

Microsoft Power BI Introduction

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27TH JUNE 2024

Course Contents

- ▶ Power BI Introduction
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- ▶ Steps – Basic
- ▶ Steps – Complex
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- ▶ Introducing DAX Formulas and Measures
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- ▶ Publishing/Sharing Reports

Power BI – The Product

What is Power BI?

- ▶ Power BI is a business analytics service that lets you visualize your data and share insights.
- ▶ Power BI was developed from taking Excel's Power Query, Power Pivot and Power View add-ins, and providing it a tool within the Microsoft Power Platform.
- ▶ Power BI allows you to develop interactive dashboards and reports.
- ▶ Which tool to use will depend on your final output – your objective will be one of the following:
 - ▶ Users will need to still manipulate the data using Excel – use the Power Query Editor
 - ▶ Need more than the maximum rows Excel can offer – use Power Query loading your data into a Data Model
 - ▶ Power Pivot has the additional feature of reporting using KPI's (Key Performance Indicators)
 - ▶ Delivery via the Web or mobile app – Power BI is the tool to use here.

Common Uses of Power BI Desktop

- ▶ Data from any range of sources across your business can be connected to **Power BI**.
- ▶ **Transform** and Refine the data sources into a single Data Model.
- ▶ **Visuals** – build charts and maps to represent the data in your model.
- ▶ **Reports** – taking your visuals, collating and presenting them on to one or more pages.
- ▶ Share reports and dashboards with other users via Power BI Services.
- ▶ Power BI has become one of the market leaders in interactive Reporting Tools – some of its competitors are Tableau, Qlik Sense, ThoughtSpot, Looker

The Process

Data Transformation

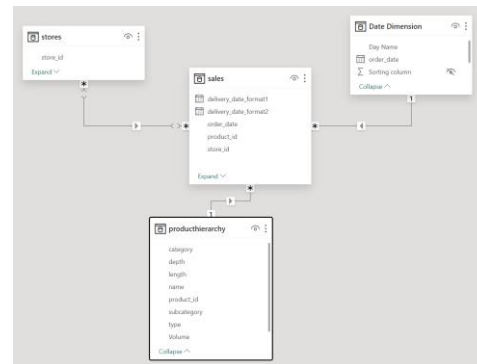


Data Model



Data Visualisation

	order_id	product_id	store_id	order_date	order_date_2
	Valid Error Empty	Valid Error Empty	Valid Error Empty	Valid Error Empty	Valid Error Empty
1	40011	P0392	S0001	01/01/2023	01-Jan-23
2	40012	P0018	S0071	01/01/2023	01-Jan-23
3	40013	P0565	S0096	01/01/2023	01-Jan-23
4	40014	P0372	S0121	01/01/2023	01-Jan-23
5	40015	P0543	S0101	01/01/2023	01-Jan-23
6	40016	P0286	S0046	01/01/2023	01-Jan-23
7	40017	P0428	S0085	01/01/2023	01-Jan-23
8	40018	P0171	S0079	01/01/2023	01-Jan-23
9	40019	P0125	S0084	01/01/2023	01-Jan-23
10	40020	P0500	S0103	01/01/2023	01-Jan-23
11	40021	P0399	S0125	01/01/2023	01-Jan-23
12	40022	P0499	S0093	01/01/2023	01-Jan-23
13	40023	P0663	S0058	01/01/2023	01-Jan-23
14	40024	P0141	S0052	01/01/2023	01-Jan-23
15	40025	P0536	S0038	01/01/2023	01-Jan-23
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17	40027	P0092	S0024	01/01/2023	01-Jan-23



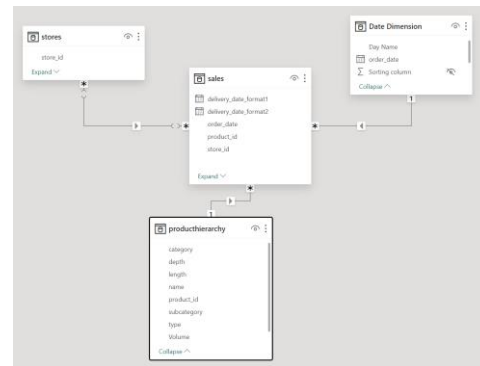
The Process

Power BI Desktop

Data Transformation

	order_id	product_id	store_id	order_date	order_date_2
	Valid	Valid	Valid	Valid	Valid
	Error	Error	Error	Error	Error
	Empty	Empty	Empty	Empty	Empty
1	40011	P0392	S0001	01/01/2023	01-Jan-23
2	40012	P0018	S0071	01/01/2023	01-Jan-23
3	40013	P0505	S0096	01/01/2023	01-Jan-23
4	40014	P0372	S0121	01/01/2023	01-Jan-23
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10	40020	P0500	S0103	01/01/2023	01-Jan-23
11	40021	P0399	S0125	01/01/2023	01-Jan-23
12	40022	P0499	S0093	01/01/2023	01-Jan-23
13	40023	P0643	S0058	01/01/2023	01-Jan-23
14	40024	P0141	S0052	01/01/2023	01-Jan-23
15	40025	P0536	S0038	01/01/2023	01-Jan-23
16	40026	P0275	S0039	01/01/2023	01-Jan-23
17	40027	P0092	S0024	01/01/2023	01-Jan-23

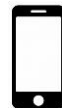
Data Model



Data Visualisation



Power BI Mobile



Power BI Cloud

Share & Collaborate

Report Designers v Consumers

- ▶ It is important to make the distinction between Report Designers and Report Consumers.
- ▶ **Designers** – you will be responsible for building or modifying the report, you will also have edit permission to the underlying dataset.
- ▶ **Consumer** – If a report or dashboard has been shared with you, you are the report consumer. You will be able to view and interact with the report, however no editing functionality of the underlying design and data will be available.

Power BI Licenses

► Power BI Desktop

Free version to download. Connect to variety of data sources, build reports including various visualisations and publish to the web. Reports build in this version cannot be distributed to other end users.

► Power BI Pro

With this version, which is chargeable, you can achieve all the functionality of Power BI Desktop, but with the ability to share with other Power BI Pro license users.

► Power BI Premium

Using Power BI Report Server, this offers you on-premise deployment and distribution of reports. This is generally used by larger organisations for deployments and workloads.

- You can download a free Power BI Desktop from <https://powerbi.microsoft.com/en-us/desktop/>

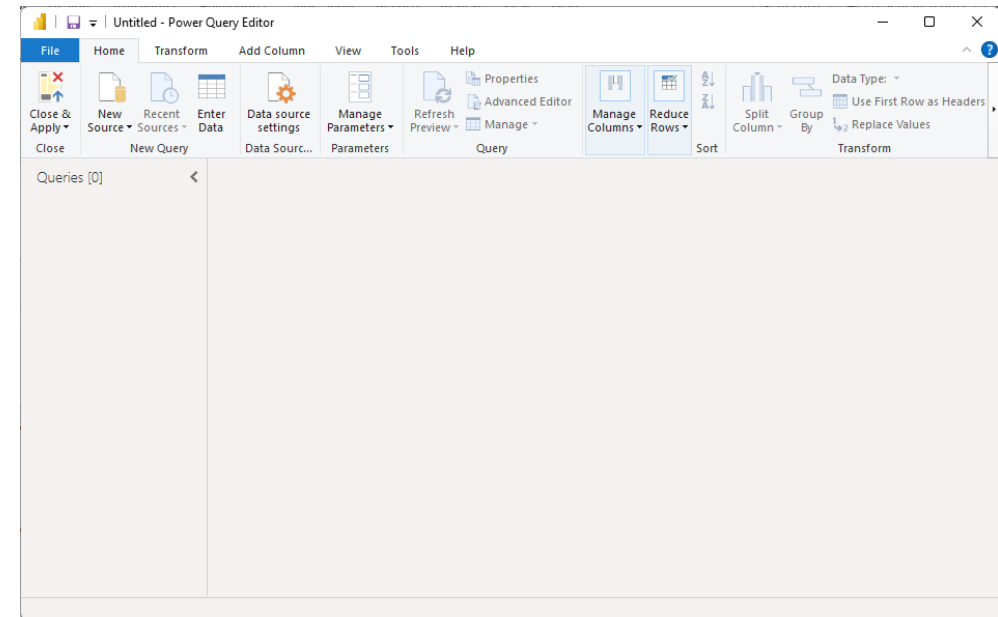
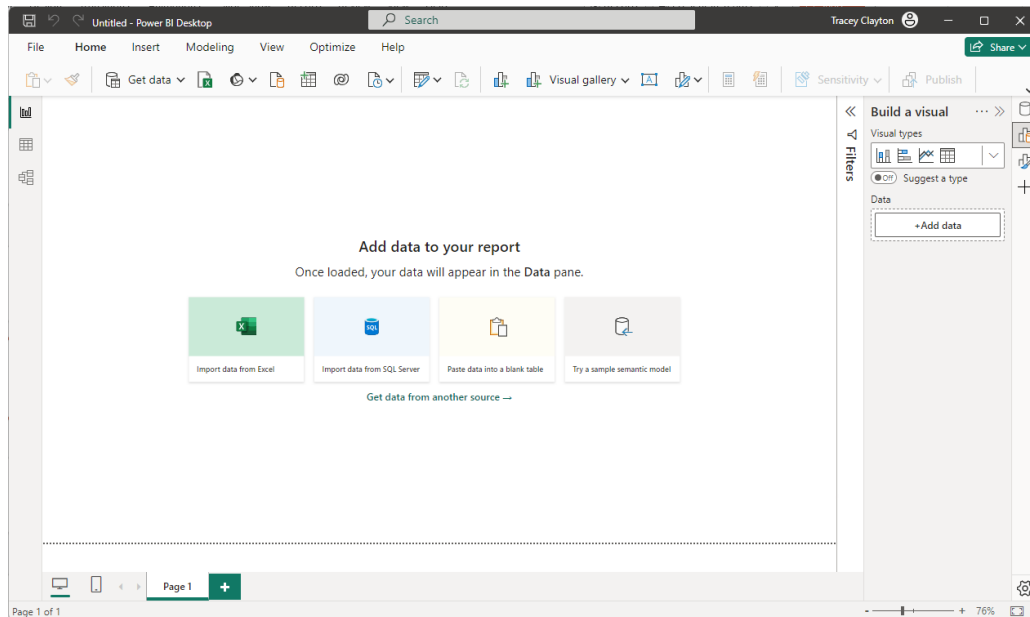
Functionality	Power BI Desktop	Power BI Cloud Service
Organise Data	Yes	Yes
Combine Data	Yes	Yes
Add or Delete Columns	Yes	Yes
Modify Tables	Yes	Yes
Create Visuals	Yes	Yes
Create Reports	Yes	Yes
Create Dashboards	No	Yes
Share Dashboards and Reports	No	Yes

Tour of the Interface

- REPORT BUILDER
- POWER QUERY EDITOR
- VIEWS
- PANES

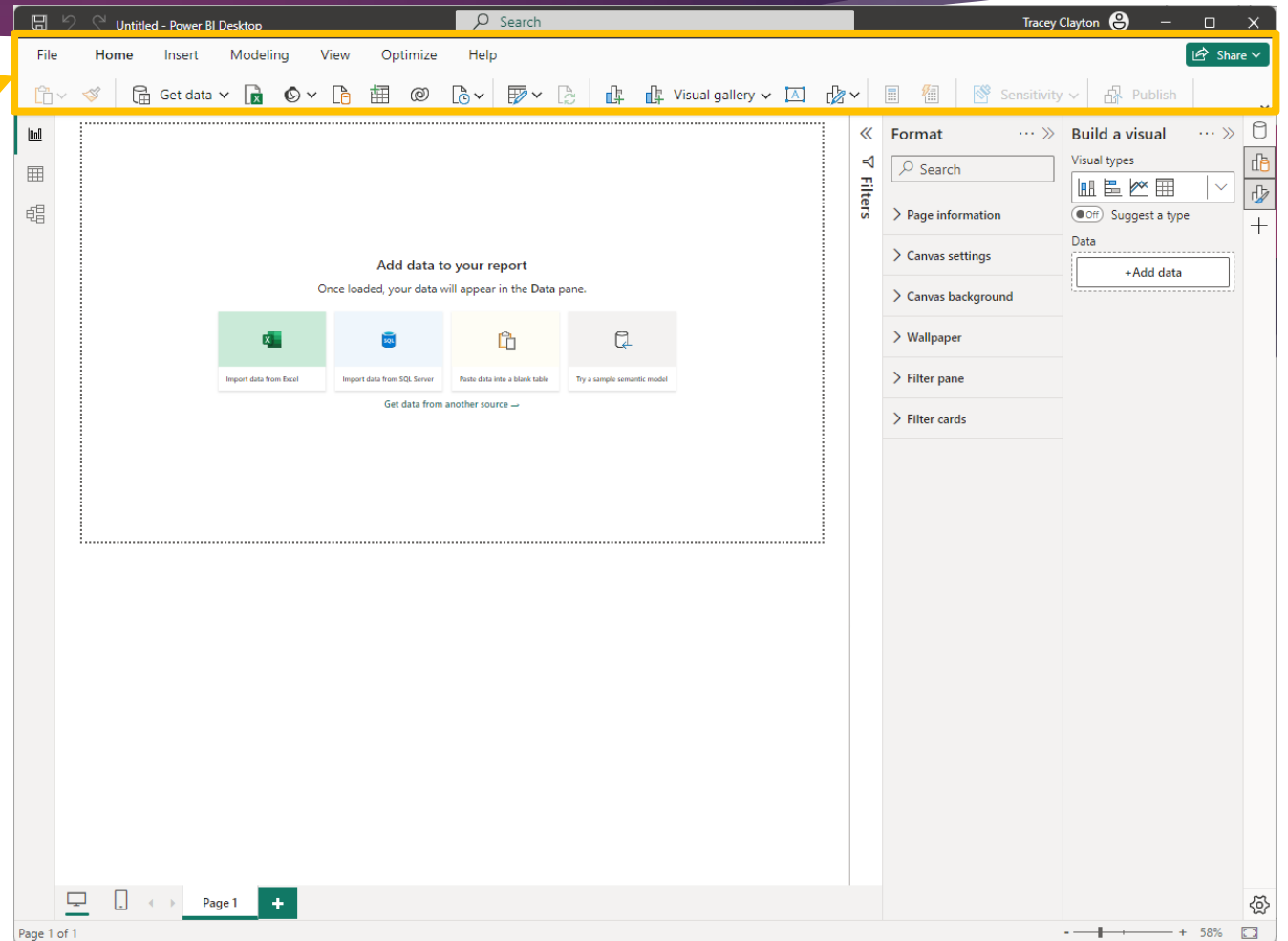
Interface Explained

- ▶ **Power BI Desktop** has two main areas you will work within:
- ▶ **Report Builder:** used to manage your data sources, data relationships, build and design your reports.
- ▶ **Power Query Editor:** used to do all transforming and shaping of your data, connecting to one or more data sources



