Communicating Insights

with Power BI

Overview

Here we explore storytelling with data and meeting the needs of different audiences. We explore more advanced capabilities of the tool that take reports to the next level. This includes web scraping and adding custom interactions to dashboards. By the end of this session you should be fully equipped to carry out end to end data analysis in Power Bl.

Learning Objectives

In this lesson, students will:

- practice storytelling with data
- better understand the audience
- see Power BI Service in action
- work closely with hierarchies, parameters, slicers and other chart interactions
- scrape the web with Power BI

Duration: 3 hours



Suggested Agenda - Communicating Insights (1/2)

Time		Activity	Topics	
0:00-0:10	10 mins	Opening	Today's Agenda & Learning Objectives	
0:10-0:15	5 mins	Housekeeping	Power BI Project	
0:15-0:20	5 mins	Topic Introduction	Communicating Insights	
0:20-0:25	5 mins	Topic Introduction	Moving Averages	
0:25-0:35	10 mins	Guided Practice	Calendar Tables	
0:35-0:45	10 mins	Guided Practice	New Measure: Rolling Average	
0:45-0:50	5 mins	Guided Practice	Plotting a Rolling Average	
0:50–1:00	10 mins	Guided Practice	Combo Charts	
1:00–1:15	15 mins	Group Exercise	Moving Averages and Combo Charts	
1:15–1:30	15 mins	Topic Introduction	Enhancing Charts for Better Communication	



Suggested Agenda - Communicating Insights (2/2)

Time		Activity	Topics	
1:30–1:40	10 mins	BREAK		
1:40–1:55	15 mins	Guided Practice	User Interactivity: Hierarchies	
1:55–2:10	15 mins	Group Exercise	Hierarchies	
2:10-2:20	10 mins	Guided Practice	Adding Hierarchies to the Model	
2:20–2:30	10 mins	Guided Practice	Slicers	
2:30-2:40	10 mins	Guided Practice	What-if Parameter	
2:40-2:50	10 mins	Independent Practice	User interactivity exercise	
2:50-3:00	10 mins	Wrap Up	Reflection, Exit Tickets	

Advanced Analytics

Hello, GAClient!



What Have We Learned So Far?

Last lesson we:

- Reviewed descriptive statistics
- Chose the best visual for a given inquiry
- Built common visualizations, including:
 - Bar and Column Charts
 - Line and Area Charts
 - Scatter Charts
 - Pie and Donut Charts
- Loaded new visualizations from outside sources
- Applied conditional formatting to charts



Today's Agenda

Here's what we'll cover today:

- Power BI Project
- Storytelling with data
- Publishing dashboards with Power BI Service
- Adding interactivity:
 - hierarchies
 - parameters
 - slicers
- Web scraping with Power BI





Learning Objectives

After this lesson, you'll be able to:

- Tell stories with data
- Cater analyses to different audiences
- Publish dashboards
- Add interactivity to the user experience
- Scrape the web with Power BI







Computers Out:

Prepare for Class

Before we begin:

Please be prepared to access the following files for this lesson:

1. TableRelationships.pbix





Advanced Analytics

Power BI Project

Overview: Power BI Project

- Your client is a food distribution company (\$20M in sales)
- Use Power BI to analyze sales data from 2012 2014:
 - Top-selling product groups
 - Profitability of different product groups
 - Impact of region, season, and fiscal year on sales
 - Customer purchasing trends
- Form groups / teams:
 - We recommend doing this in pairs
 - If preferred, individual work or groups of three are OK
 - You can keep the same groups as the previous project!



Prompt

Your task: Create visuals and written overviews, organized in three Power BI sheets, to answer the questions outlined in the project document.

What should you turn in?

- 1. A Power BI data model (.pbix file) including three sheets with information and visuals addressing questions from each of the three prompts below.
- 2. A one-paragraph overview of your findings for each of the three prompts, included as text in the relevant sheet.

How will you communicate your work?

Submit your Power BI file to {email address} by {date and time}.



Evaluation Rubric

Score	Expectations				
0	Incomplete. • Work was not submitted, or fewer than 50% of the requirements were complete.				
1	Partial credit. Does not meet expectations. • You have <u>not</u> answered one or more questions from any of the three prompts. OR • You have <u>not</u> provided a one-paragraph overview of your findings for each of the three prompts.				
2	 Meets expectations. Your visualizations have answered all questions from all of the three prompts. (this may require more visuals than in the suggested layout) You have provided a one-paragraph overview of your findings for each of the three prompts. 				
3	 Surpasses expectations. Your visualizations have answered all questions from all of the three prompts. (this may require more visuals than in the suggested layout) You have provided an overview of findings for each of the three prompts. In your overview, you have outlined limitations of your exploratory analysis, and a list of next steps for analysis You've included an executive summary that connects your findings across each of the three prompts. 				



Advanced Analytics

Communicating Insights



Why Are We Doing This?

How do I move from reports to dashboards?

How do I convey the right information in a way that makes sense?

Can a well-designed dashboard support self-service analytics?

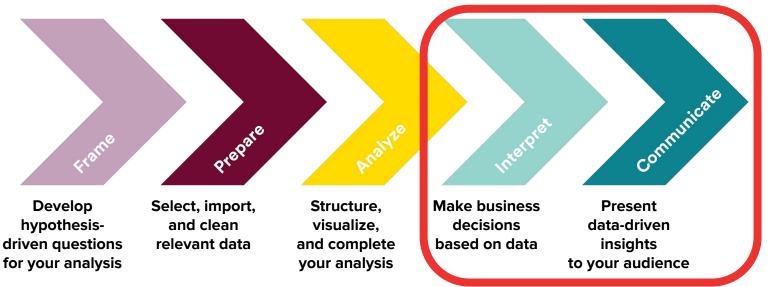
How do I show what I want to say?

How do I support different stakeholders from the same data?



