

Prepare and Visualize Data with Microsoft Power BI

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Presentation Outline

- Introduction to **Microsoft Power BI**
- **Get Data** in Power BI
- **Clean, Transform and Load Data** in **Power BI**
- **Configure a Semantic Model**
- **Design Power BI Reports**

Module I

Introduction to MS Power BI

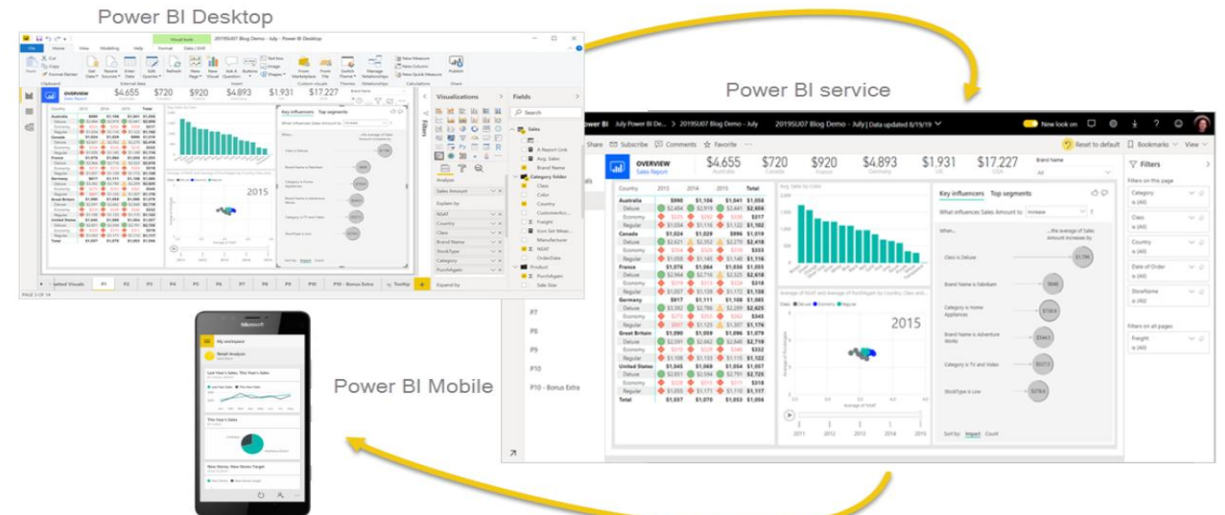
Introduction

- **Microsoft Power BI** is a comprehensive reporting solution that supports **data preparation, visualization, distribution, and management** through powerful development tools and an online platform.
- Power BI can scale from **simple reports** using a single data source to **complex models** with multiple data connections and consistent visual themes. It enables the creation of **interactive, visually engaging reports** that drive analytics and decision-making across teams, departments, or entire organizations.
- While Power BI is an essential tool for **data analysts**, all **data professionals** can benefit from understanding how it works to **explore, analyze, and communicate data insights** effectively within their organizations..

Power BI Tools

There are three primary components to Power BI:

- **Power BI Desktop** for creating semantic models and reports with visualizations.
- **Power BI service** for creating dashboards from published reports and distributing content with apps.
- **Power BI Mobile** for on-the-go access to the Power BI service content, designed for mobile.



Building blocks of Power BI

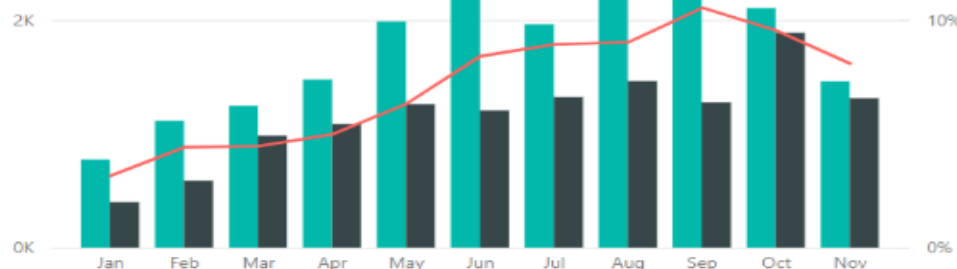
The building blocks of Power BI are

- **Semantic models:** consist of all **connected data sources**, **transformations**, **relationships**, and **calculations** that together define the meaning and logic of your data.
- **Visualizations:** In **Power BI Desktop**, when you create a **visualization** (or a *visual*), you place it on the **report canvas**. You can add multiple visuals to build the pages of your report.
 - Click on data points in one visual to **filter or highlight** related data in other visuals
 - Use **drillthroughs** to explore more detailed information
 - Apply **filters and slicers** to dynamically adjust the displayed data



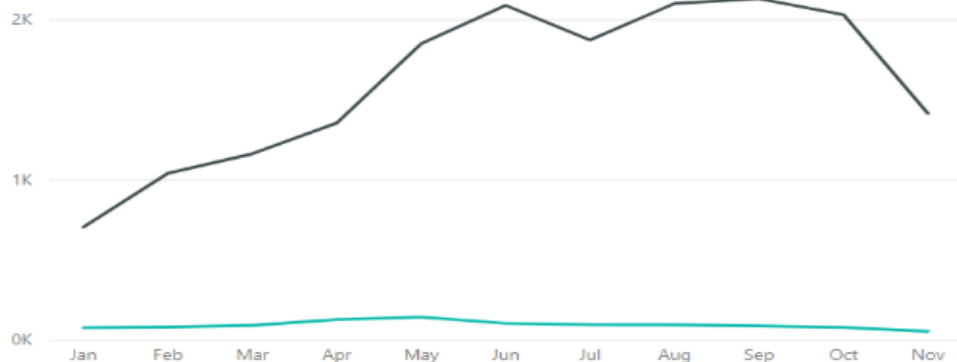
New Hires

New Hires New Hires SPLY Actives YoY % Change



New Hires by Month and FPDesc

FPDesc Full-Time Part-Time



Tap the arrows above on the left to drill down. To drill up, tap the up arrow.

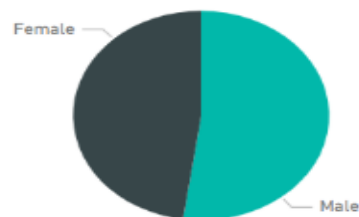
New Hires and Actives by Region and Ethnicity

Ethnicity Group A Group B Group C Group D Group E Group F Group G Actives

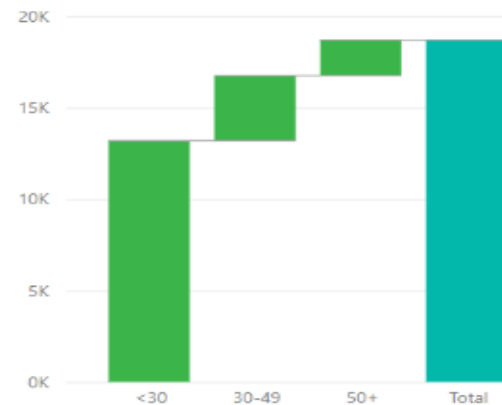


Tap the arrows above on the left to drill down. To drill up, tap the up arrow.

New Hires by Gender



Increase Decrease Total



obvIENCE ©

Filters

Search

Filters on this page

AgeGroup is (All)

Ethnicity is (All)

FPDesc is (All)

Gender is (All)

Month is not Dec

Region is (All)

VP is (All)

Year is 2014

Add data fields here

Filters on all pages

Add data fields here

Create a dashboard

- In the **Power BI service**, you can create **dashboards** after publishing a report. A dashboard is a **single page** made up of **tiles**. You add tiles by *pinning visuals* from a report to the dashboard.
- Unlike report visuals, **tiles aren't interactive**; clicking a tile takes the user to the underlying report for detailed information.
- Dashboards are ideal for showing **high-level summaries**.

Total Stores
NEW & EXISTING STORES

104

This Year's Sales
NEW & EXISTING STORES

\$22M

This Year's Sales
BY CHAIN



New Stores, New Stores Target
YEAR TO DATE



This Year's Sales
NEW STORES ONLY

\$2M

This Year's Sales, Last Year's Sales
BY FISCAL MONTH



Total Sales Variance %, Sales Per Sq Ft, This Year's Sales
BY DISTRICT



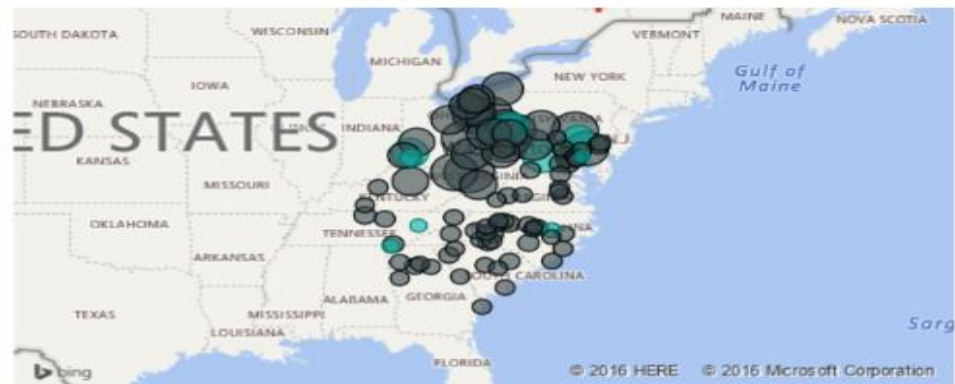
New Stores
NEW STORES ONLY

10

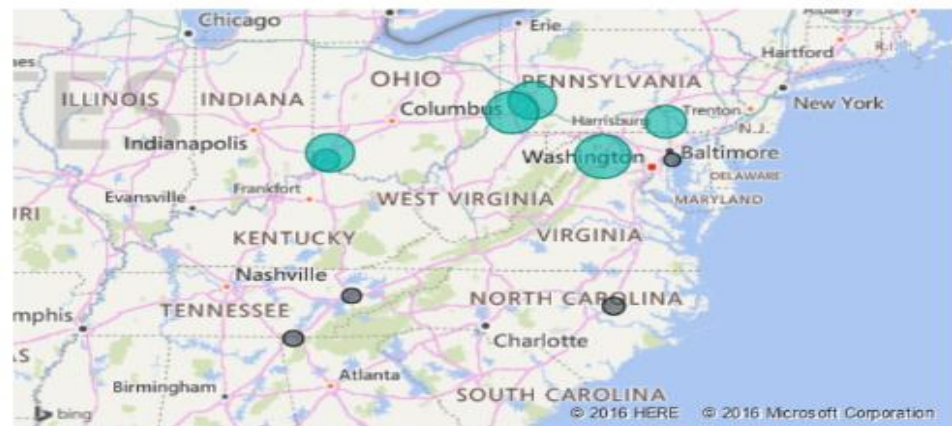
Stores Opened This Year
BY OPEN MONTH, CHAIN