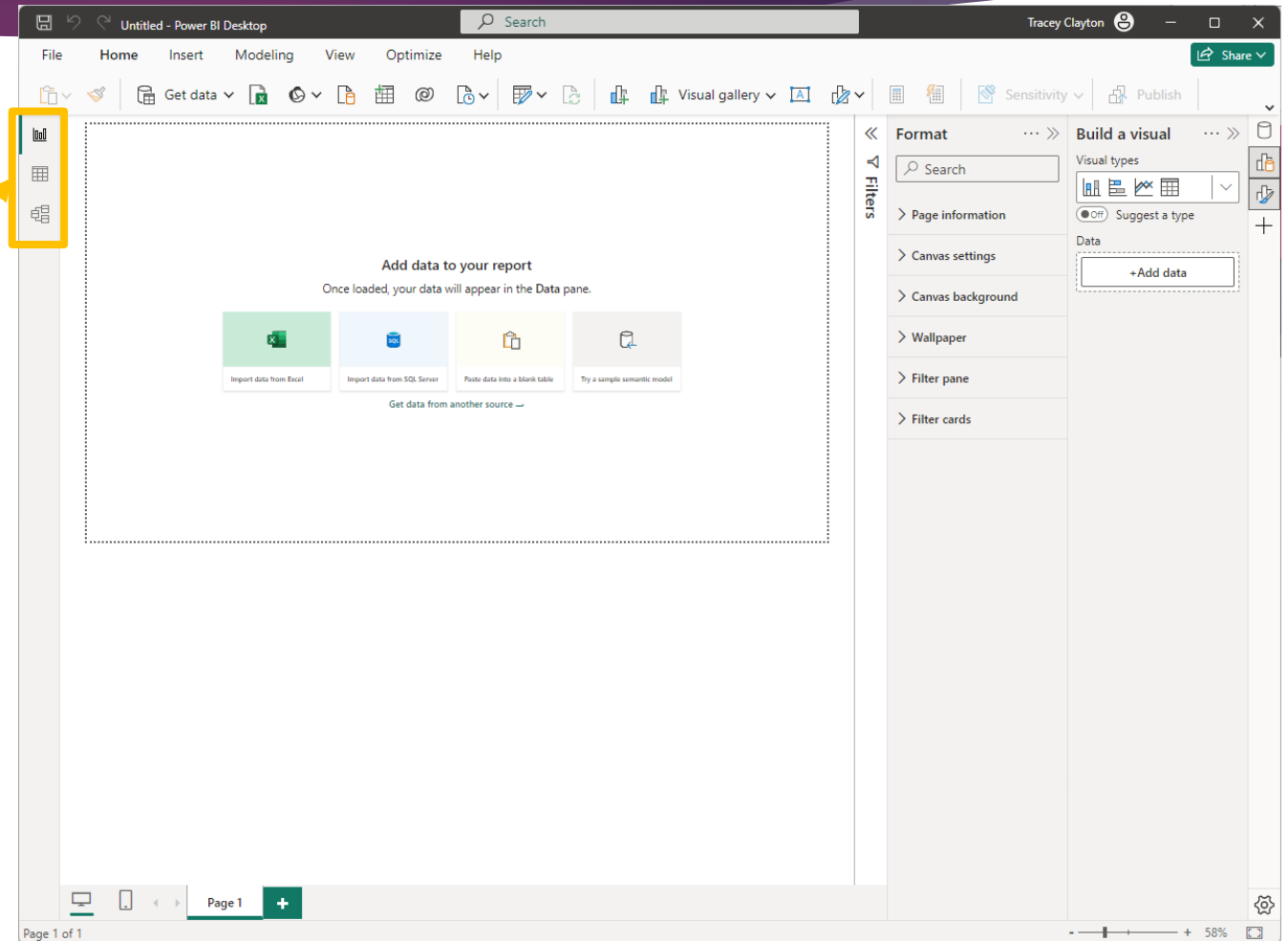
Report Builder

- ▶ Essentially separated into 6 Areas:
- ▶ **Menu Ribbon** – select all your Power BI features



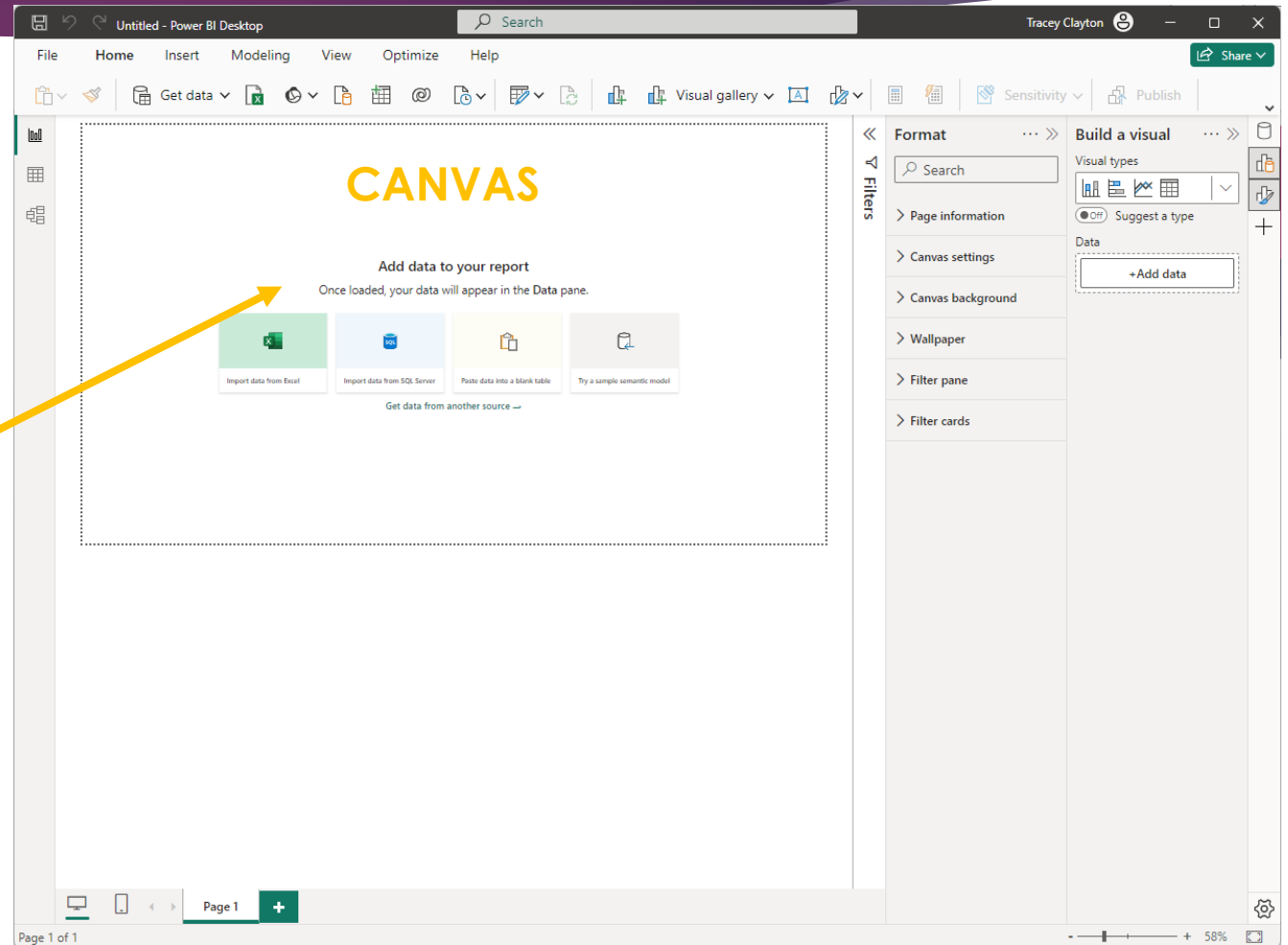
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- ▶ **Report Views** – switch between the visual report view, data view and model (relationships)



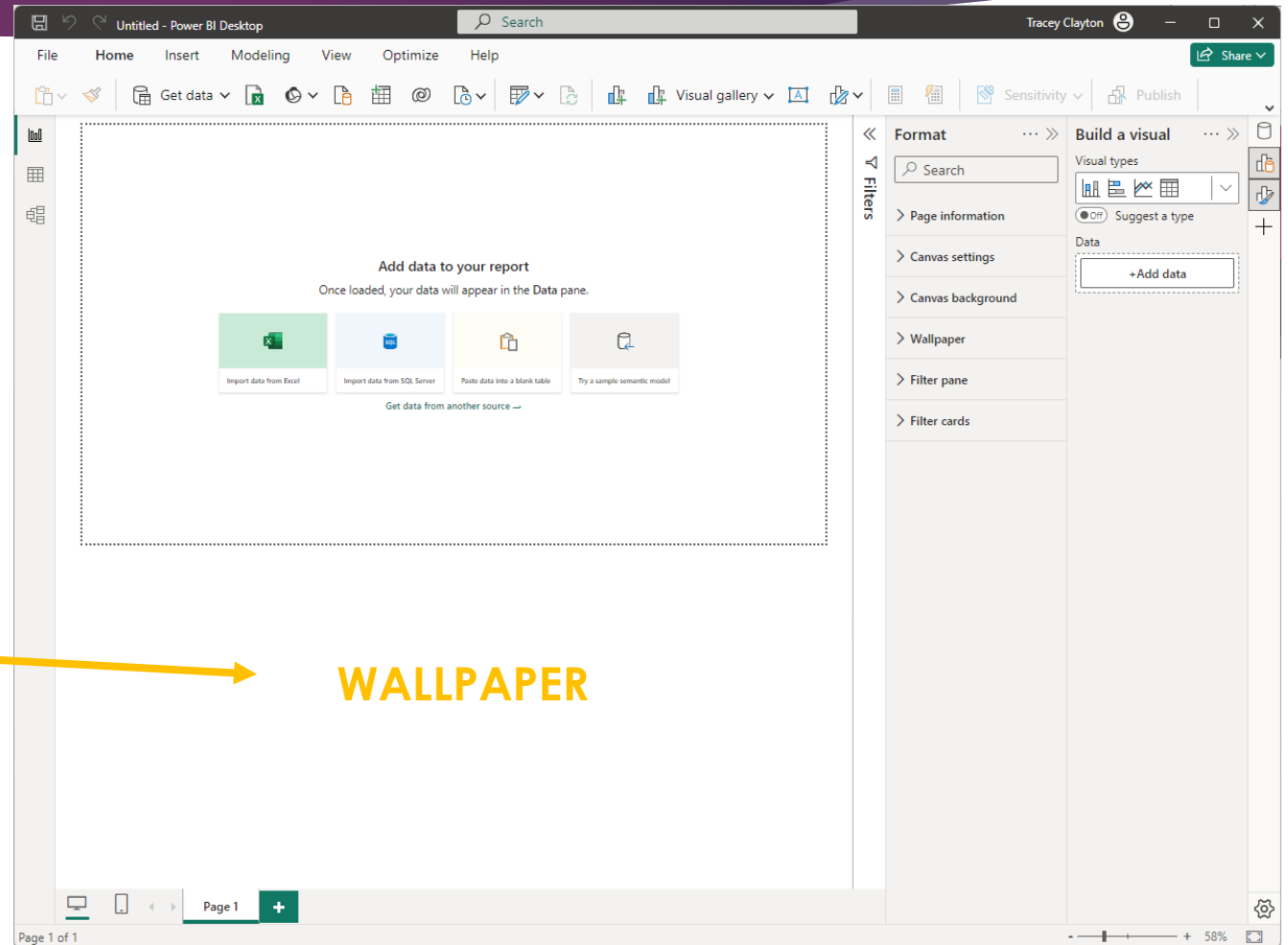
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- ▶ **Canvas** – apply all visualisations to the page area.