Data Journey

Now that we're comfortable using a variety of tools, it is time to bring it all together with interactive reports and dashboards.





How does this lesson fit in?

Power BI Unit Overview
It's time to focus on the audience, and ways to make reports more visually compelling and nuanced.

Our goal is to develop interactive dashboards that support self-service analytics.

	Lesson	Description
1	Why BI Tools?	Orient individuals to Power BI with an interactive session exploring pre-existing dashboards and the insights they reveal in Power BI. Evaluate what makes a dashboard/analysis effective or not from a communication and clarity perspective.
2	Wrangling + Exploring	Learn how to clean, join, and label data in Power BI in order to set it up for analysis. Then, begin exploring relationships between variables you've brought into an analysis to identify those with the most compelling insights.
3	Exploratory Data Analysis	Model and program relevant variables from exploration into dashboards in Power BI to make your dashboards live entities that others can explore. Begin introducing the concept of significance of findings in stats terms in order to identify the reliability of results.
4	Communicating Insights	Visualize datasets in Power BI to explore and communicate findings. Then, discuss how to use Power BI to share insights & templates.
5	Lab 2	Use Power BI to analyze sales data and answer prompts related to products, sales, and marketing.



Lesson Context

For this lesson, we are <u>Product Analysts</u> at the multinational manufacturing company called "Adventure Works Cycles". We've been tasked with interpreting the purchasing habits of our customers... and we'll be doing that in Tableau! To do that, we will:

- 1. Build moving average charts to visualize trends in past data
- 2. Use visual cues to make table charts more powerful
- 3. Improve our Scatter Plots by using color/size to encode an additional measure(s)
- 4. Improve Bar Charts with additional formatting options

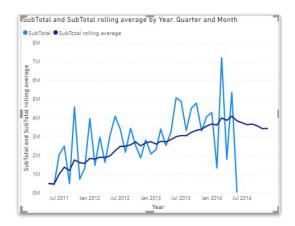


Advanced Analytics

Moving Averages

What is a Moving Average?

- Moving averages smooth the data to form a trend-following indicator.
- They do not predict direction, but rather define the current direction with a lag.

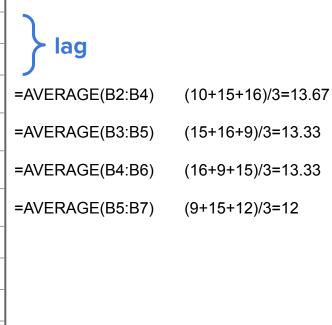


- Moving averages lag because they are based on past data.
- Moving averages are also called rolling averages.
- Simple moving averages are different from cumulative moving averages, which compute averages from the *first* date to the *current* one (the number of values being averaged steadily increases instead of sliding).



How is a Moving Average Calculated?

	Α	В	С	
1	date	sales	3-day average	
2	20-May-12	10		
3	21-May-12	15		lag
4	22-May-12	16	13.66666667	=AVERAGE
5	23-May-12	9	13.33333333	=AVERAGE
6	24-May-12	15	13.33333333	=AVERAGE
7	25-May-12	12	12	=AVERAGE
8	26-May-12	20	15.66666667	
9	27-May-12	15	15.66666667	
10	28-May-12	10	15	
11	29-May-12	14	13	





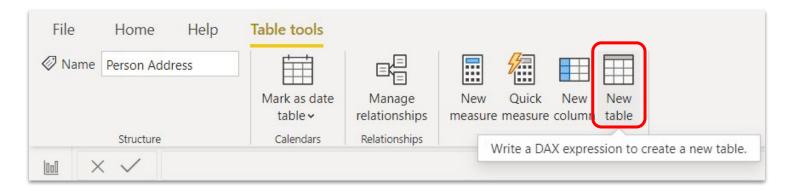
Moving Averages

Guided Walkthrough: Setting Up a Calendar Table

This involves adding a table to our model using DAX commands.

First, load **TableRelationships.pbix** into Power Bl.

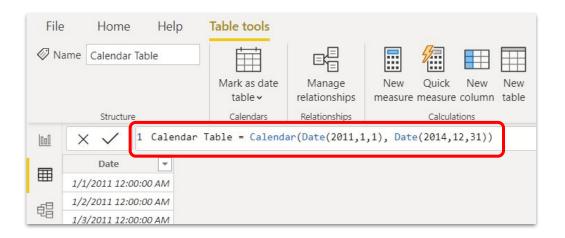
In the Data view, open the Table tools ribbon and click New table.





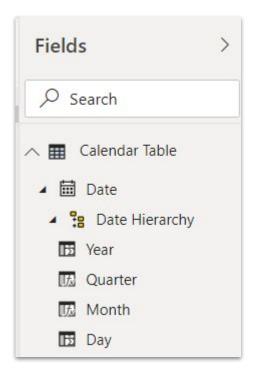
Enter the following DAX formula:

Calendar Table = Calendar(Date(2011,1,1), Date(2014,12,31))





Note that Power BI automatically provides a date hierarchy:

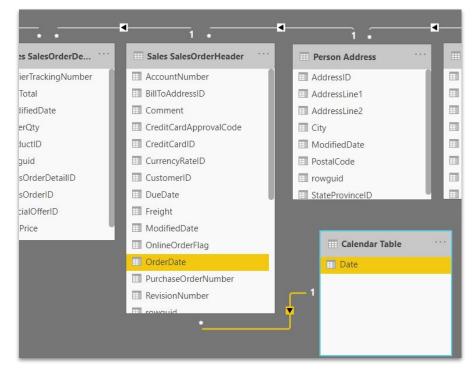




Open the Model view, and link

Calendar Table to SalesOrderHeader

on Date and OrderDate





Moving Averages

Guided Walkthrough: New Measure: Rolling Average

We could write the new measure in DAX, but Power BI provides a shortcut.

