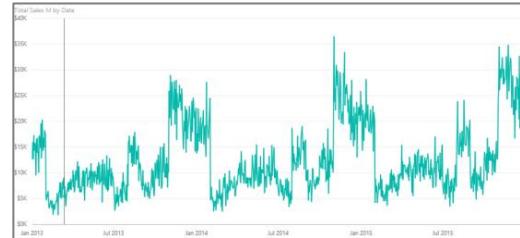
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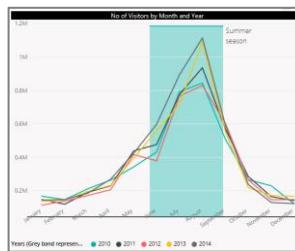
Ionic Memory

Spark the Ionic memory – Precognitive attributes

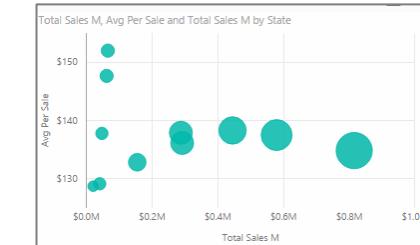
Very Precise Quantitative Perception: Length and 2D Positioning



Not Very Precise Quantitative Perception: Width, Size, Intensity, Blur

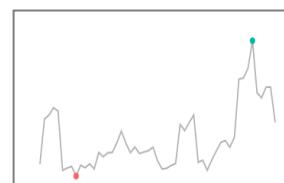


Sales was up 20% YoY



No Quantitative Perception = Orientation, Shape, Enclosure, Added Marks

Region	Total Sales M	Sales YoY
South	\$1,566,447	10.66%
MidWest	\$992,456	5.42%
NorthEast	\$931,919	11.98%
Pacific	\$758,435	13.94%
Mountain	\$283,976	27.43%
	\$133	▼ -85.34%



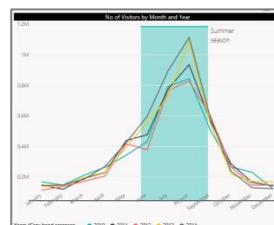
Iconic Memory

Spark the Iconic memory – Shapes

Shape size perception: the pie chart, which



Not Very Precise Quantitative Perception: Width, Size, Intensity, Blur

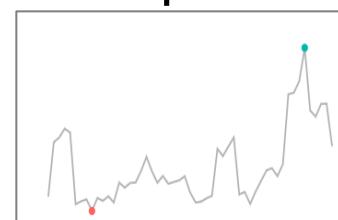


Sales was up 20% YoY



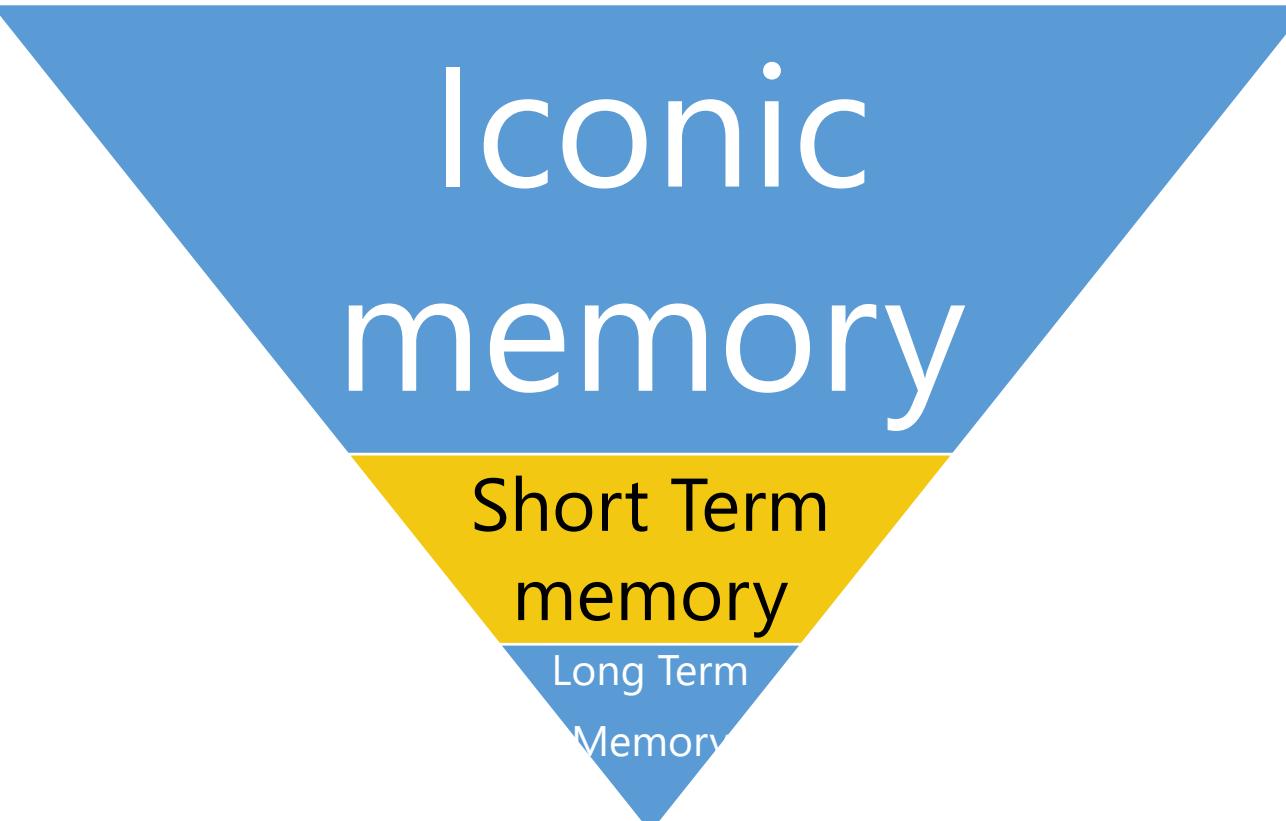
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Short Term Memory

Short Term Memory



Iconic
memory

Short Term
memory

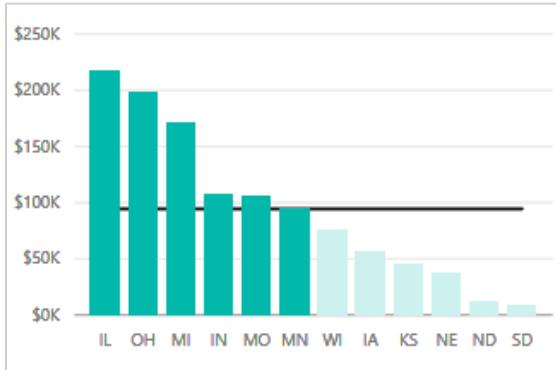
Long Term
Memory

- Lasts only a few seconds
- Can take in 3 to 5 pieces of info at most
- Memory tries to form these 3-5 pieces using patterns it detects in data
- If these pieces of info do not have a story the data will not pass to Long Term Memory

Short Term Memory

Spark the Short Term Memory – Gestalt's principles

Proximity Similarity



Continuity

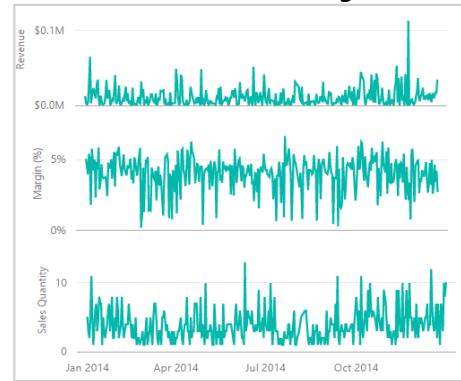
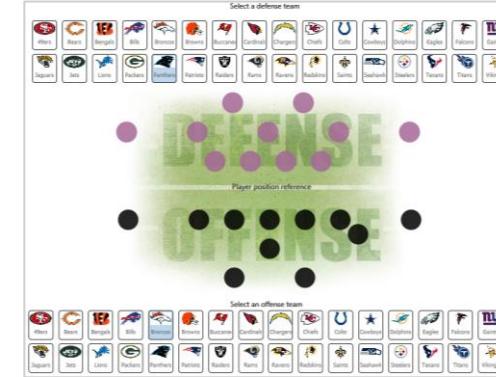
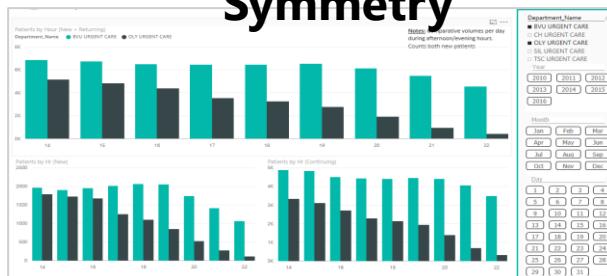


Figure & Ground



Enclosure Symmetry

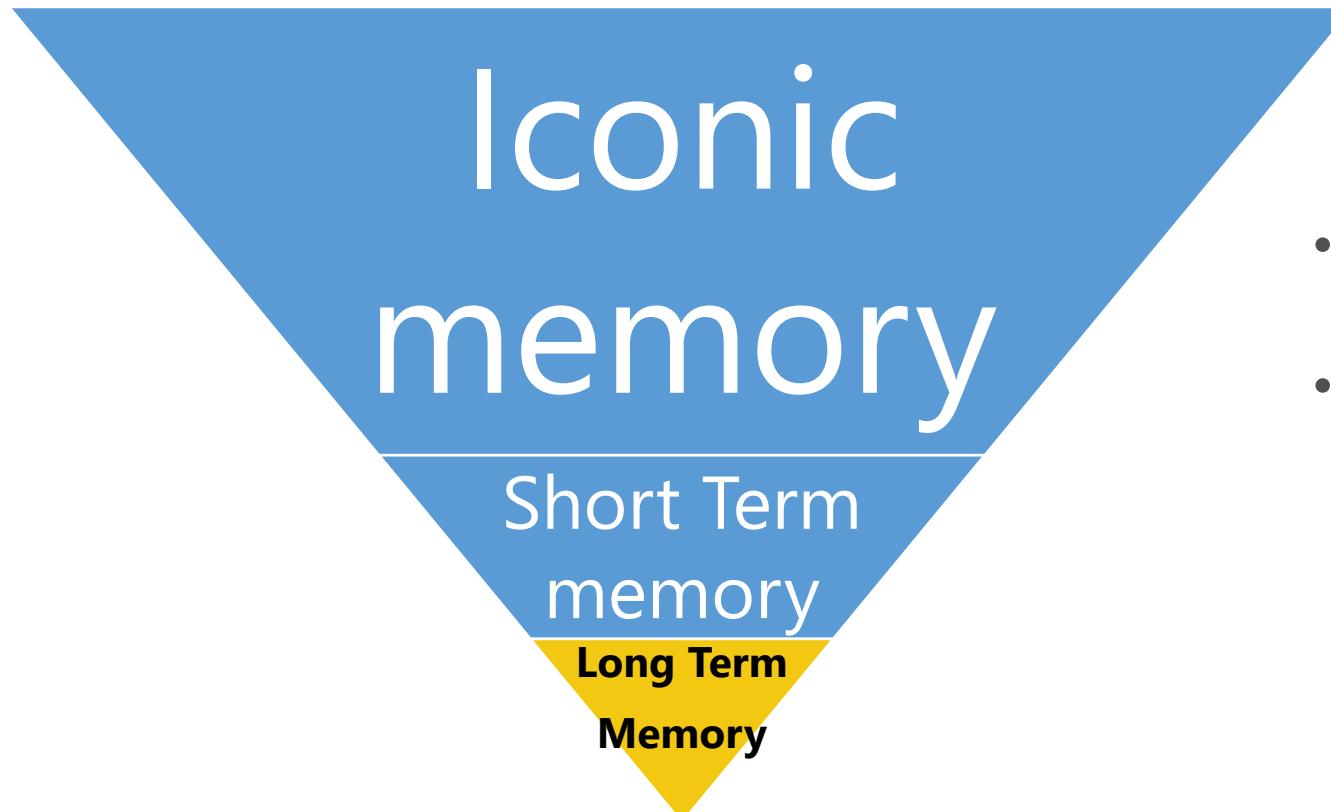


Continuity Symmetry



Long Term Memory

Long Term Memory



- **Lasts for a Long Time**
- **Data needs to be in Long Term Memory to induce decision making**

Long Term Memory

Sparkling Long Term Memory

- Have a **clear call for action**
- Use Pre-cognitive Techniques **Spark Interest**
- Use Gestalt's principles **Data Pattern**
- Connect dots using Text/Audio to tell a story

Power BI

Data Visualization in a Day

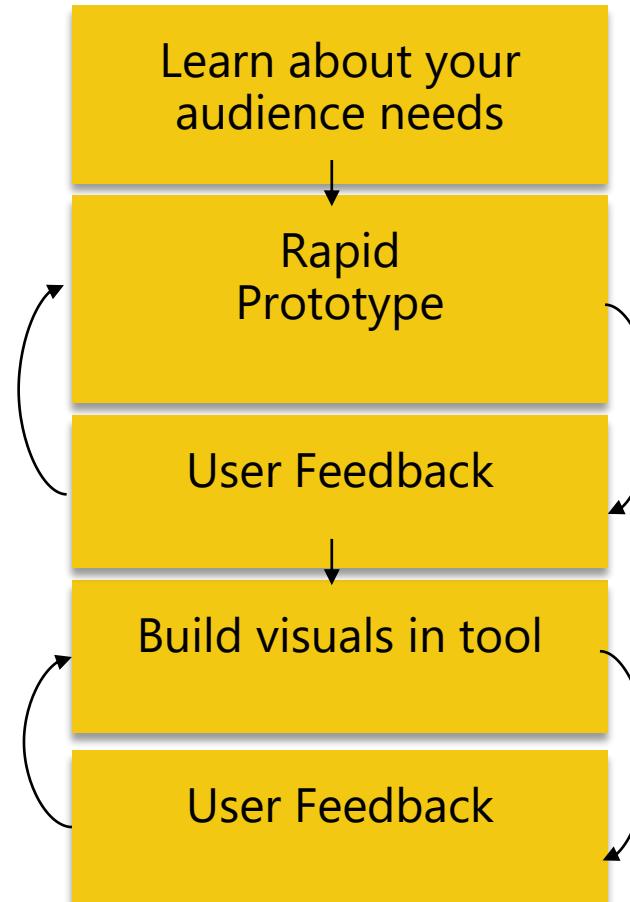
The Process Behind Data Visualization

Data Structure and Data Grain

Top 5 Questions

Who? Where?
What? How Many?
When? Why?

Start Visuals with
Sample Data



Use Whiteboard
or Storyboard
to plan POC

Think Agile!!

Convert the Story to a Date Model

List your big questions:

1. What is my Total Sales for a Selected Year and Region?
2. How is my Total Sales doing Year Over Year?
3. How are my Units trending for various States in my region?
4. How is my Sales doing by Channel, Device, Category for selected Year?
5. Which categories are performing best to worst by Total Sales ?

What are you
Measuring?

Units
Total Sales
Gross Profit

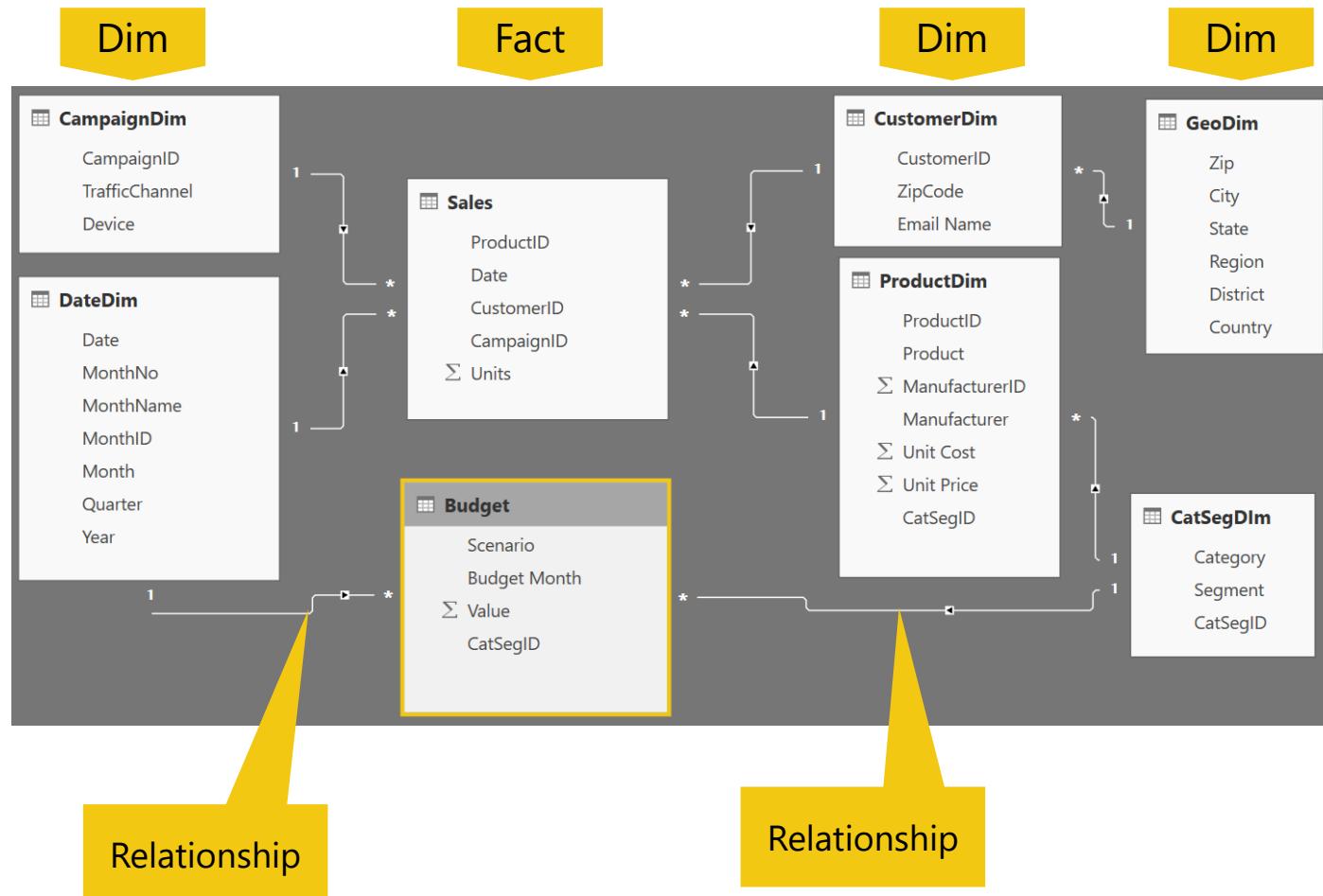
These are **Measures**
which live in **Fact**
tables

How are you describing
or Slicing?

By Time (Year, Month)
By Geography (Region, State or City)
By Campaign (Channel or Device)

These are
Attributes that
live in **Dimension**
tables

Convert Story to a Data Model



- Measures (e.g. Units or Sales) live on **Fact** tables
- Descriptive **attributes** (e.g. Campaign, Customer name) live on **Dimension** tables
- **Relationships** tie the data together so you can slice your measures by your attributes

Power BI

Data Visualization in a Day

Dashboards and Reports

Terminology and Definitions

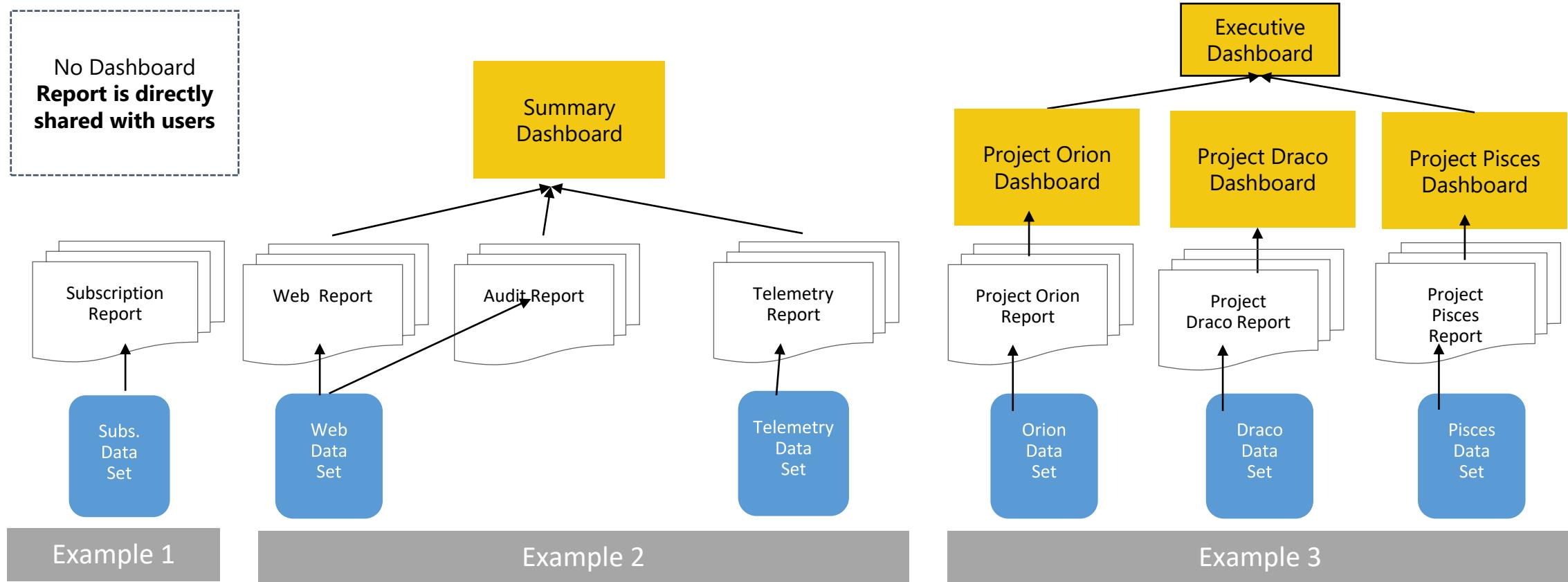
A Power BI **dashboard** is a single page, often called a canvas, that uses visualizations to tell a story. Because it is limited to one page, a well-designed dashboard contains only the most-important elements of that story.