This Year's Sales
BY POSTAL CODE, STORE TYPE



This Year's Sales
BY CITY, CHAIN



Sales Per Sq Ft
BY NAME



Module II

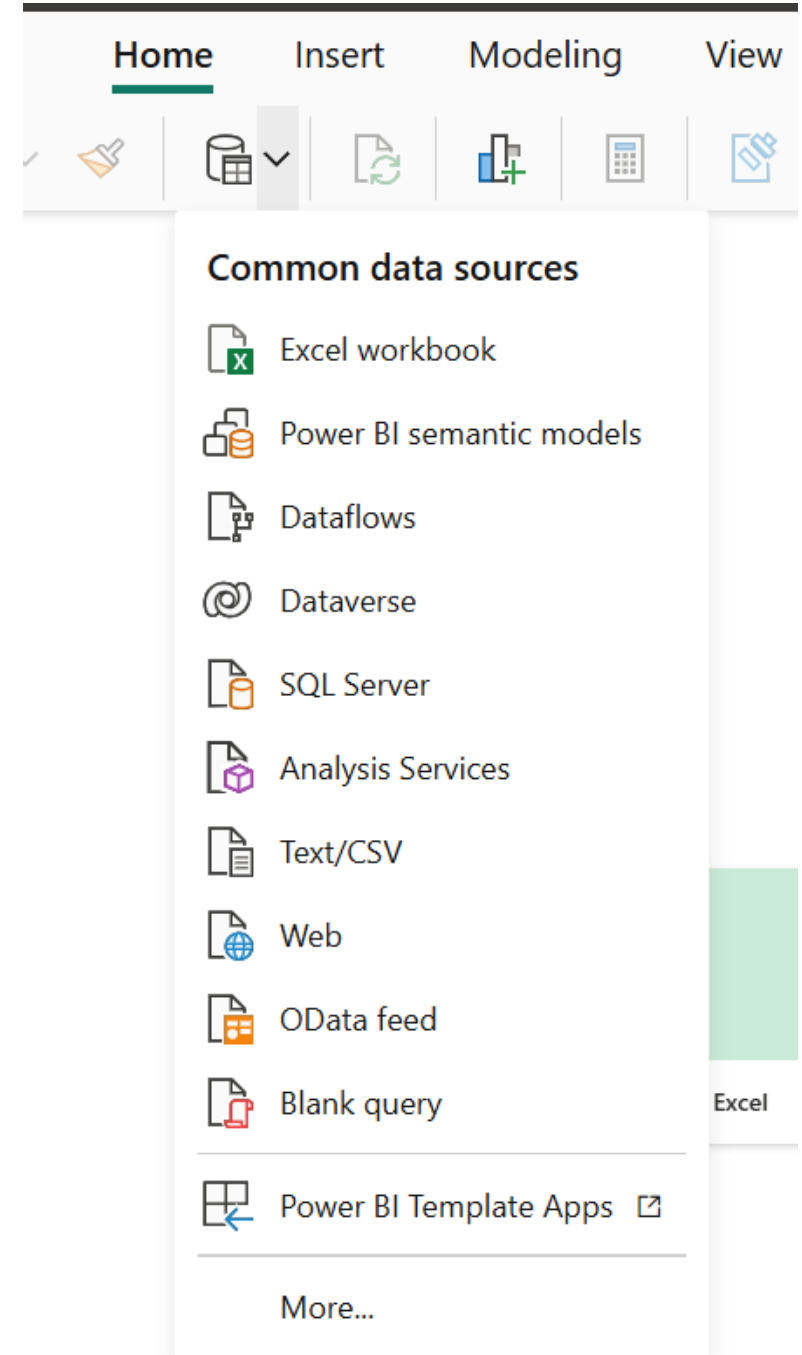
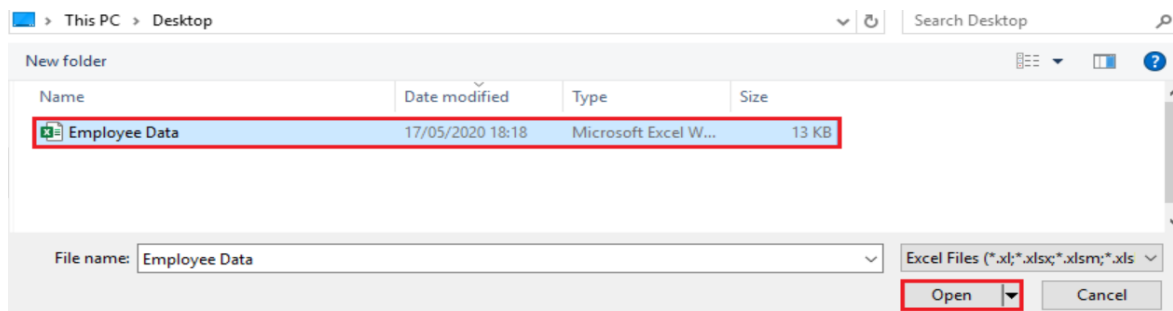
Get Data in Power BI

In this module we will learn to:

- Identify and connect to a data source
- Get data from a file, like Microsoft Excel

Connect to data in a file

- In Power BI, on the **Home** tab, select **Get data**. In the list that displays, select the option that you require, such as **Text/CSV** or **XML**.



Select the file data to import

- After connecting to Power BI Desktop, the **Navigator window** opens, displaying your data source.
- Select a **table** or **entity** to preview its contents and confirm the correct data for the Power BI model.
- **Check** the **boxes** for the tables you want to import, activating the **Load** and **Transform Data** buttons.

Select the file data to import

Navigator

Display Options ▾

 Employee Data.xlsx [1]

☒  Employee Data

Employee Data

Department	Extension	Position Title	Join Date	Experience
MARKETING	425	Marketing Advisor	01/01/2019	2 years
MARKETING	206	Marketing Advisor	01/03/2018	3 years
MARKETING	207	Brand Manager	01/01/2015	6 years
MARKETING	349	Senior Brand Manager	04/10/2010	10 years
MARKETING	425	Marketing - Coordinator	05/02/2019	2 years
MARKETING	210	Marketing - Coordinator	06/02/2019	2 years
MARKETING	208	Marketing Consulatant	07/05/2015	6 years
MARKETING	249	Marketing Consulatant	08/02/2015	6 years
OPERATIONS	425	Supervisor	09/01/2010	11 years
OPERATIONS	216	Administrator	10/06/2018	2 years
OPERATIONS	215	Operations Manager	11/04/2015	6 years
OPERATIONS	350	Senior Finance Manager	12/05/2010	11 years



Load

Transform Data

Cancel

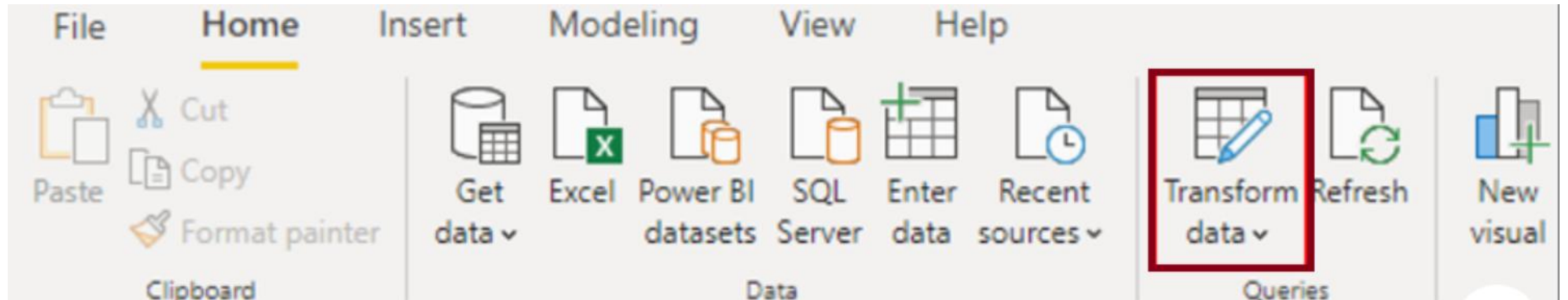
Module III

Clean, Transform and Load Data in Power BI

In this module we will learn to:

- Resolve inconsistencies, unexpected or null values, and data quality issues.
- Combine queries.
- Profile data so you can learn more about a specific column before using it.

Get started with Power Query Editor



Power Query Editor in Power BI

Allows actions such as:

- Renaming columns or tables
- Changing data types (e.g., text to number)
- Removing or filtering rows
- Setting the first row as headers
- Performing various other data-cleaning tasks
- Does not alter** the original data source.
- Ensures data is **clean, consistent, and ready** for reporting.

Untitled - Power Query Editor

FileHomeTransformAdd ColumnViewToolsHelp

Close & Apply

New Source

Recent Sources

Enter Data

Data source settings

Manage Parameters

Refresh Preview

Properties

Advanced Editor

Manage

Choose Columns

Remove Columns

Keep Rows

Remove Rows

Sort

Split Column

Group By

Replace Values

Data Type: Whole Number

Use First Row as Headers

Merge Queries

Append Queries

Combine Files

Queries [1]

Orders

This preview may be up to 721 days old.