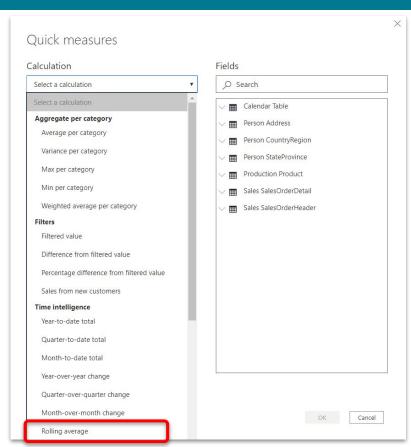






New Measure: Rolling Average

Open Quick measures and select *Rolling average*



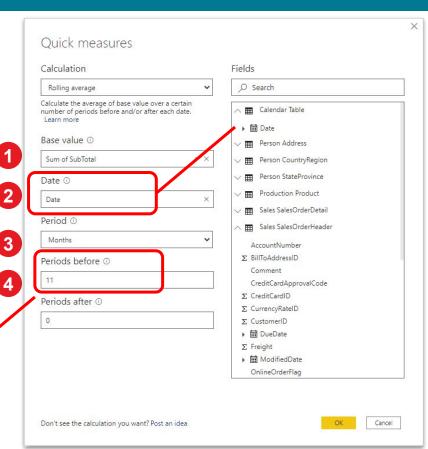


Guided Walk-Through:

New Measure: Rolling Average

- Add Sales SalesOrderHeader
 SubTotal to Base value
- Add Calendar Table Date to Date
- 3. Set *Period* to Month
- 4. Set a 12 month rolling average

Note: The window used in the rolling average calculation includes the current time point. The number of points averaged is (periods before) + 1 + (periods after)



Moving Averages

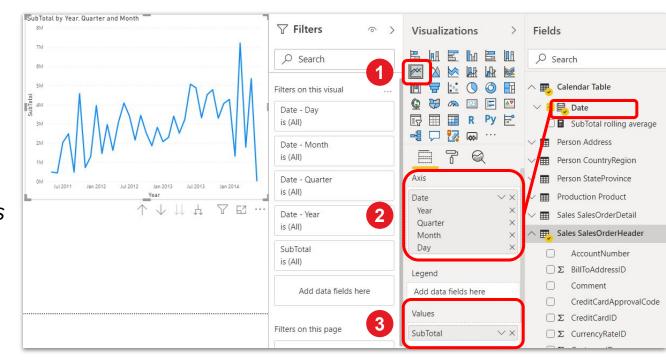
Guided Walkthrough: Plotting a Rolling Average

Guided Walk-Through: Plotting a Rolling Average

In the Report view, add a Line Chart

Add Calendar Table
Date to *Axis*

Add SubTotal to Values

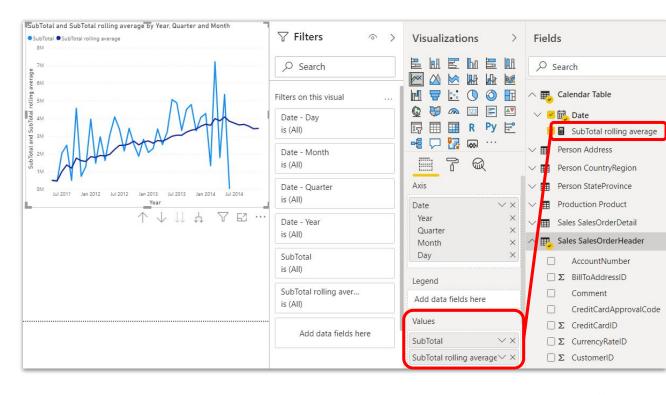






Guided Walk-Through: Plotting a Rolling Average

Now add SubTotal rolling to *Values*





Moving Averages

Guided Walkthrough: Combo Charts

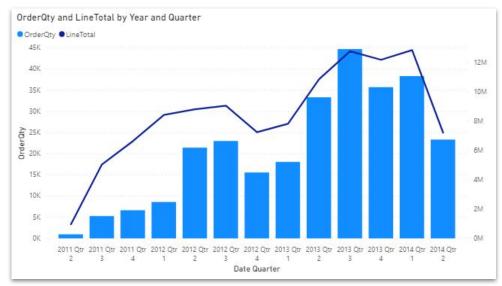
Combo Charts

Combo charts overlay two sets of data that share the same x-axis values.

Note that relative vertical positions don't matter!

Each data set usually has its own y-axis, so the only thing we're comparing are the relative shapes of each chart.

Let's create a **combo chart** that shows quarterly units sold against quarterly revenue.

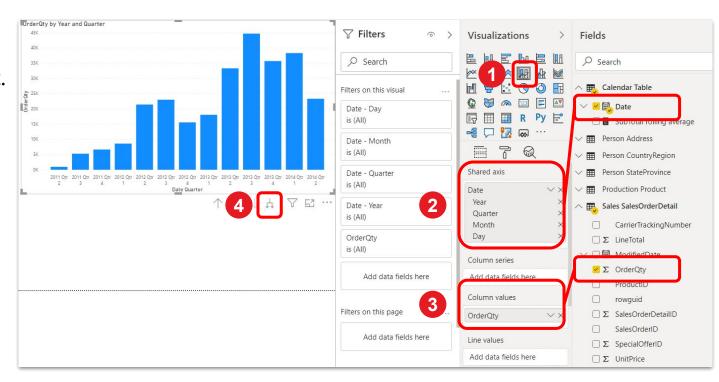




Open a Line and stacked column chart.

Drag **Date** to *Shared* axis, and **OrderQty** to *Column values*.