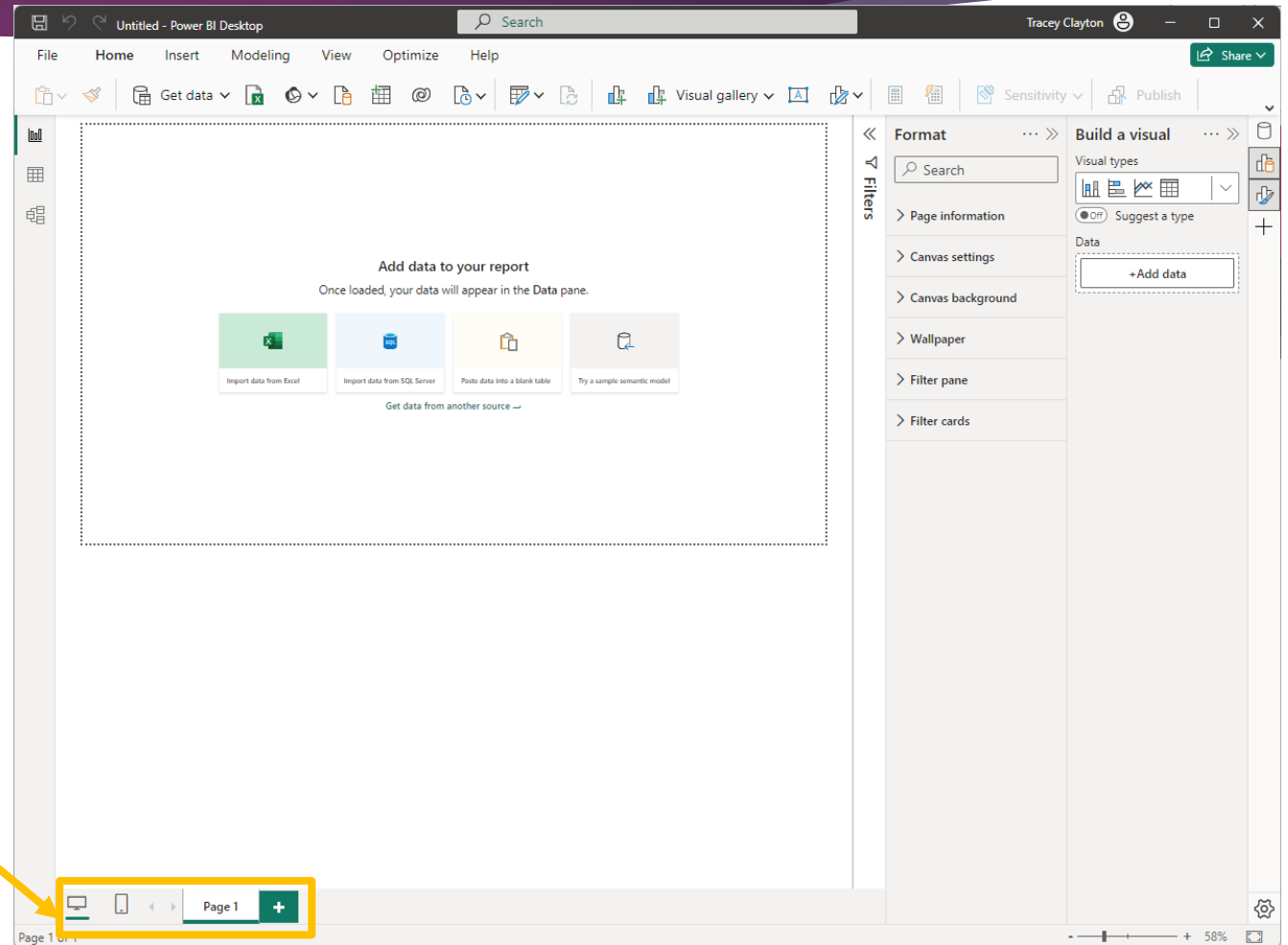
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- ▶ **Wallpaper** – control the background colour/image



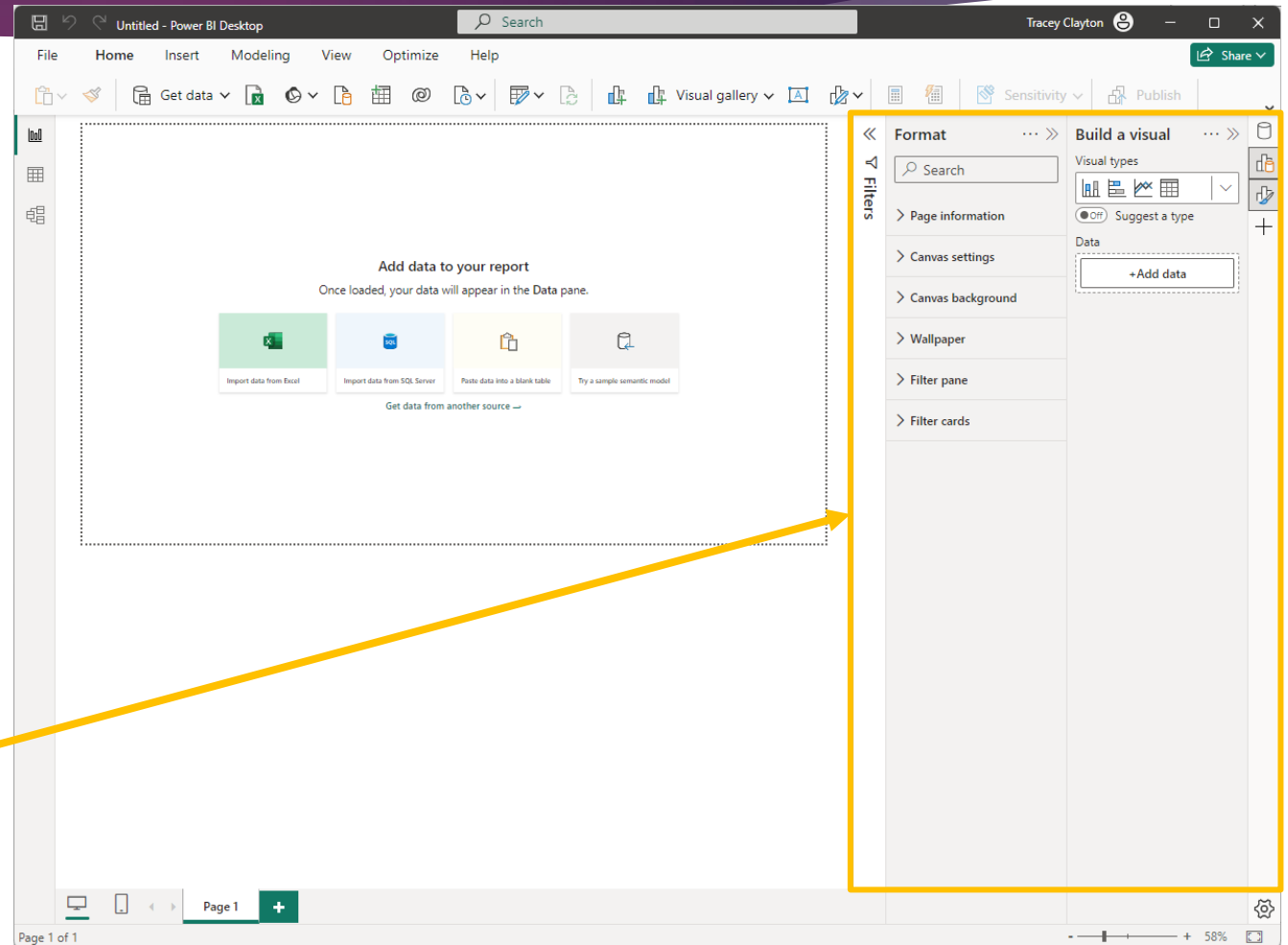
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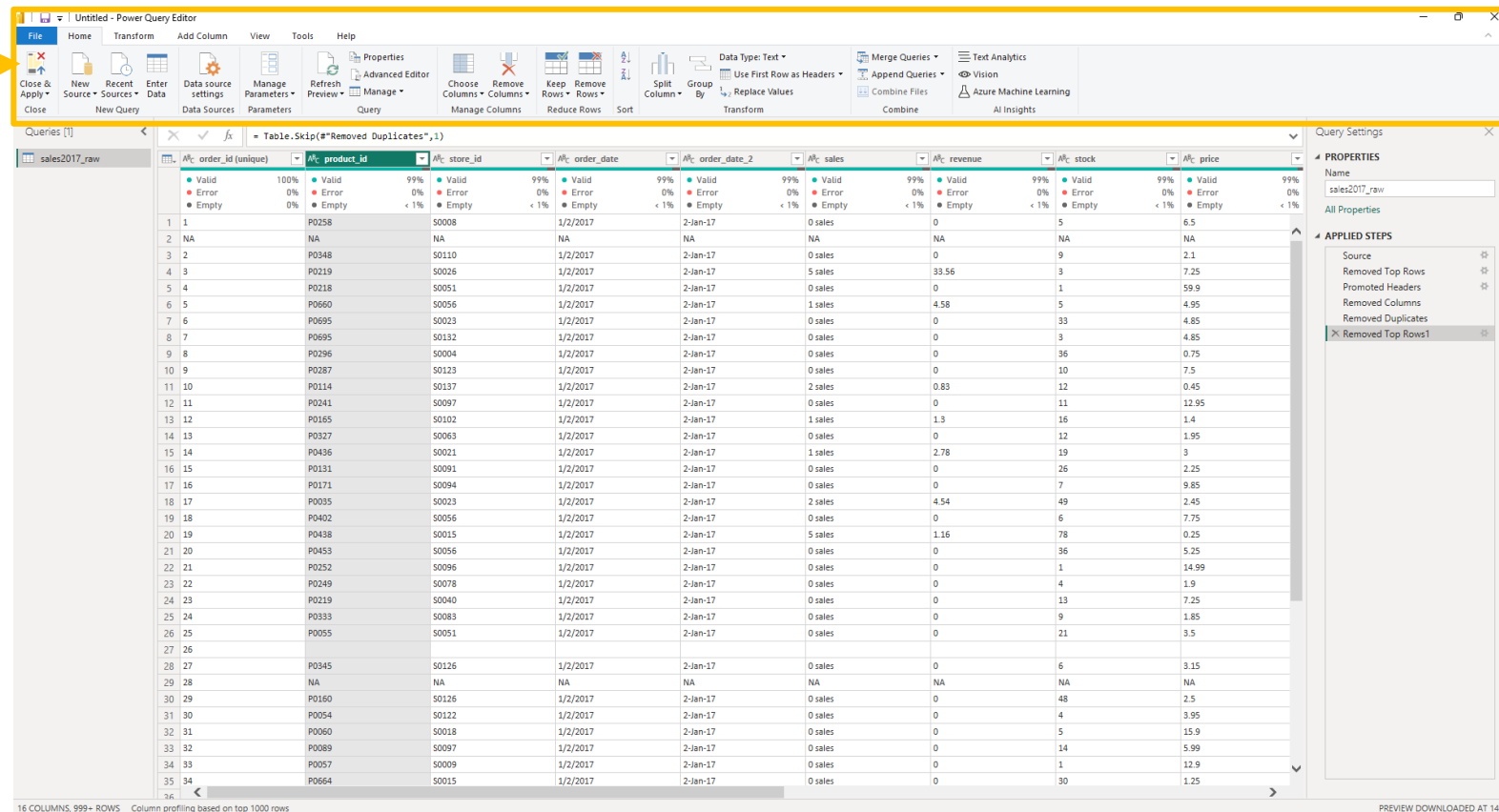
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- ▶ **Panes** – switch on and off the various panes of tasks/format to apply to your report.



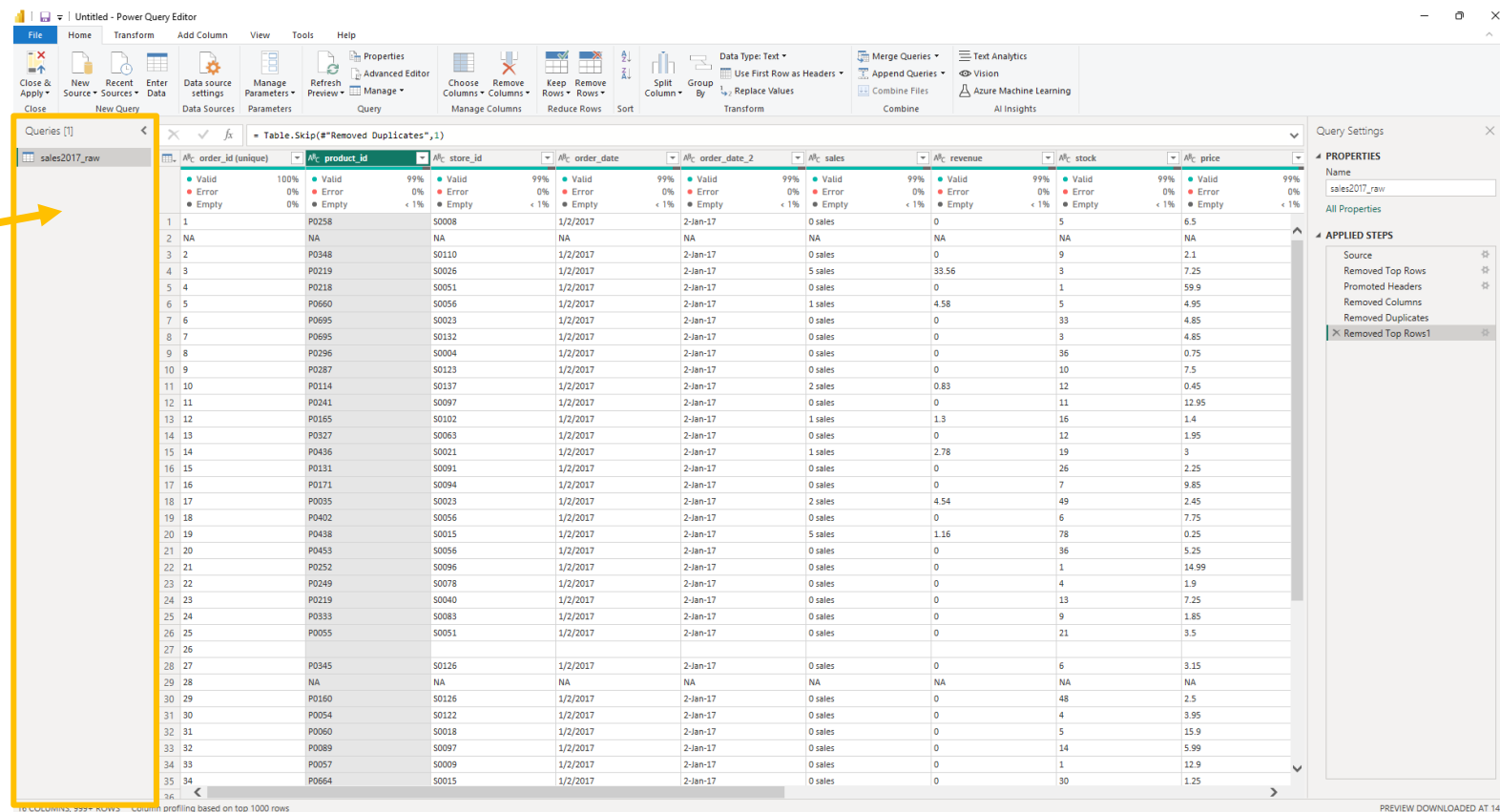
Power Query Editor

- ▶ Access the Power Query Editor by selecting **Home, Transform Data** on the Report Builder Ribbon.
- ▶ **Top Ribbon Menu** – the main navigation area to perform tasks.