Refresh

fx

= Table.TransformColumnTypes(#"Promoted Headers",{{"Row ID", Int64.Type},

123 Row ID

ABC Order ID

Order Date

Ship Date

ABC

1	1	CA-2016-152156	08/11/2016	11/11/2016	S
2	2	CA-2016-152156	08/11/2016	11/11/2016	S
3	3	CA-2016-138688	12/06/2016	16/06/2016	S
4	4	US-2015-108966	11/10/2015	18/10/2015	S
5	5	US-2015-108966	11/10/2015	18/10/2015	S
6	6	CA-2014-115812	09/06/2014	14/06/2014	S
7	7	CA-2014-115812	09/06/2014	14/06/2014	S
8	8	CA-2014-115812	09/06/2014	14/06/2014	S
9	9	CA-2014-115812	09/06/2014	14/06/2014	S
10	10	CA-2014-115812	09/06/2014	14/06/2014	S
11	11	CA-2014-115812	09/06/2014	14/06/2014	S
12	12	CA-2014-115812	09/06/2014	14/06/2014	S
13	13	CA-2017-114412	15/04/2017	20/04/2017	S
14	14	CA-2016-161389	05/12/2016	10/12/2016	S
15	15	US-2015-118983	22/11/2015	26/11/2015	S
16	16	US-2015-118983	22/11/2015	26/11/2015	S
17	17	CA-2014-105802	11/11/2014	18/11/2014	S

PROPERTIES

Name

Orders

All Properties

APPLIED STEPS

Source

Navigation

Promoted Headers

Changed Type

21 COLUMNS, 999+ ROWS Column profiling based on top 1000 rows PREVIEW DOWNLOADED ON SUNDAY, 19 NOVEMBER 2023

Combine multiple tables into a single table

You can **combine** the tables in two different ways: **merging** and **appending**.

- **Append Queries:** adding rows of data to another table or query.
- **Merge Queries:** combine data from two or more tables.
 - The merge is based on a **common column** shared between the tables.

Scenario

☒		HR.Employees
☐		Nums
☐		Production.Categories
☐		Production.Products
☒		Production.Suppliers
☒		Sales.Customers
☐		Sales.OrderDetails

Append Queries

Append

Concatenate rows from three or more tables into a single table.

☐ Two tables ☒ Three or more tables

Available tables

Production Suppliers

Sales Customers

HR Employees

Add >>

Tables to append

Production Suppliers

Sales Customers

HR Employees

^

v

OK

Cancel

	1 ² ₃ id	A ^B _C company	A ^B _C name	1 ² ₃ phone
1	12347	emp124	John Kate	1625535511
2	76478	emp273	Luke John	1028777351
3	82482	emp291	Michael Uji	1245245672
4	97436	emp173	Kate Fitch	2352467634
5	12462	emp270	Eve Jun	3578999554
6	35237	emp715	Don Potre	3579006677
7	23467	emp183	Marc Wetb	2245789954
8	13892	emp163	Sara Scotts	2388367234
9	56356	emp172	Mitch Potter	1234683673
10	23478	emp812	Liliy Kithc	4567800522
11	45783	emp818	Ren Swrte	2357997515
12	86563	sup126	Mike Firt	7163615121
13	96352	sup889	Josie Lind	1831635671
14	48256	sup761	Joanna Threven	2936827338
15	28461	sup163	Michael Bob	1937293165
16	83613	sup162	Mimi Jukth	2916384462
17	96351	cus145	Mike Poi	1626258811
18	64826	cus134	John Likec	1363718361
19	92647	cus018	Theresa Yulia	2467355553
20	91661	cus182	Ren Thibe	3345783234
21	1736	cus104	Ron Mikel	1235799789
22	1835	cus103	Joy Qui	2345689411
23	1745	cus141	Cat Yate	2345678986

Merge Queries

Merge

Select a table and matching columns to create a merged table.

Sales Orders

orderid	custid	empid	orderdate	requireddate	shippeddate	shipperid	freight	shipname
10248	85	5	7/4/2014	8/1/2014	7/16/2014	3	32.38	Ship to 85-B
10249	79	6	7/5/2014	8/16/2014	7/10/2014	1	11.61	Ship to 79-C
10250	34	4	7/8/2014	8/5/2014	7/12/2014	2	65.83	Destination SCC
10251	84	3	7/8/2014	8/5/2014	7/15/2014	1	41.34	Ship to 84-A

Sales OrderDetails

orderid	productid	unitprice	qty	discount
10248	11	14.00	12	0
10248	42	9.80	10	0
10248	72	34.80	5	0
10249	14	18.60	9	0
10249	51	42.40	40	0

Join Kind

Left Outer (all from first, matching from second)

☐ Use fuzzy matching to perform the merge

Fuzzy matching options

✓ The selection matches 830 of 830 rows from the first table.

OK

Cancel

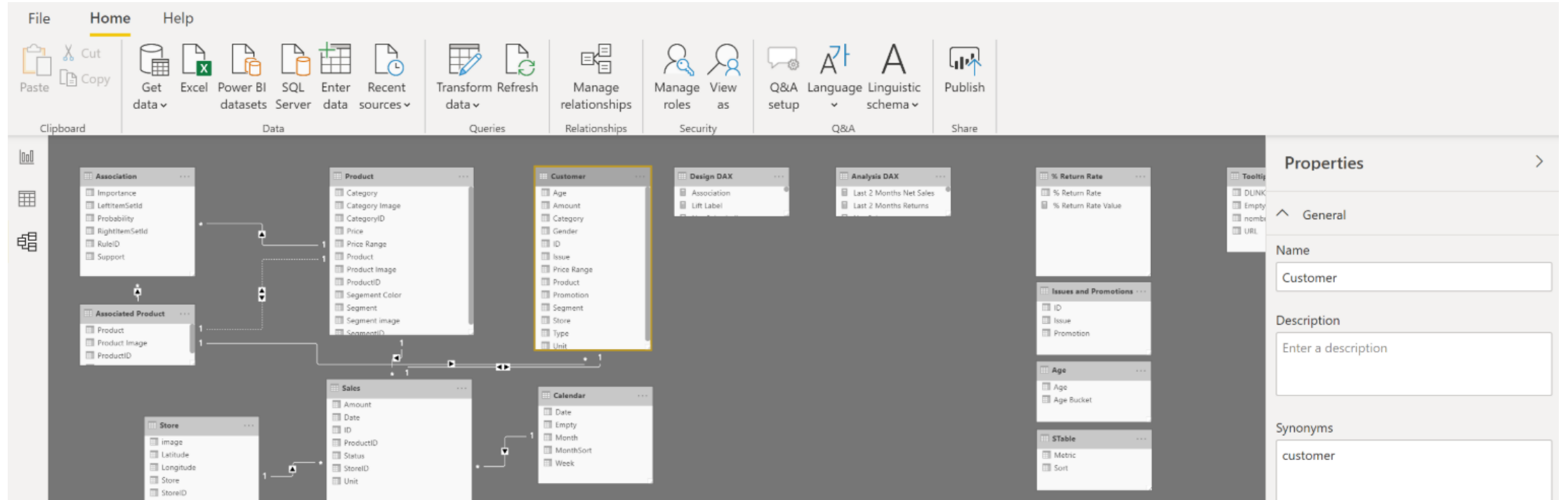
Full Outer - Displays all rows from both tables.						
	orderid	orderdate	shipperid	OrderDetails.productid	OrderDetails.qty	OrderDetails.unitprice
1	1	4/23/2018	12	124	12	14
2	2	4/25/2018	24	134	55	11.2
3	3	6/12/2018	19	641	57	45
4	4	6/13/2018	13	98	5	112.5
5	5	7/23/2018	11	312	23	11.1
6	6	7/25/2018	33	124	78	11.2
7	7	8/1/2019	77	137	11	572.1
8	8	8/10/2019	11	124	36	1331.9
9	9	8/11/2019	81	789	85	898.1

Profile data in Power BI

Helps with

- Determining **anomalies** (outliers in the data)
- Examining and **developing** the **underlying data structures**
- Querying **data statistics** such as **row counts, value distributions, minimum, maximum values** and **averages**
- Identifying the **distribution of the data** which would otherwise be complicated

Examine data structures

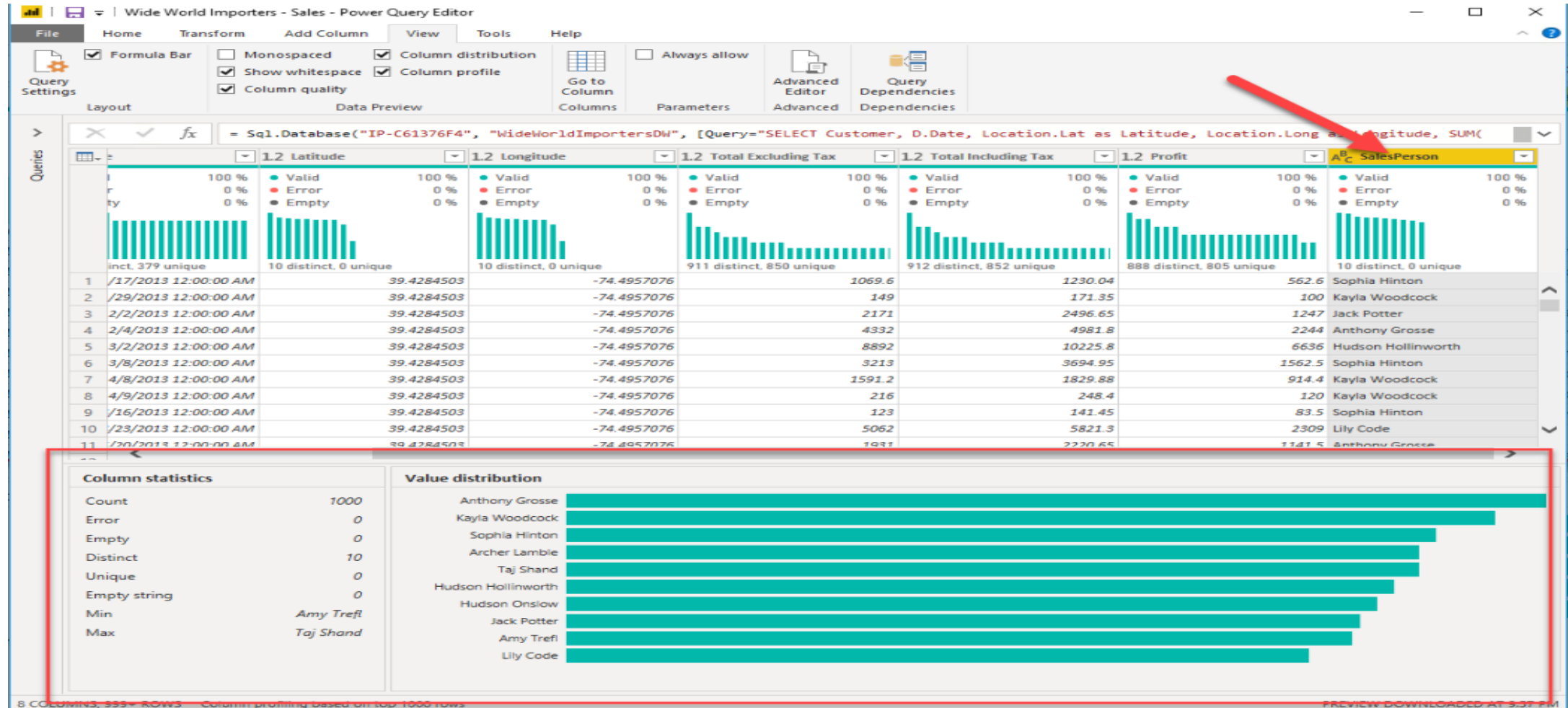


You can view the current semantic model under the **Model** tab on Power BI Desktop.

