

pmOne

START SMART AND BECOME A DIGITAL LEADER

pmOne – Your Data and AI Solution Provider



POWER BI TRAINING

From data modeling to the finished report

Lecturer info

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Experience: Strategy; Performance Marketing; Data Engineering

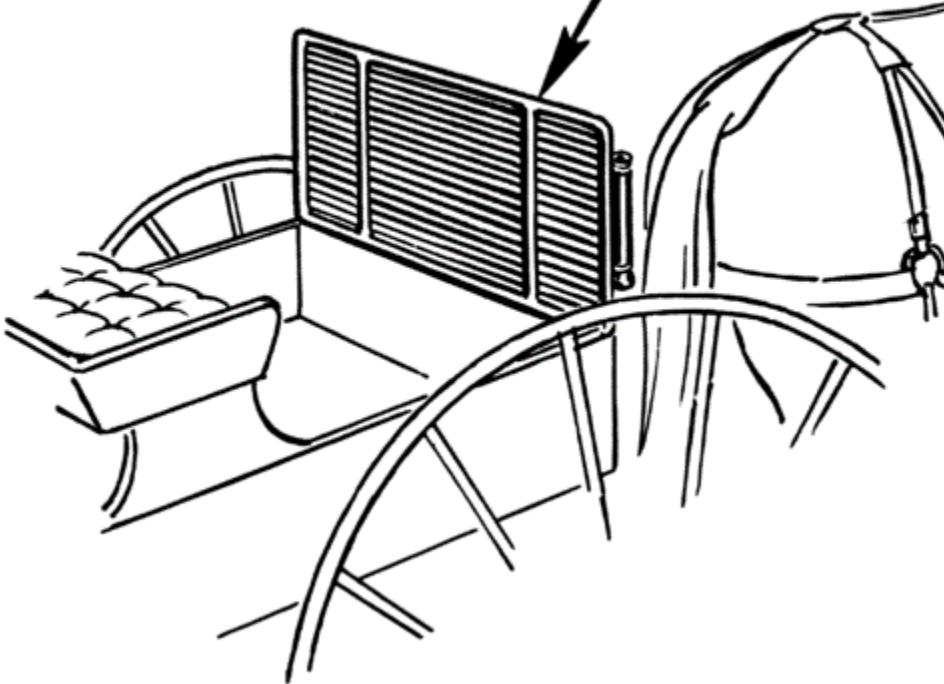
COMPANY INFO

asdfasdfasdfasdfasdfasdf

WHAT IS A DASHBOARD?

30 sec history lesson

DASHBOARD



LITERALLY FROM MTHS

TO THIS



Dashboard for Customers |

[Home](#)
[Reset](#)