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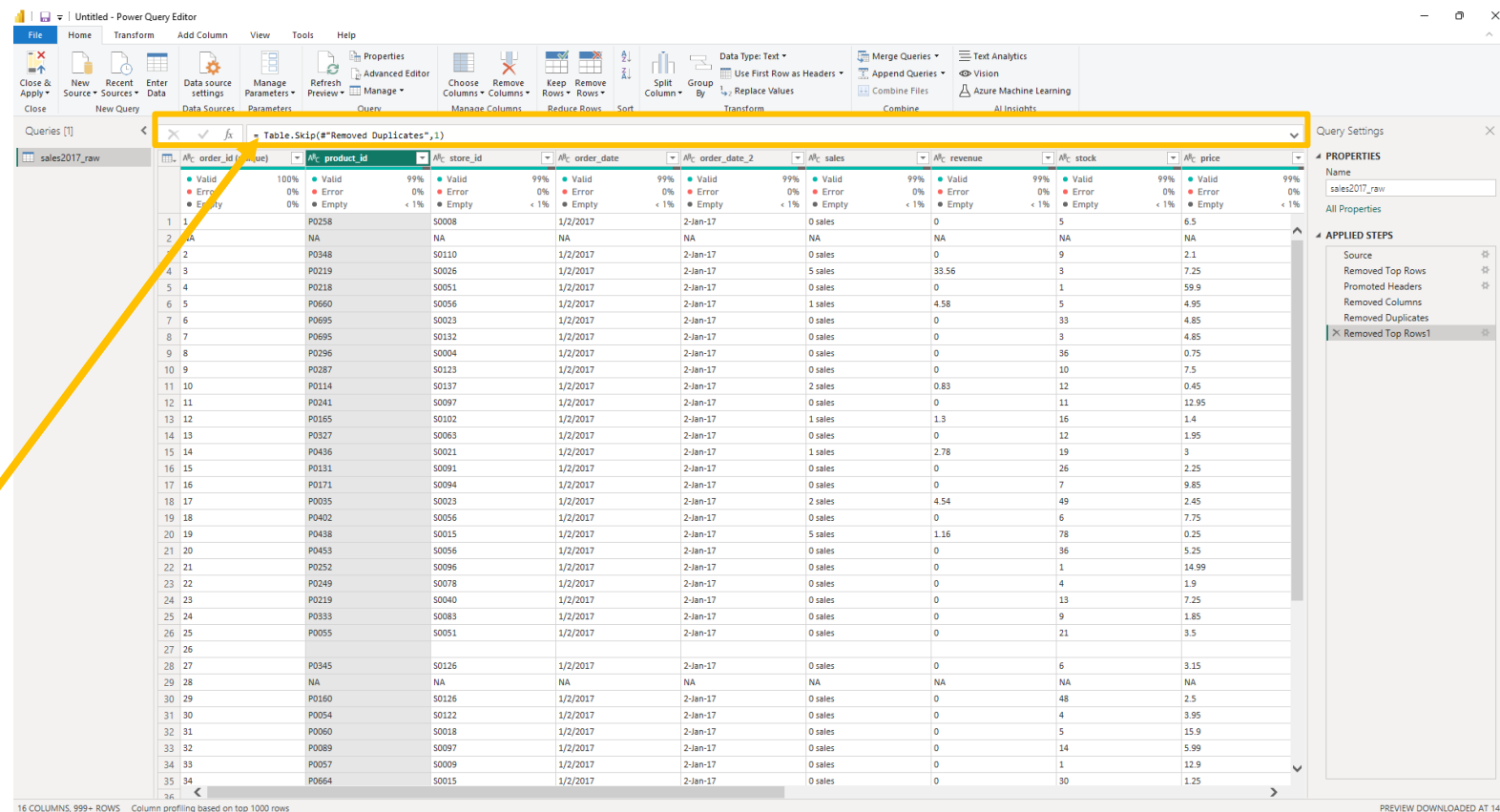
The screenshot shows the Power Query Editor window with the following components:

- Top Ribbon Menu:** Includes tabs for File, Home, Transform, Add Column, View, Tools, and Help. The Home tab is active, showing options like Close & Apply, New Source, Recent Sources, Enter Data, Data source settings, Manage Parameters, Refresh Preview, Properties, Advanced Editor, Choose Columns, Remove Columns, Keep Rows, Remove Rows, Sort, Split Column, Group By, Data Type: Text, Use First Row as Headers, Replace Values, Merge Queries, Append Queries, Combine Files, Text Analytics, Vision, Azure Machine Learning, and AI Insights.
- Queries List:** Shows a list of queries, including 'sales2017_raw'.
- Data Table:** A table with columns: order_id (unique), product_id, store_id, order_date, order_date_2, sales, revenue, stock, and price. The table contains 35 rows of data, with columns showing data types and validity percentages.
- Query Settings:** A panel on the right showing the query name 'sales2017_raw' and the applied steps: Source, Removed Top Rows, Promoted Headers, Removed Columns, Removed Duplicates, and Removed Top Rows1.

	order_id (unique)	product_id	store_id	order_date	order_date_2	sales	revenue	stock	price
1	1	P0258	S0008	1/2/2017	2-Jan-17	0 sales	0	5	6.5
2	NA	NA	NA	1/2/2017	2-Jan-17	0 sales	0	NA	NA
3	2	P0348	S0110	1/2/2017	2-Jan-17	0 sales	0	9	2.1
4	3	P0219	S0026	1/2/2017	2-Jan-17	5 sales	33.56	3	7.25
5	4	P0218	S0051	1/2/2017	2-Jan-17	0 sales	0	1	59.9
6	5	P0660	S0056	1/2/2017	2-Jan-17	1 sales	4.58	5	4.95
7	6	P0695	S0023	1/2/2017	2-Jan-17	0 sales	0	33	4.85
8	7	P0695	S0132	1/2/2017	2-Jan-17	0 sales	0	3	4.85
9	8	P0296	S0004	1/2/2017	2-Jan-17	0 sales	0	36	0.75
10	9	P0287	S0123	1/2/2017	2-Jan-17	0 sales	0	10	7.5
11	10	P0114	S0137	1/2/2017	2-Jan-17	2 sales	0.83	12	0.45
12	11	P0241	S0097	1/2/2017	2-Jan-17	0 sales	0	11	12.95
13	12	P0165	S0102	1/2/2017	2-Jan-17	1 sales	1.3	16	1.4
14	13	P0327	S0063	1/2/2017	2-Jan-17	0 sales	0	12	1.95
15	14	P0436	S0021	1/2/2017	2-Jan-17	1 sales	2.78	19	3
16	15	P0131	S0091	1/2/2017	2-Jan-17	0 sales	0	26	2.25
17	16	P0171	S0094	1/2/2017	2-Jan-17	0 sales	0	7	9.85
18	17	P0035	S0023	1/2/2017	2-Jan-17	2 sales	4.54	49	2.45
19	18	P0402	S0056	1/2/2017	2-Jan-17	0 sales	0	6	7.75
20	19	P0438	S0015	1/2/2017	2-Jan-17	5 sales	1.16	78	0.25
21	20	P0453	S0056	1/2/2017	2-Jan-17	0 sales	0	36	5.25
22	21	P0252	S0096	1/2/2017	2-Jan-17	0 sales	0	1	14.99
23	22	P0249	S0078	1/2/2017	2-Jan-17	0 sales	0	4	1.9
24	23	P0219	S0040	1/2/2017	2-Jan-17	0 sales	0	13	7.25
25	24	P0333	S0083	1/2/2017	2-Jan-17	0 sales	0	9	1.85
26	25	P0055	S0051	1/2/2017	2-Jan-17	0 sales	0	21	3.5
27	26								
28	27	P0345	S0126	1/2/2017	2-Jan-17	0 sales	0	6	3.15
29	28	NA	NA	NA	NA	NA	NA	NA	NA
30	29	P0160	S0126	1/2/2017	2-Jan-17	0 sales	0	48	2.5
31	30	P0054	S0122	1/2/2017	2-Jan-17	0 sales	0	4	3.95
32	31	P0060	S0018	1/2/2017	2-Jan-17	0 sales	0	5	15.9
33	32	P0089	S0097	1/2/2017	2-Jan-17	0 sales	0	14	5.99
34	33	P0057	S0009	1/2/2017	2-Jan-17	0 sales	0	1	12.9
35	34	P0664	S0015	1/2/2017	2-Jan-17	0 sales	0	30	1.25

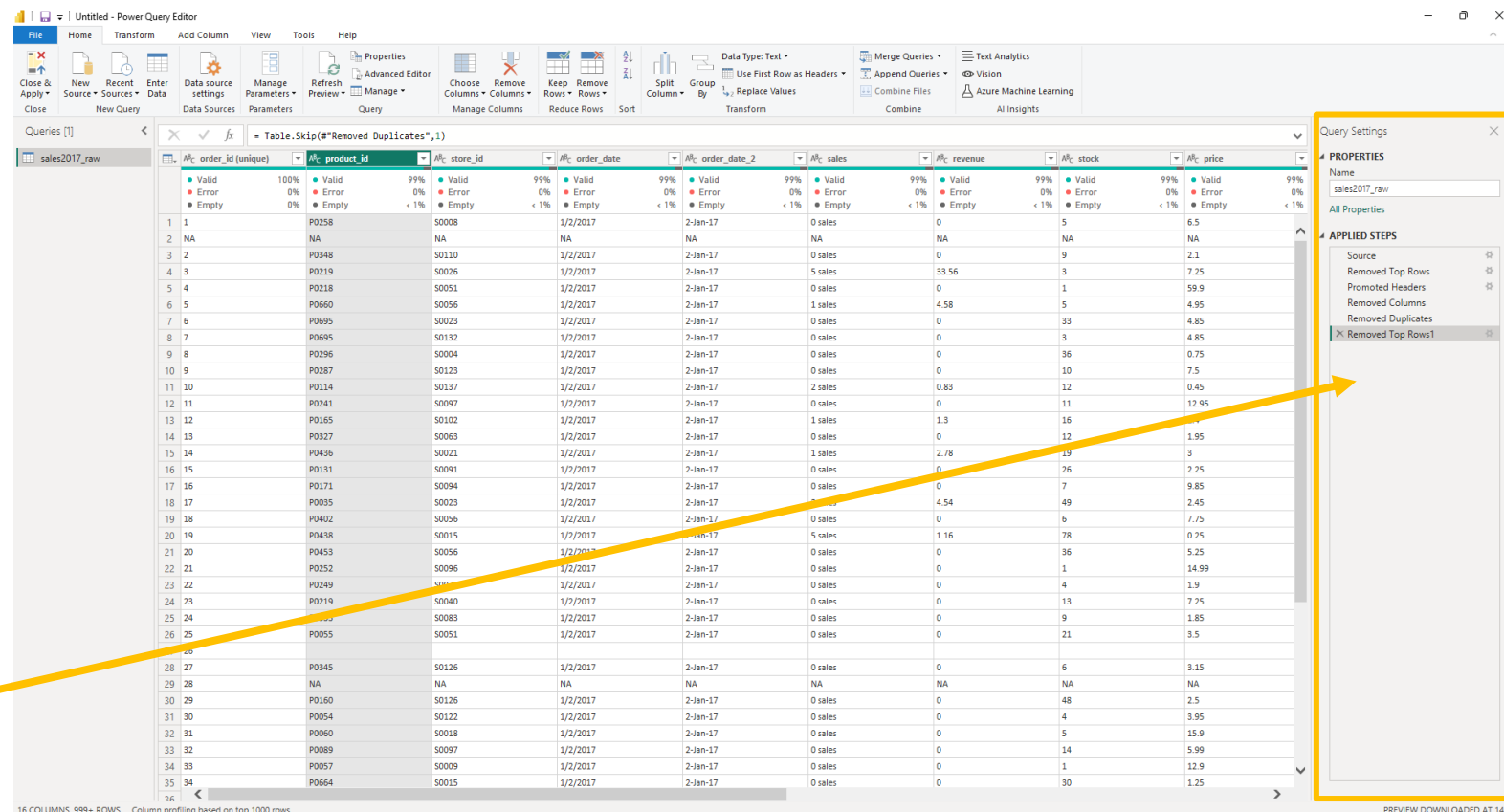
Power Query Editor

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- ▶ **Top Ribbon Menu** – the main navigation area to perform tasks.
- ▶ **Data Queries** – This will display where all your project Data files reside.
- ▶ **Data Pane** – view and manipulate/tidy the data Columns and Rows.
- ▶ **M Code** – view each of your steps in M Code format.