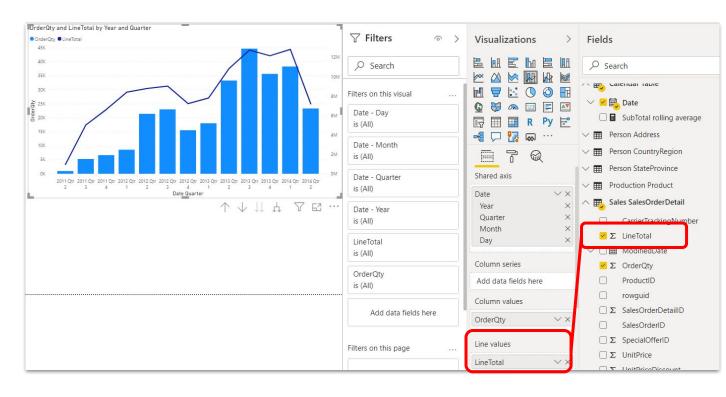
Drill down to Quarter





Drag **LineTotal** to *Line values*

That's it!





Moving Averages

Group Exercise: Moving Averages and Combo Charts



Group Exercise:

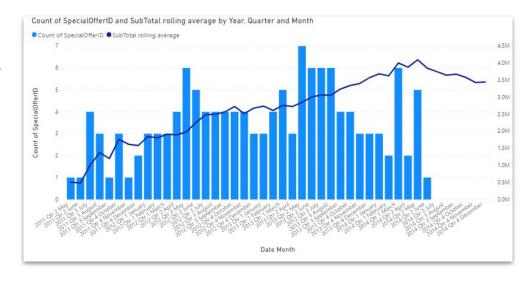
Moving Averages and Combo Charts



Your boss thanks you for the sales report, and now wants you to investigate the effect of AdventureWorks Special Offers.

Pair up. Create a Combo Chart with a bar chart of the number of *distinct* special offers per month alongside the moving average of the revenue.

This should show how effective the special offers have been!





Let's discuss as a group:

- What other combinations of data would work well with moving averages?
- 2. What questions do you have on combo charts?
- 3. How can you apply this in your own role?



Advanced Analytics

Enhancing Charts for Better Communication

Enhancing Charts for Visual Communication

When humans "see" something...

There is a *physical process* where our sensory organs (eyes) react to a stimulus in the environment, sending a signal to our brain.

Then there is a *cognitive process* run by our brain which makes sense of the signal from our eyes to form our perception of our physical environment.



The human brain has 3 types of memory which we will use to our advantage:

- Iconic Memory
- Working Memory
- Long Term Memory



Iconic Memory

- Preattentive Processing: automatic & unconscious
- Information remains in iconic memory for less than a second while extremely rapid processing takes place before the information is forwarded to working memory
- Detects color and location of objects in 2D space
- Used to group & highlight objects and grab attention Ex: red text among black text

Why is this important?

We can use colors as visual cues that will be processed instantly.

We can also use symbols (arrows) to indicate upward or downward change which is also processed instantly.



Working Memory

- Attentive Processing: higher-level cognitive processing
- Combines iconic memory into meaningful visual chunks
- Temporary, limited storage capacity; information is retained from a few seconds to a few hours if periodically rehearsed
- Only 3-4 chunks of information can be stored in working memory at one time. Either they move to long-term memory or are forgotten

Why is this important?

By designing a visual display of information to **form larger, coherent patterns that combine multiple data values in to chunks**, you can make it easier for your users to hold more information in working memory.



Long Term Memory

- Consciously or unconsciously, rehearses a chunk of information to move it from working to long-term memory where it is **stored** in an intricate neural **network of links and cross-references/associations.**
- Holds our ability to recognize images and detect meaningful patterns

Why is this important?

By designing a visual display that is **consistent** with use of **layout**, **chart types & color** we "train" our users to **make sense** of the patterns in the data we are displaying on the dashboard.



How many 5's do you see?

9876890194710912450102938383980110923483010919830183109580901712890093841015010921840 1091903914832769801097171928789504101932549198719187410981094868597899713181098310081 9028972178321789124641091098174786346809129384678191098370081902834678912883287189101



There are 6 of them...

98768901947109124**5**0102938383980110923483010919830183109**5**8090171289009384101**5**010921840 1091903914832769801097171928789**5**04101932**5**49198719187410981094868**5**97899713181098310081 9028972178321789124641091098174786346809129384678191098370081902834678912883287189101

This is an example of using preattentive visual attributes to **grab and direct** our readers' attention and how to work within the limits of working memory.



Review: Visualization Best Practices

- **1.** Add context to KPIs: To bring context to your KPIs, include supporting information next to the value in smaller text.
- Color accessibility: Use different line styles with different colors to help improve the clarity of your charts. Be consistent with color meanings in your dashboards.
- 3. Chart type and placement: Charts are an essential part of data visualization. Choose the best chart that will help bring clarity to that data. Place charts according to their importance and size.



Review: Visualization Best Practices

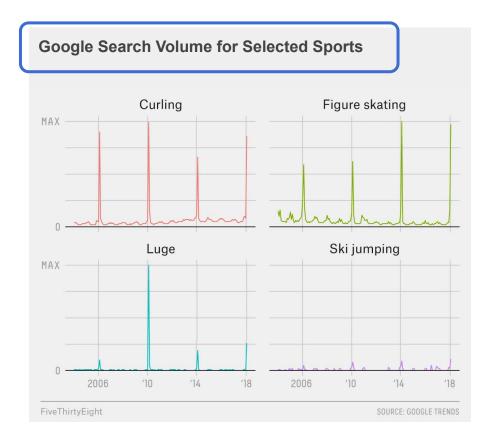
- 4. Information hierarchy: Placement plays a key role in information hierarchy. Information at the top of a page is seen as *more important* than information at the bottom (because in English, it is read first).

 Group related information together in order of importance.
- **5. Declutter your worksheets and dashboards**: Too much information makes it difficult to see what is important. Strive for a cleaner, simpler style of design.



Data Should Tell A Story

This is **not** a great title...