A Power BI **report** is a multi-perspective view into a dataset, with visualizations that represent different findings and insights from that dataset. A report can have a single visualization or pages full of visualizations.

Workspaces are containers for dashboards, reports, workbooks, and datasets in Power BI. There are two types of workspaces: *My workspace and app (group) workspaces.

Datasets, Reports, Dashboards (in Service)

Published from PBIX



- Data sets contain the Data Model with tables (created by Power Queries) with relationships and DAX calculations.
- The same Data set can be used to build multiple reports
- A report can only be built from 1 data set
- A Dashboard can be built from multiple reports and/or multiple dashboards

Layouts – Dashboard vs Report

Dashboard Layout



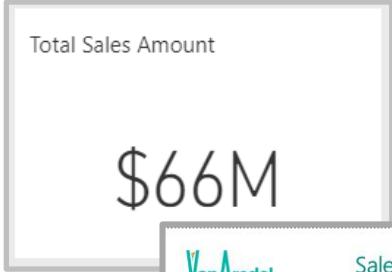
Typically provides snapshot of Business overview and may contain data from multiple reports

Report Layout

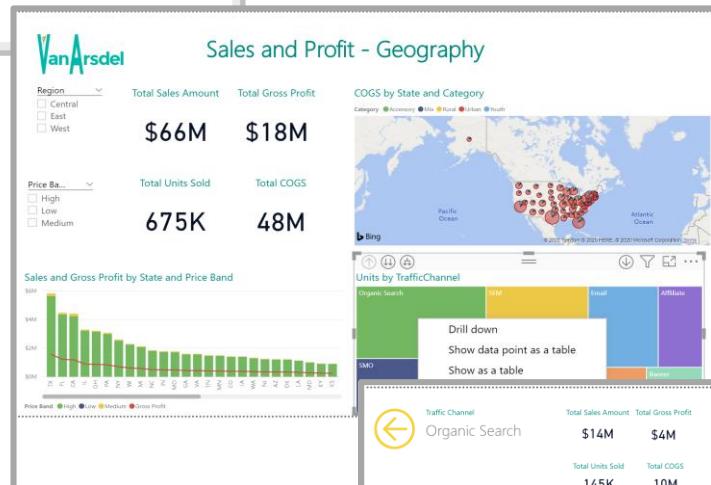
Performance Comparison Across Segments					
Segment	Sales	Monthly V T B	Daily Ave Sales	VTB	VTB %
Accessory	\$1,067,508	███████████	173,908.60	19.46%	
Convenience	\$2,554,423	███████████	-260,215.44	-9.25%	
Moderation	\$7,533,866	███████████	1,201,974.45	18.98%	
Total	\$11,155,796	███████████	1,115,667.61	11.11%	

Typically answers 1 Business Question

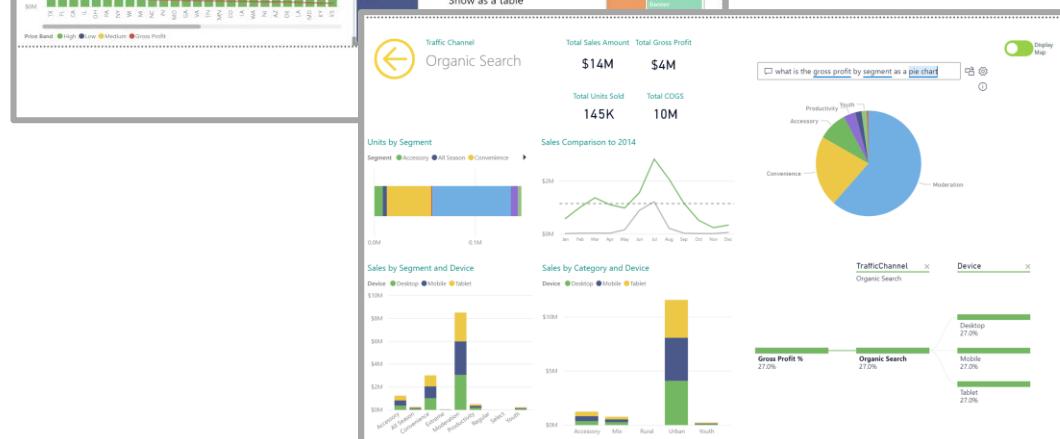
Dashboard to Report Transitions



Dashboard Tile (single KPI) Action Oriented – click thru to report

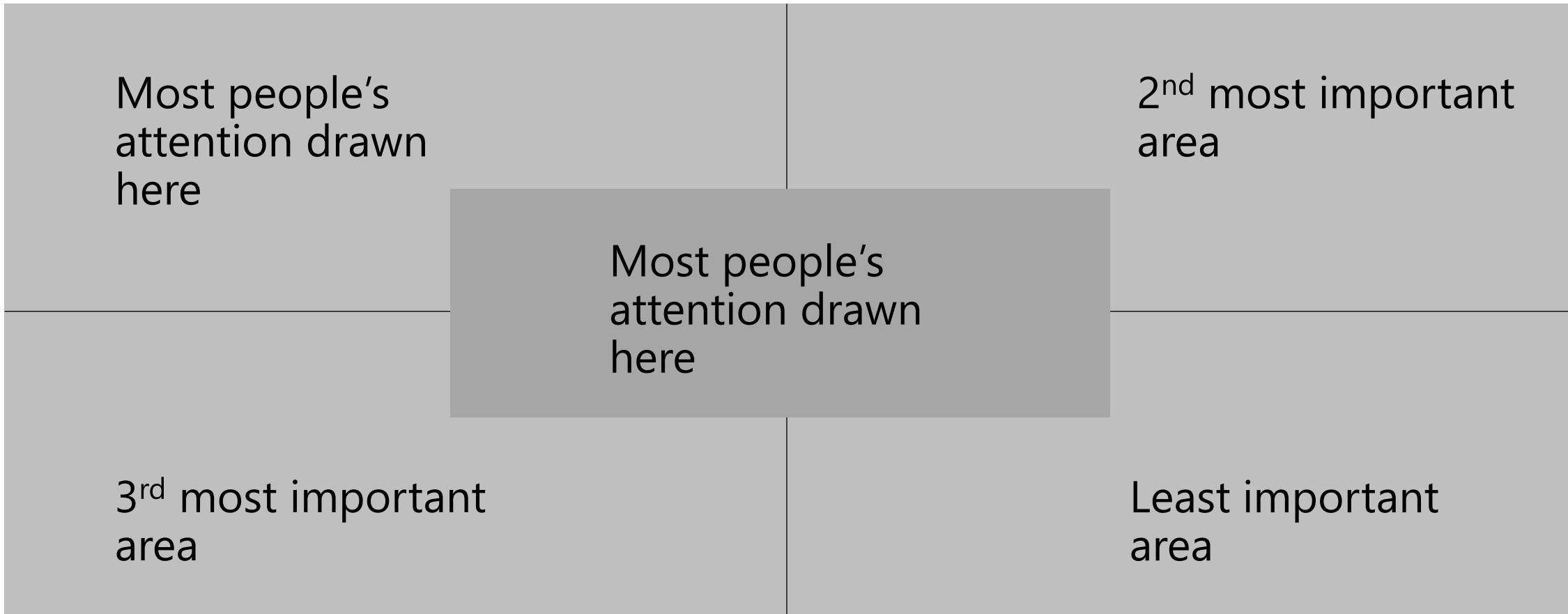


Report – tell Top level story of KPI
* Drill to another Report (Sliced to Specific details)



In Report can use "Back" to navigate back up

Layouts



Power BI

Data Visualization in a Day

Dashboards – Layout & Structure

Column Layouts

Title
Area 1

Title
Area 2

Title
Area 3

1st KPI
Area 1

1st KPI
Area 2

1st KPI
Area 3

2nd KPI
Area 1

2nd KPI
Area 2

2nd KPI
Area 3

Chart
Area 1

Chart
Area 2

Chart
Area 3

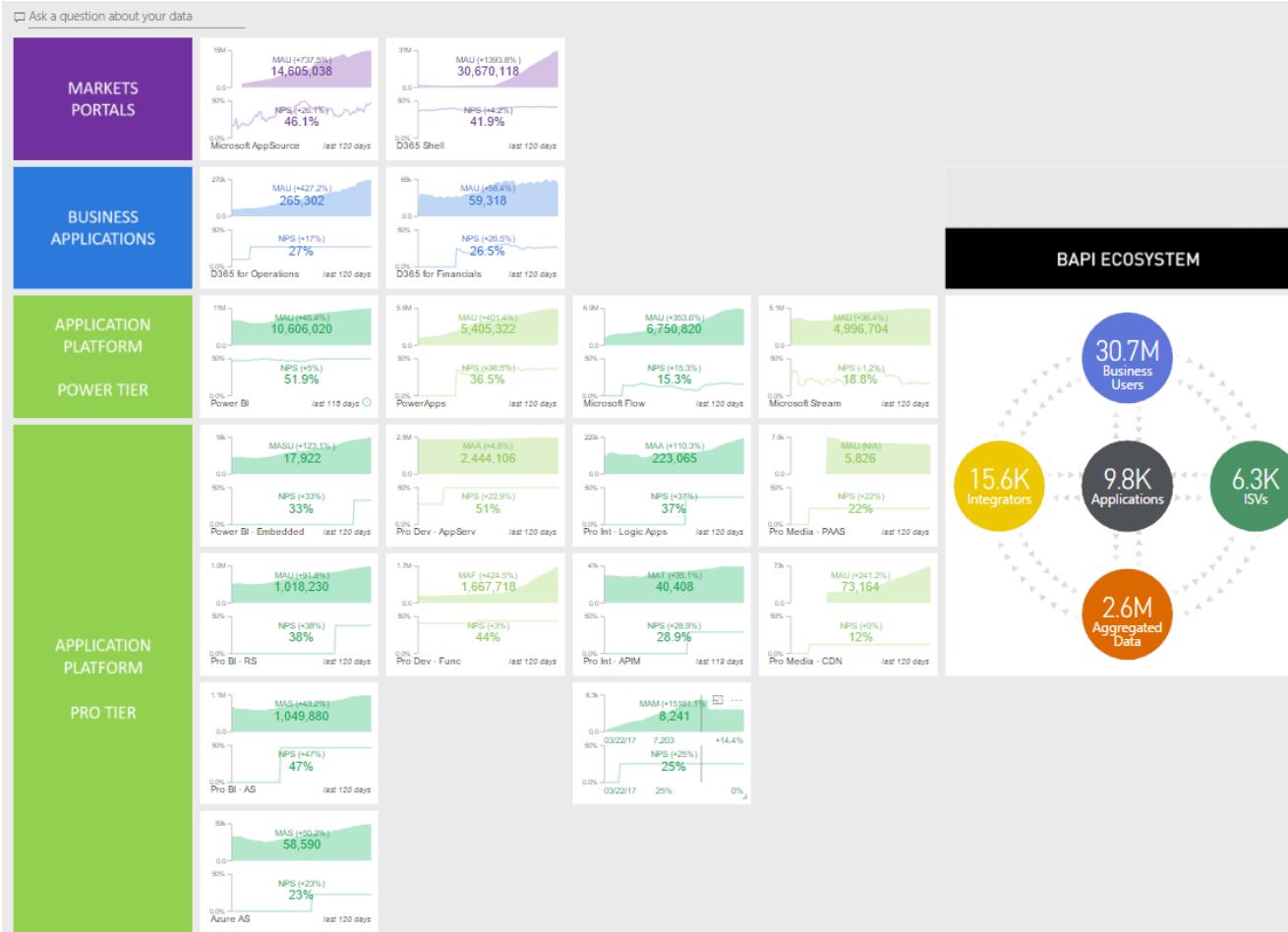
What is this layout most suitable for?

Dashboard Layouts – Vertical Matrix Layout



- Layout is useful when
 - Each row has a story
 - Each column has similar KPIs
 - Usually helpful in Marketing, Supply Chain (think conversion funnels etc.)

Dashboard Layouts – Horizontal Matrix



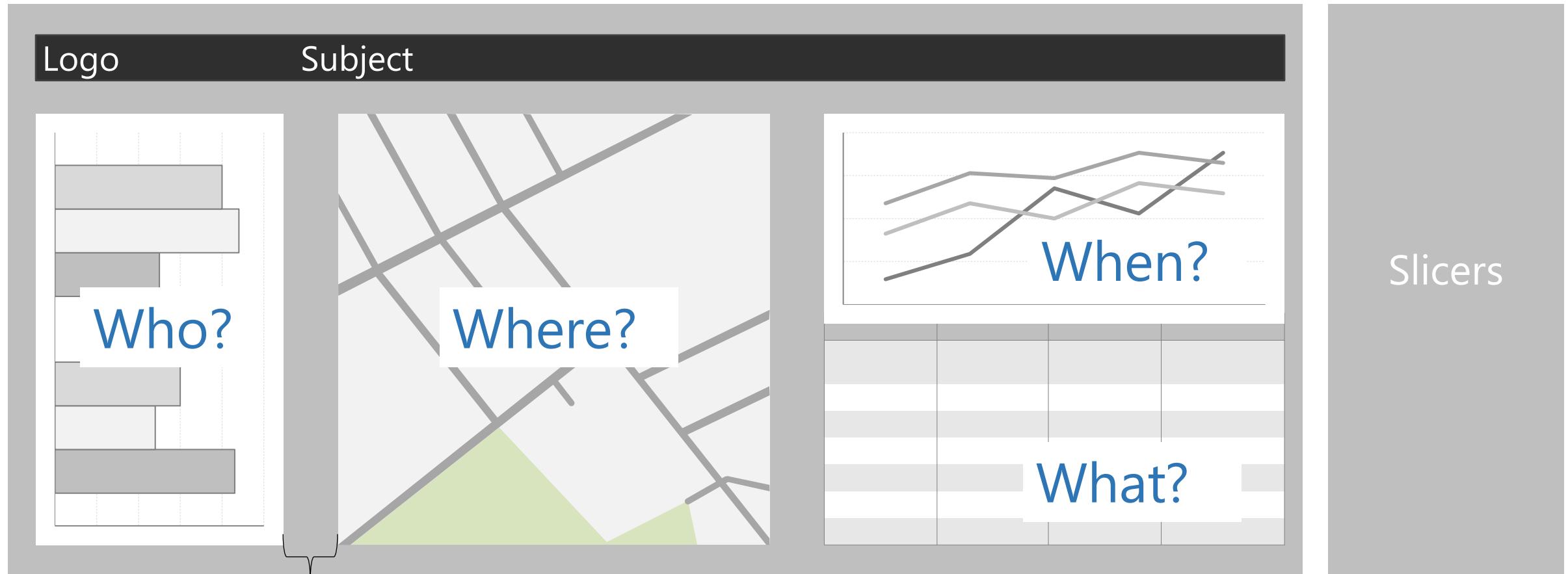
This Dashboard is currently in use by Microsoft to manage their cloud business.

Power BI

Data Visualization in a Day

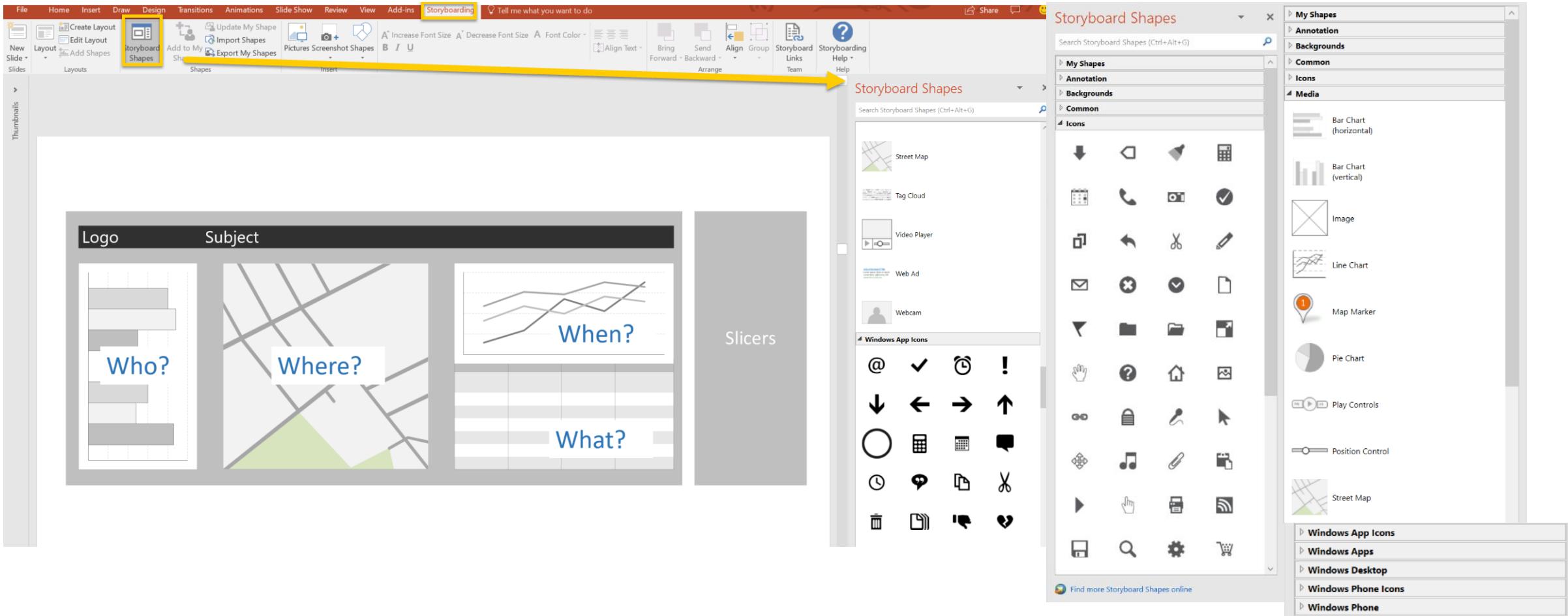
Reports – Layout and Structure

Use Storyboarding to Design Report Layout



Control this space. If all objects tell the same story, use the same gap space.
If some objects tell a different story, make the gap bigger