Find data anomalies and data statistics

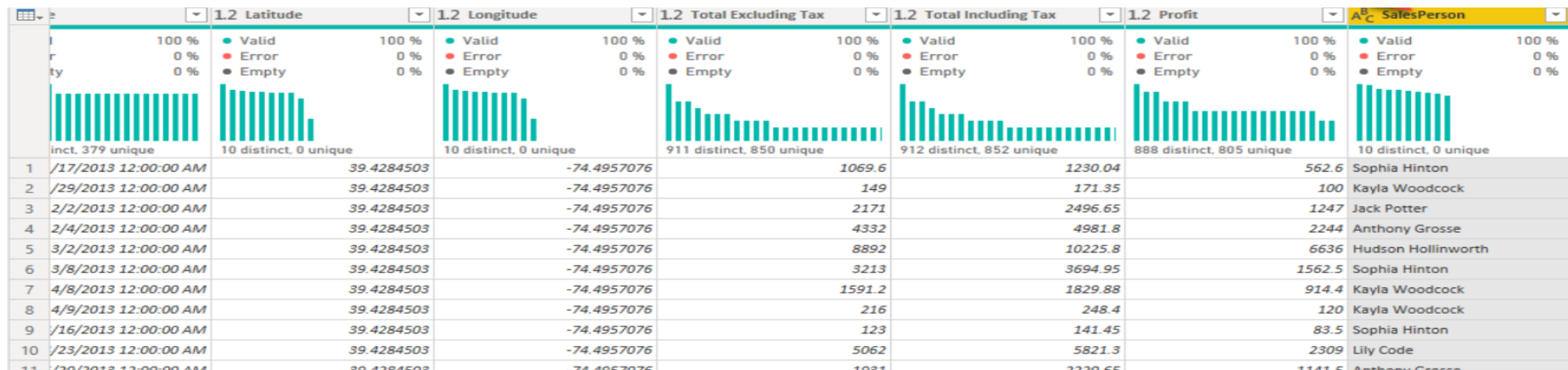
- Power Query Editor determines data anomalies by using the **Column Distribution** feature.
- Select **View** on the ribbon, and under **Data Preview**, you can choose from a few options. To understand data anomalies and statistics, select the **Column Distribution**, **Column Quality**, and **Column Profile** options. The following figure shows the statistics that appear.

Find data anomalies and data statistics



Column Distribution

- Column distribution shows the **spread of data** within a column.
- Counts of **distinct values** include all different values, including duplicates and nulls.
- Counts of **unique values** include only values that appear once, excluding duplicates and nulls.



Column Profile

- Includes the **row count**, useful for verifying successful data import.
- Highlights **outliers**, **empty rows**, and **string values** in the column.
- For text data, shows the **first** and **last** values alphabetically.
- Numeric column statistics include:
 - **Min** and **Max** Values
 - Count of **zeroes** and **null values**
 - **Average** value
 - **Standard deviation**
 - Count of **even** and **odd values**

Column statistics	
Count	1000
Error	0
Empty	0
Distinct	10
Unique	0
Empty string	0
Min	Amy Trefl
Max	Taj Shand

Value distribution graph

- Shows the counts for each distinct value in a column.
- Helps **detect outliers** by highlighting values that occur far more often than others.
- Provides a starting point for investigating unusual patterns in the data.



Module IV

Configure a Semantic Model

In this module we will learn to:

- Create and configure relationships
- Configure Hierarchies

Configure relationships

- Ensure **appropriate relationships** exist between tables in multi-table models.
- Relationships **propagate filters** from one table to another.
- Filter propagation continues along the **relationship paths**, potentially across multiple tables.

Cardinality types

- Every relationship has a cardinality type, which is either:
 - One-to-many (**1:***)
 - Many-to-one (***:1**)
 - One-to-one (**1:1**)
 - Many-to-many (***:***)

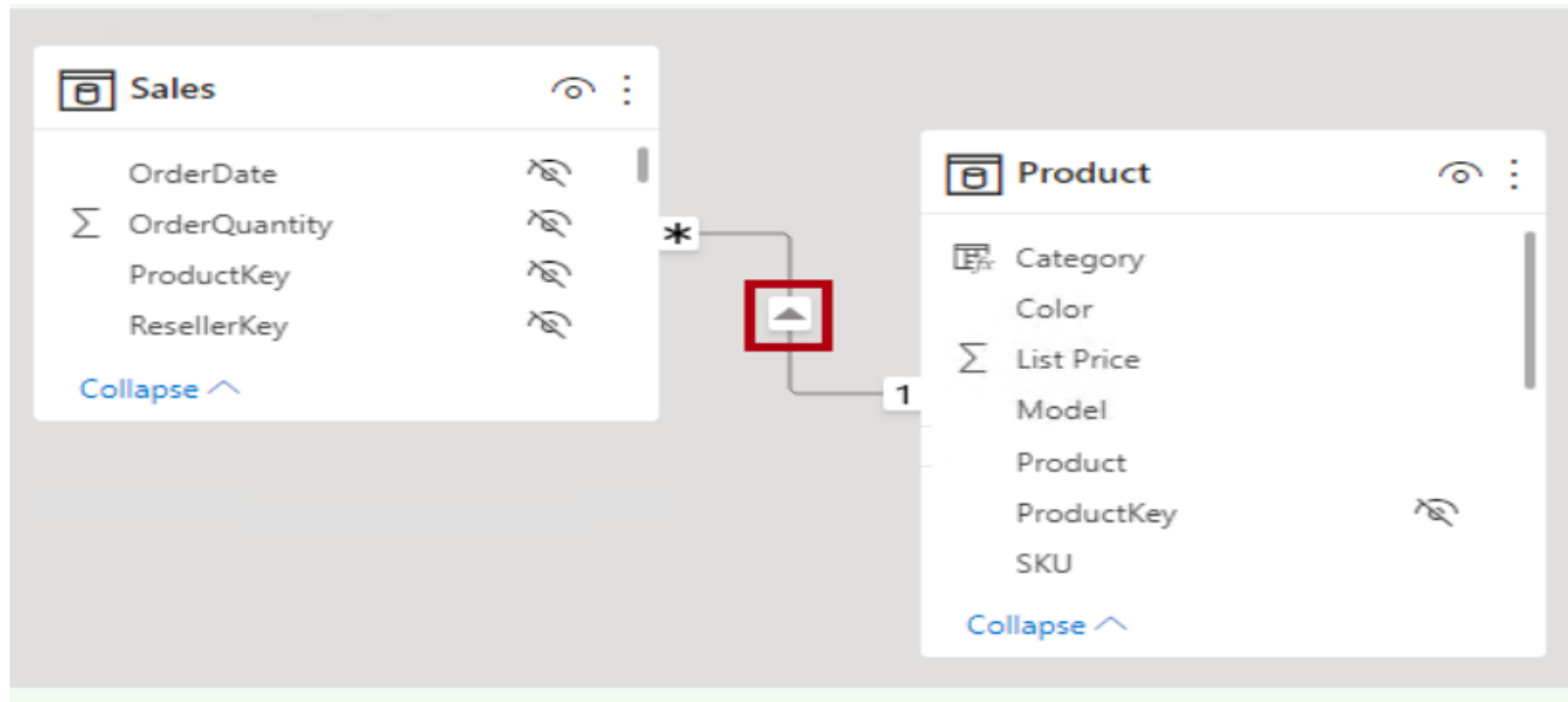
Understand cross filter direction

- In **Power BI**, **Cross Filter Direction** controls how filters flow between related tables in your **data model** i.e. how filtering one table affects the other in relationships.
- It determines **which table's data filters the other** when you interact with visuals and slicers

Types of cross filter direction

Single Direction (One-way filter)

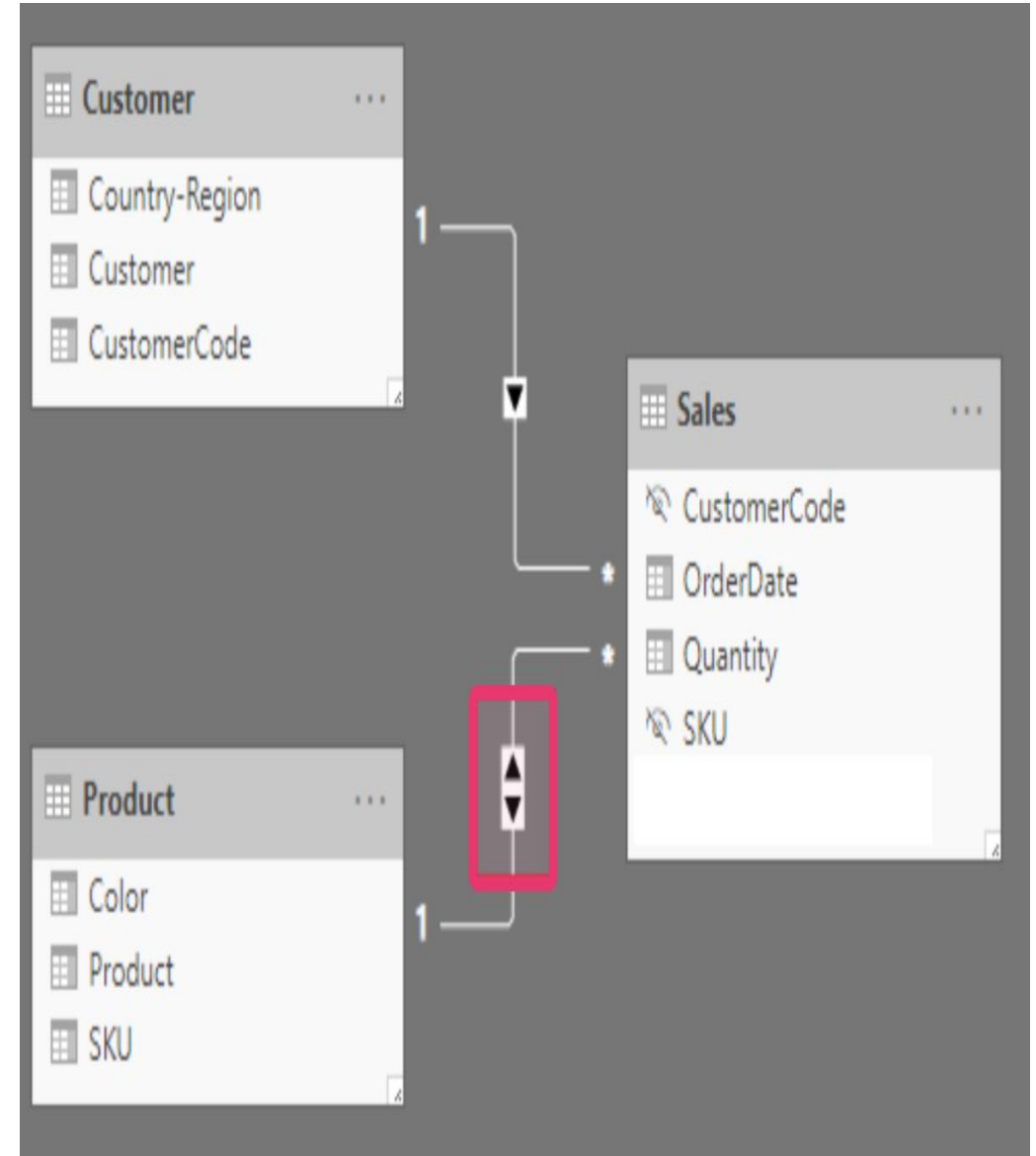
- The filter flows from one table to another