pmOne

17,412
Customers

1.83K
€ Revenue per Customer

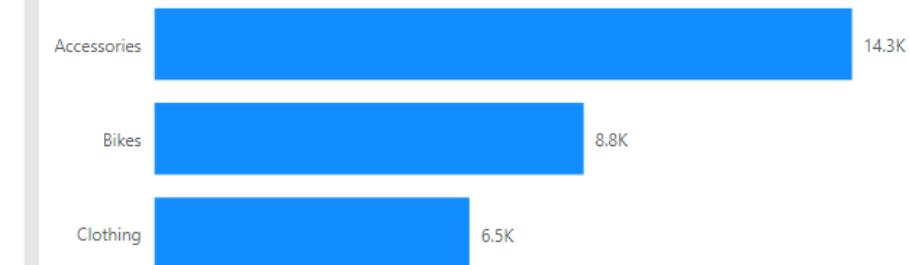
€ 31.82M
€ Revenue

€ 13.40M
€ Profit

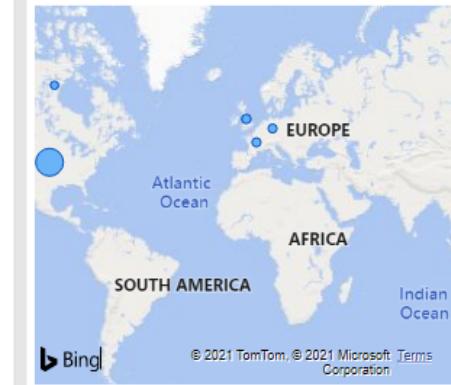
by Date



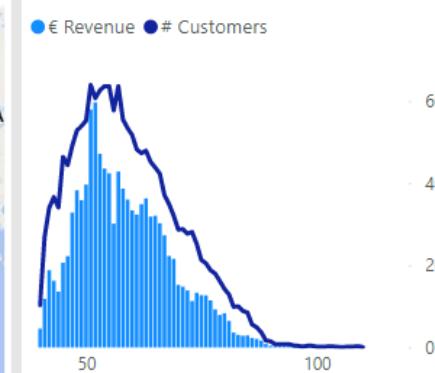
by Product