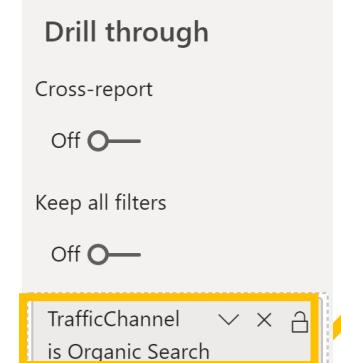
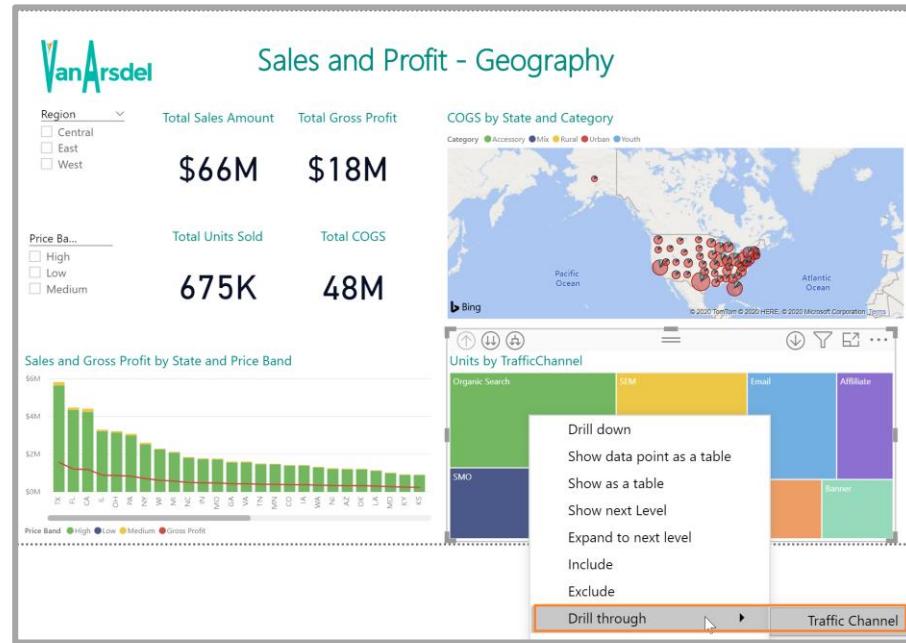
Storyboarding Tools



Install the Storyboarding Toolbar: <https://docs.microsoft.com/en-us/vsts/work/backlogs/office/storyboard-your-ideas-using-powerpoint>

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Report Channel – Drill Through Filters

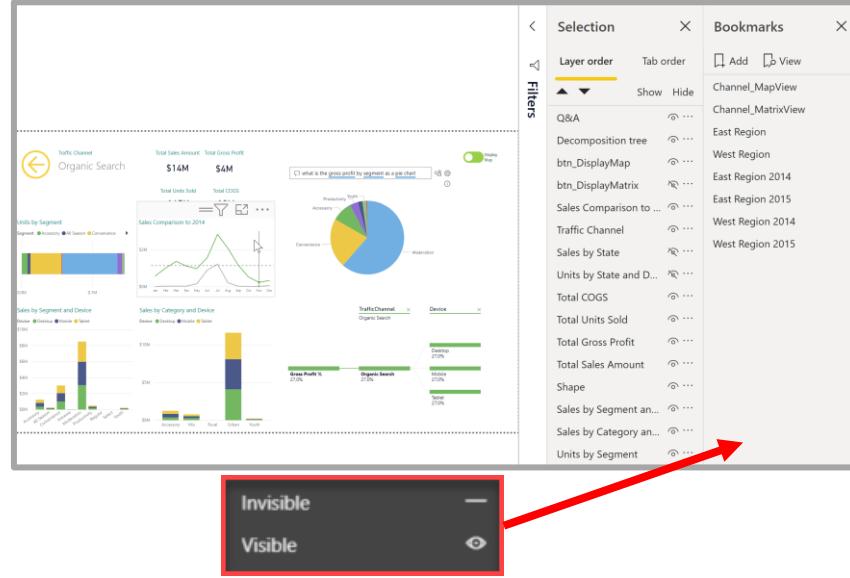


Drill through allows you to create a page that provides details on a single 'entity' in your model:

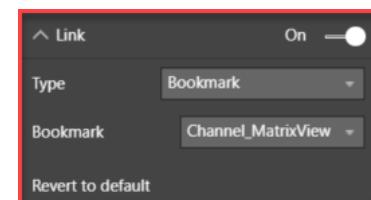
- Allows quick navigation to a report page for more depth on that entity
- Can be accessed by almost any visual which contains that entity
- Quick "Back" button that is functional in Power BI Service as well



Report Channel – Bookmarks and Toggles

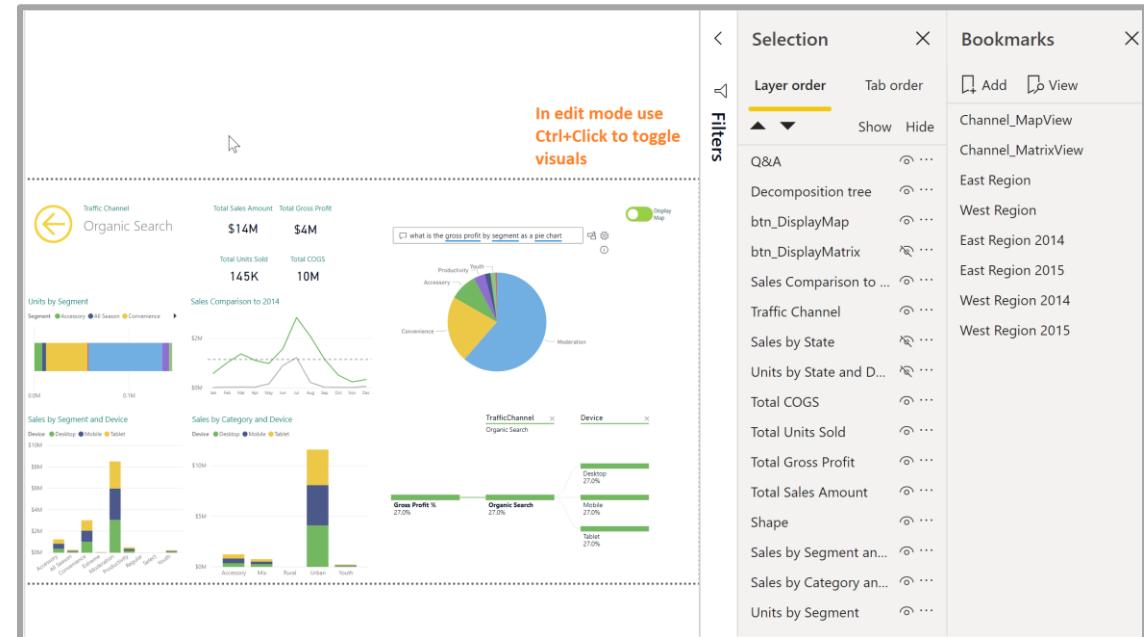


1. Use **Selection** pane to choose visuals for bookmark
2. Manage Bookmarks on the **Bookmark** pane
 - **Add** creates bookmark
 - **Update** updates existing bookmark (...)
3. Assign bookmarks to images/shapes from the Format Pane – Link Section
 - Turn link ON
 - Type = Bookmark
 - Assign Bookmark name



Bookmarks let you save interesting states as part of your report. Once you have a list of bookmarks, you can use these in several ways including organizing and transitioning visuals:

- Includes the current page
- Any filters and slicers selected
- Sort Order
- Which visuals should appear on the report



Create Custom Tooltip Report

A screenshot of the Power BI desktop interface. On the left, there is a visual card for 'Aaron Alexander' showing sales and units. To the right is a map visualization with several red dots representing locations. A tooltip is open over one of the dots, displaying the 'CustomerID' field value '1'. The tooltip also includes a 'Keep all filters' button and a dropdown menu set to 'CustomerID is (All)'. The ribbon at the top has 'Visualizations' selected. A red arrow points from the bottom-left towards the tooltip area.

- You can **Hide** the tooltip (or any other) report!
 - *Right click to hide*

Create a custom tooltip report for any **field** as a new page

1. Create the Tooltip Report

- **Page Information** – enable Tooltip
- **Page Size** – use **Tooltip** or set custom size
- **View Ribbon**, set **Page View to Actual Size**
- Place key **Field** in **Tooltip Field Well**
- Does not work with the Matrix or Table visual (yet)

2. Assign the Custom tooltip to each chart for which you want the tooltip to appear – the **field** must be visible on the chart

A screenshot of the Power BI desktop interface. It shows a master report with a bar chart for 'Alan Webster'. The chart has three bars with values \$103, 1, and 1. A tooltip is displayed over the first bar, showing the 'CustomerID' value '233598'. The tooltip also includes a 'Report page' dropdown set to 'Customer-ToolTip'. The ribbon on the right side has 'Toolip' selected under the 'General' section. A red box highlights the tooltip area and the 'Customer-ToolTip' dropdown in the ribbon.

Slicers vs Filters

When to use a Slicer

- Display commonly-used or important filters on the report canvas for easier access.
- Make it easier to see the current filtered state without having to open a drop-down list.
- Filter by columns that are unneeded and hidden in the data tables.
- Create more focused reports by putting slicers next to important visuals.

Slicer Limitations

- Slicers do not support input fields.
- Slicers cannot be pinned to a dashboard.
- Drilldown is not supported for slicers.
- Slicers do not support visual level filters.

When to use a Filter

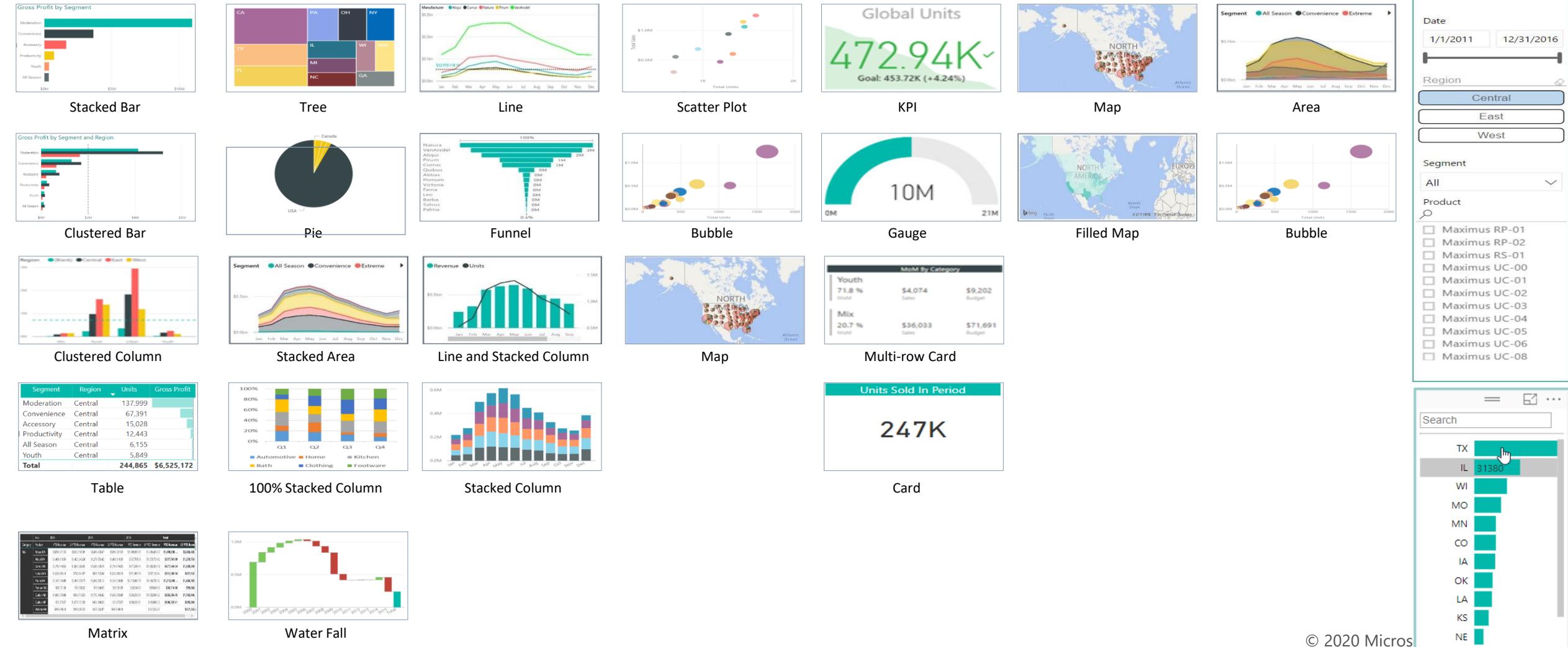
- There are too many items to display as a slicer
- When you need to take up as little space as possible. A slicer takes up too much room
- When running into performance issues, filters are less time consuming than slicers.

Power BI

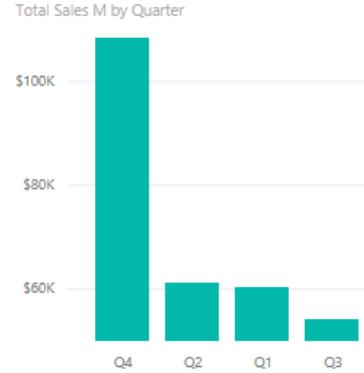
Data Visualization in a Day

Chart Selection

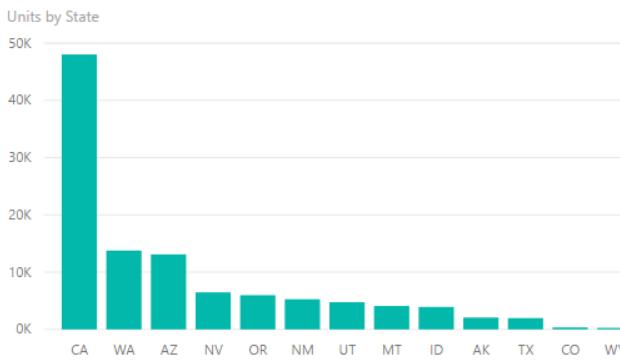
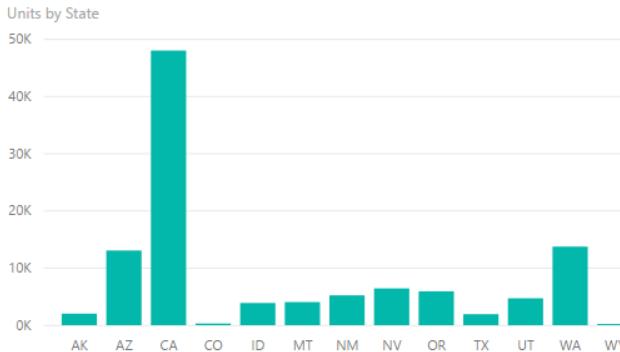
Choose the Right Charts for the Right Purpose



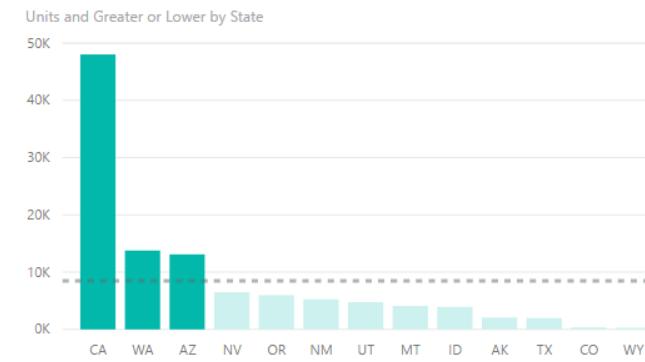
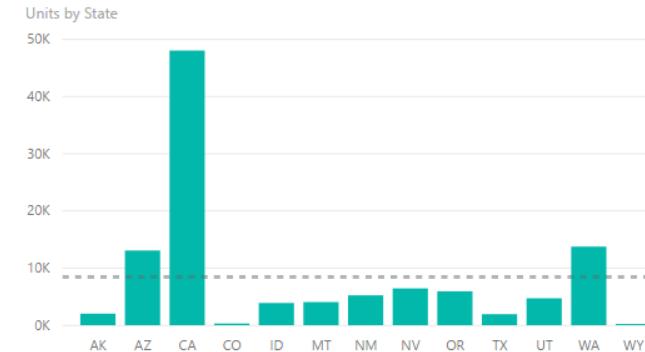
Column Charts for Comparison



- Start Axis at 0

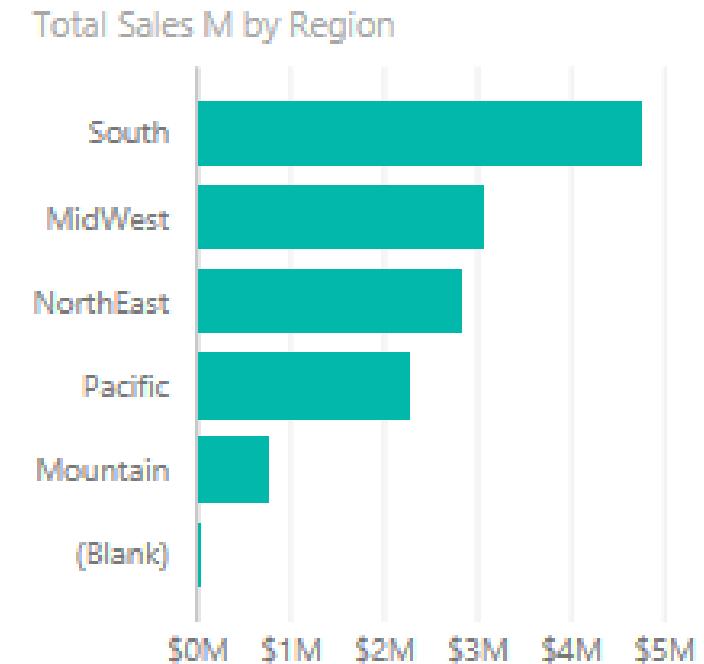
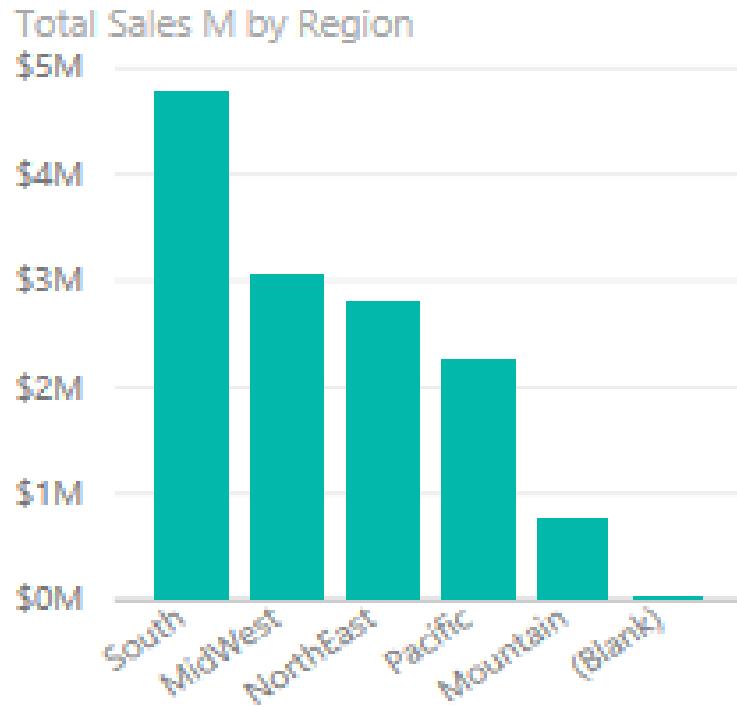


- Sort Chart



- Try to Have a Reference Line
- Use colors to draw attention

Column Chart vs Bar Chart for Comparison

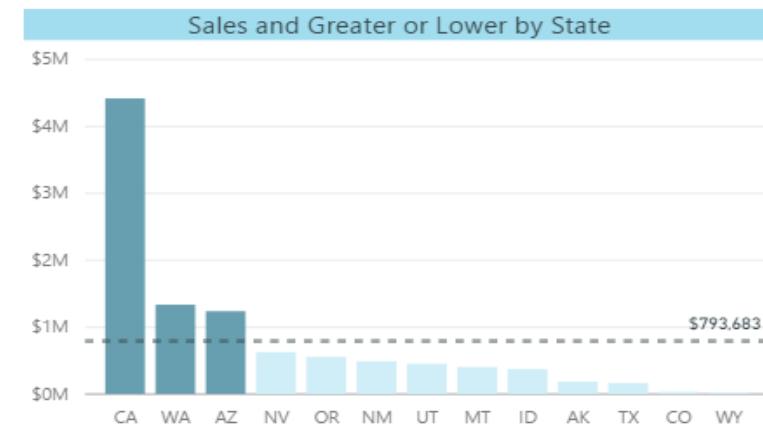
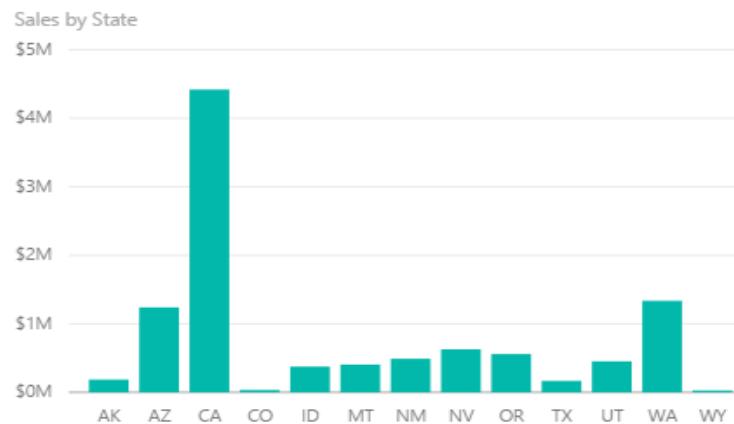


- When you have too many elements to display in a column, the bar chart can be easier to scroll.