Types of cross filter direction

Both Directions (Bi-directional filter)

- The filter flows **both ways** between tables.
- Useful when you want to aggregate or analyze data from both tables interactively.
- Often used when you have **complex relationships** (like many-to-many) or **no clear hierarchy** between tables.



Configure Hierarchies

- **Optional but helpful:** Hierarchies guide report authors on relationships between column in a table.
- **Implementation:** A table can have one or more hierarchies; levels must come from columns in that table and define a navigational path.

Configure Hierarchies

▼  Date

☐ Date

▼ ☐  Fiscal

☐ Year

☐ Quarter

☐ Month

☐ Month

☐ Quarter

☐ Year

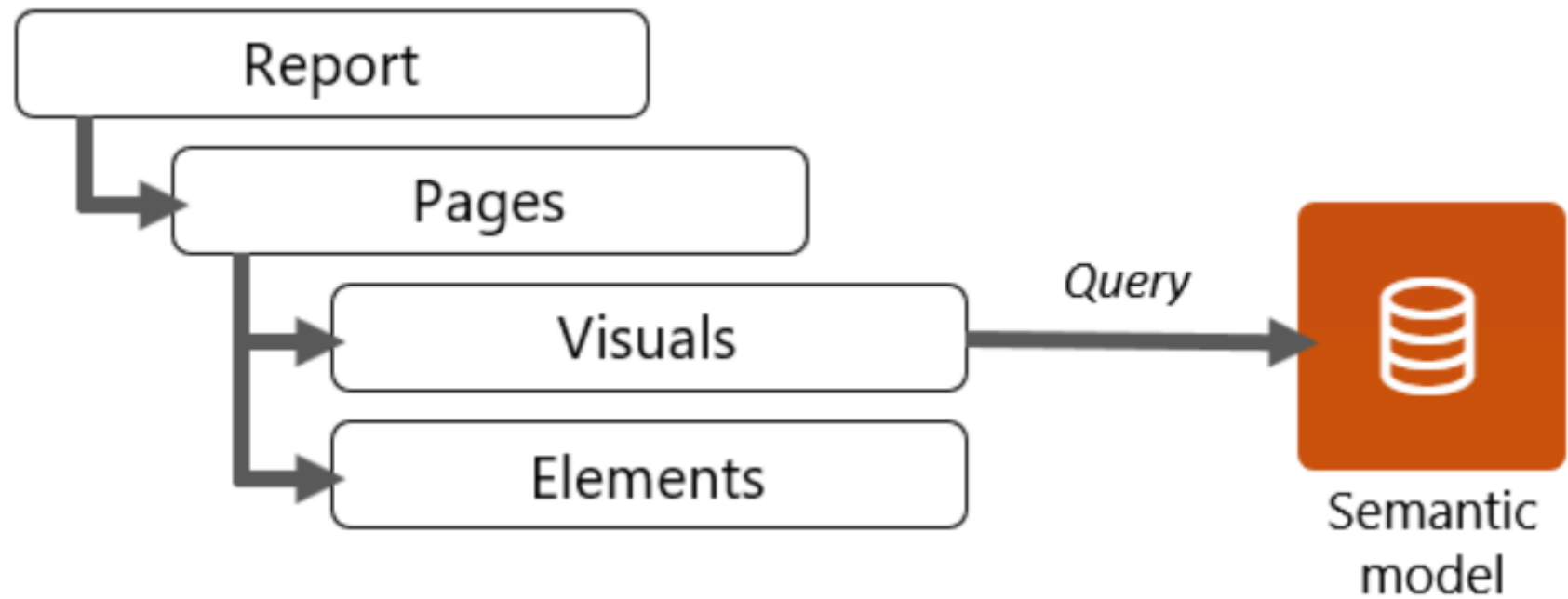
Module V

Design Power BI Reports

In this module we will learn about:

- Report Structure
- How to design the analytical report layout
- How to design visually appealing reports
- How to use report objects
- Select report visuals

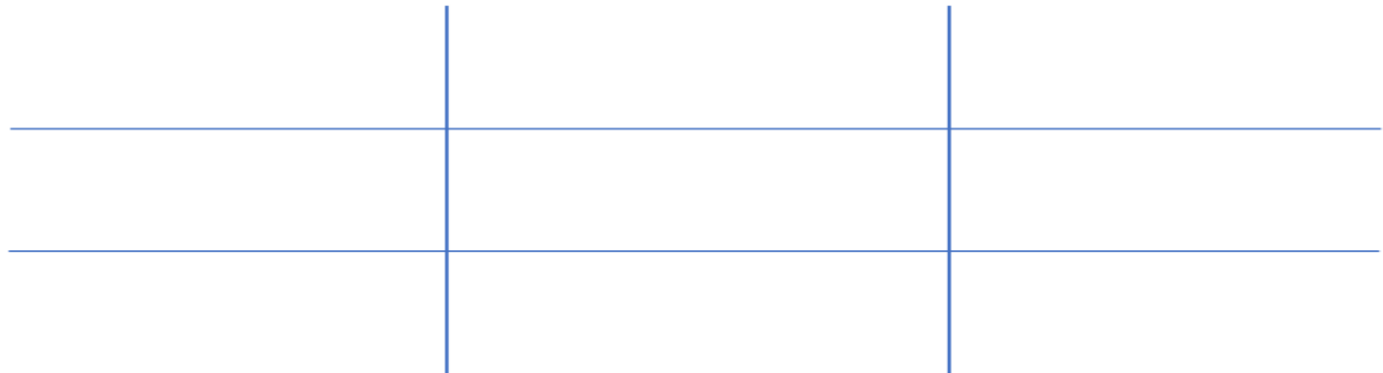
Report structure



Design the analytical report layout

Placement

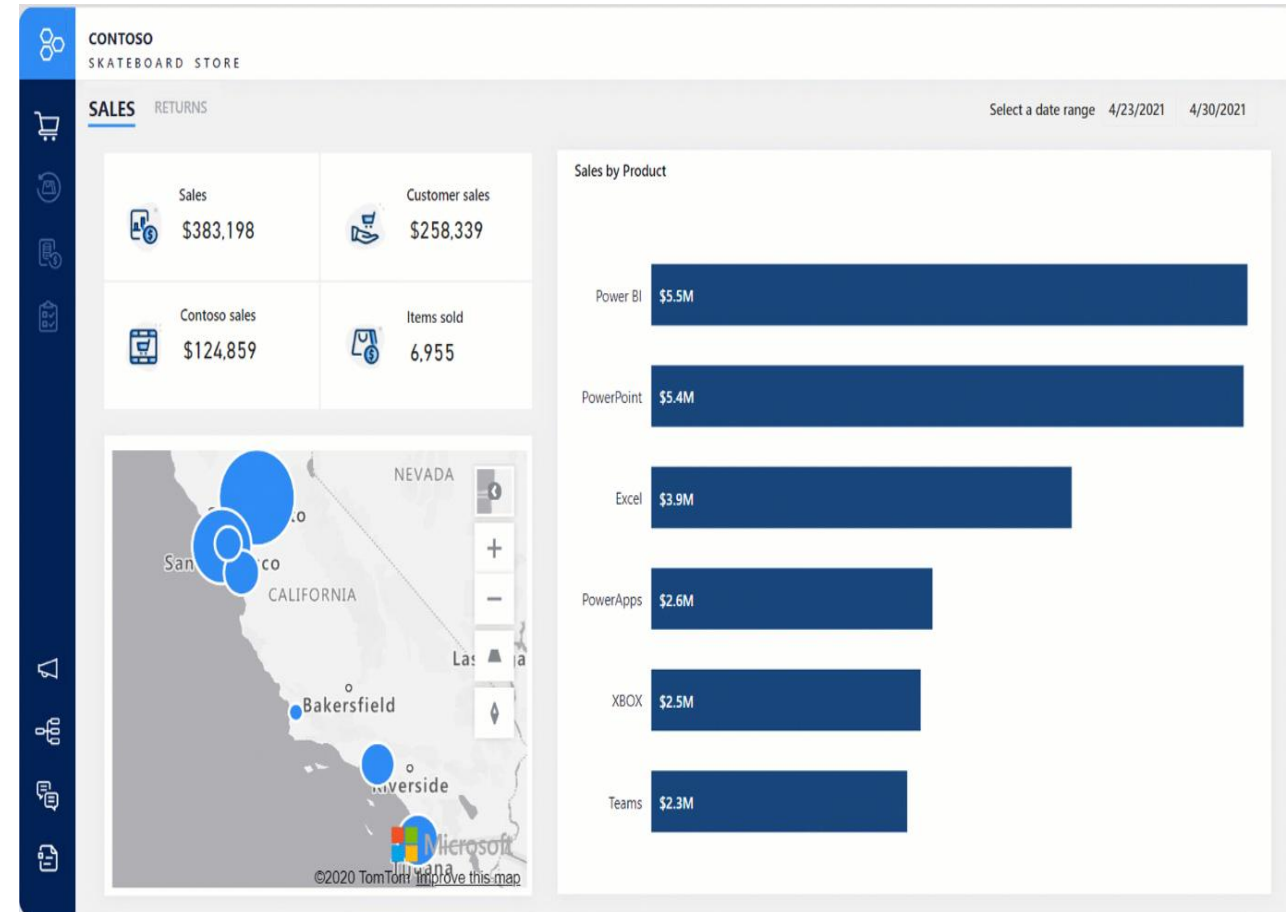
- Place the most important visuals in the **upper-left corner**
- Arrange visuals **left to right, top to bottom** for logical flow.
- Align edges and group related visuals for an **organized and clean layout**.
- Use the **rule of thirds** to position visuals within a balanced grid structure.