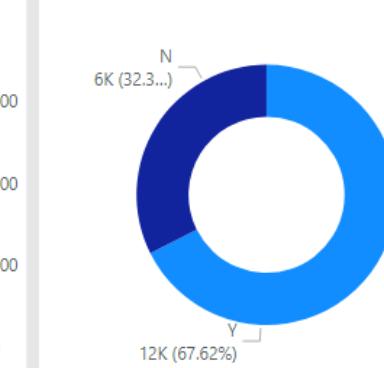
by Country



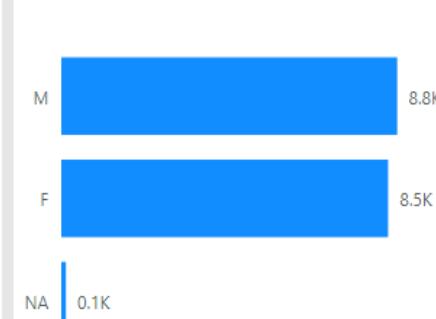
by Age



by Home Owner



by Gender

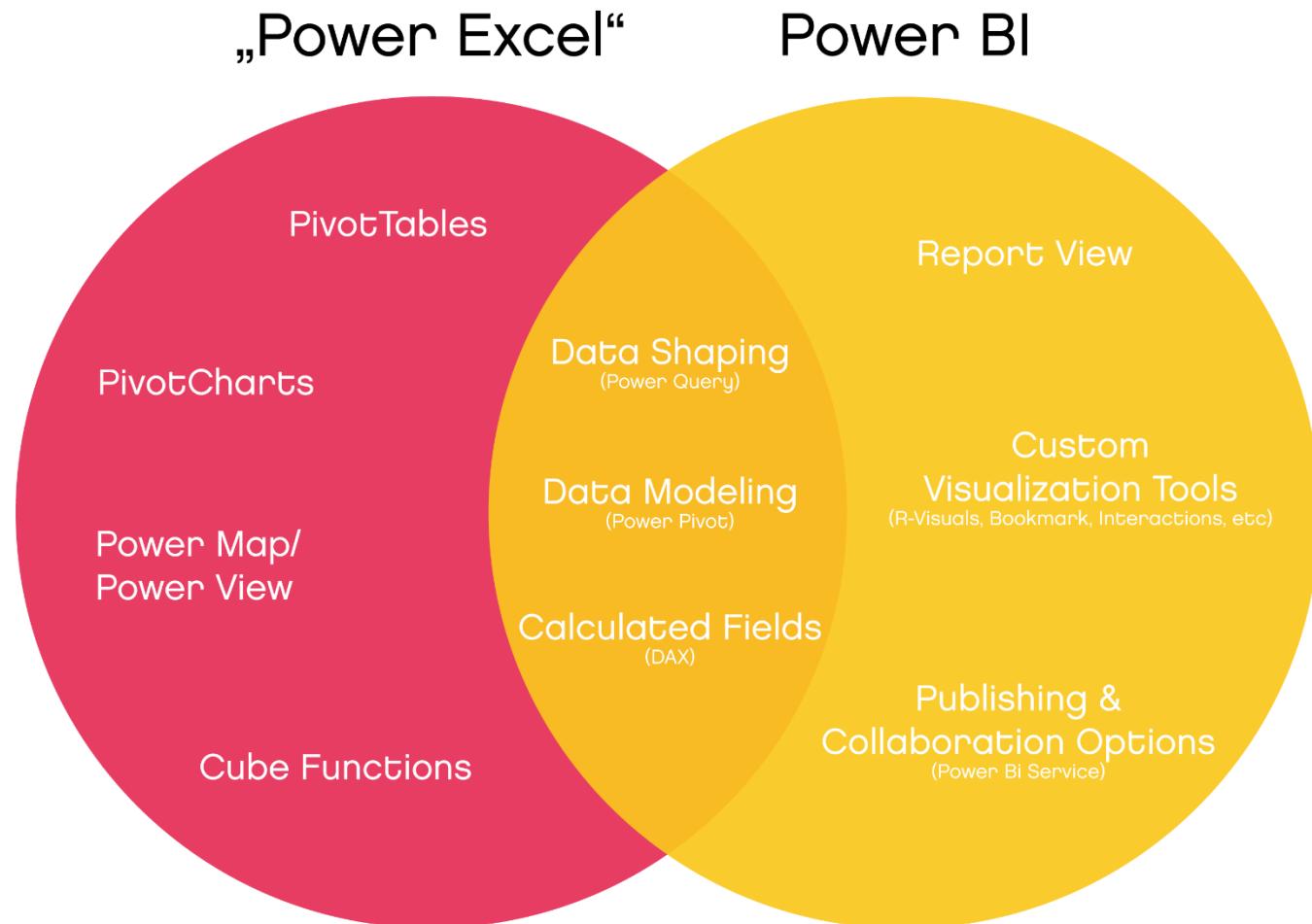


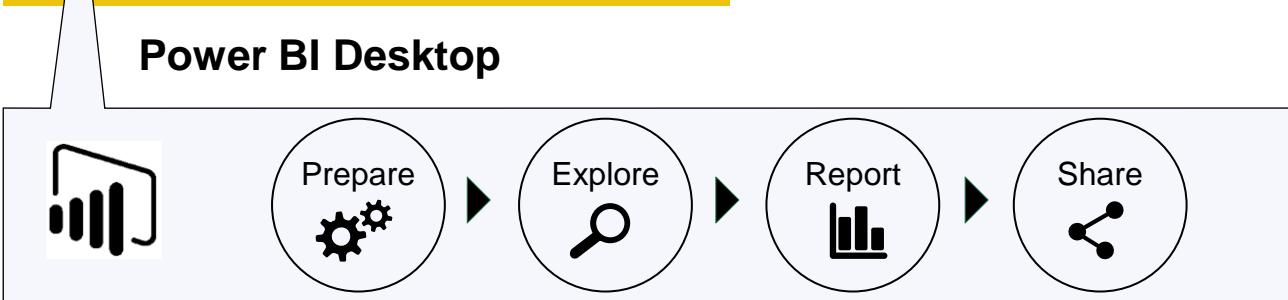
AND NOW THIS

WHAT IS POWER BI?