Lab 01 - Update Column Chart

Refer to Data Visualization Lab – Lab 01

Formatting a Chart – PBIX Tab “Lab 1”



- Update the chart on the left to the one on the right.

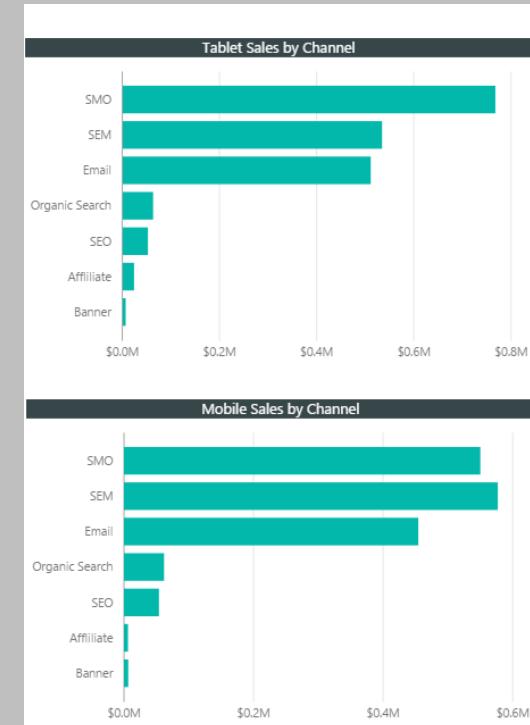
Note: For the gradient, there is a Measure called "Greater or Lower" which should be helpful

Lab 02 – Update Column Chart

Refer to Data Visualization Lab – Lab 02

Sorting a Chart – PBIX Tab “Lab 2”

Challenge:
Create 2nd chart which sorts by first



Line Charts

Sales Comparison to 2014

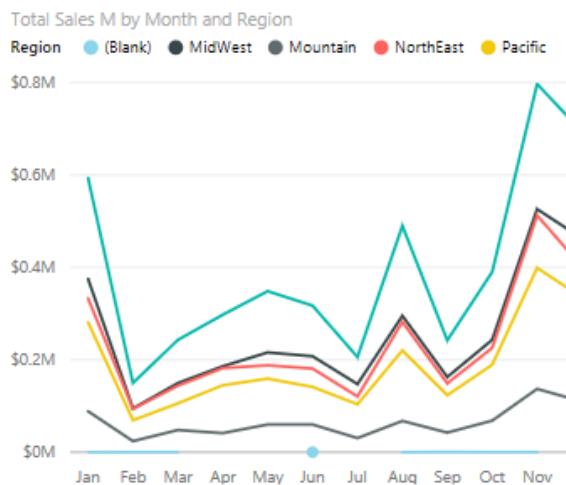
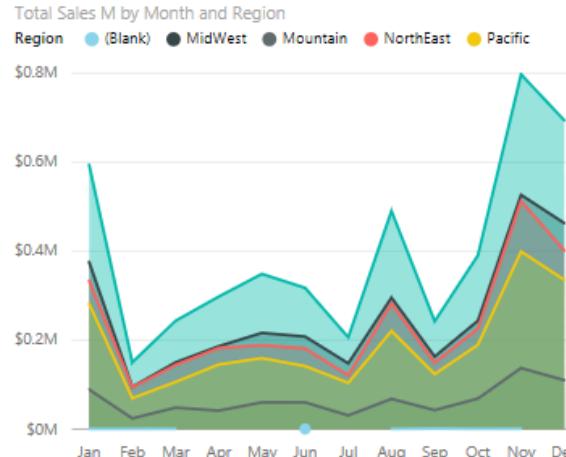


Sales by Date



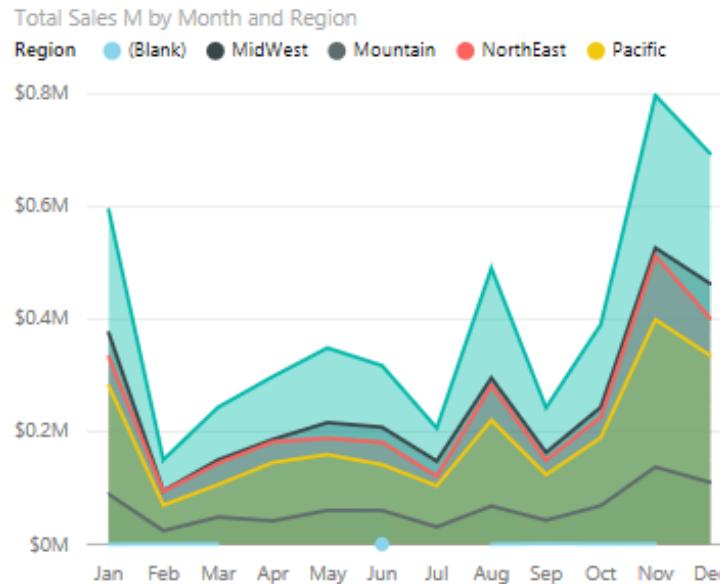
- Start Axis based on your “Business scenario”
 - Choose the right Aspect Ratio
 - Try to have a Reference Line
 - Use colors to draw attention strategically
- Decide whether to “Show items with no data”
 - Data can be misleading if the breaks are connected
 - In the formatting pane, change the axis to **categorical** from **continuous**

Area Chart vs Line Chart



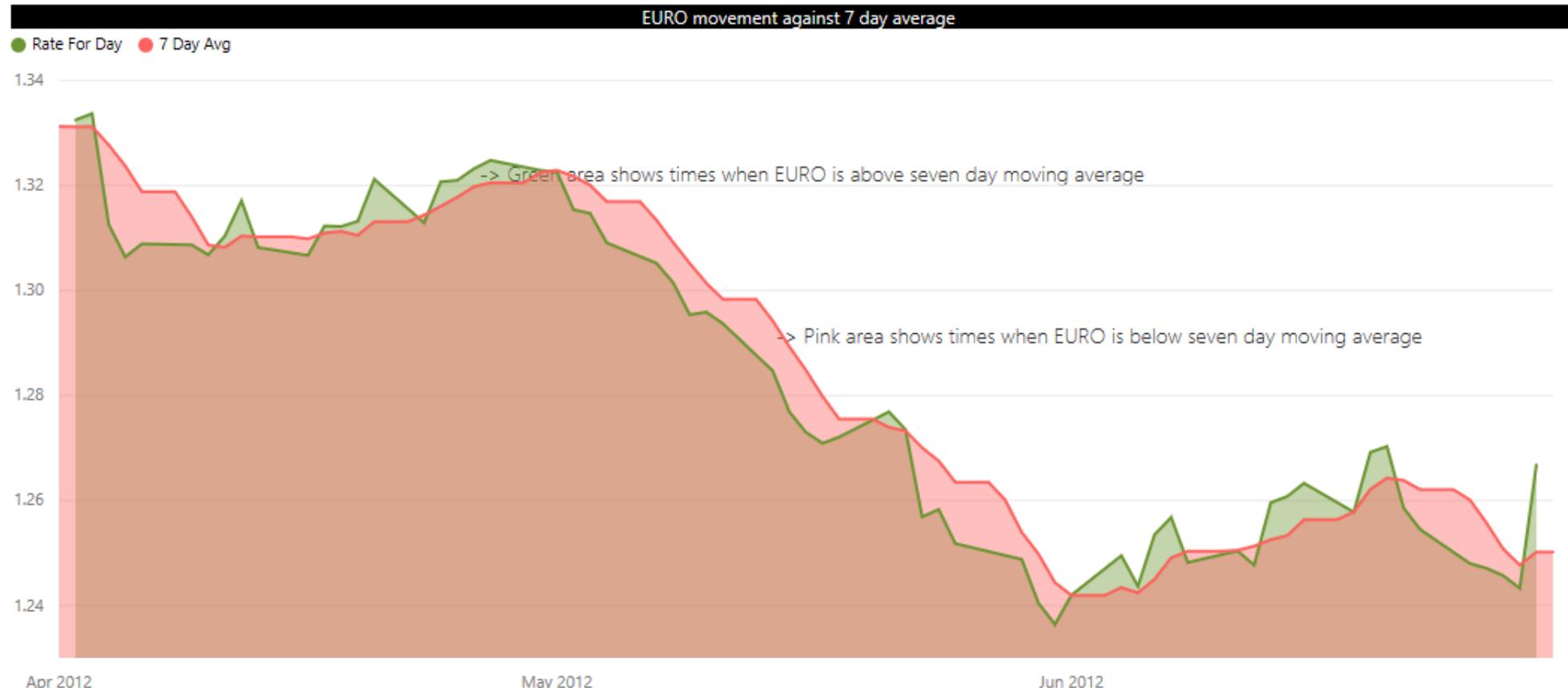
- Choose Area Charts sparingly (when # of series < 5)
- Too many colors can be distracting
- Often Line charts are the better option
 - Would a Line Chart better portray my meaning?
 - Is the Area the meaningful thing I am measuring?

Stacked Area Charts



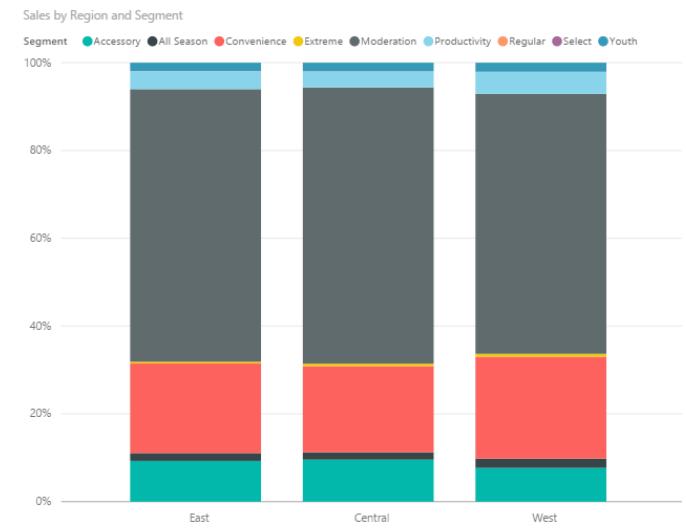
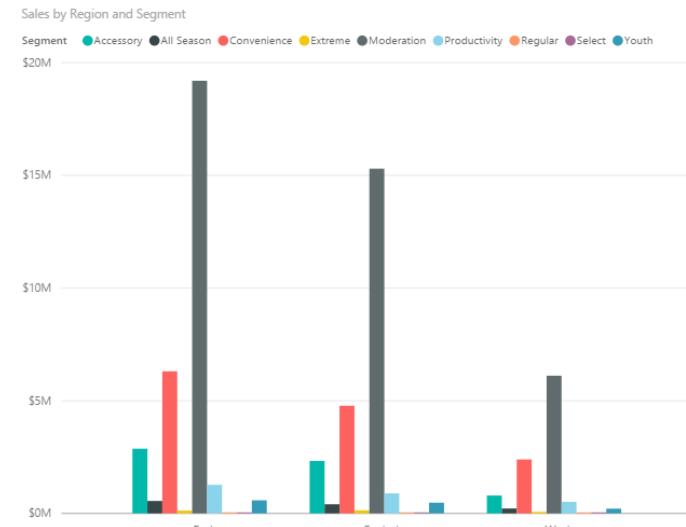
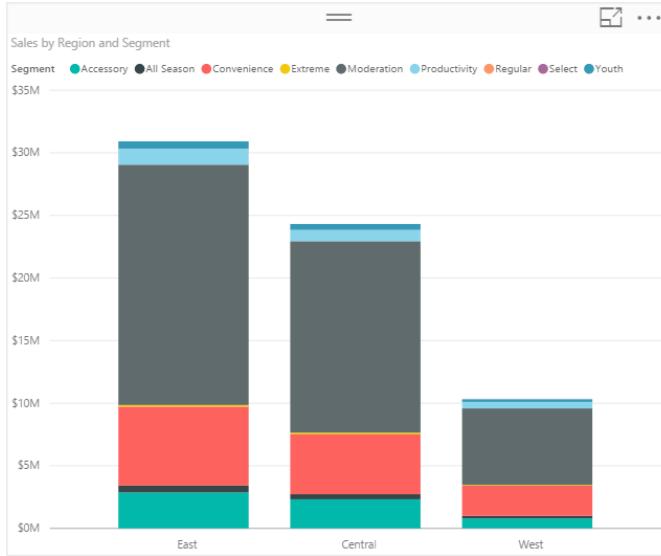
- Used to show how proportions and totals are changing
- Choose this chart wisely
- Can lead to misleading conclusions
- The eye tends to interpret the trends using the top lines of each shaded region rather than using the area of each region

One Use Case for Area Charts



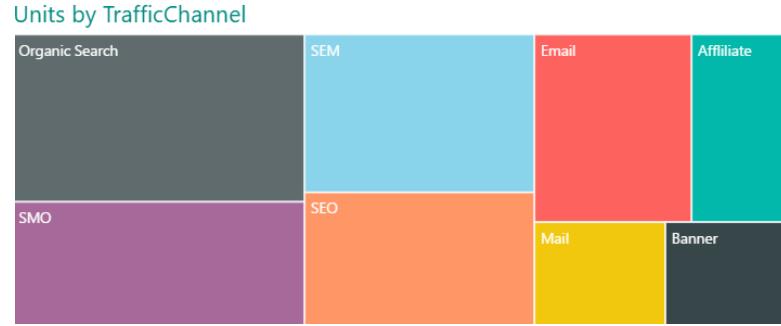
- To see when a trend goes above or below a reference line

Stacked vs Clustered Column (Bar) Chart Types

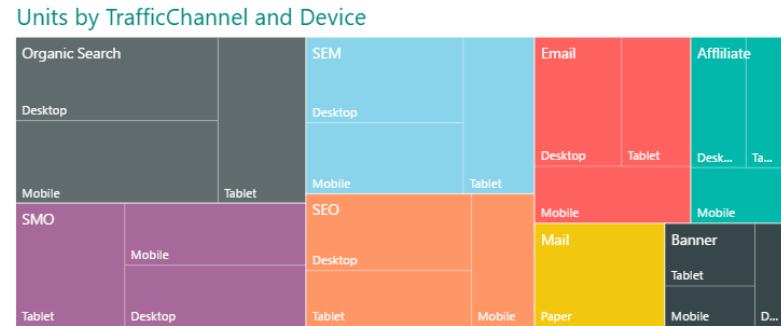


- Shows Totals
- Shows Part to whole relationship
- Inter-Category Comparison
- Intra-Category Comparison
- Shows Mix% change
- Ignore absolute numbers

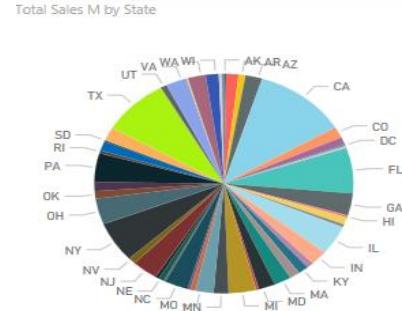
Constructing Effective Tree Maps



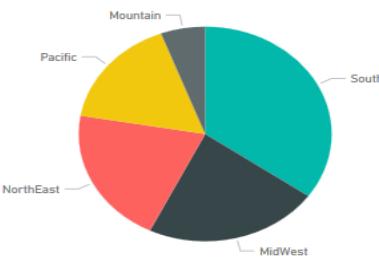
- Tree map is useful to visualize proportions
- Use Drill down to allow navigation to detail



Constructing Effective Pie Charts



Bad Pie chart



Good Pie chart

- Do not have more than 3-5 categories (if you have more then put a slicer and choose a default)
- Have data labels
- Choose right Sort Order
- Choose appropriate colors
- Pie chart is a widely used but is not a recommended visual because we can't intuitively understand the segment size

Constructing Effective Tables



Region	Total Sal...	Sales...
South	\$1,788,579	14.2 %
Pacific	\$849,265	12.0 %
NorthEast	\$1,049,957	12.7 %
Mountain	\$271,125	-4.5 %
MidWest	\$1,133,694	14.2 %
	\$945	610.2 %

- Reduce precision
- Use muted background color
- Choose the right font size
- Use white space for columns instead of borders
- Highlight items using Symbols
- Sort Table based on Key KPIs



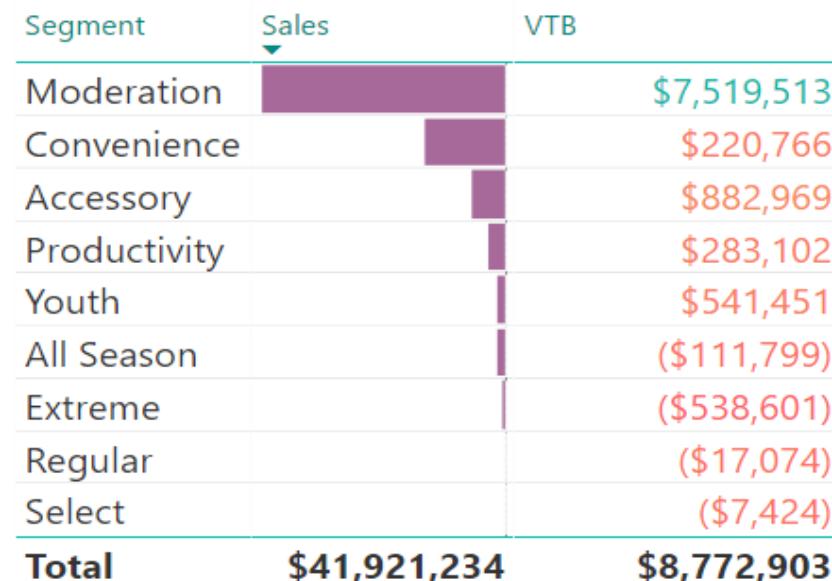
Region	Total Sales M	Sales YoY
South	\$1,788,579	14.18%
MidWest	\$1,133,694	14.23%
NorthEast	\$1,049,957	12.67%
Pacific	\$849,265	11.98%
Mountain	\$271,125	▼ -4.53%
	\$945	610.16%

Lab 03 - Table

Refer to Data Visualization Lab – Lab 03

Create a table with conditional formatting – Pbix tab “Lab 3”

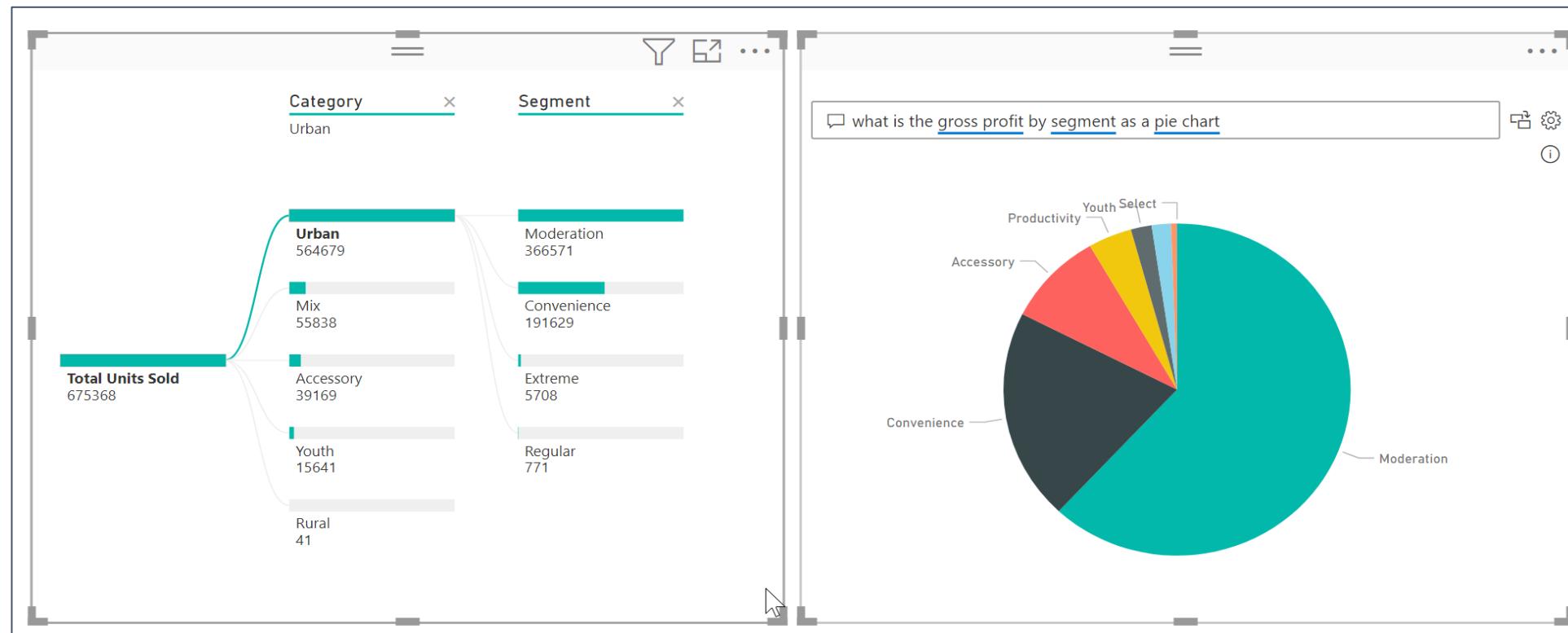
Segment	Sales	VTB
Accessory	\$3,566,905	882,969.17
All Season	\$768,092	-111,799.45
Convenience	\$8,613,502	220,765.90
Extreme	\$221,704	-538,600.51
Moderation	\$26,205,280	7,519,513.20
Productivity	\$1,722,832	283,102.11
Regular	\$12,930	-17,074.40
Select	\$4,265	-7,423.59
Youth	\$805,723	541,451.01
Total	\$41,921,234	8,772,903.43