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- ▶ **M Code** – view each of your steps in M Code format.
- ▶ **Query Properties and Steps** – query naming and current steps are displayed and edited here.



Obtaining Data

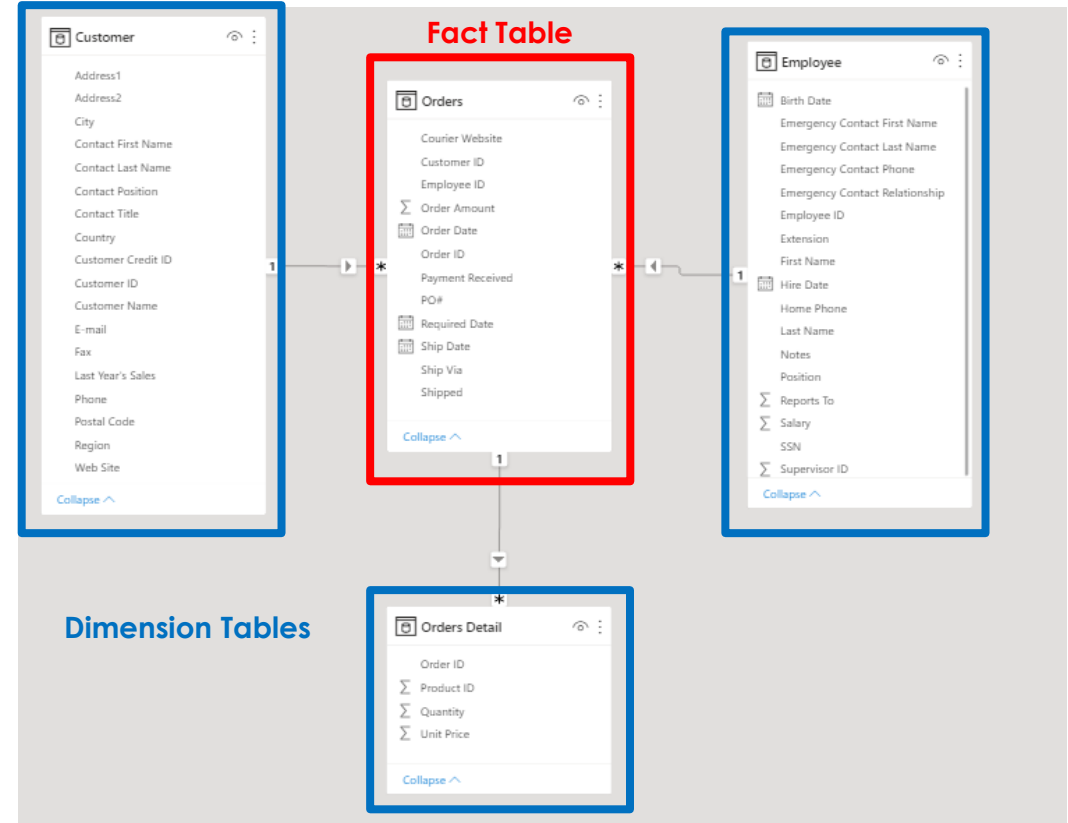
- DATA SOURCES
- REPOINT TO MOVED DATA

Data Sources

- ▶ First step to using Power BI is to gather the data you require for reporting.
- ▶ Connect to a wealth of sources, ie, Data on the Web, SQL, Microsoft Excel Sheets, CSV files to name a few.
- ▶ Placing a series of Similar CSV or Excel files into a folder allows Excel Power Query to combine/append the files into one data source in Power BI
- ▶ Data is obtained via Excel Power Query and a Data Model is created.
- ▶ In most part this will be a collection of Tables with Relationships applied.

Data Schema

- Logical Arrangement of tables in multidimensional databases.
- The arrangement will have a Fact Table and many Dimension Tables linked to the facts.





Activity: Connecting Data

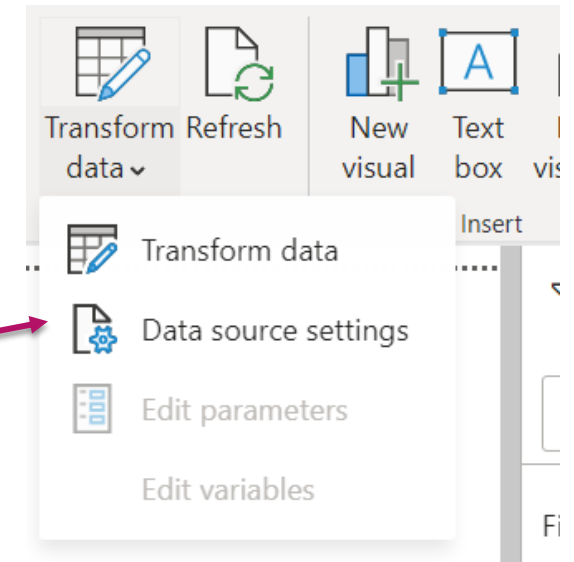
Repointing to Moved Data Source

- ▶ From Time to Time, the underlying Data Source files may be moved or even renamed, this will loose the connection to the data, disabling refreshing.
- ▶ Use one of the two methods to repoint the data:

Select **Transform Data** to open Power Query Editor and select **Data Source Settings**

or

Selecting the **Transform Data** drop-down will enable you to switch locations/filename as required.



Steps - Basic

- REMOVE COLUMNS/ROWS
- DATA TYPE CHANGE
- FILTERS

Shaping Data

- ▶ Normally a data source will need some **'Refinement'** known as **'Transformation'**.
- ▶ As you apply customisation, the data is **'Shaped'** into the format required – each change is recorded as a Step.
- ▶ System Steps are standard PowerBI feature, ie. Source – these are displayed with a cog symbol to the right, selecting will display the details about the step.
- ▶ Each custom Step you apply will display the detail, which can be updated.
- ▶ A custom Step can be deleted if necessary.

The screenshot displays the Power BI Query Editor interface. At the top, the formula bar shows the transformation: `= Table.RemoveColumns(#"Changed Type",{ "Website", "Fax", "Phone"})`. Below this is a table of customer data. To the right, the 'Query Settings' pane is open, showing the 'APPLIED STEPS' list. The steps are: Source, Navigation, Promoted Headers, Changed Type, and Removed Columns. The 'Removed Columns' step is currently selected and highlighted in yellow. Red arrows point from the text in the list on the left to the formula bar and the 'Removed Columns' step in the settings pane.

CustomerCreditID	CustomerName	ContactFirstName	ContactLastName
24	Pedal Pusher Bikes Inc.	Tony	Garneau
45	Cycles and Sports	Zachary	Barbera
50	Crazy Wheels	Davy	Douglas
51	Biking's It Industries	Katie	Cronin
60	Bikes for Tykes	Dave	Elkins
71	BBS Pty	Victoria	Ashworth
143	Down Under Bikes	Dave	Flynn
144	Canberra Bikes	Craig	Stobbs
145	Kangaroo Trikes	Sandra	Anderson
146	Bicycle Bikes	Bruce	Hude

Query Settings

PROPERTIES

Name: Customer

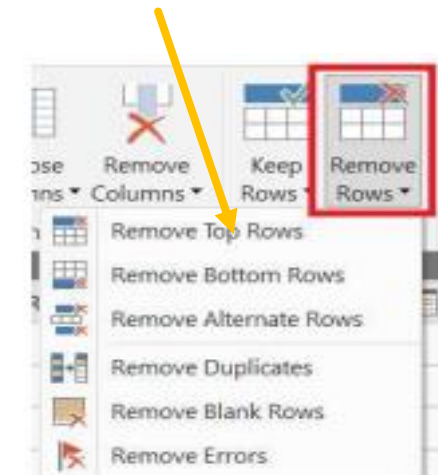
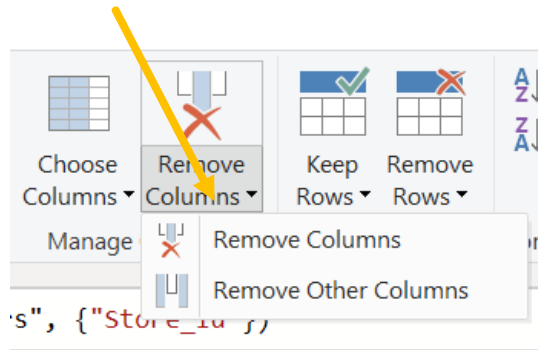
[All Properties](#)

APPLIED STEPS

- Source
- Navigation
- Promoted Headers
- Changed Type
- Removed Columns**

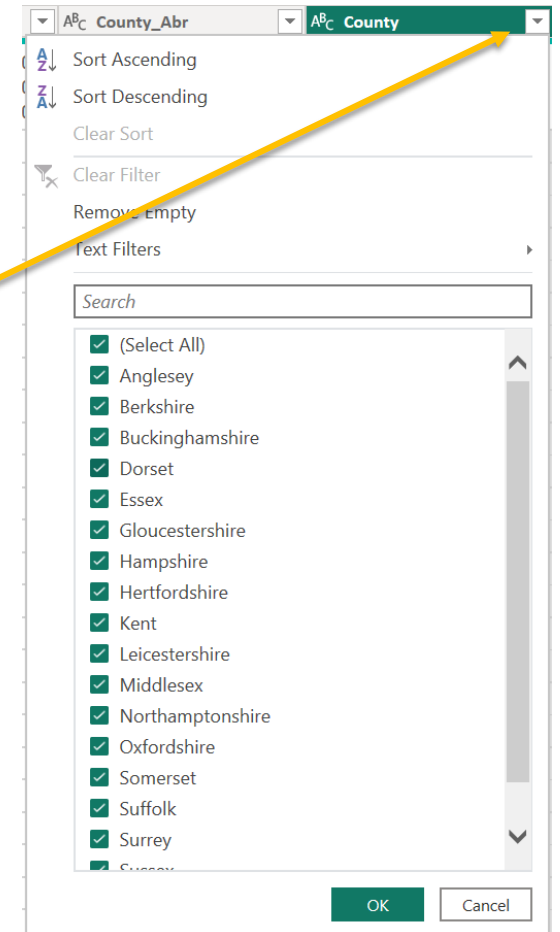
Removing Columns/Rows

- ▶ Power Query can be used to exclude unwanted columns and rows from the source table.
- ▶ The option is labelled as Remove, but really means Exclude – the underlining connected data table is not modified in any way.
- ▶ **Columns** – Use the Manage Columns section on the Ribbon to remove a selected column or remove all others than the selected.
- ▶ **Rows** – Use the Reduce Rows section on the ribbon to remove rows at top/bottom, duplicates, blanks and error rows.



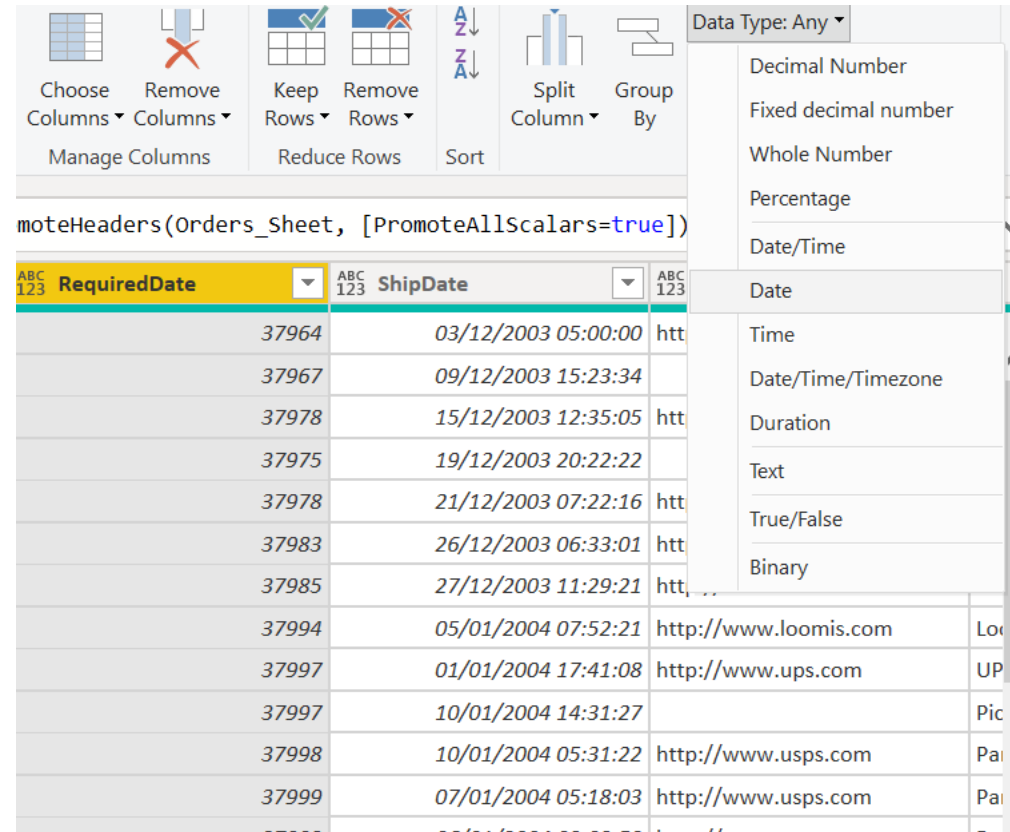
Filters

- ▶ Use the Filters function in Power Query to remove any irrelevant data from being displayed in the resulting Table.
- ▶ For example, a query is returning Invoices and Credit Notes – you may only want to report on Invoices, this column can be filtered to the data of Invoices only, just same as filtering an Excel Table.
- ▶ The Filter is stored as a step, so you can remove or amend the step to display the relevant data.