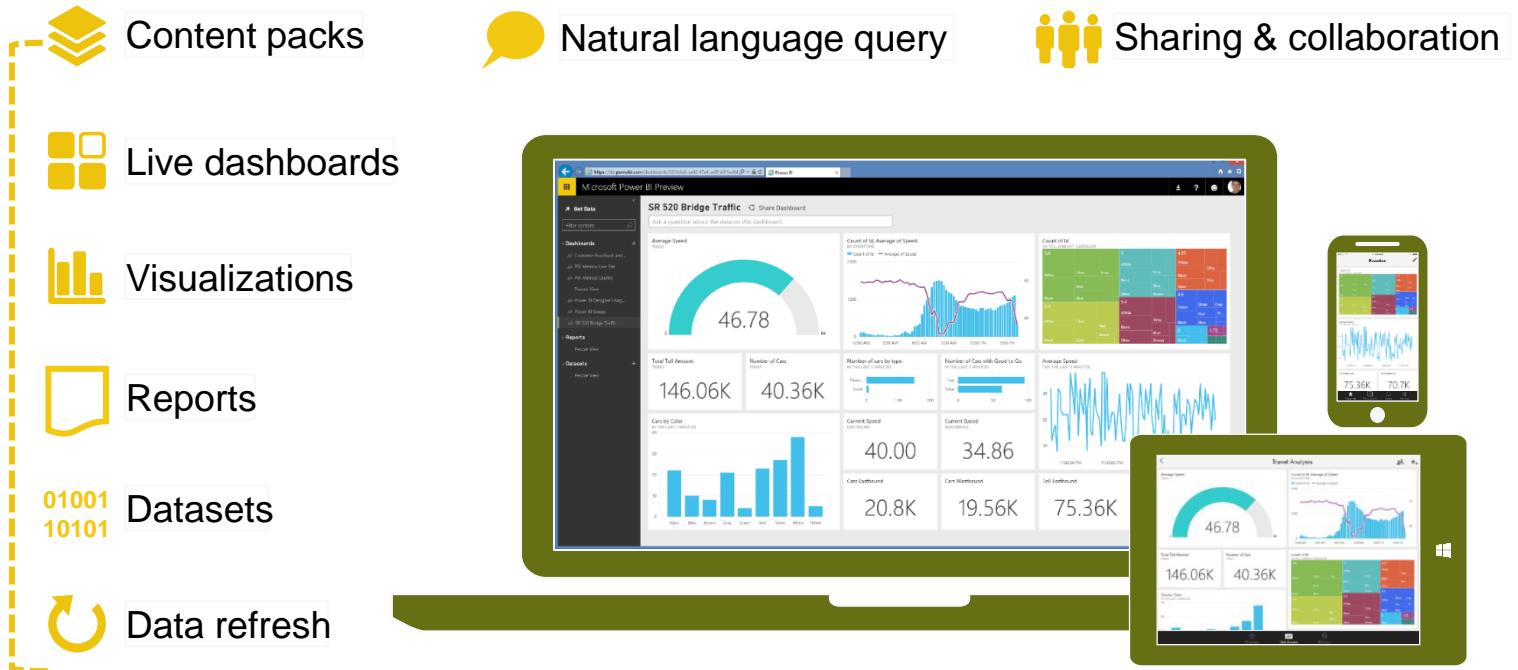
30 sec history lesson

„POWER EXCEL“ VS. POWER BI





Power BI service



Power BI REST APIs



POWER BI

Further reading & inspiration

- Power BI-Documentation
<https://docs.microsoft.com/de-de/power-bi/>
- Power BI Training Videos
<https://docs.microsoft.com/de-de/power-bi/guided-learning/>
- Power Query M References:
<https://docs.microsoft.com/de-de/powerquery-m/power-query-m-reference>
- DAX (Data Analysis Expression) References:
<https://docs.microsoft.com/de-de/dax/dax-function-reference>
- Power BI Solution templates
<https://powerbi.microsoft.com/de-de/solution-templates/>
- Power BI Blog
<https://powerbi.microsoft.com/de-de/blog/>
- The Data Visualisation Catalogue
<http://www.datavizcatalogue.com/>

ADVENTUREWORKS

Default sample database for all Microsoft products

 Name

Mark as date table ▾

Manage relationships

 New measure

 Quick measure

 New column

 New table

OrderDate	OrderNumber	ProductKey	CustomerKey	TerritoryKey	OrderLineItem	OrderQuantity	Revenue	Cost	Profit
Sunday, December 13, 2015	SO48539	377	22921	9	1	1	2181.5625	1320.6838	860.8787
Sunday, December 13, 2015	SO48540	377	22931	9	1	1	2181.5625	1320.6838	860.8787
Monday, December 14, 2015	SO48556	377	22936	9	1	1	2181.5625	1320.6838	860.8787
Thursday, December 17, 2015	SO48583	377	23106	9	1	1	2181.5625	1320.6838	860.8787
Saturday, December 19, 2015	SO48607	377	22946	9	1	1	2181.5625	1320.6838	860.8787
Wednesday, December 23, 2015	SO48651	377	22926	9	1	1	2181.5625	1320.6838	860.8787
Tuesday, December 29, 2015	SO48714	377	23104	9	1	1	2181.5625	1320.6838	860.8787
Thursday, January 21, 2016	SO48958	377	23310	9	1	1	2181.5625	1320.6838	860.8787
Sunday, January 24, 2016	SO48993	377	23410	9	1	1	2181.5625	1320.6838	860.8787
Friday, January 29, 2016	SO49022	377	23116	9	1	1	2181.5625	1320.6838	860.8787
Saturday, February 13, 2016	SO49299	377	23533	9	1	1	2181.5625	1320.6838	860.8787
Wednesday, February 17, 2016	SO49336	377	23523	9	1	1	2181.5625	1320.6838	860.8787
Friday, February 19, 2016	SO49357	377	23542	9	1	1	2181.5625	1320.6838	860.8787
Saturday, February 20, 2016	SO49366	377	23546	9	1	1	2181.5625	1320.6838	860.8787
Wednesday, February 24, 2016	SO49404	377	23425	9	1	1	2181.5625	1320.6838	860.8787
Tuesday, March 8, 2016	SO49626	377	23998	9	1	1	2181.5625	1320.6838	860.8787
Sunday, March 13, 2016	SO49730	377	23226	9	1	1	2181.5625	1320.6838	860.8787

DATA MODELLING

Modify data to make it more legible and easier to analyze.