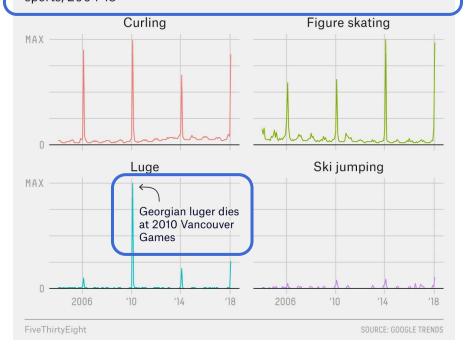


Data Should Tell A Story

This is a compelling title...

...and **this** gives context to outliers.

Every four years, Americans get really interested in curling Monthly U.S. Google Trends search-index data for selected Olympic sports, 2004-18



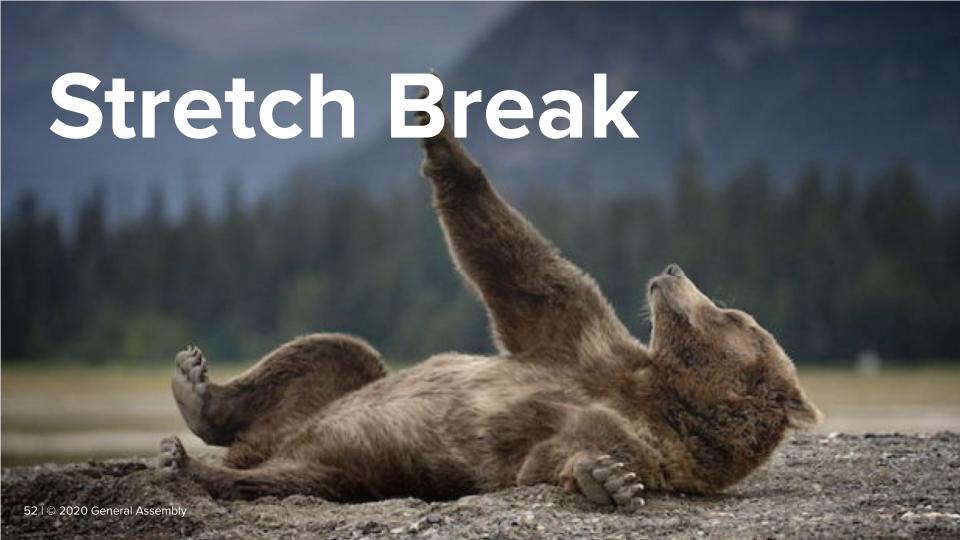


Before we dive into hierarchies, slicers and parameters:

What are some other design "best practices" to consider when crafting better dashboards?







Advanced Analytics

User Interactivity

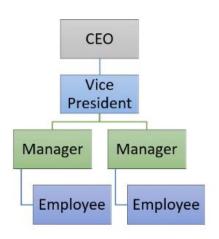
- Hierarchies
- Slicers
- What-if Parameter

User Interactivity

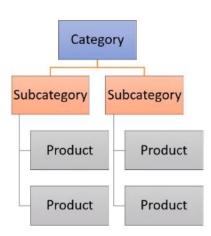
Guided Walkthrough: Hierarchies

Hierarchies

Hierarchy is a system or organization in which people or groups are ranked one above the other according to status or authority.









Hierarchies

- We've already seen Power BI's built-in date hierarchy. We can drill down/ roll up across levels of the hierarchy (Year/Quarter/Month/Week etc).
- We can create our own hierarchies by combining fields on the same chart.
- For example, a visual might have a product hierarchy to show the total
 Sales at Product Name > Country levels. The hierarchy allows the user to
 drill down/roll up to show the sales broken down by level, and sort by level.

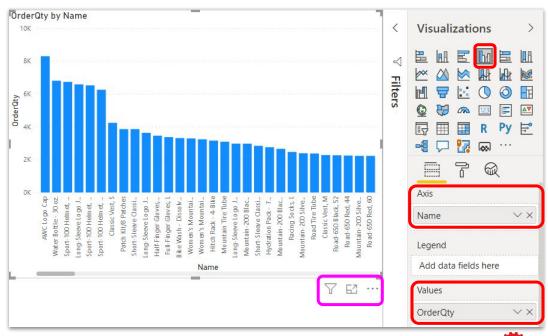


In Report view, open a new page and add a Clustered column chart.

Drag **SalesOrderDetail**OrderQty to *Values*

Drag **Production.Product** Name to *Axis*.

Notice that we only see the filter icon on the visual.

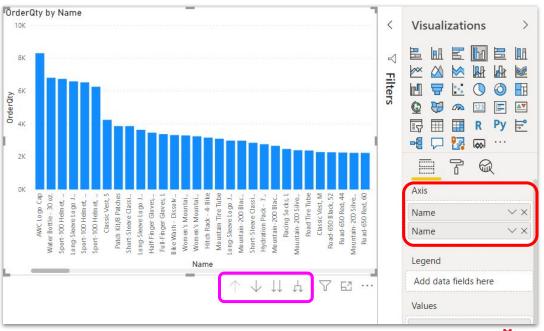




Now drag **Person.CountryRegion** Name to *Axis*.

Make sure Country Name appears *below* Product Name

Notice we now see hierarchy icons.

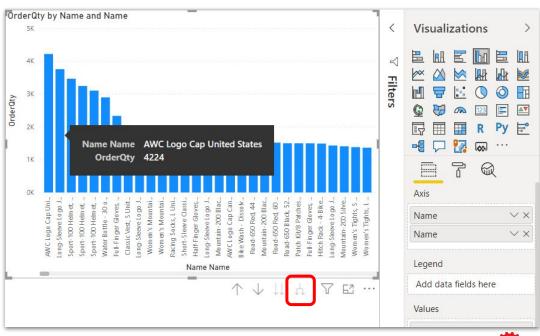




Click the icon to Expand all down one level in the hierarchy

Now there are bars for each Product Name/Country Name combination, sorted by Order quantity.

However, we can change the sort!