Lab 04 – Decomposition Tree and Q&A

Refer to Data Visualization Lab – Lab 04

Create a composition tree and a Q&A visual – Pbix tab “Lab 4”



Constructing Effective Cards



-4%

MoM

Total Sales

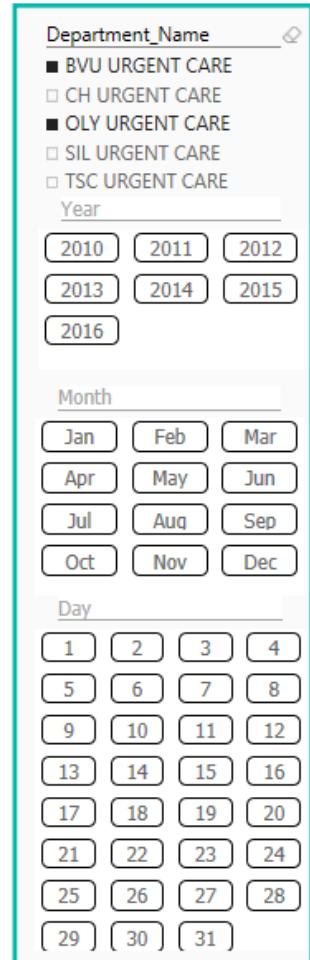


\$14M

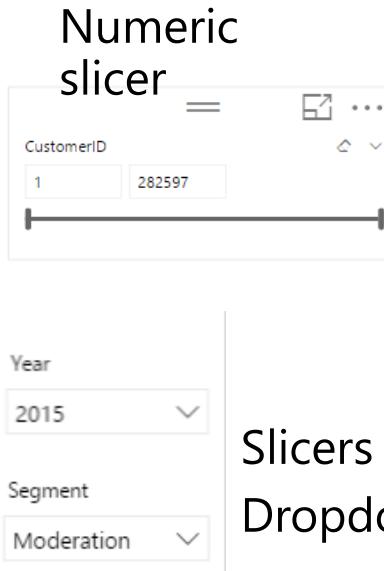
- Category Labels can be renamed per each visual
- Choose right precision levels
- Use colors to draw attention to KPIs that matter most
- Use KPIs in conjunction with Symbols to draw attention

Constructing Effective Slicers

Slicer
as List



Chiclet
slicer

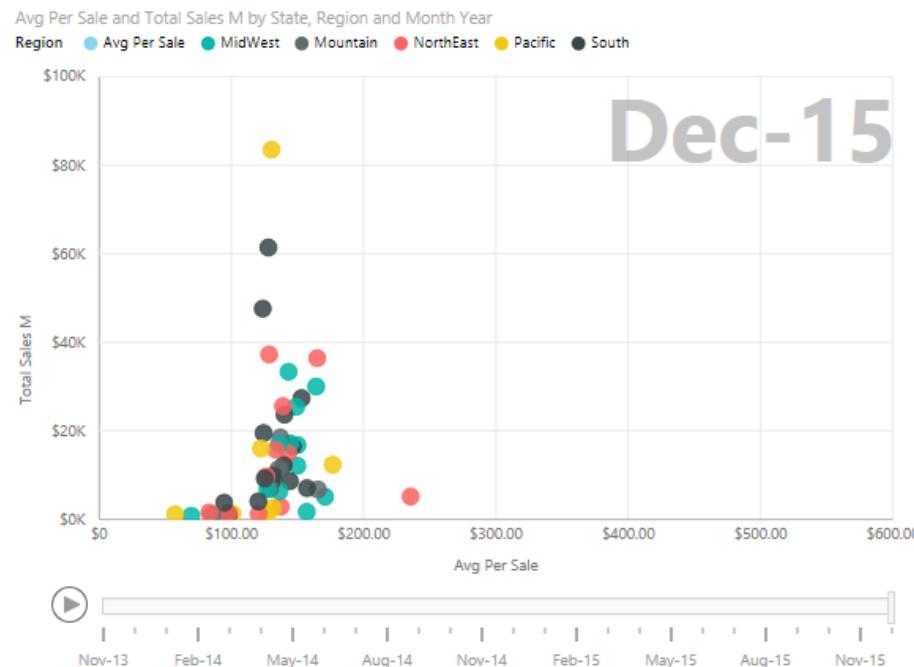


Chiclet
slicer

Slicers as
Dropdown

- Enclose Slicers using a **subtle** box
- Group Slicers together and keep them on right side of page
- Conserve space by using Dropdown Slicers
- Use “Chiclet Slicers” for a different look
- When Slicing Dates, use the Date Slicer

Constructing Scatterplot Charts



- Used to see distributions of 2 or more variables
- Use Hierarchies
- Helps to identify outliers
- Useful for categorization or clustering
- Time Axis used to show changes over time
- Choose colors wisely

Power BI

Data Visualization in a Day

Custom Visuals

Power BI Customizations

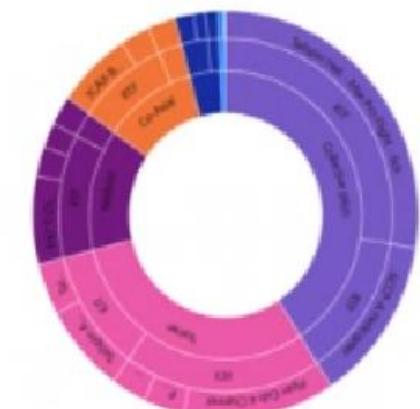
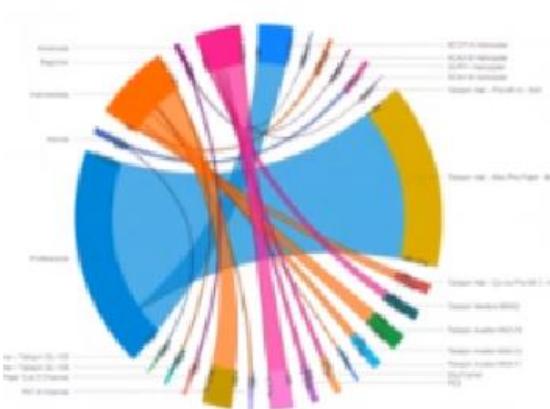
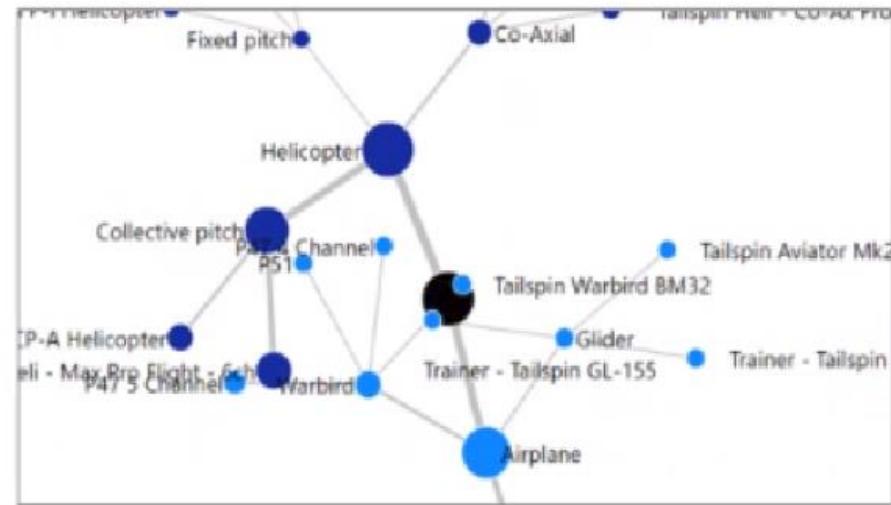
Custom Visuals

250+ Custom visuals available from [AppSource](#)

R and Python Integration

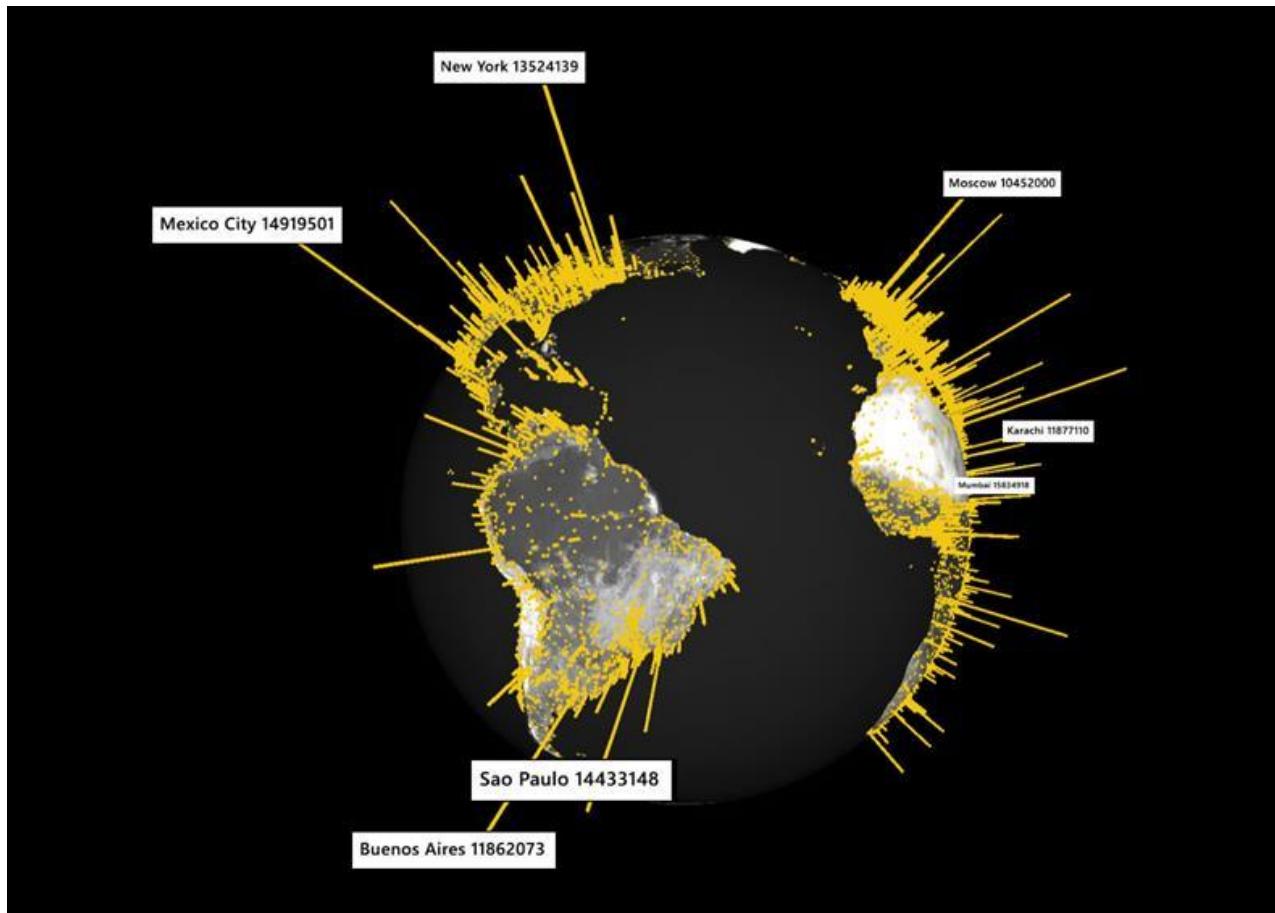
3rd Party Tools

Tools to develop, test, package new custom visuals



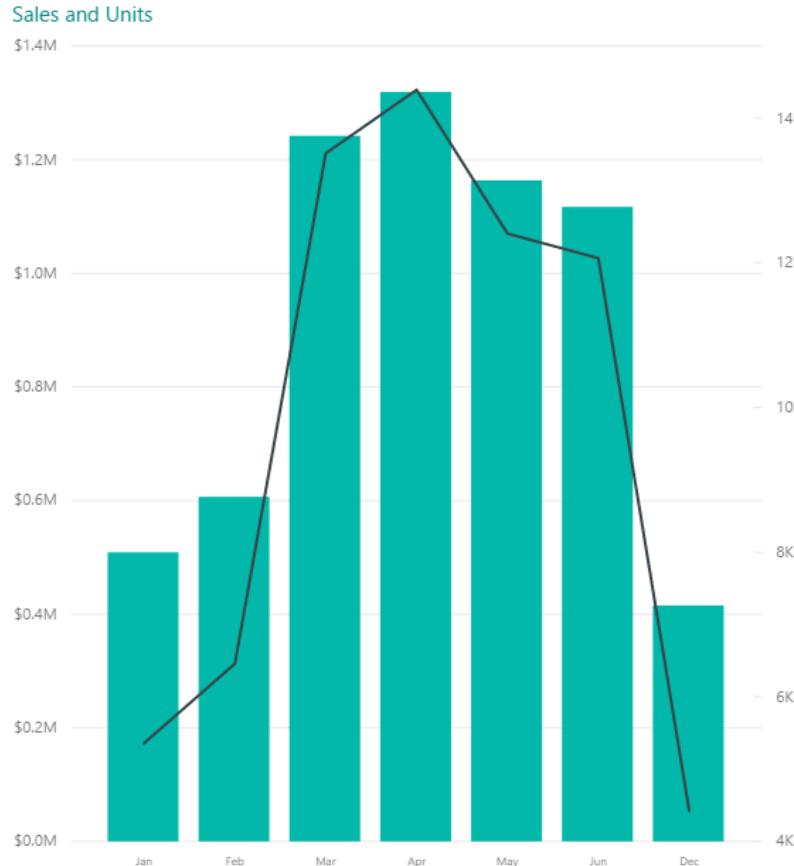
Power BI Customizations

Create Custom Visual



Custom Slicers

Standard and Custom Slicers



Standard Date Slicer (Range)

Year

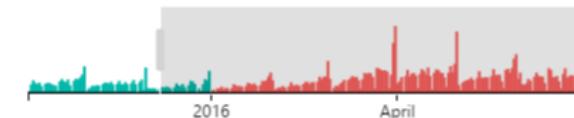
Standard Date Slicer (Relative)

Date

Last ▾ 2 Years ▾

10/4/2015 - 10/3/2017

TimeBrush



Hierarchy Slicer

Category

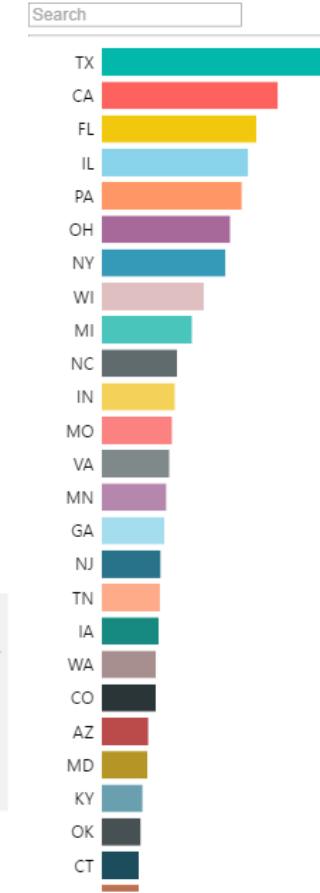
- ▲ Accessory
 - Desktop
 - Mobile
 - Paper
 - Tablet
- ▶ Mix
- ▶ Rural
- ▶ Urban
- ▶ Youth

Chiclet Slicer

Category

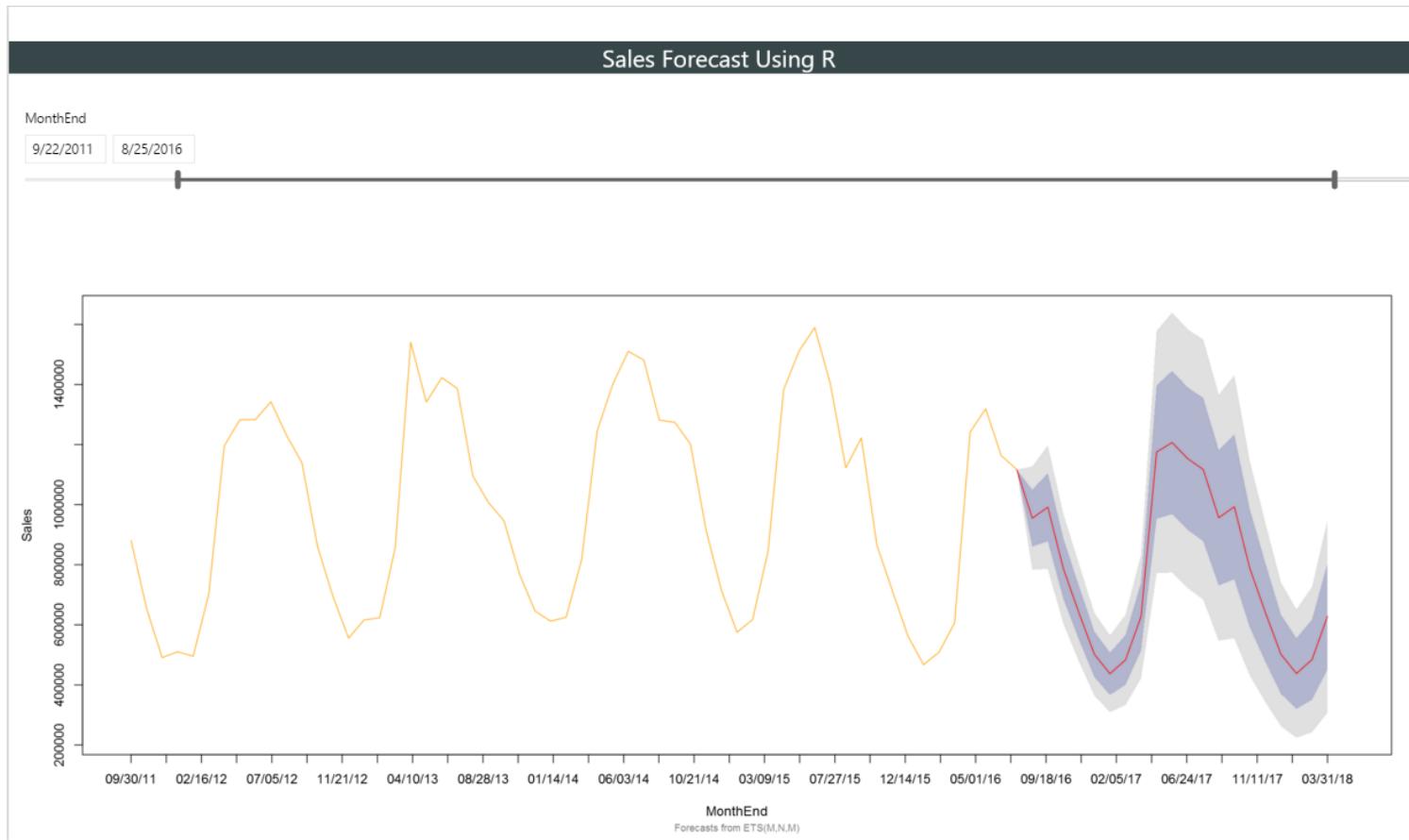
Accessory	Urban
Mix	Youth
Rural	

Attribute Slicer



Power BI Customizations

Create Custom Visual Using R Visual



Visuals can be created in R and Python

Power BI

Data Visualization in a Day

Publishing and Formatting

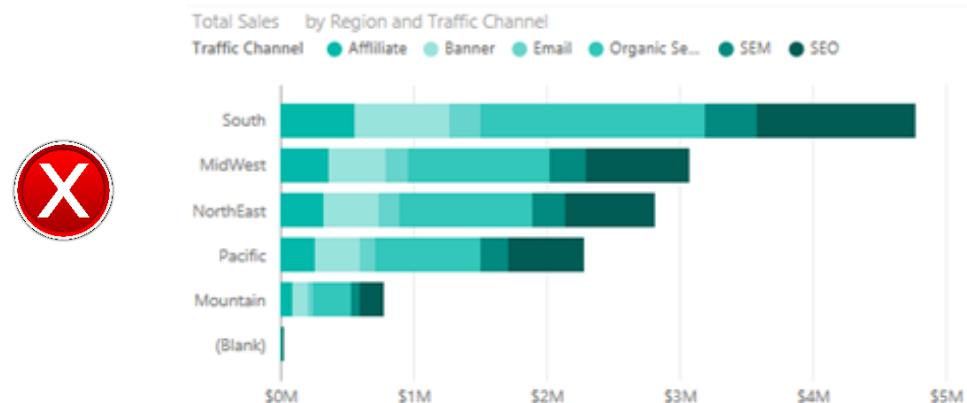
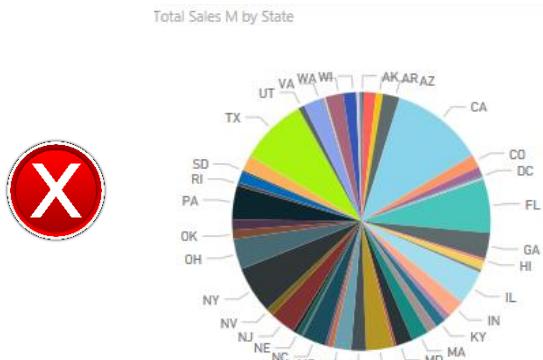
Colors

How do you pick a color scheme?