Table: Sales

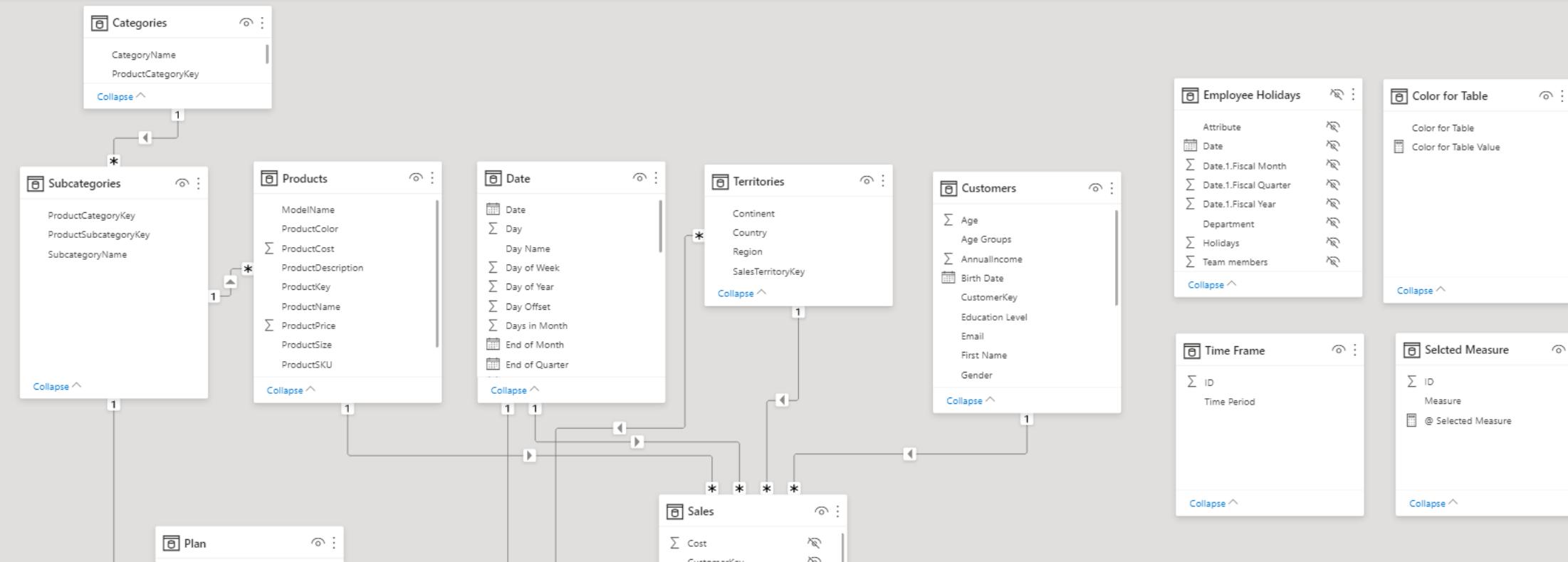
Fields

Search

- >  Sales
 - >  Categories
 - >  Color for Table
 - >  Customers
 - >  Date
 - >  Employee Holidays 
 - >  Plan
 - >  Products
 - >  Selcted Measure
 - >  Subcategories
 - >  Territories
 - >  Time Frame

File Home Help

A horizontal bar with various icons for navigating and managing data in Power BI.