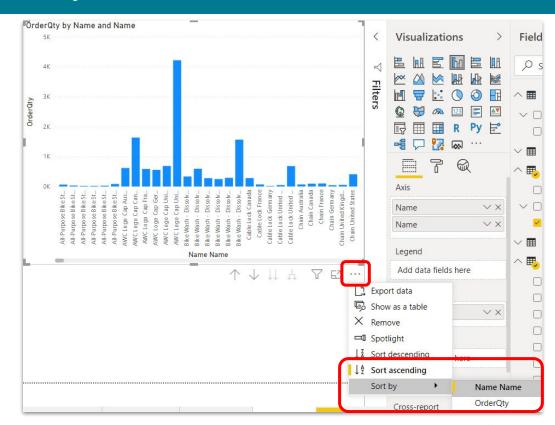
Guided Walk-Through: <u>Example: Product</u> Hierarchy

Click the ellipsis, expand Sort by, and select **Name Name**

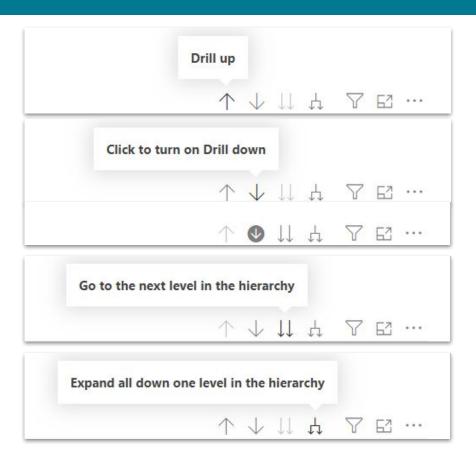
Also, select Sort ascending

Data now sorts by Product Name followed by Country Name.

Note that this hierarchy is only available to this visual.







Group Exercise: Product Hierarchy by Category

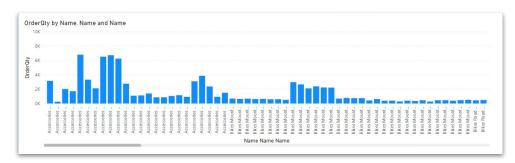


Management has asked to see Order Quantity by Product Category, Subcategory and Name.

Load the **Production.ProductCategory** and **Production.ProductSubcategory** tables and add them to the Data Model appropriately.

Create a Clustered Column Chart that shows **OrderQty** against a Product Category/Subcategory/Name hierarchy.

Drill down to Product Name, and sort by Name ascending.







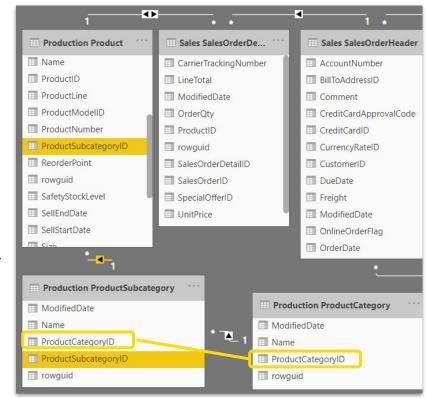
Group Exercise:

Product Hierarchy by Category - Solution

Load the **Production.ProductCategory** and **Production.ProductSubcategory** tables and add them to the Data Model appropriately.

Link ProductSubcategory to Product on ProductSubCategoryID

Link ProductCategory to ProductSubcategory on ProductCategoryID







Group Exercise:

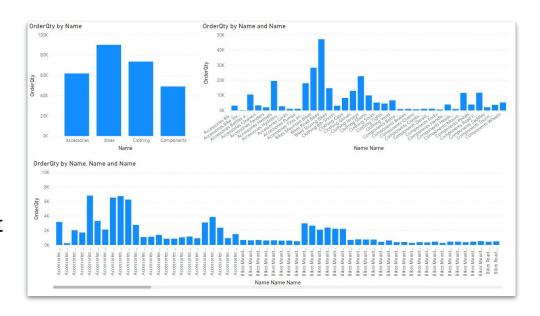
Product Hierarchy by Category - Solution

Create a Clustered column chart.

Drag all three Name fields to *Axis*, and drag OrderQty to *Values*.

Drill down twice to Product Name

Click the ellipsis to change the sort options.



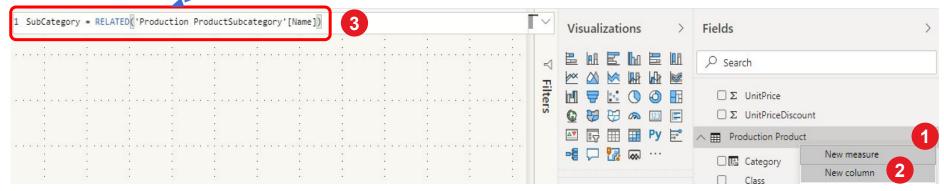




Guided Walk-Through: Adding Hierarchies to the Model



Repeat the same steps to create the second column **SubCategory**





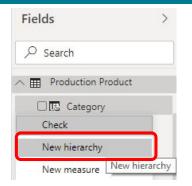




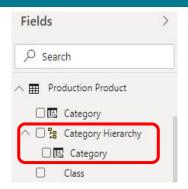
Guided Walk-Through:

Adding Hierarchies to the Model

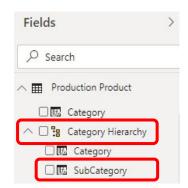
1- Right click on Category and select New hierarchy



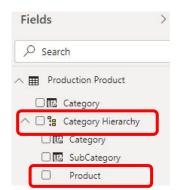
2- New hierarchy is created **Category Hierarchy**



3- Drag the
SubCategory
column and
drop it on
Category
Hierarchy



4- Repeat step 3 to add the Product.Name to the Category Hierarchy and rename it to Product