Data Type Changes

- ▶ Power Query will try to identify the type of data stored within a column using the Data Type Detection process.
- ▶ Occasionally the type selected may not be determined correctly, use a Step to update the data type as required.
- ▶ This will again only change the Data Type for the time the data is being view through the query and not the underlying data file.



The screenshot shows the Power Query ribbon with the 'Data Type' dropdown menu open. The menu lists various data types: Decimal Number, Fixed decimal number, Whole Number, Percentage, Date/Time, Date, Time, Date/Time/Timezone, Duration, Text, True/False, and Binary. The 'Data Type: Any' dropdown is currently selected. Below the ribbon, a table is visible with columns 'RequiredDate' and 'ShipDate'. The 'RequiredDate' column has a dropdown menu open showing the date '37964'. The 'ShipDate' column has a dropdown menu open showing the date '03/12/2003 05:00:00'. The table also includes a third column with values like 'http://www.loomis.com' and 'http://www.ups.com'.

RequiredDate	ShipDate	
37964	03/12/2003 05:00:00	http://www.loomis.com
37967	09/12/2003 15:23:34	http://www.ups.com
37978	15/12/2003 12:35:05	
37975	19/12/2003 20:22:22	
37978	21/12/2003 07:22:16	
37983	26/12/2003 06:33:01	
37985	27/12/2003 11:29:21	
37994	05/01/2004 07:52:21	http://www.loomis.com
37997	01/01/2004 17:41:08	http://www.ups.com
37997	10/01/2004 14:31:27	
37998	10/01/2004 05:31:22	http://www.usps.com
37999	07/01/2004 05:18:03	http://www.usps.com



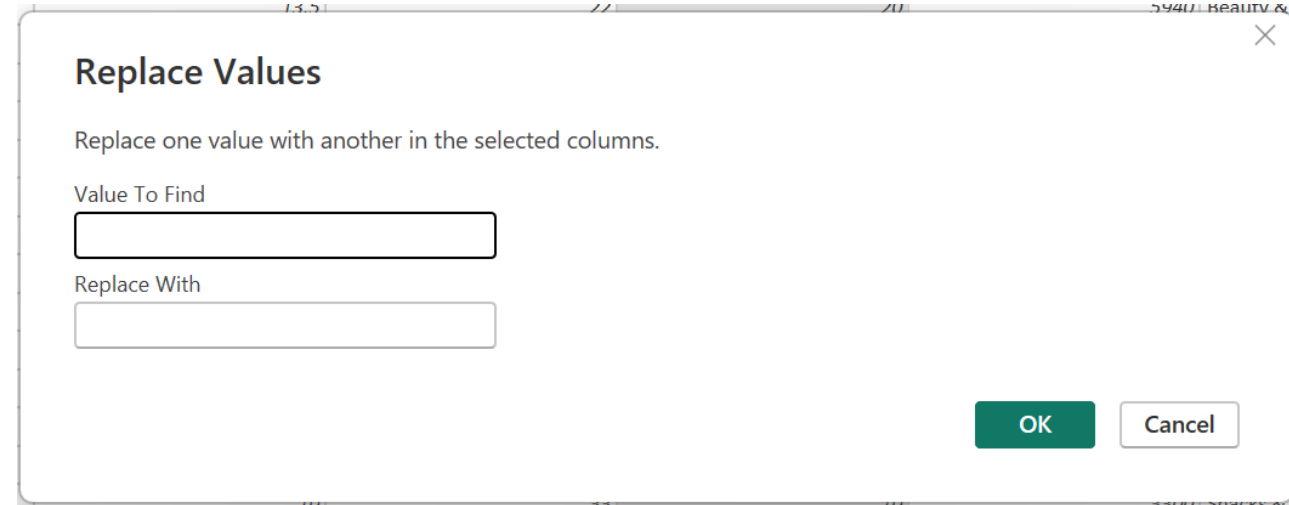
Activity: Simple Steps

Steps - Complex

- REPLACE VALUES
- SPLIT/MERGE
- COMBINE: APPEND & MERGE
- PIVOT/UNPIVOT
- ADD COLUMNS
- CONDITIONAL COLUMNS

Replacing Values

- ▶ Replacing values works in two modes:
 - ▶ **Replace Entire Cell Contents** – this is the default option when working on a non-text column. It can be selected on for a text column if necessary.



The screenshot shows a 'Replace Values' dialog box with a close button (X) in the top right corner. The dialog contains the following elements:

- Replace Values**: The title of the dialog.
- Replace one value with another in the selected columns.**: A descriptive instruction.
- Value To Find**: A label above a text input field.
- Replace With**: A label above a second text input field.
- OK**: A green button to confirm the replacement.
- Cancel**: A white button to cancel the operation.

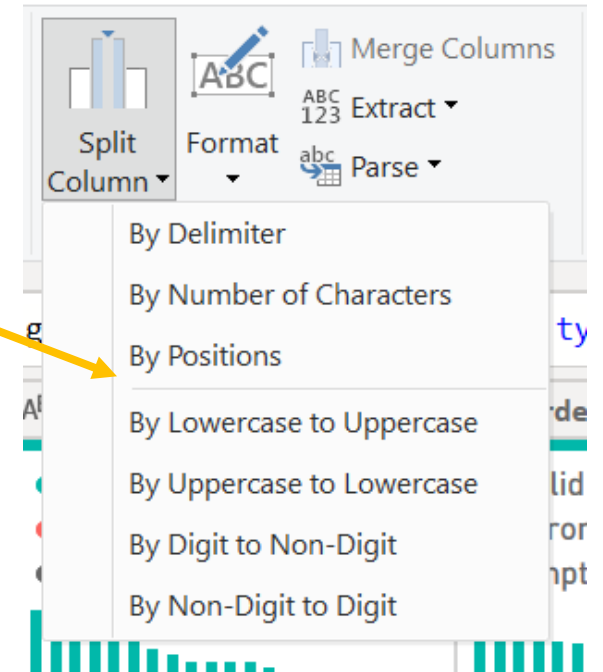
Replacing Values

- ▶ Replacing values works in two modes:
 - ▶ **Replace Entire Cell Contents** – this is the default option when working on a non-text column. It can be selected on for a text column if necessary.
 - ▶ **Replace Instances of a Text String** – this is the default option for text columns. Additional features will be available
- ▶ When working with text, this feature is case sensitive.

The screenshot shows a 'Replace Values' dialog box overlaid on a spreadsheet. The dialog has a title bar with a close button (X). The main title is 'Replace Values'. Below it, a subtitle reads 'Replace one value with another in the selected columns.' There are two input fields: 'Value To Find' and 'Replace With'. Below these fields, there is a section for 'Advanced options' with two checkboxes: 'Match entire cell contents' (unchecked) and 'Replace using special characters' (checked). Below the checkboxes is a dropdown menu labeled 'Insert special character' which is currently open, showing a list of special characters: 'Tab', 'Carriage Return', 'Line Feed', 'Carriage Return and Line Feed', and 'Non-breaking Space'. At the bottom right of the dialog are 'OK' and 'Cancel' buttons. The background spreadsheet shows columns with headers 'S0008', '02/01/2021', '02/01/2021', '0 sales', and '0'.

Splitting & Merging Columns

- ▶ To separate values out in a Column to create new columns, use the Split Column feature.
- ▶ Split Column has different methods of where the split will occur In this case, the column(s) selected can be split by positions.

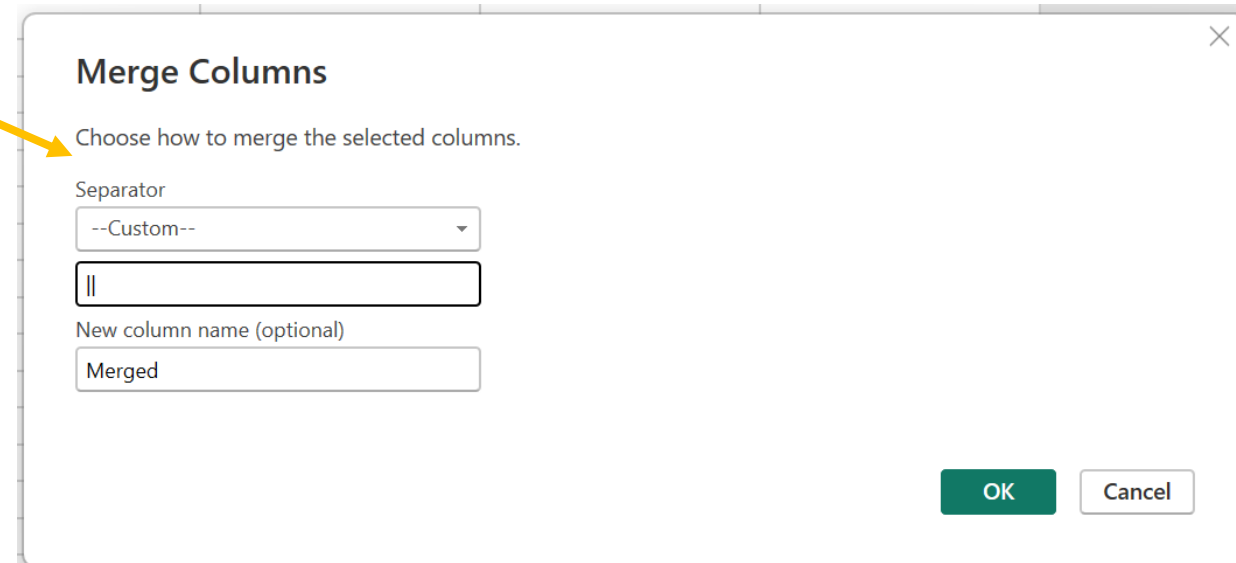


Splitting & Merging Columns

- ▶ To separate values out in a Column to create new columns, use the Split Column feature.
- ▶ Split Column has different methods of where the split will occur In this case, the column(s) selected can be split by positions.
- ▶ Merging Columns will join together one or more columns using a separator if necessary.

Splitting & Merging Columns

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- ▶ Merging Columns will join together one or more columns using a separator if necessary.



Merge Columns

Choose how to merge the selected columns.

Separator

--Custom--

||

New column name (optional)

Merged

OK Cancel

Activity: Complex Steps

Pivot / Unpivot Columns

- ▶ Occasionally we are presented with data in a Table where the Column and Row data needs to be pivoted to give us the correct format to be used in our reports.
- ▶ The following example shows the Date / Value data is shown as individual column values.
- ▶ Once pivoted, the data will be in a format we can deal with the Dates / Values in a better format in our reports.

	A ^B _C Country ▾	1 ² ₃ 6/1/2020 ▾	1 ² ₃ 7/1/2020 ▾	1 ² ₃ 8/1/2020 ▾
1	USA	785	450	567
2	Canada	357	421	254
3	Panama	20	40	80

	A ^B _C Country ▾	A ^B _C Attribute ▾	1 ² ₃ Value ▾
1	USA	6/1/2020	785
2	USA	7/1/2020	450
3	USA	8/1/2020	567
4	Canada	6/1/2020	357
5	Canada	7/1/2020	421
6	Canada	8/1/2020	254
7	Panama	6/1/2020	20
8	Panama	7/1/2020	40
9	Panama	8/1/2020	80

Activity: Complex Steps – Pivot Column

Append / Merge Data Queries

- ▶ Combining two queries is one of the most basic and also essential tasks that you would need to do in most of data preparation scenarios.
- ▶ There are two types of combining queries - **Merge** and **Append**
- ▶ **Append:** The results in two (or more) queries (which are tables themselves) combined into one query in which Rows will be appended after each other
- ▶ **Merge:** The combining queries are based on matching rows, rather than columns. There should be joining or matching criteria between two queries. (for example StoreID column of both queries to be matched with each other)



Activity: Complex Steps – Combine/Append

Adding Columns

- ▶ Columns can be added to your data query to add more flexibility for your report design.
- ▶ Columns are added using the Power Query M formula language.
- ▶ For example, we have an Order Date and a Delivery Date – maybe having a value already calculated to show the Duration between Order Date and Delivery will be valuable and useful for the report.

Custom Column

Add a column that is computed from the other columns.

New column name

Duration

Custom column formula ⓘ

= [delivery_date_format1]-[order_date]

Available columns

- order_id (unique)
- product_id
- store_id
- order_date
- order_date_2
- delivery_date_format1
- sales

<< Insert

[Learn about Power Query formulas](#)

✓ No syntax errors have been detected.