Design the analytical report layout

Balance

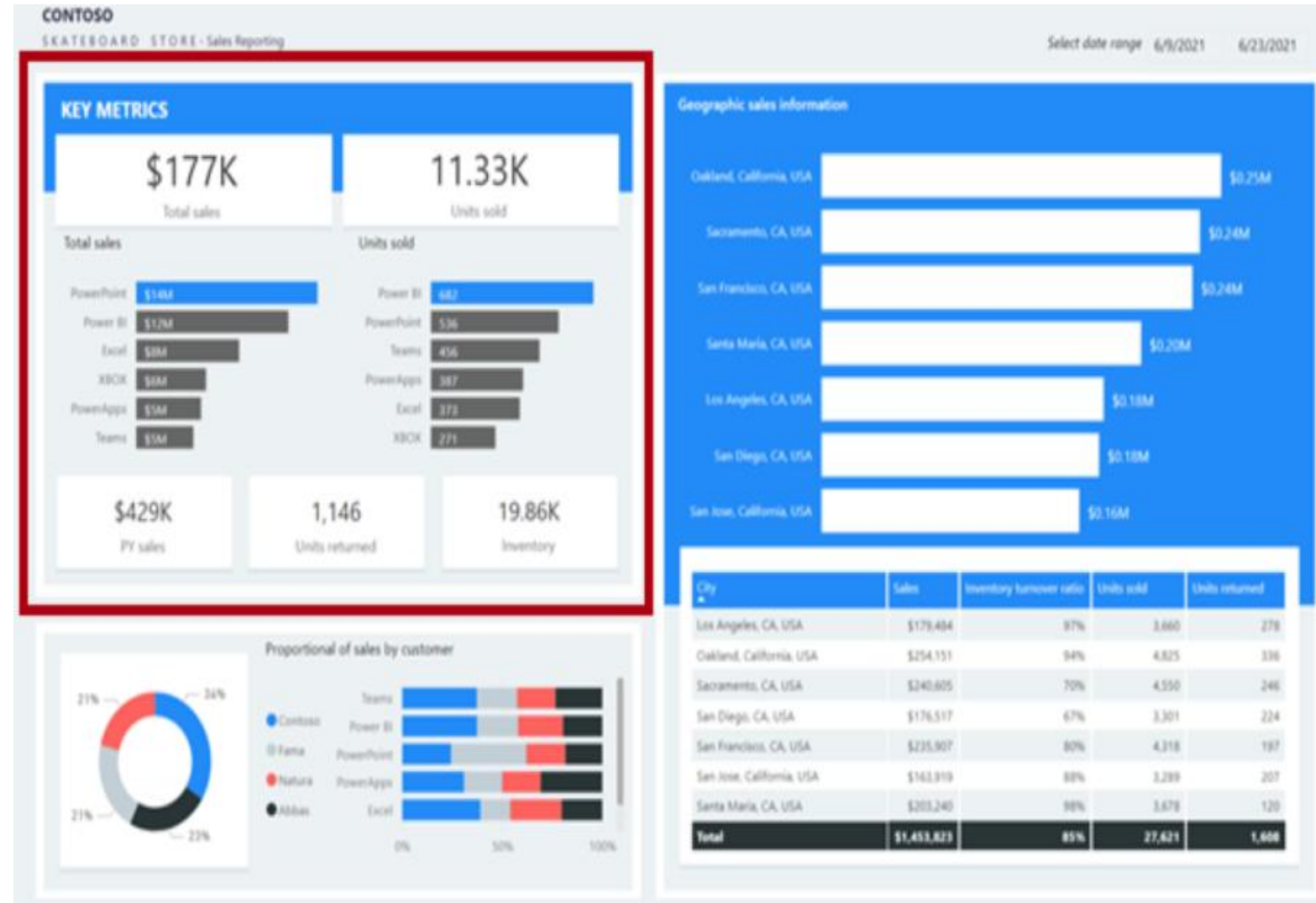
- Create **symmetrical** balance for uniformity by evenly distributing visual weight.
- Use **asymmetrical balance** (e.g., golden ratio) for visual interest.
 - Combine a **dominant visual** with smaller supporting visuals for harmony.



Design the analytical report layout

Proximity

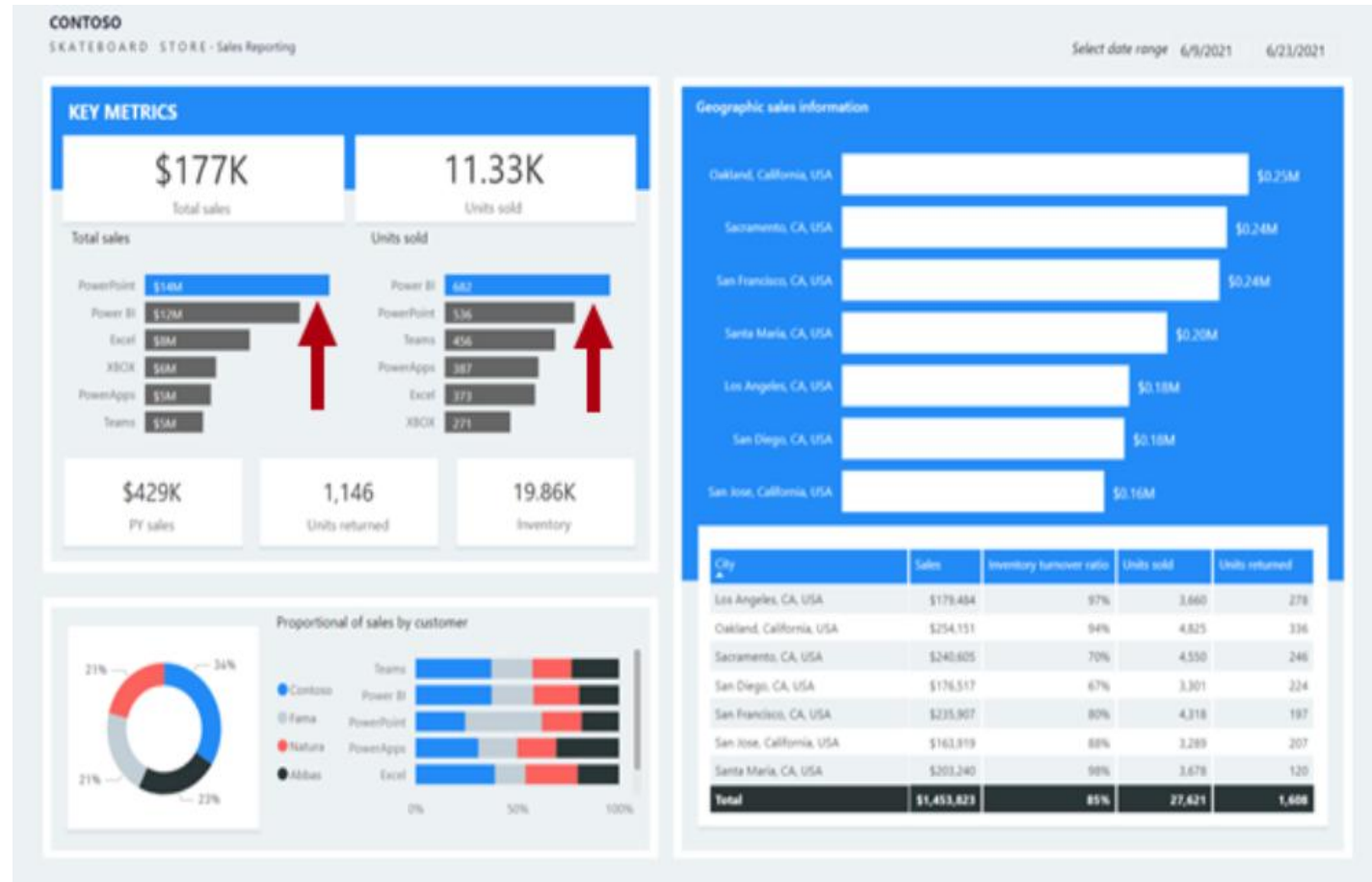
- Place **related visuals close together** to show connection.
- Use **spacing** to separate different sections for clarity.



Design the analytical report layout

Contrast

- Use **color, font, or style differences** to emphasize key visuals or insights.
- Guide viewers' attention to important data or interaction points.