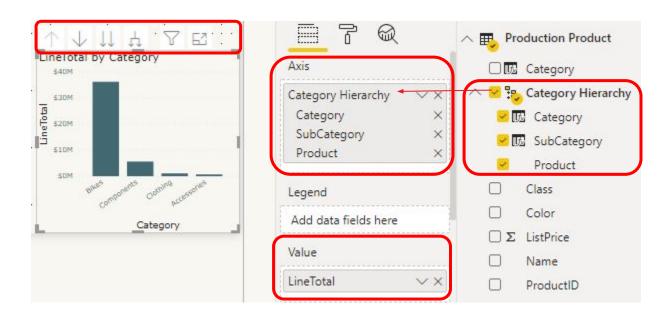






Guided Walk-Through:

Adding Hierarchies to the Model



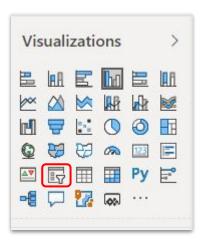
Once the **Category Hierarchy** is created, you can use it as the Date Hierarchy example to breakdown **LineTotal** and drill from **Category** to **SubCategory** to **Product** levels



User Interactivity

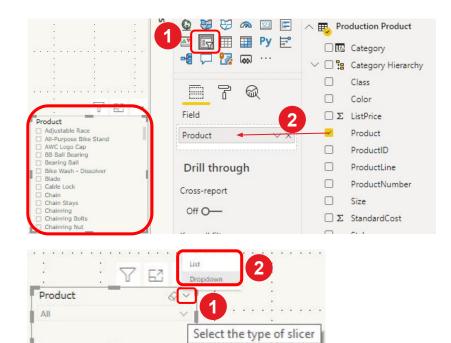
Guided Walkthrough: Slicers

- Slicer is one of the visuals to allow the users to filter and narrows data shown in the other visualizations in a report to make it more interactive.
- The slicer visual allows to have multiple options for user interactions based on the the data type of the column used: categorical, numerical, date



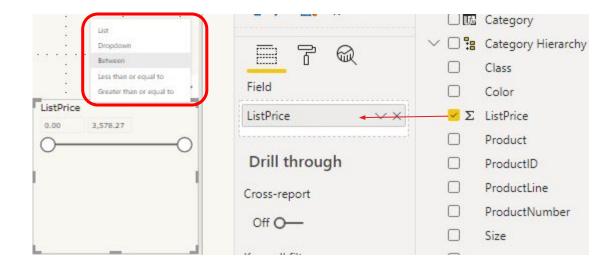


- To create a slicer, choose the Slicer visual from the Visualization pane.
- Select (or drag and drop) the Product(Name) column to the Field
- Because the column is categorical, the slicer presented it by default as a List
- If you have a long list and you need to convert this slicer to a **Dropdown**, hover over the top right corner and click on the **down arrow** and choose **Dropdown**
- You can resize the slicer as the default full size is not needed now



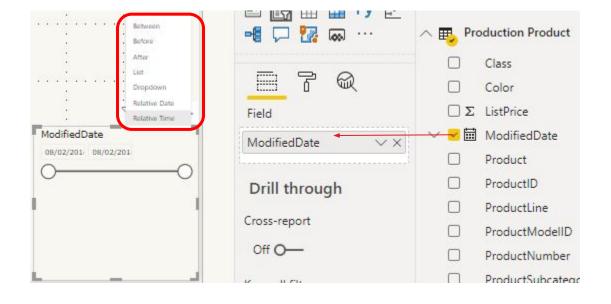


When you try a numerical column like **ListPrice**, the default sicer type is **Between** range but in addition to **List** and **Dropdown**, you have also **Less than or equal to** and **Greater than or equal to** options



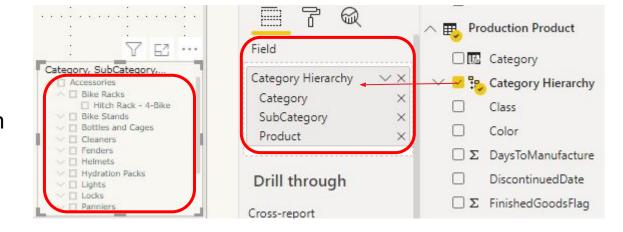


When you try a date column like ModifiedDate, the default sicer type is Between range but in addition to List and Dropdown, you have also Before, After, Relative Date and Relative Time options





You can use **Hierarchy** in the **Slicer** and you can also build the hierarchy in the **Slicer** visual by dragging and dropping the columns in the right order of the hierarchy levels e.g. Category, SubCategory, Product.

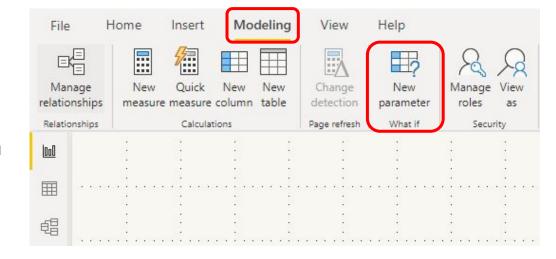




User Interactivity

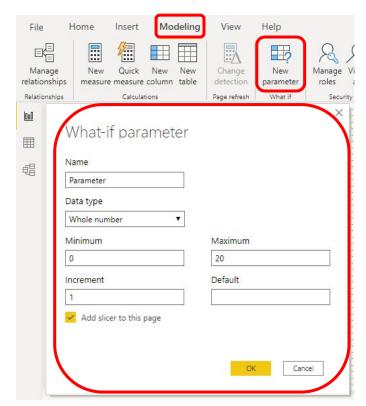
Guided Walkthrough: What-if Parameter

- What-if parameter is a very powerful user interaction feature to allow users build what-if scenarios using DAX expressions.
- Create a what-if parameter on the **Modeling** tab. When you select it, a dialog box appears where you can configure the parameter.