OK Cancel



Activity: Adding Columns

Adding Conditional Columns

- ▶ One of the most powerful features in Power BI is the ability to create conditional columns.
- ▶ These columns allow you to add new columns to your datasets based on specific conditions, giving you more control over your data analysis.
- ▶ Conditional Columns follow the logical if/then/else statements.

Add Conditional Column

Add a conditional column that is computed from the other columns or values.

New column name:

	Column Name	Operator	Value	Output
If	county abr - cou...	begins with	ABC 123 EX	South East
Else If	county abr - cou...	begins with	ABC 123 SY	South East
Else If	county abr - cou...	begins with	ABC 123 SX	South East

Else:

```
= Table.AddColumn("#Filtered Rows", "Area", each if Text.StartsWith(["county abr - county - town"], "EX") then "South East" else if Text.StartsWith(["county abr - county - town"], "SY") then "South East" else if Text.StartsWith(["county abr - county - town"], "SX") then "South East" else "North West")
```

Activity: Conditional Columns

Extract Relationships

- RELATIONSHIP MANAGEMENT
- JOIN KINDS
- HIERARCHIES
- WORKING WITH RELATED TABLES

Relationships

- ▶ Usually most reports created will be using 1 or more Tables of data.
- ▶ Data is normalised down into multiple Tables to ensure you are working efficiently and data is not being duplicated – this also improves performance when running reports.
- ▶ Fact-Dimension Model (Star Schema) is where we will have a Fact Table (where most transactions occur) and probably multiple Dimension Tables (which is more likely static information).
- ▶ In more complex scenarios, a Dimension Table can act as Dimension but also Transactional.

Our Model

Sales Table

OrderID	ProductID	OrderAmount	CustomerID	Region	City
101	2	456	1	Surrey	Woking
102	5	12.4	3	Berkshire	Bracknell
103	3	100	1	Surrey	Woking

Our Model

Sales Table

OrderID	ProductID	OrderAmount	CustomerID	Region	City
101	2	456	1	Surrey	Woking
102	5	12.4	3	Berkshire	Bracknell
103	3	100	1	Surrey	Woking

Customer Table

CustomerID	Region	City	Country	LastYearsSales
1	Surrey	Woking	England	275000
2	Surrey	Guildford	England	23898
3	Berkshire	Bracknell	England	14522

Our Model

Sales Table

OrderID	ProductID	OrderAmount	CustomerID
101	2	456	1
102	5	12.4	3
103	3	100	1

Fact Table

Customer Table

CustomerID	Region	City	Country	LastYearsSales
1	Surrey	Woking	England	275000
2	Surrey	Guildford	England	23898
3	Berkshire	Bracknell	England	14522

Dimension Table

Our Model

Sales Table

OrderID	ProductID	OrderAmount	CustomerID
101	2	456	1
102	5	12.4	3
103	3	100	1

Foreign Key

Fact Table

Primary Key

Customer Table

CustomerID	Region	City	Country	LastYearsSales
1	Surrey	Woking	England	275000
2	Surrey	Guildford	England	23898
3	Berkshire	Bracknell	England	14522

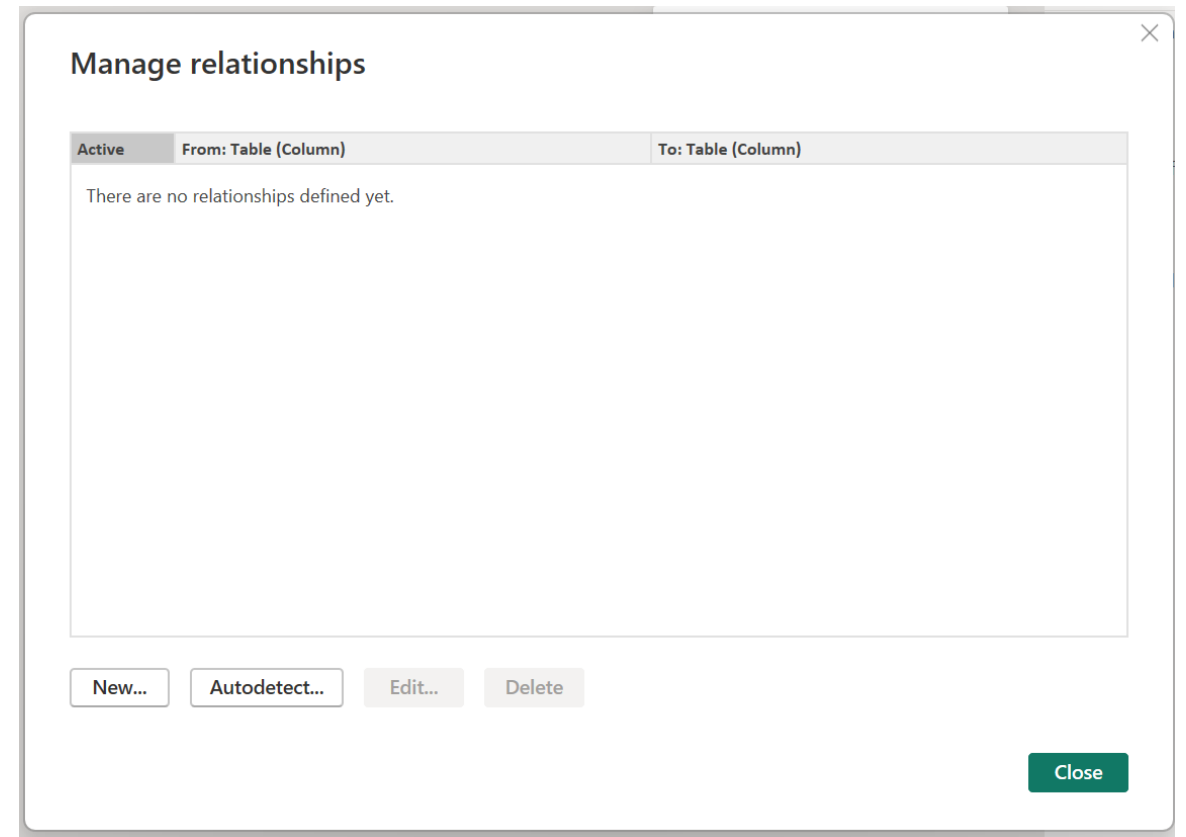
Dimension Table

Relationship Cardinality

- ▶ The Relationship Cardinality means having unique or multiple instances per value for the joining fields between two tables.
- ▶ Cardinality is defined by the Relationship and it refers to the Relationship between two tables.
- ▶ Types of Cardinality:
 - a) **Many to one (*:1)** the column in a given table can have more than one instance of a value, and the other related table has only one instance of a value.
 - b) **One to one (1:1)** the column in one table has only one instance of a particular value, and the other related table can have more than one instance of a value.
 - c) **One to many (1:*)** the column in one table has only one instance of a particular value, and the other related table has only one instance of a particular value.
 - d) **Many to Many (*:*)** you can establish a many-to-many relationship between tables, which removes requirements for unique values in tables.

Editing Relationships

- ▶ Switch to the Model View to see your Data Model tables and any relationships currently add.
- ▶ Use the Manage Relationship button when in the Model View to Add, Edit, Autodetect and Delete Relationships.



Activity: Relating Query Tables

Visualisations & Manipulation

- MATRIX
- CONDITIONAL FORMATTING
- CHART
- KPI'S
- FILTER: BASIC & ADVANCED
- TOP 10
- SLICER
- DRILL THROUGH

Report Design

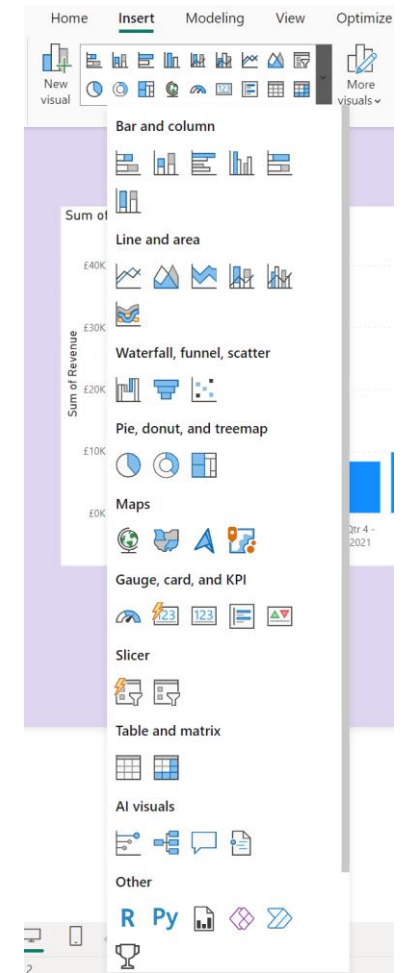
- ▶ Each report you create will contain a variety of different data and visuals to meet your end requirement.
- ▶ There are some general steps you will take to build the final report for Publishing:
 1. **Theme** – select the desired Theme for Colours/Fonts or customise a existing Theme to suit the current report being generated.
 2. **Canvas** – apply the background Colour/Wallpaper to be used, Filter Pane and Filter Card settings.
 3. **Setup a Page Template** – containing Shapes/Text Boxes/Images to be used on all pages. You may have several Page Templates. Once created you can copy these to start as the building blocks for a report page.
 4. Add the Visuals and functionality.



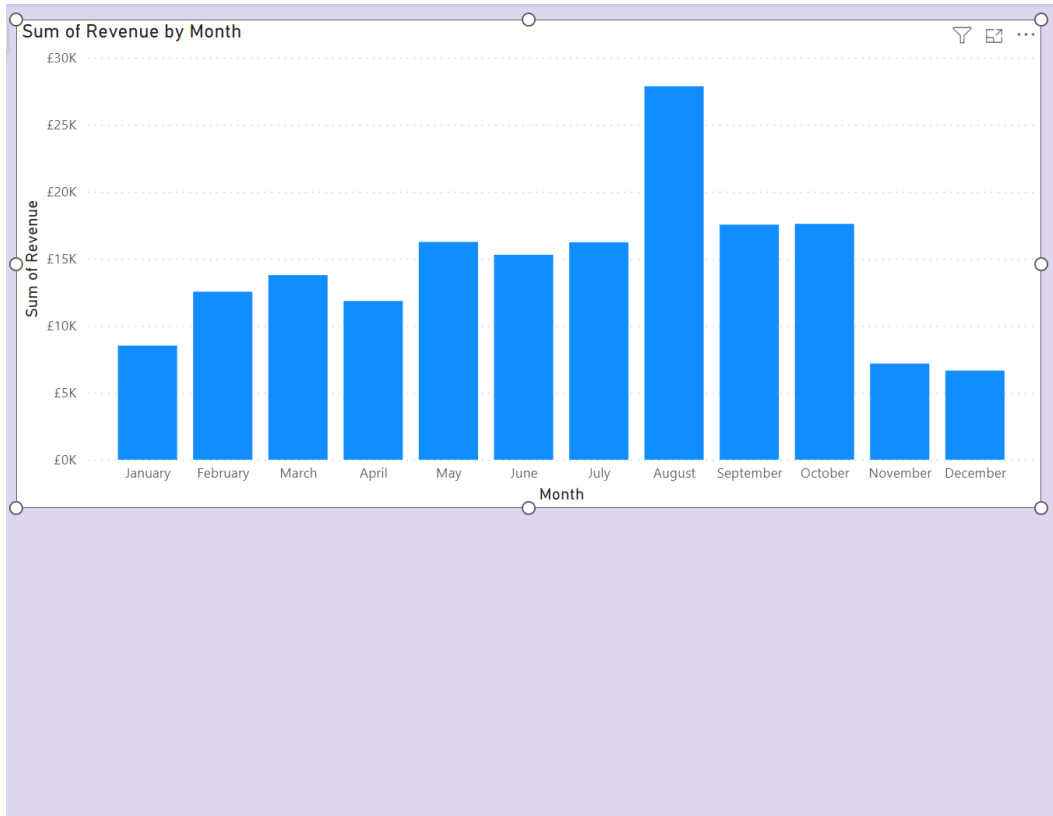
Activity: Building a Page Layout Template

Visualisations

- ▶ We now have our data transformed and ready to apply to the visual side of the Power BI file.
- ▶ Adding visuals is a simple click away.
- ▶ There are many visual types, depending on what you are trying to present to the audience will be governed by the visual used.
- ▶ Visuals are added from the Home or Insert Ribbon Tab.



Visual Settings



Format

Visual Properties

Size and style

Title

X-axis

Y-axis

Legend

Small multiples

Gridlines

Zoom slider

Columns

Data labels

Plot area background

Reference line

Error bars

Build a visual

Visual types

Suggest a type

X-axis

Month

+Add data

Y-axis

Sum of Revenue

+Add data

Legend

+Add data

Small multiples

+Add data

Tooltips

+Add data

► Each Visual you will use the Build a Visual Pane to add the necessary data fields.

► The Format Pane will give you a wealth of options to apply for the selected Visual.