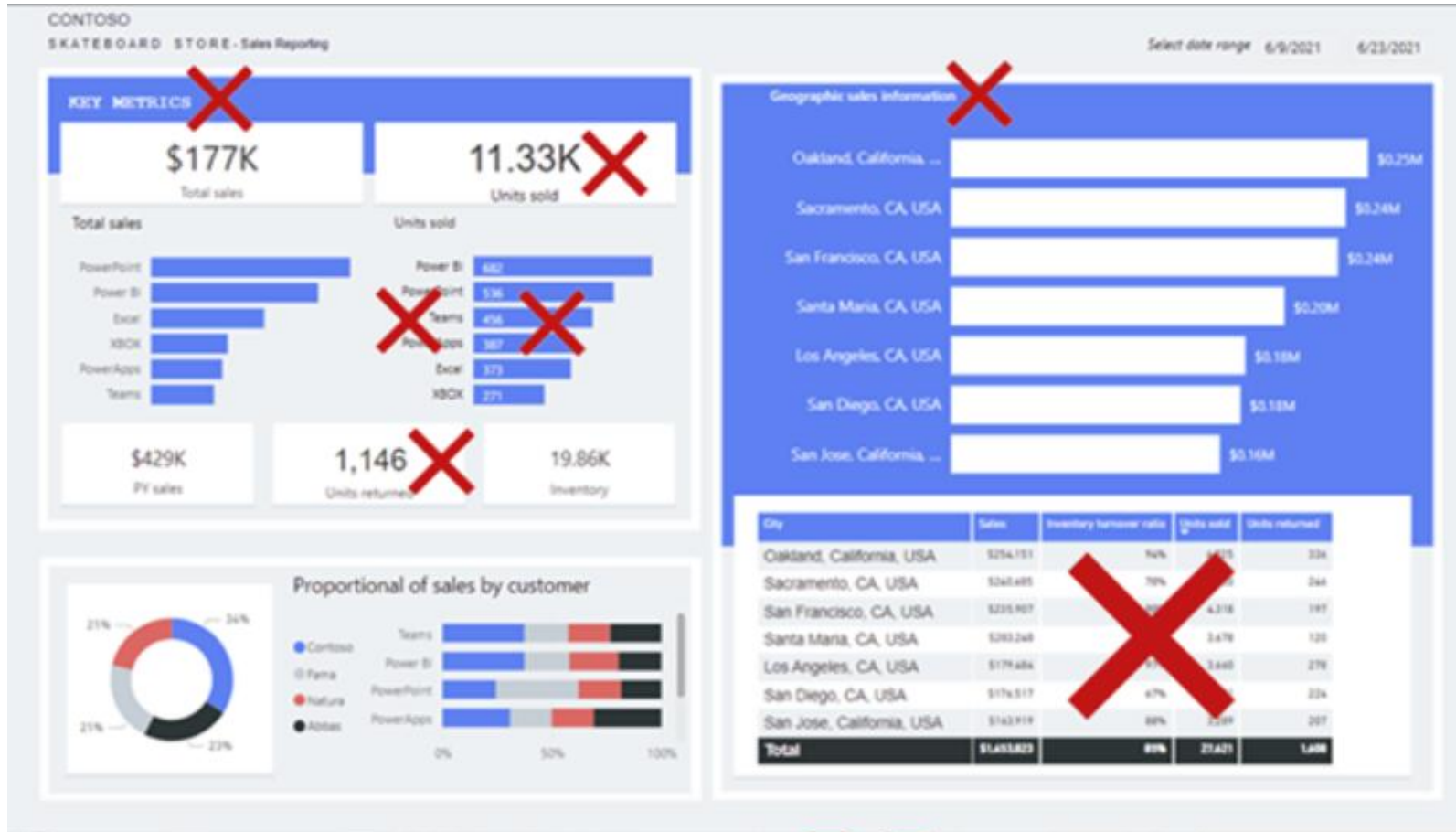


Design visually appealing reports

Consistency

- Keep **fonts, colors, and spacing** uniform
- Maintain consistent **titles and labels**
- Apply a **report theme** to ensure consistency
- Use themes for **branding** and **professional presentation**

Consistency



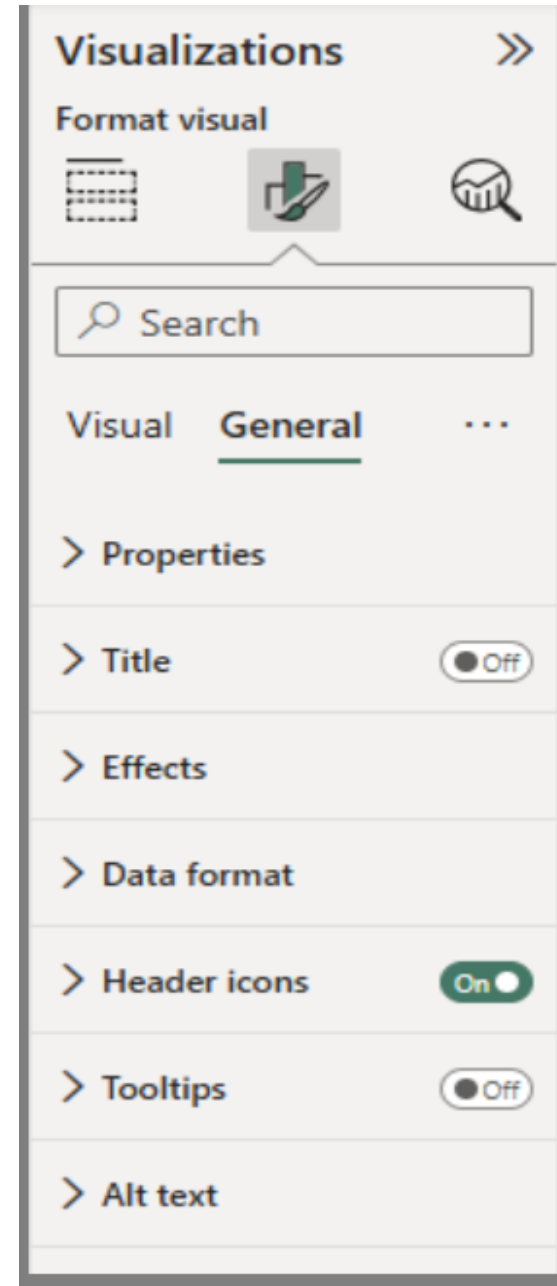
Use Report Objects

Report objects are laid out on each report page and include:

- **Visuals** - Visualizations of semantic model data.
- **Elements** - Provide visual interest, but don't use semantic model data. Elements include text boxes, buttons, shapes, and images.

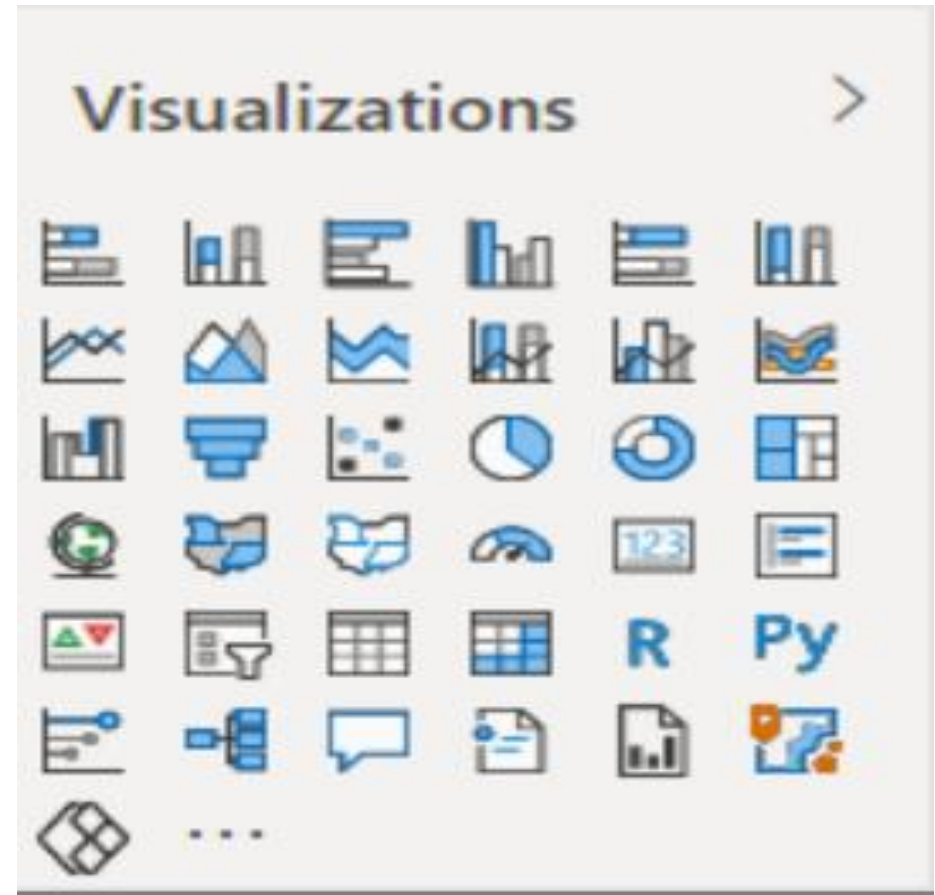
Use Report Objects

- All report objects have some properties in common, set in various sections of the **Format** options.



Visuals

- Visuals are visualizations of semantic model data. Power BI includes over 30 core visuals, which are built in and available to all reports.



How to add and configure a visual

- **Select Visual Type:** Choose and place the desired visual on the report page.
- **Map Fields:** Drag fields from the semantic model into the visual's wells.
- **(Optional)Apply Filters:** Use visual-level filters to narrow down displayed data.
- **Modify Field Mappings:** Adjust field names, summarization, or show items with no data.
- **(Optional)Set Sorting:** Define the sort field and choose ascending or descending order.
- **(Optional) Format Visual:** Customize layout, colors, and style for better presentation.
- **(Optional) Add Analytics:** Overlay insights like reference lines, anomalies, or forecasts

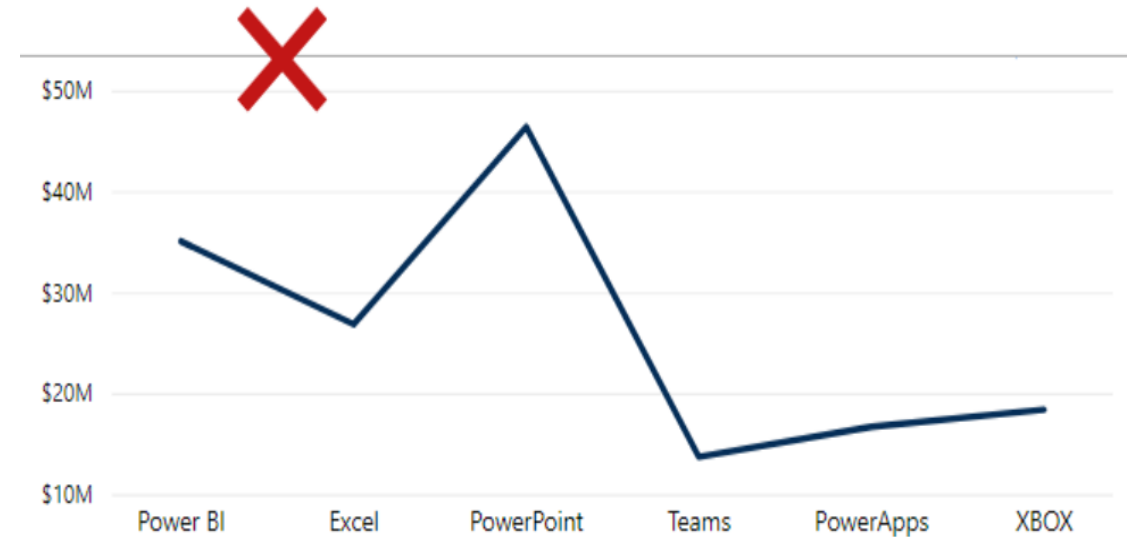
Select report visuals

Goal of Data Visualization

- Communicate information clearly, accurately, and effectively.
- The right visual helps users understand data; the wrong one can mislead or confuse.