- Check with your Marketing team for Color/Style Guides
- Use Cynthia Brewer's [Color Brewer](#) or other sites to choose Color Blind friendly colors
- Use the [Adobe Color Wheel](#) to get custom complementary colors
- [Paletton.com](#) is the color scheme generator that the Power BI product team uses
- Color Blind Sensitive: **Contrast Analyzer** is a tool you can use that creates a "lens" to see how people with visual disabilities would view your reports:
<https://developer.paciellogroup.com/resources/contrastanalyser/>
- Use Power BI's default color scheme

Things to Remember when Using Colors

- Do not have more than 3-5 colors display on a single visual (think of Short-Term memory)
- The eye cannot differentiate more than 5 colors of same hue
- Try to have a semantic meaning for your colors (Red = Bad, Green = Good)

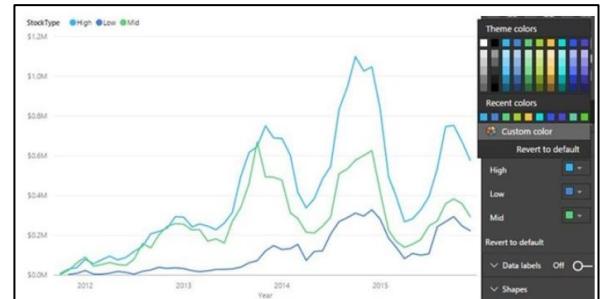


Make Your Own Theme

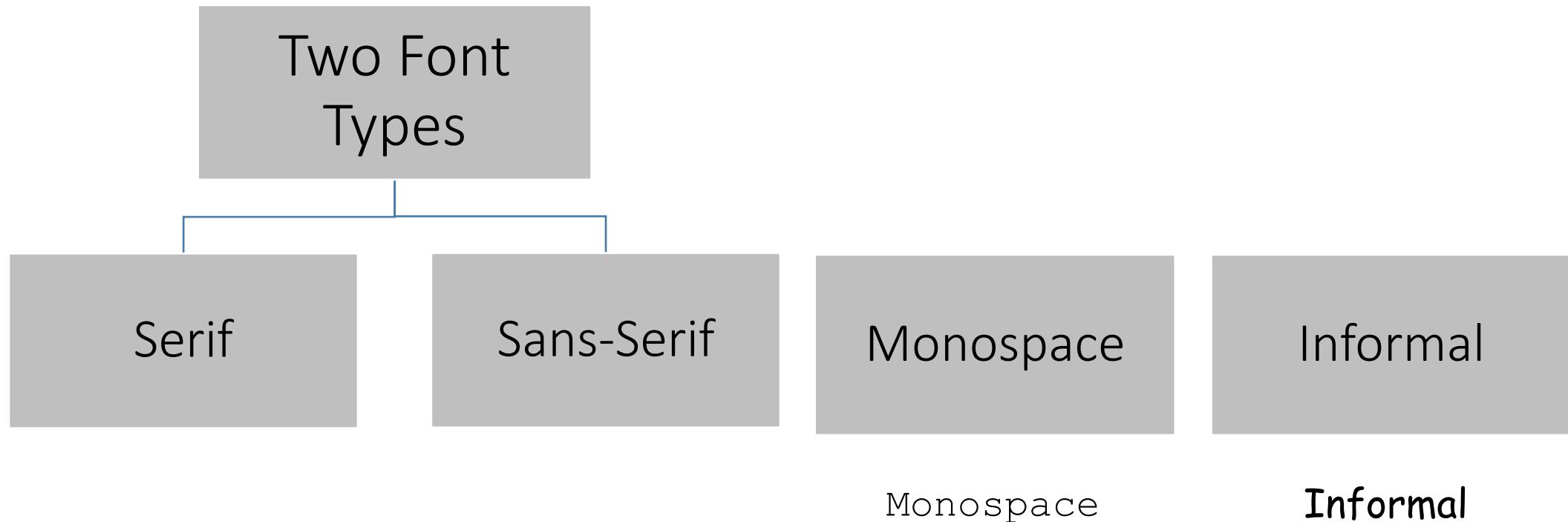
Theme files are simple JSON files

- Import the theme into your PBIX to update styles in your report
 - Color palette
 - Font
 - Visual Formatting (and more...)
- Check out pre-made themes in the [Power BI Theme Gallery](#)
- Blog post on how to apply themes:
<https://powerbi.microsoft.com/en-us/blog/power-bi-community-report-theme-gallery/>
- Theme Generator: <https://powerbi.tips/tools/report-theme-generator-v3/>

```
{  
  "name": "waveform",  
  "dataColors": [ "#31B6FD", "#4584D3", "#5BD078", "#A5D028", "#F5C040", "#05E0DB",  
    "#3153FD", "#4C45D3", "#5BD0B0", "#54D028", "#D0F540", "#057BE0" ],  
  "background": "#FFFFFF",  
  "foreground": "#F2F2F2",  
  "tableAccent": "#5BD078"  
}
```



Font



- Sans-Serif fonts most suited for Digital Media in a Professional Setting
 - Ex. Segoe, Calibri, Trebuchet

Changing Font Weight using three Techniques

- Change font size

Hi Power BI

- Segoe UI Light 28

Hi Power BI

- Segoe UI Light 24

- Choose different font with greater weight from same family

Hi Power BI

- Segoe UI (Body) 24

Hi Power BI

- Segoe UI Light 24

- Bold an existing font

Hi Power BI

- Segoe UI Light 24 (Bolded)

Hi Power BI

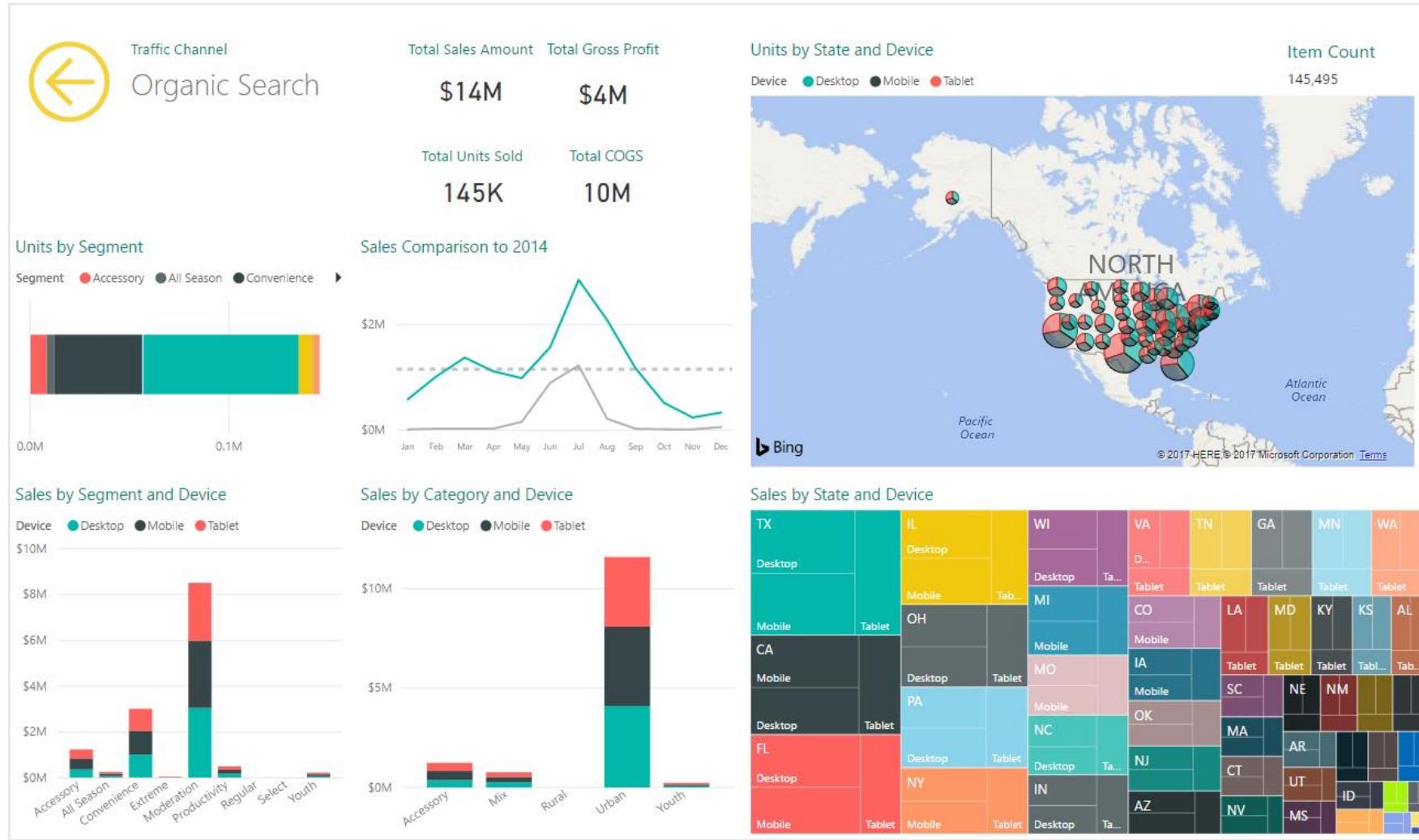
- Segoe UI Light 24 (Non-Bolded)

Try all three techniques to see which one looks the best

Font Recommendations

- Choose at the most 2-3 font types/sizes on a report page/dashboard
- Choose a lighter weight font Ex. "Segoe UI Light" for
 - Axis
 - Non important Data Labels
 - Text box
 - Non Titles
- Use a higher weight font from same family for Titles rather than (bold) Ex. Segoe UI Bold

Use of Fonts

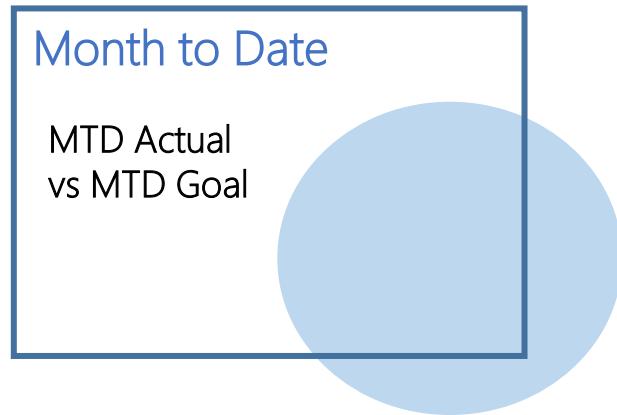


Icons

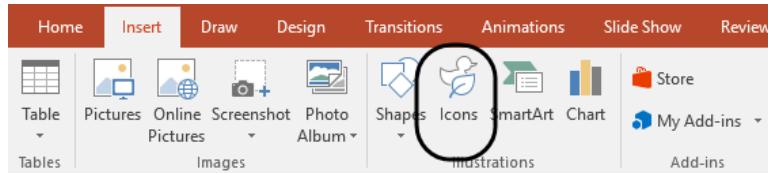


- Effective use of icons can add to perceptual depth of a report
- Don't over use icons or misuse icons

Dashboard Tile Art



- Rectangle image size 1.81" by 2.66"
- Add header text
- Add subtitle text
- Add circle shape for icon emphasis
- Add icon from native **Office 2016 Icon library**
- Change color of icon graphic
- Snip out the box and save as PNG



Proportional Sizes for Custom Dashboard Tiles

Rule of Thumb Formula:

- 1 x 1 Tile – 266:181 pixels
 - 2 x 1 Tile – 540:181 pixels
 - 3 x 1 Tile – 816:181 pixels
-
- Images Width = $266 * (\text{Number of Tiles Wide}) + 8(\text{Number of Tiles Wide} - 1)$
 - Image Height = $181 * (\text{Number of Tiles High}) + 8(\text{Number of Tiles High} - 1)$

Pro Tip: Tile sizes don't have to be exact, just proportional (i.e. 2.66" by 1.81")

Symbols



Different Ways to Use Symbols

- Unicode Symbols - You can find Unicode symbols at [Unicode-table.com](http://unicode-table.com) or [Unicode.org](http://unicode.org) (need to convert hex to dec)
(rendered in Black/White)
- Locate the web page for the desired symbol
- Scroll down to see the "Your Browser" section
- Highlight the symbol and copy (Ctrl+C)
- Paste (Ctrl+V) into the formula bar of your DAX



Times New Roman

KPIs

Different Ways to Obtain/Use KPIs



- Use the KPI visualization in Power BI Desktop
- If you *import* an Excel data model with KPIs into Power BI Desktop, the KPIs will be maintained and render in color
- If you *connect* Power BI Desktop to either SSAS Multi-Dimensional or Tabular Model which contains KPIs, the KPIs will render in color in your visualizations
- In the Table Visual, use conditional formatting to set colors in a column then set the column width very small to only display the colors

Report Layout Hacks

Can this be done in Power BI?

Performance Comparison Across Segments					
Segment	Sales	Monthly V T B	Daily Ave Sales	VTB	VTB %
Accessory	\$1,067,508			173,908.60	19.46%
Convenience	\$2,554,423			-260,215.44	▼ -9.25%
Moderation	\$7,533,866			1,201,974.45	18.98%
Total	\$11,155,796			1,115,667.61	11.11%

Bar Charts as KPIs



You can do the same with Pie Charts

Spark Lines



Spark line with Min, Max



YoY growth with +/-



Win loss charts

How do you create these with Power BI?

Hyperlinks and Images

Table with URL



Type	Link
file	
ftp	
http	
https	
mailto	
news	
telnet	

- Full path of the URL in a field
- Modify the **Data Category** (modeling ribbon)
 - ImageURL – to see image
 - WebURL – to see Link Symbol
- Supports all link types displayed at left.

How do you create these with Power BI?

Report Accessibility

- Turn on markers and use different markers for each line
- Don't rely on color or conditional formatting to provide insights
- Pick an intentional sort order for each visual on your report.
- Select a theme that is high contrast and color blind friendly
- Ensure contrast between text and background
- Use text sizes and fonts that are easily readable.
- Include a title, axis labels, and data labels in all visuals.
- Use meaningful titles for all report pages.

Report Accessibility – Built-in Features

Built-in accessibility features

- Keyboard navigation
- Screen-reader compatibility
- High contrast colors view
- Focus mode
- Show data table

Report Accessibility – Configurable Built-in Features

Built-in accessibility features requiring configuration

- Alt text
- Tab order
- Titles & labels
- Markers
- Report themes

Lab 05

Refer to Data Visualization Lab – Lab 05

Product Sales and Geography – Pbix

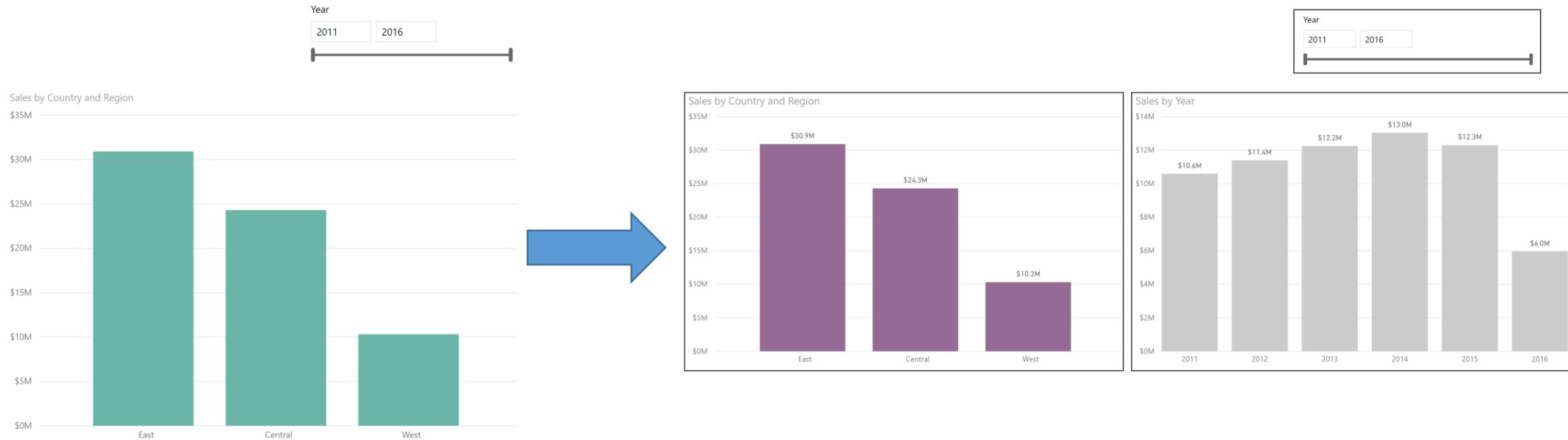


- Update the chart on the left to the one on the right.

Lab 06

Refer to Data Visualization Lab – Lab 06

Edit Interactions – Pbix tab “Lab 6”

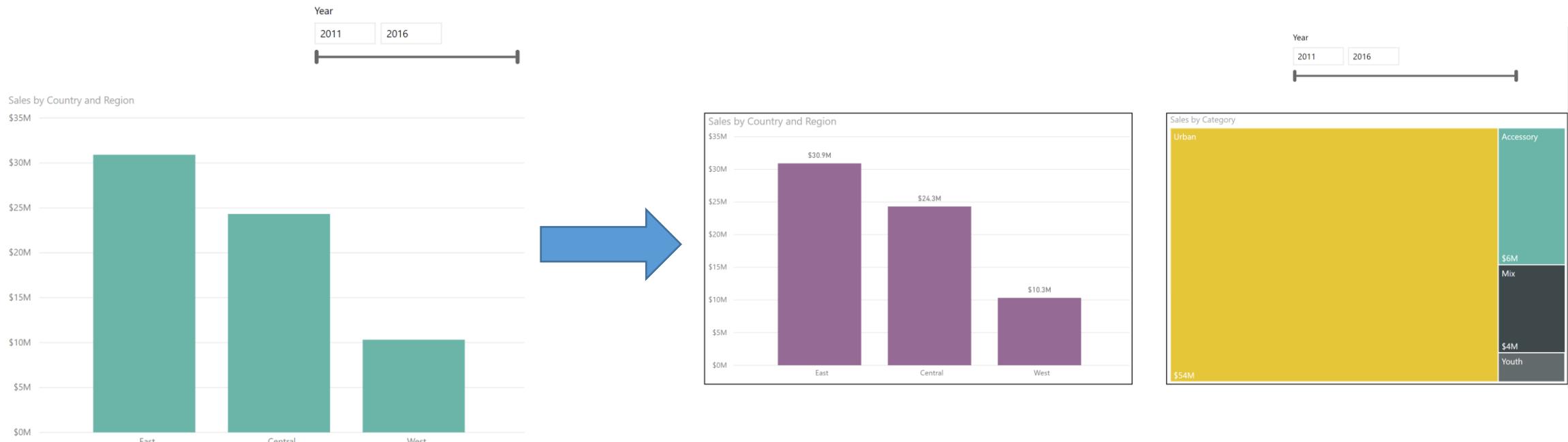


- Update the chart on the left to the one on the right.