Matrices v Tables

- ▶ **Tables** are used to display detailed, granular data.
- ▶ **Tables** are simpler and easier to read.
- ▶ **Tables** will have less flexibility with design and data aggregation

County	Town	Year	Sum of Revenue
Anglesey	Holyhead	2021	£123.88
Anglesey	Holyhead	2022	£904.38
Anglesey	Holyhead	2023	£234.59
Berkshire	Ascot	2021	£51.79
Berkshire	Ascot	2022	£147.13
Berkshire	Ascot	2023	£236.9
Berkshire	Bracknell	2021	£319.96
Total			£171,291

- ▶ **Matrices** are used to display summarizing and aggregation of data.
- ▶ **Matrices** are more complex in appearance and require more effort to interpret.
- ▶ **Matrices** have a variety of options for data organisation, grouping and drill down

County	2021	2022	2023	Total
⊞ Anglesey	£123.88	£904.38	£234.59	£1,262.85
⊞ Berkshire	£738.3	£1,265.98	£4,427.68	£6,431.96
Ascot	£51.79	£147.13	£236.9	£435.82
Bracknell	£319.96	£645.99	£2,359.17	£3,325.12
Maidenhead	£22.77	£72.93	£998.64	£1,094.34
Reading	£70.52	£118.08	£215.91	£404.51
Slough	£273.26	£281.85	£617.06	£1,172.17
⊞ Buckinghamshire	£2,108.03	£3,636.25	£7,413.51	£13,157.79
⊞ Dorset	£2,246.41	£3,745.9	£7,015.04	£13,007.35
⊞ Essex	£834.85	£1,257.85	£3,467.01	£5,559.71
⊞ Gloucestershire	£2,256.22	£2,766.41	£4,289.82	£9,312.45

Activity: Tables & Matrix

Charts

- ▶ Power BI has 30 different types of charts to visualise your data
- ▶ The top Chart types are:
 1. Clustered Bar Chart
 2. Clustered Column Chart
 3. Waterfall Chart
 4. Combo Chart
 5. Area Chart
 6. Line Chart
 7. Pie Chart
 8. Doughnut Chart





Activity: Charts & Cards

Conditional Formatting

- ▶ Conditional Formatting in Power BI allows you to apply different formats based on a rule or criteria
- ▶ The formatting applied can be:
 - ▶ Colours
 - ▶ Icons
 - ▶ Data Bars
 - ▶ Text Styles
- ▶ Use the Conditional Formatting option within the Formatting Pane
- ▶ The example to the right has icons applied to the Sum of Revenue column – where the value fits within a range the icon will show

County	2021	2022	2023	Total
Anglesey	✗ £123.88	✗ £904.38	✗ £234.59	£1,262.85
Berkshire	✗ £738.3	✗ £1,265.98	£4,427.68	£6,431.96
Buckinghamshire	£2,108.03	£3,636.25	✓ £7,413.51	£13,157.79
Dorset	£2,246.41	£3,745.9	✓ £7,015.04	£13,007.35
Essex	✗ £834.85	✗ £1,257.85	£3,467.01	£5,559.71
Gloucestershire	£2,256.22	£2,766.41	£4,289.82	£9,312.45
Hampshire	✗ £879.07	✗ £1,035.98	£1,792.28	£3,707.33
Hertfordshire	✗ £730.11	✗ £1,132.79	£2,168.07	£4,030.97
Kent	✗ £1,380.64	£1,940.62	£6,241.04	£9,562.3
Leicestershire	✗ £1,287.71	£1,811.26	£5,598.56	£8,697.53
Middlesex	£2,294.27	£3,523.09	£5,937.08	£11,754.44
Northamptonshire	£5,742.49	✓ £6,701.78	✓ £13,058.64	£25,502.91
Oxfordshire	✗ £1,257.73	£3,053.85	✓ £9,890.66	£14,202.24
Somerset	✗ £1,138.22	✗ £1,085.52	£2,830.49	£5,054.23
Suffolk	£2,482.89	£2,607.14	£4,959.5	£10,049.53
Surrey	£2,224.97	£3,261.56	✓ £6,618.94	£12,105.47
Sussex	£2,859.02	£4,525.84	✓ £7,662.15	£15,047.01
Wiltshire	✗ £589.4	✗ £892.39	✗ £1,363.14	£2,844.93
Total	£31,174.21	£45,148.59	£94,968.2	£171,291

Activity: Basic Conditional Formatting

Top N Filtering

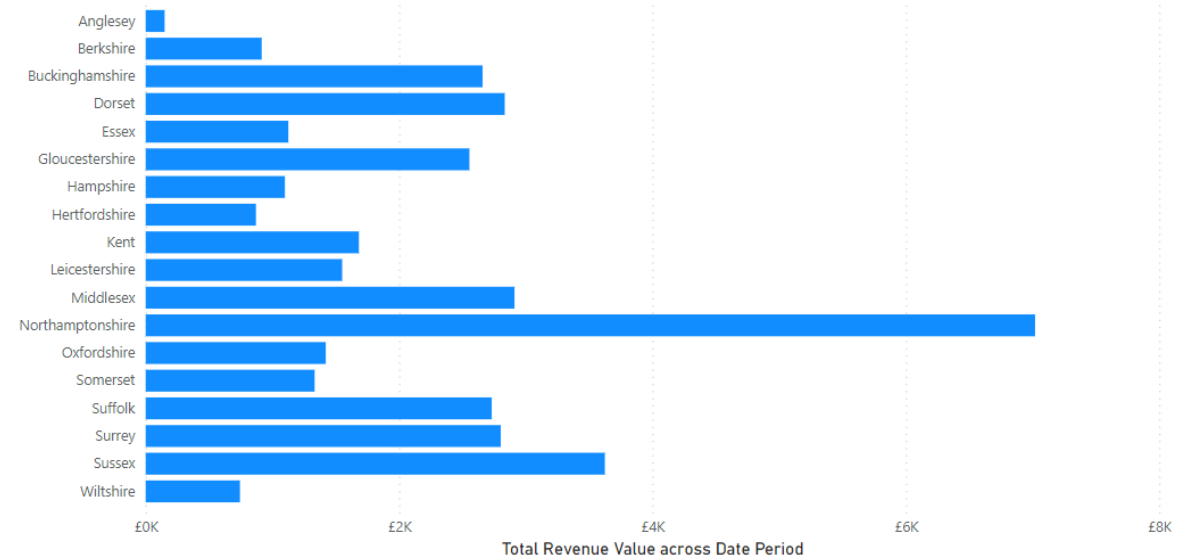
- ▶ Filtering on the Visual and Page can be set to Basic (standard value selections), Advanced (set against a condition, ie. Value \geq X) and also Top N.
- ▶ Top N enables a user to see the top results of numerical data.
- ▶ The following example, shows us the Top 5 Counties based on their Sum of Revenue for all years.

County	2021	2022	2023	Total
Northamptonshire	£5,742.49	£6,701.78	£13,058.64	£25,502.91
Sussex	£2,859.02	£4,525.84	£7,662.15	£15,047.01
Oxfordshire	£1,257.73	£3,053.85	£9,890.66	£14,202.24
Buckinghamshire	£2,108.03	£3,636.25	£7,413.51	£13,157.79
Dorset	£2,246.41	£3,745.9	£7,015.04	£13,007.35
Total	£14,213.68	£21,663.62	£45,040	£80,917.3

Slicers

- ▶ Slicers are a type of on Canvas Visual Filters.
- ▶ These enable a user to sort and filter a packed report and view only the information they require.
- ▶ Slicers can operate on a Canvas as either:
 - ▶ Checkboxes
 - ▶ Radio Buttons
 - ▶ Dropdown Lists
 - ▶ Tiles (Buttons)
 - ▶ Sliders

Total Revenue Value across Date Period by County



Date

01/01/2021 12/03/2022





Activity: Simple Slicers

KPI's

- ▶ Key Performance Indicator (KPI) is a visual cue, metric or measure used to evaluate the performance of an organisation or business process.
- ▶ KPI's are created by using a combination of data visual techniques, ie. Charts, tables and maps and data calculations.
- ▶ Very useful to monitor progress – identify where improvements are needed or define success.

Revenue by Month 2021



Revenue by Month 2022



DAX Formulas & Measures

- INTRODUCING DAX FORMULAS
- MEASURES
- QUICK MEASURES

Introducing DAX

- ▶ Power BI supports two different languages, **M** language and **DAX** (Data Analysis Expression) that can be used to filter, manage, and visualize data.
- ▶ **M** is the query formula language used in the Power Query Editor in order to prepare data before it can be loaded into the Power BI model.
- ▶ **DAX** is an analytical data calculation language which can be used for in-depth data analysis during the Data View phase.
- ▶ **M** and **DAX** are not dependent upon each other and follow totally different structures and logics, and have different underlying codes.
- ▶ **M** and **DAX** cannot be used simultaneously since the M language is used in Query Editor while **DAX** is used in the Data View model.
- ▶ You will generally use DAX calculations in either **Calculated Columns** or **Measures**.

Calculated Columns

- ▶ Calculated Columns are evaluated at the Row Level within the Power BI Model.
- ▶ They will be a member of the Table as a new Column
- ▶ To add a new Calculated Column, within the Report view, select one of the following:
 - a) Right-click on table name, select New Column
 - or
 - b) Select the table and choose New Column from the Table Tools ribbon tab
- ▶ Within the formula window, enter the required code:

A screenshot of the Power BI formula bar. It shows a dropdown menu with 'X' and '✓' icons. The text '1 Column =' is visible, indicating the start of a new calculated column formula.

```
1 Discounted Price = if(Sales[promo_discount] == "NA", sales[price],sales[price]-(sales[price]*Sales[promo_discount]/100))
```

Activity: Introducing DAX Columns

Measures

- ▶ As discussed, **Calculated Columns** are part of a Table, a physical value.
- ▶ They will be calculated for every single row in the table, which in turn will take time to perform and increases the data size of the table.
- ▶ A **Measure** is not part of a table, just part of the overall **Data Model**.
- ▶ **Measure** are calculated to find aggregated values and calculated on the fly.
- ▶ They do not take up physical space in memory or the Data Model.

Structure	Formatting
✓	1 Revenue 5% Split = <code>sum(sales[revenue])*0.05</code>

Quarter	Revenue 5% Split
Qtr 1	£1,663.827
Qtr 2	£2,196.797
Qtr 3	£3,105.897
Qtr 4	£1,517.731
Total	£8,484.252

£8.48K
Revenue 5% Split



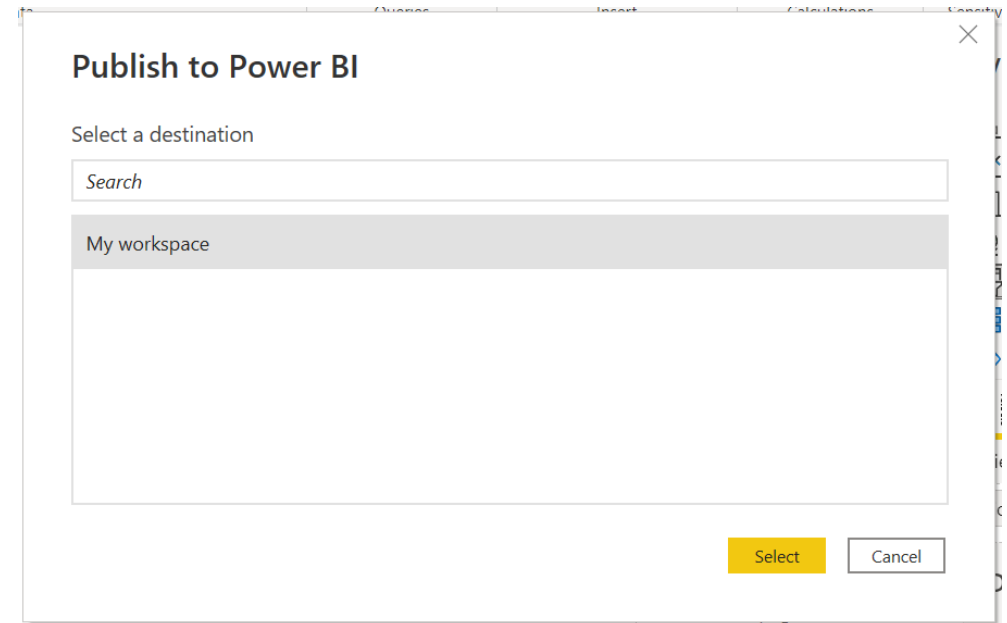
Activity: Introducing Simple DAX Measures

Publishing/Sharing Reports

- PUBLISH TO THE WEB
- PDF

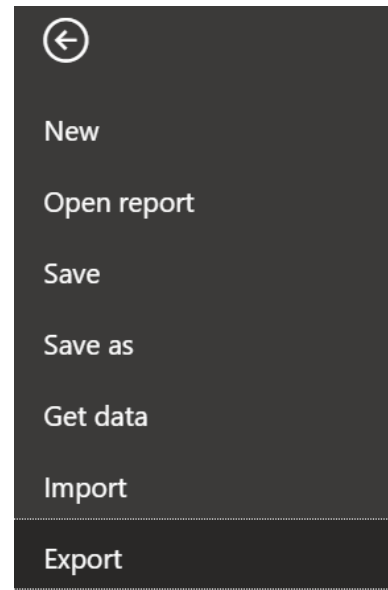
Publishing to the Web

- ▶ Publishing to the Web will make your interactive Power BI content available to additional users
- ▶ A unique URL is generated for the report, this can then be shared in various ways with colleagues or made publicly available on the web
- ▶ You must have a Power BI Pro license to be able to share reports with other users
- ▶ Use **File, Publish, Publish to Web** to start the process off



Export to PDF

- ▶ Reports generated in Power BI can be exported as **PDF** format.
- ▶ Useful when online distribution is not available to individuals.
- ▶ Using this method, any Slicers and/or Filters will become static at this point in the exported Report.
- ▶ Within **Power BI**, select **File, Export, PDF**



Export