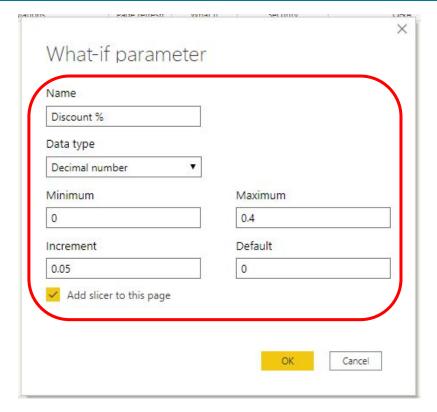
- What-if parameter is a very powerful user interaction feature to allow users build what-if scenarios using DAX expressions.
- Create a what-if parameter on the **Modeling** tab. When you select it, a dialog box appears where you can configure the parameter.





Scenario: let's assume we need to visualize the impact on historical sales if we were giving discount. We need to allow the users to dynamically try 5%, 10%, 15% 40% discount and see the impact on the fly.

Configure a new What-if parameter named **Discount** using the values show on the right and click OK

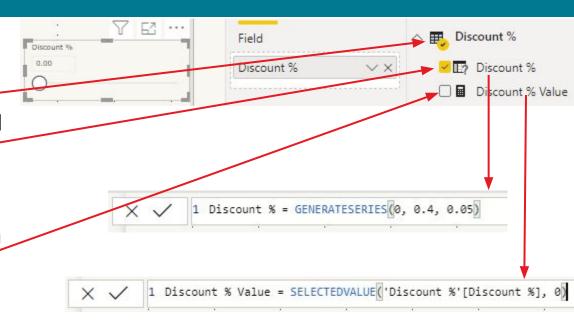






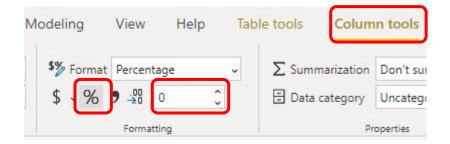
A new single value Slicer was automatically added to the report page based on a new table (**Discount %**) automatically created with 2 fields:

- Discount % is a calculated column using a DAX GENERATESERIES function as seen in the formula bar
- 2. Discount % Value is a DAX measure using SELECTEDVALUE function to get the one selected value from the slicer.





- When you move the slider in the Slicer visual you see the associated value moves from 0.00 to 0.05, 0.10 0.40
- Click on the **Discount** % column and in the **Column Tools** in the menu click on % format and change decimal places from **Auto** to **0**
- Try the slider now to see the associated value moves from 0% to 5%, 10% 40%





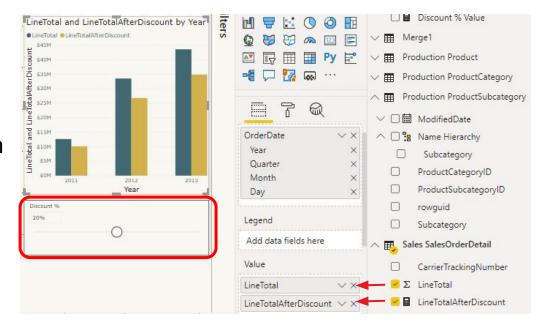
- Now the What-if parameter is ready to be used in a new measure to calculate line total after discount
- Click on the SalesOrderDetail table, right click and choose New
 Measure and in the formula bar write this DAX expression:
 LineTotalAfterDiscount = SUM('Sales SalesOrderDetail'[LineTotal])*
 (1-'Discount %'[Discount % Value])

```
1 LineTotalAfterDiscount = SUM('Sales SalesOrderDetail'[LineTotal])* (1-'Discount %'[Discount % Value])
```

 The new measure LineTotalAfterDiscount can now be used to compare to the LineTotal and try different discount rates using the slicer



- Create a new Clustered
 Column Chart with
 OrderDate in Axis and both
 LineTotal and
 LineTotalAfterDiscount are in
 the chart Value field.
- Now move the slider and see the impact of the discount on the new measure compared to the original value
- You can try to use the same technique on more complex what-if planning scenarios





Advanced Analytics

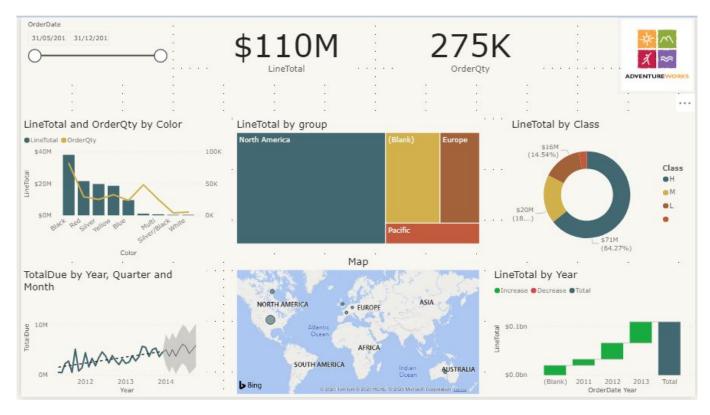
Activity



Solo Exercise:

Create this BI Report







Advanced Analytics

Let's Review!

What did we learn?

- How to add more data to your apps (expand our data model).
- Join tables together in Power Bl.
- Create a table and chart from our data.
- Work with a worksheet.

What Did We Just Cover?

In this lesson, we:

•





Finish That Sentence

What are your biggest takeaways from today?



"Something that really got me thinking is..."

"The best thing I got out of today is..."

"I discovered..."

"I still want to learn about..." "I was surprised that..."



Ask Me Anything!





A Few Good References

Time Intelligence: Calendar Table





Don't Forget Your Exit Tickets!



See you next time!

Thank you!



Guided Walk-Through: Optional: Mark as Date Table

It's not required, but setting as a Date table helps whe

Click the ellipsis to the rig select *Mark as date table*.

Select the Date column ar

DO NOT USE (CAUSES ERROR)