Lab 07

Refer to Data Visualization Lab – Lab 07

Create a Treemap – Pbix tab “Lab 7”



- Update the chart on the left to look like the one on the right.

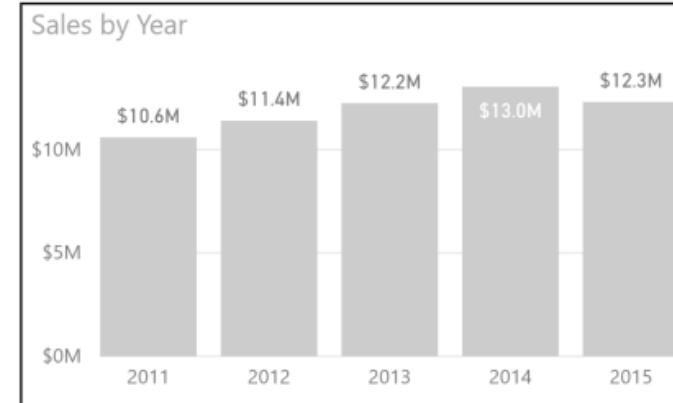
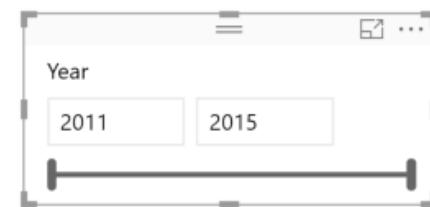
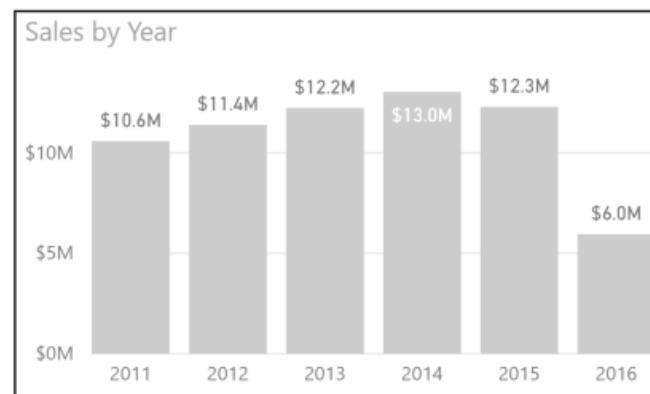
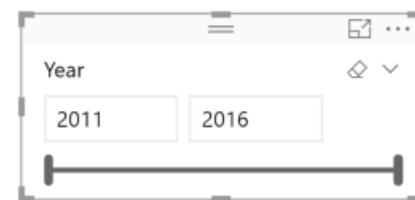
Lab 08

Refer to Data Visualization Lab – Lab 08

Working with Filters – Pbix tab “Lab 8”

1. We do not have full year sales for 2016. I do not want 2016 data to show in this report page. How would I achieve this ?

2. I want 2016 data to be filtered out of the entire report. How would I achieve this ?



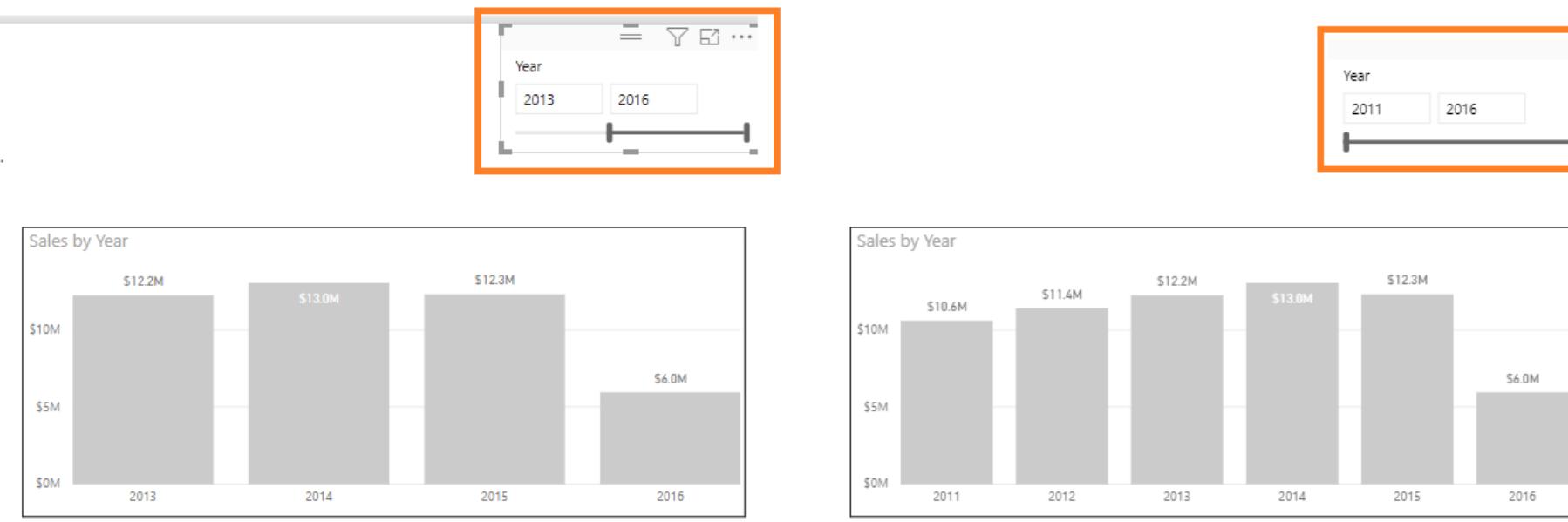
Lab 09

Refer to Data Visualization Lab – Lab 09

Sync Slicers – Pbix tab “Lab 9”

Filter Year slicer to 2013 to 2016.

Notice data is not filtered by year here. I want all Year slicers to be synced.



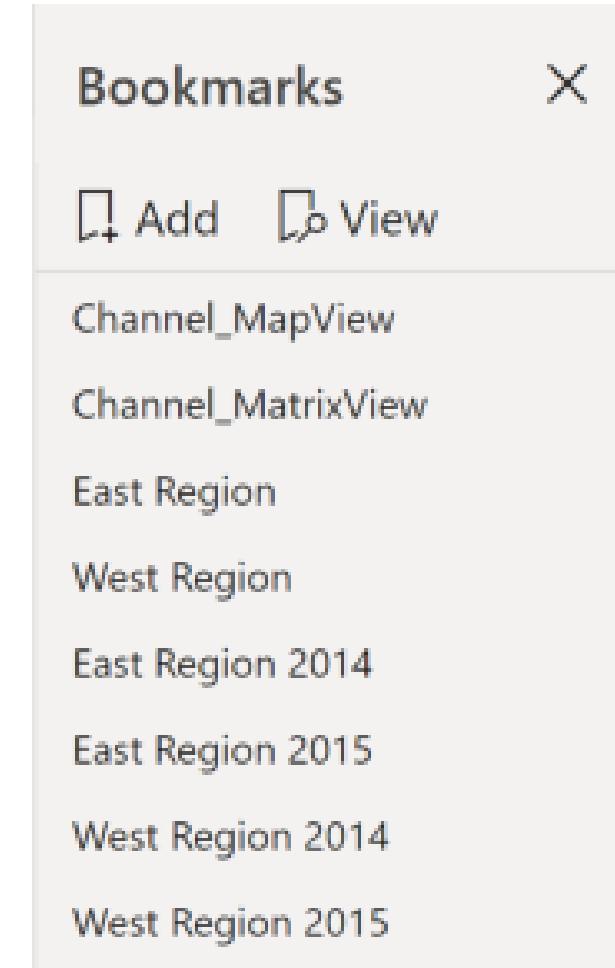
Lab 10

Refer to Data Visualization Lab – Lab 10

Creating Bookmarks – Pbix tab “Lab 10”

Notice there is a steady increase in Sales from 2011 through 2014. In 2015 there is a decrease.

1. Is this consistent across all Regions ?
2. Is there a difference in Sales by Product Segment in 2014 compared to 2015 ?
3. Use Bookmarks to capture your story.



Power BI

Data Visualization in a Day

Sample Report Authoring Process

Original Report

Original Report

MAIN KPIs

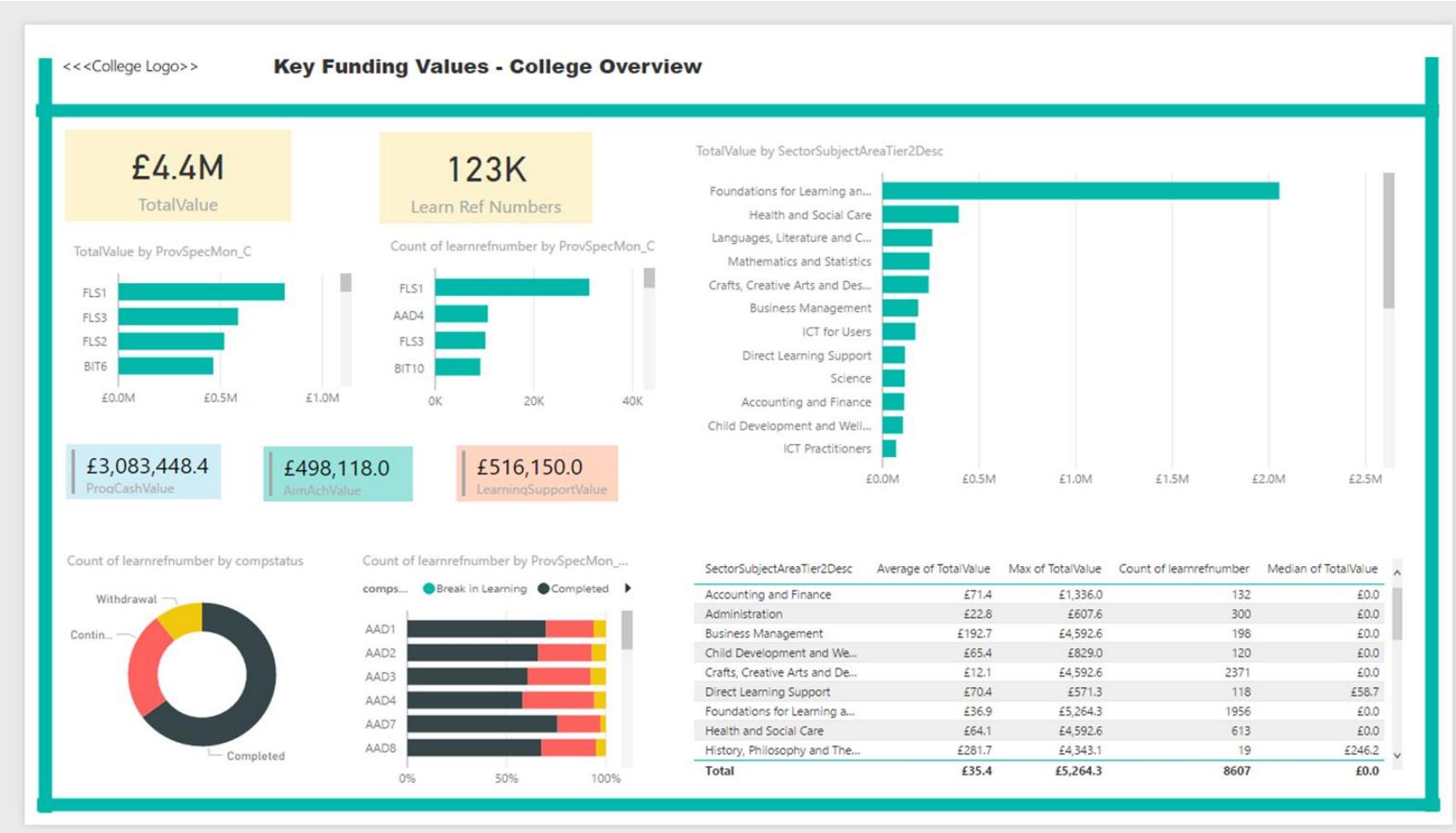
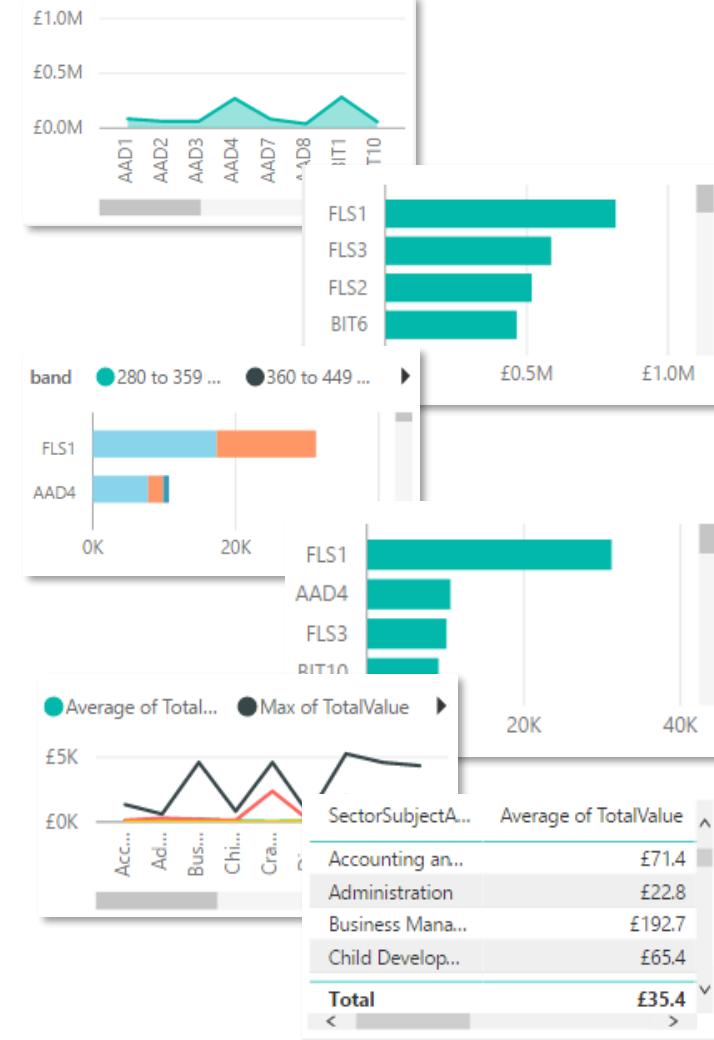
KPIs DETAILS

INDICATORS

PROPORTIONS

SSA TIER 2

Chart Selection



Report Alignment

SSA TIER 2

MAIN KPIS

£4.4M Total Value 123K Learn Reference Numbers

KPIs DETAILS

Provider Monitoring Field/School/Dept	Learn references
FLS1	£0.81M
FLS3	£0.59M
FLS2	£0.52M
BIT6	£0.46M
FLS8	£0.38M

£498,118.0 AimAchValue £3,083,448.4 ProgCashValue £516,150.0 LearningSupportValue

INDICATORS

Count of learnrefnumber by c... Proportion by Completion Status

PROPORTIONS

Break in Learner
Completed
Continuing
Withdrawal

10.55%
24.1%
64.72%

0% 50% 100%

TotalValue by SectorSubjectAreaTier2Desc

SectorSubjectAreaTier2Desc	Average of TotalValue	Max of TotalValue	Count of learnrefnumber	Median of TotalValue
ICT Practitioners	£305.4	£4,592.6	22	£0.0
History, Philosophy and Theology	£281.7	£4,343.1	19	£246.2
Service Enterprises	£239.1	£749.3	12	£299.7
Business Management	£192.7	£4,592.6	198	£0.0
Accounting and Finance	£71.4	£1,336.0	132	£0.0
Mathematics and Statistics	£71.3	£894.9	186	£0.0
Direct Learning Support	£70.4	£571.3	118	£58.7
Total	£35.4	£5,264.3	8607	£0.0

Branding/Targeting

FLEXIBLE LOGO

The screenshot shows a web browser displaying the website infoassetmanagement.com/products.html. The header features a large, bold 'IAM' logo followed by the text 'INFO ASSET MANAGEMENT'. Below the header is a navigation menu with links for HOME, ABOUT US, CONTACT US, PRODUCTS, SERVICES, and PRIVACY. A social media sharing bar is visible above the main content area. The main content area contains a heading 'College Information Asset Manager' and a paragraph about the challenges of managing information assets. To the right is a callout box containing a laptop screen showing software interfaces. At the bottom of the page are four sections targeting different professionals: IT Professionals, Finance Professionals, Quality Professionals, and Marketing and Student Services Professionals. Each section includes a brief description and a bullet point. The background of the page is dark blue.

MAIN COLOR

© 2020 Microsoft. All rights reserved.

Color Selection

The dashboard features a header with the IAM logo and 'INFO ASSET MANAGEMENT'. Below the header, there are several data visualizations:

- A large blue square.
- A red square.
- A black square.
- A grey square.
- A white square.
- A chart showing 'Total Value' of £4.4M.
- A chart showing 'Learn Reference Numbers' of 123K.
- A table for 'Provider Monitoring Field/School/Dept' with data for FLS1 through BIT1.
- A table for 'Learn references' with data for FLS1 through BIT1.
- Three numerical values: £498,118.0, £3,083,448.4, and £516,150.0.
- A donut chart showing 'Proportion by Completion Status' with segments: Completed (64.72%), Continuing (24.00%), Break in Lear... (10.55%), and Withdrawal (0.73%).
- A horizontal bar chart showing 'Proportion by Completion Status' for learners AAD1 through AAD7.

On the right side, there is a section titled 'SSA Tier 2 Funding Distribution' with a horizontal bar chart showing funding amounts for various subjects. Below this is a table with columns: SectorSubjectAreaTier2Desc, Average of TotalValue, Max of TotalValue, Count of learnrefnumber, and Median of TotalValue.