Categorical Visuals

- Use **bar or column charts** to compare categories.
- Avoid **line charts** for categorical data as they imply false continuity.
- **Sort by value** (not alphabetically) unless a natural sequence exists.



Time Series Visuals

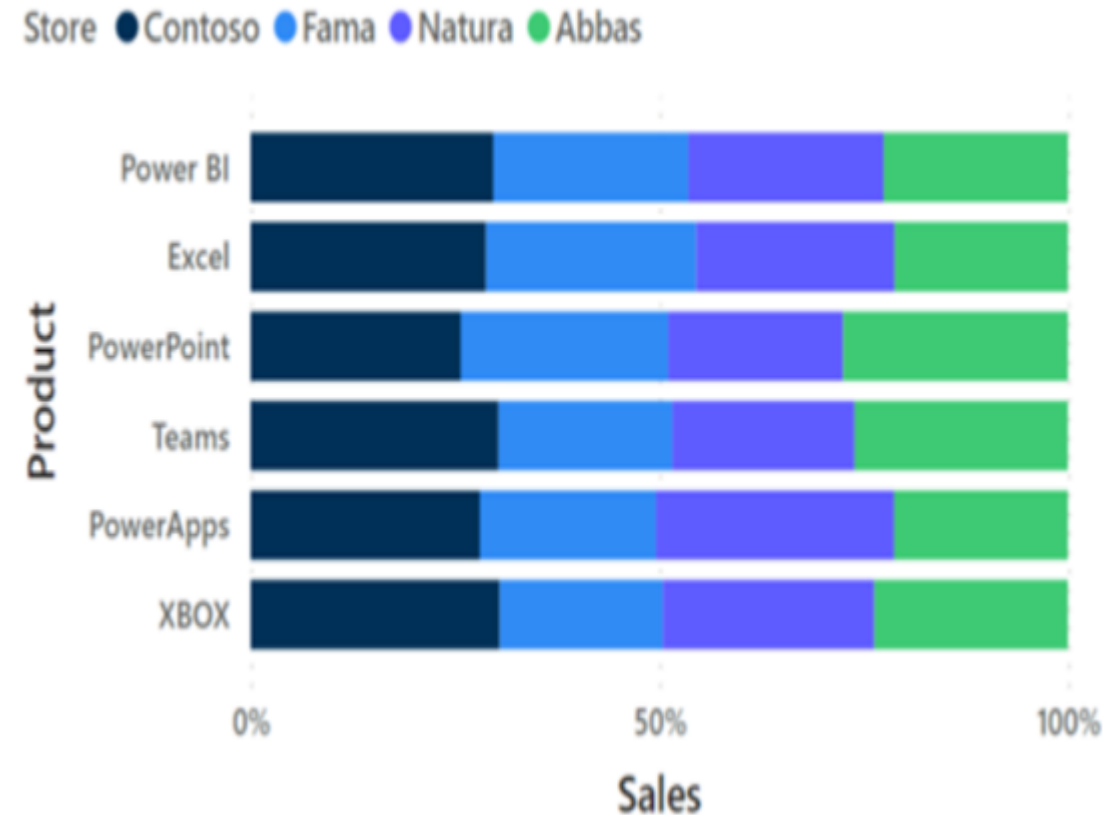
- Use **line or column charts** to show data over time.
- Place time on the **X-axis**, sorted from earliest to latest periods (left to right)
- Add **analytics** (like forecasts or trend lines) to enhance insight.
- If data gaps exist, prefer **column charts** over line charts.



Proportional Visuals

- Show data as **part of a whole**. They effectively communicate how a value is distributed across a dimension.
- **Column and bar chart visuals** work well for visualizing proportions across multiple dimensions.
- Use only when **all values are positive or all negative**.
- Emphasize proportions, not exact numbers (show actual values in tooltips if needed).

Sales by Product and Store



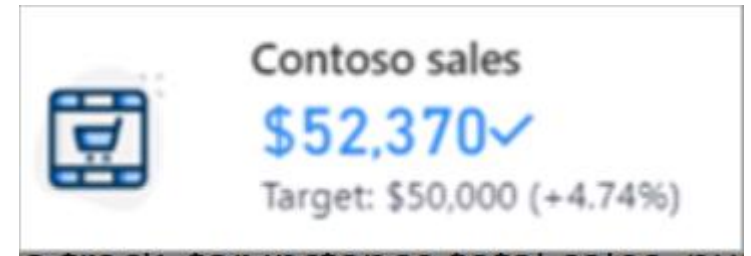
Numeric Visuals

- Use **card visuals** for single key metrics (e.g., total sales).
- Use **multi-row cards** for multiple callouts.
- Ideal for dashboards highlighting top KPIs.



Performance Visuals

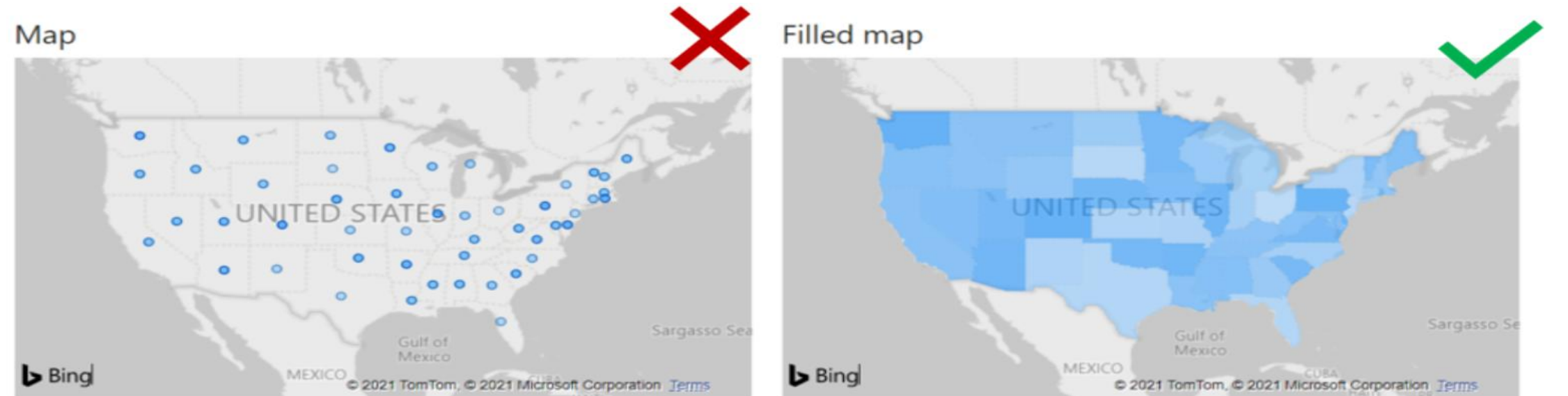
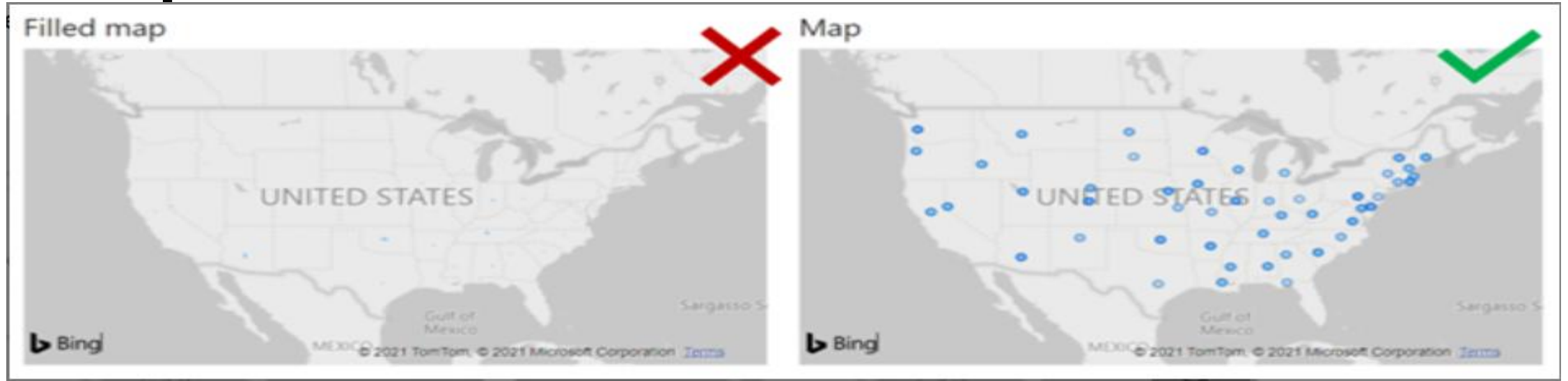
- Show actual vs. target using **KPI**, **gauge**, **table**, or **matrix visuals**.
- Highlight **variance** with color or icons (e.g., red = below target).



Geospatial Visuals

- Use **Map** or **Filled Map** visuals for location-based data.
- Choose the map type based on **granularity**
- If location isn't essential, consider using a categorical chart instead.

Geospatial Visuals



Summary

- **Get Data**
Pull data from various sources like files, databases, cloud apps, and websites, using methods specific to each source (e.g., Excel tables)
- **Clean, Transform, and Load Data**
Transform raw data into a readable, usable format and combine queries to make navigation easier.
- **Configure a Semantic Model**
Build a semantic layer over your data by defining relationships that enable automatic filter propagation.
- **Design Power BI Reports**
Arrange visuals and apply formatting, analytics, and styling to clearly communicate insights while selecting the right visual types for the data.