SectorSubjectAreaTier2Desc	Average of TotalValue	Max of TotalValue	Count of learnrefnumber	Median of TotalValue
ICT Practitioners	£305.4	£4,592.6	22	£0.0
History, Philosophy and Theology	£281.7	£4,343.1	19	£246.2
Service Enterprises	£239.1	£749.3	12	£299.7
Business Management	£192.7	£4,592.6	198	£0.0
Accounting and Finance	£71.4	£1,336.0	132	£0.0
Mathematics and Statistics	£71.3	£894.9	186	£0.0
Direct Learning Support	£70.4	£571.3	118	£58.7
Child Development and Well Being	£65.4	£829.0	120	£0.0
Languages, Literature and Culture of ...	£65.1	£4,592.6	203	£72.7
Health and Social Care	£64.1	£4,592.6	613	£0.0
Science	£62.1	£3,757.6	156	£43.7
Total	£35.4	£5,264.3	8607	£0.0

Background Color

INFO ASSET MANAGEMENT

Key Funding Values
College Overview

KEY METRICS

£4.4M Total Value **123K** Learn Reference Numbers

Provider Monitoring Field/School/Dept Learn references

Field/School/Dept	Total Value	Learn References
FLS1	£0.81M	31K
FLS3	£0.59M	11K
FLS2	£0.52M	10K
BIT6	£0.46M	9K
FLS8	£0.38M	8K
BIT1	£0.28M	8K

£498,118.0 AimAchValue **£3,083,448.4** ProgCashValue **£516,150.0** LearningSupportValue

Proportion by Completion Status

Completion Status	Proportion
Break in Lear...	10.55%
Completed	64.72%
Continuing	24.73%
Withdrawal	10.55%

SSA Tier 2 Funding Distribution

band: All

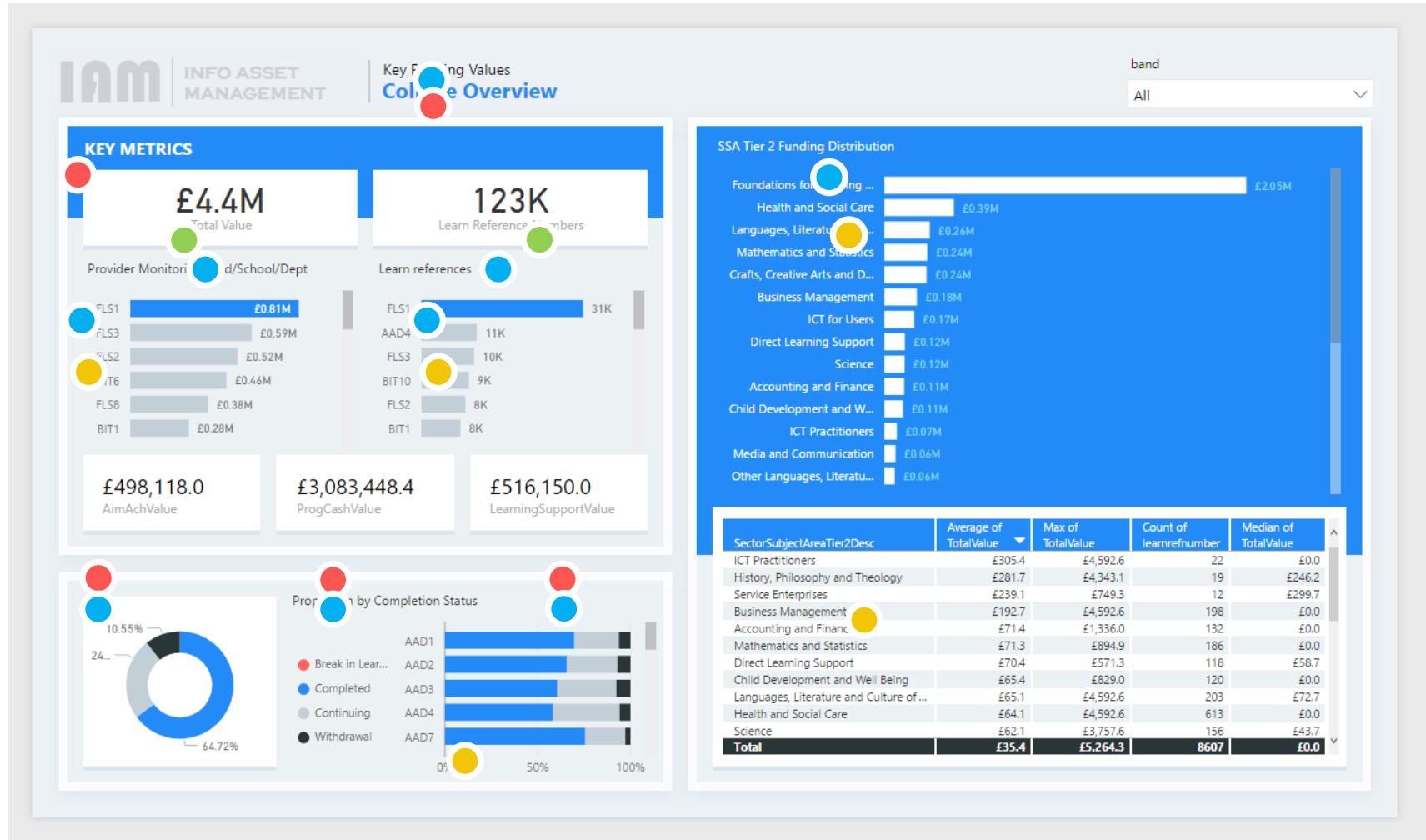
SectorSubjectAreaTier2Desc	Average of TotalValue	Max of TotalValue	Count of learnrefnumber	Median of TotalValue
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Total	£35.4	£5,264.3	8607	£0.0

Text Selection

Font
Segoe UI

8 ●
9 ○
14 ●
30 ●

Types
Normal
Bold



Final Report

INFO ASSET MANAGEMENT

Key Funding Values
College Overview

KEY METRICS

£4.4M Total Value	123K Learn Reference Numbers
-----------------------------	--

Provider Monitoring Field/School/Dept

Field/School/Dept	Total Value
FLS1	£0.81M
FLS3	£0.59M
FLS2	£0.52M
BIT6	£0.46M
FLS8	£0.38M
BIT1	£0.28M

Learn references

Reference Type	Count
FLS1	31K
AAD4	11K
FLS3	10K
BIT10	9K
FLS2	8K
BIT1	8K

£498,118.0
AimAchValue

£3,083,448.4
ProgCashValue

£516,150.0
LearningSupportValue

Proportion by Completion Status

Completion Status	Percentage
Completed	64.72%
Continuing	24.24%
Break in Lear...	10.55%
Withdrawal	0.0%

SSA Tier 2 Funding Distribution

Subject Area	Total Value
Foundations for Learning ...	£2.05M
Health and Social Care	£0.39M
Languages, Literature and ...	£0.26M
Mathematics and Statistics	£0.24M
Crafts, Creative Arts and D...	£0.24M
Business Management	£0.18M
ICT for Users	£0.17M
Direct Learning Support	£0.12M
Science	£0.12M
Accounting and Finance	£0.11M
Child Development and W...	£0.11M
ICT Practitioners	£0.07M
Media and Communication	£0.06M
Other Languages, Literatu...	£0.06M

SectorSubjectAreaTier2Desc

SectorSubjectAreaTier2Desc	Average of TotalValue	Max of TotalValue	Count of learnrefnumber	Median of TotalValue
ICT Practitioners	£305.4	£4,592.6	22	£0.0
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Power BI

Data Visualization in a Day

Report Authoring – Best Practices

Report Optimization – High Level

- Visuals generate queries against source data
- Minimum of 1 query per visual
- Queries are sent in parallel
- Inappropriate use of visuals/slicers can generate very large amount of queries and slow things down

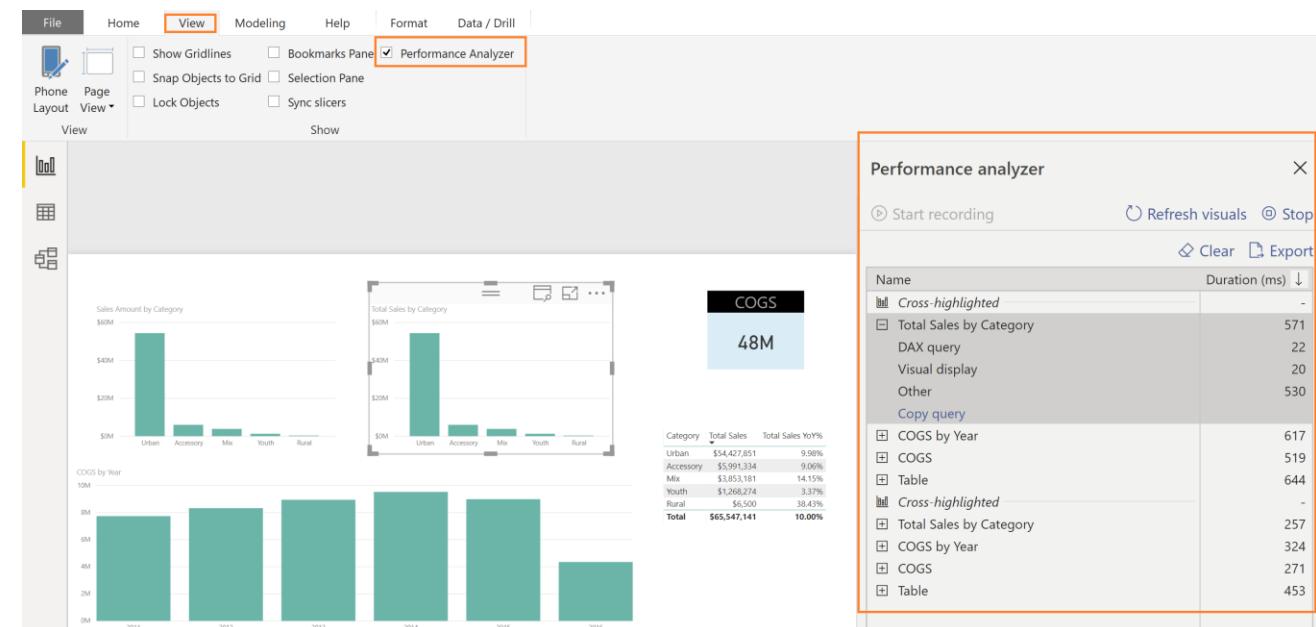
Goals

- Reduce number and complexity of queries
- Reduce amount of data being returned to report

Performance Analyzer

Using Performance Analyzer:

- You will know how each of your report elements, such as visuals and DAX formulas, are performing
- You can see and record logs that measure how each of your report elements performs when users interact with them, and which aspects of their performance are most (or least) resource intensive



Be Careful with Custom Visuals, Test Performance

Scenario

- Custom visuals can be poorly optimized

Why is it undesired?

- Can be the slowest visuals, dragging down the user experience

Proposed solutions

- Replace with built in visuals, or use certified custom visuals
- Test custom visual performance in isolation then compare

Filters vs Slicers

Scenario

- Slicers in report contain thousands of values

Why is it undesired?

- High memory load, especially with multiple interacting slicers. Slicers issue two queries (populate, fetch selection details)

Proposed solutions

- Use filter instead of slicer, or to force context and limit values
- Restructure to provide drillthrough to detail

Use Slicer Selection Defaults

Scenario

- Unfiltered visuals containing high number of values

Why is it undesired?

- High memory load, more data to fetch and process

Proposed solutions

- Set default value and set and single/multi-select property
- Restructure to provide drillthrough to detail

Use Synced Slicers with Care

Scenario

- Report with many pages, many visuals and synced slicers

Why is it undesired?

- Higher memory load and more queries

Proposed solutions

- Use filter instead of slicer, or to force context and limit values
- Restructure to provide drillthrough to detail

Use Query Reduction Features

Scenario

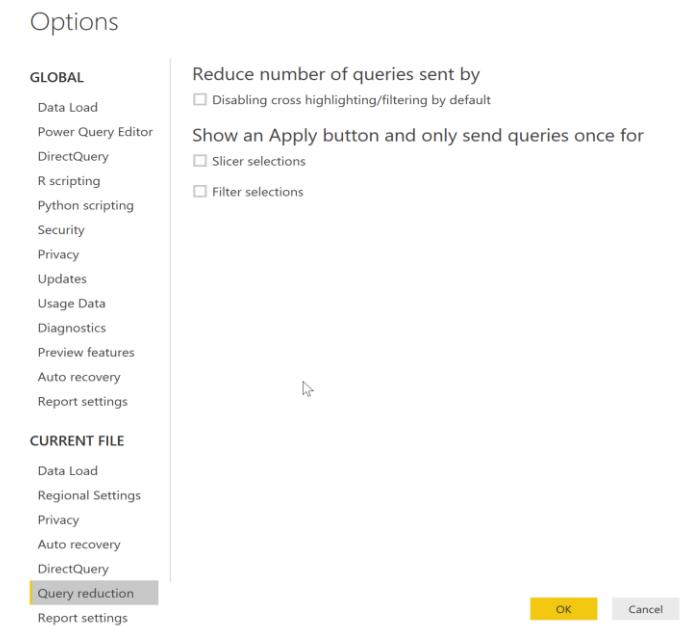
- Previously discussed high no. of visuals/slicers

Why is it desired?

- Lower memory load, less data to fetch and process

Proposed solutions

- Consider no cross-highlighting and adding Apply buttons to slicers and filers



Avoid Intensive Data Export

Scenario

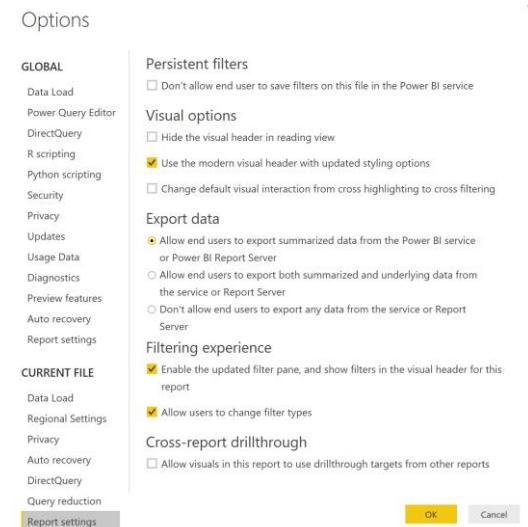
- Table visual containing many fields and complex measures
- Users export detail data

Why is it undesired?

- Leaf level queries are expensive and can consume a lot of memory, especially for large models

Proposed solution

- Limit export at design time



Power BI

Data Visualization in a Day

Dashboard Design

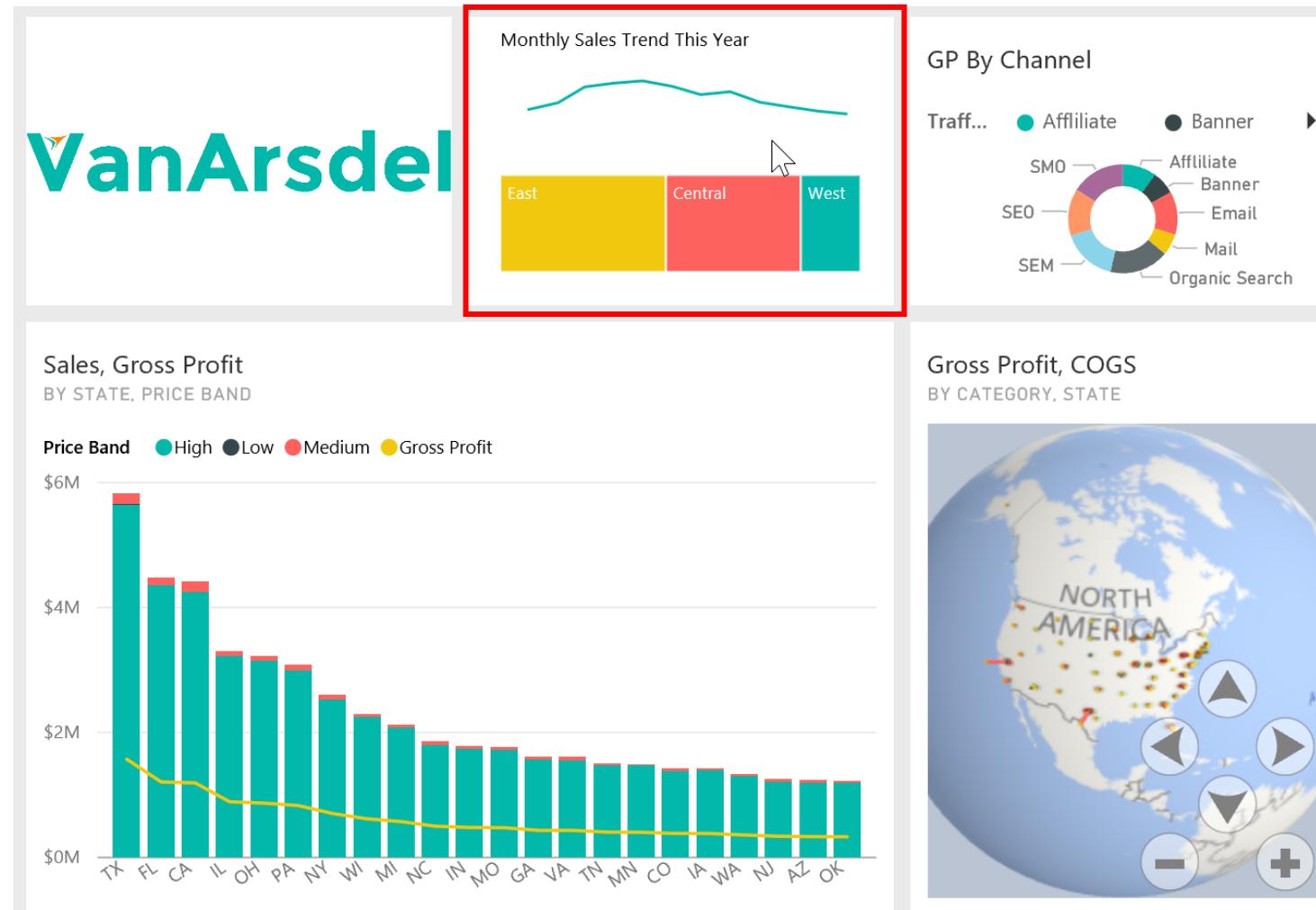
Dashboard Optimization – High Level

- Dashboards were designed to provide a fast summary view with drill to report if desired
- Some configurations reduce speed and usefulness

Goals

- Use Power BI dashboard tile cache wherever possible
- Employ a “launch pad” design principle

Pin Report Visuals to a Dashboard as Tiles



Useful when:

- The visual you need is constructed of multiple parts
- You want very specific formatting on tile
- Manually update the URL to an appropriate URL

Tip – Avoid very busy Report Tiles

Scenario

- Pinning a live report tile with high number of visuals

Why is it undesired?

- Executed on demand, not cached so could be slower
- Negatively impacts perceived dashboard load experience

Proposed solutions

- Pin individual visuals instead of the report page
- Design metrics/dashboards to truly meet users' information needs. Usually requires more iterations

Tip – Manage Dashboard Cache Refresh

Scenario

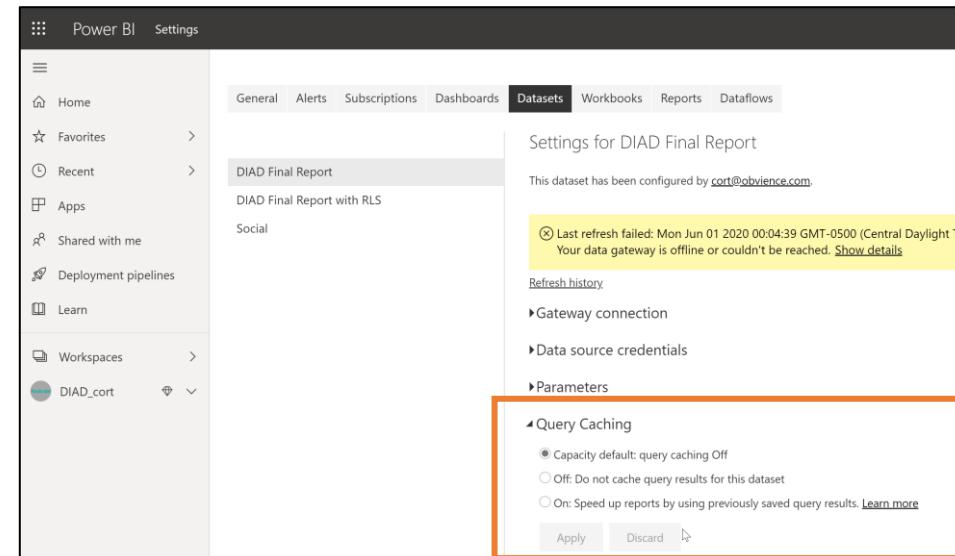
- Many dashboards hitting source, which may have many unique RLS contexts

Why is it undesired?

- By default, tiles from in-memory sources will refresh after a scheduled data refresh
- By default, tiles from DQ sources will refresh cache every hour. May overload source

Proposed solution

- Reduce Cache Refresh frequency
- External DW's often refreshed only daily, so align schedules



Best Practices for Dashboard Design

- Consider your audience
- Create a story on one screen
- Accent the most important information
- Place important information in the top left
- Be sure to choose the right visualization for the data
- Be sure to encode quantitative data nicely
- Don't mix levels of precision and time
- Don't mix large and small measures on the same scale
- Don't clutter your charts with data labels that aren't needed

Power BI

Data Visualization in a Day

Final Thoughts

Sample Business Questions for Agile Process

1. What is my Total Sales for a Selected Year and Region?
2. How is my Total Sales doing Year Over Year?
3. How is Gross Profit for various States in my region?
4. How is my Sales doing by Channel, Device, Category for selected Year?
5. How is my Total Sales and YoY Growth for the region doing compared to other regions?
6. What is my Total Sales for selected Year, Month across Categories?
7. How are my Product Sales by Geography?
8. How is VTB, YoY, MoM for various categories which ones are doing good and bad?
9. How is my 12 month VTB trend for my categories?
10. How is my 1 month Avg Per Sale trend for my categories? What is the Min and Max Avg Per Sale?

Power BI Support Resources

Contact Support

- Report Errors, Issues – Support.PowerBI.com

Resources

- Community.PowerBI.com – Community Forum
- [Report Theme Gallery](#) – A showcase for stunning report themes
- [Data Stories Gallery](#) – Get inspired with Data Stories by other Power BI users
- [R-Visuals Gallery](#) – Get inspired by others use of R for analyzing their data
- Store.office.com – Custom PBI visuals and R visuals you can download and use in your story
- [Power BI Blog](#) - weekly updates
- [User Voice for Power BI](#) – Vote on (or submit) your favorite new ideas for Power BI
- [Issues.PowerBI.Com](#) – log issues with the community
- [Whitepaper](#) - Creating an Enterprise Class Dashboard *Solution with Power BI*
- [Guided Learning Self Service Power BI training](#)
- [DAX Formula Language](#) – syntax for DAX
- [DAX Patterns](#) – Great website to learn new patterns for the DAX Language
- [Power Query Formula Language](#) – syntax for the “Query” language
- [Paletton.com](#) – a color scheme generator
- <https://unicode-table.com/en/> – Unicode Character Table
- [Theme Generator](#)
- [Contrast Analyzer](#): a tool that creates a “lens” to show how people with different visual disabilities might see your reports
- [Charticulator](#): a tool that helps to build custom visuals

Thank you!
Please fill our survey:
<https://aka.ms/PBIAdvanced>
Select: Advanced Data
Visualization

Power BI

Data Visualization in a Day

Questions?