RELATIONSHIPS

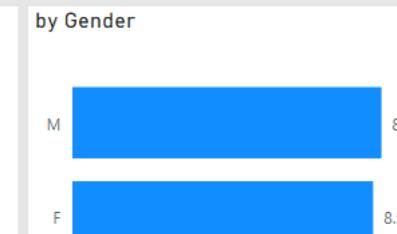
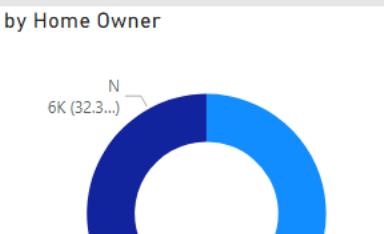
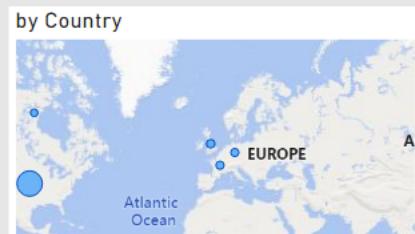
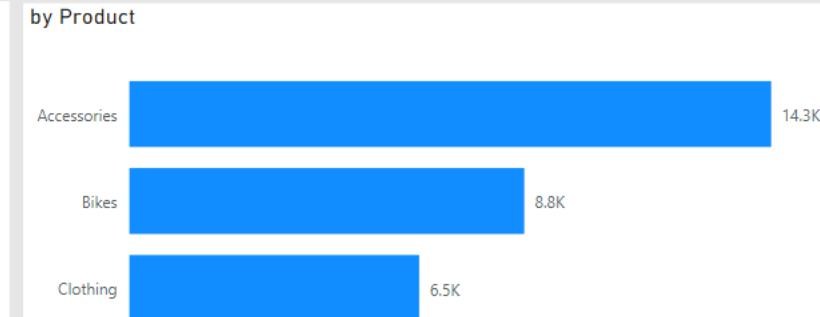
Create relations between tables that help connect data points between tables

Dashboard for Customers |

Home

Reset

pmOne

17,412
Customers**1.83K**
€ Revenue per Customer**€ 31.82M**
€ Revenue**€ 13.40M**
€ Profit

DATA VISUALIZATION

Use a variety of visuals to make data analysis more accessible and presentable

First Page

Page 1



CategoryName

Adventure Works Revenue Analy X +

https://app.powerbi.com/groups/me/reports/995653f6-1d2f-4349-a9c4-0a6bd8f09e61/ReportSection...

Not syncing

pmOne Power BI My workspace Adventure Works Reven... | Data updated 8/19/21 Trial: 44 days left Search ...

Home Favorites Recent Create Datasets Goals Apps Shared with me Deployment pipelines Leads Workspaces My Get started

Pages <> File Export Share Chat in Teams ...

Dashboard for Customers | Home Reset pmOne Filters

17.412 # Customers 1.83K € Revenue per Customer by Date

€ 31.82M € Revenue € 13.40M € Profit

Accessories 14.3K

Bikes 8.8K

Clothing 6.5K

by Country by Age ● € Revenue ● # Customers

600 400 200 0

6K (32.3...) N

12K (67.62%) Y

400 200 0

600 400 200 0

M 8.8K

F 8.5K

NA 0.1K

PUBLISH AND COLLABORATE

Use the Power BI Service to publish reports, collaborate with teammates and present to stakeholders

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THE LIFE OF A REPORT



AGENDA

Power BI Training (Module 0)

Power BI intro

- Show example of full dashboard
- Show possibilities but don't go in detail how it works, yet

Lecturer intro

- Show experience and their dashboards

Company intro

- Show scope and case studies

Adventure works intro

- Columns, data types, table relations

Module intro

- Explain structure of course
- Highlight what the course will accomplish
- Show a finished report from previous lecture

AGENDA

Power BI Training (Module 1)

Power BI intro

- Show example of full dashboard
- Show possibilities but don't go in detail how it works, yet

Lecturer intro

- Show experience and their dashboards

Company intro

- Show scope and case studies

Adventure works intro

- Columns, data types, table relations

Module intro

- Explain structure of course
- Highlight what the course will accomplish
- Show a finished report from previous lecture

AGENDA

Power BI Training (Module 2)

Power BI intro

- Show example of full dashboard
- Show possibilities but don't go in detail how it works, yet

Lecturer intro

- Show experience and their dashboards

Company intro

- Show scope and case studies

Adventure works intro

- Columns, data types, table relations

Module intro

- Explain structure of course
- Highlight what the course will accomplish
- Show a finished report from previous lecture

AGENDA

Power BI Training (Module 3)

Power BI intro

- Show example of full dashboard
- Show possibilities but don't go in detail how it works, yet

Lecturer intro

- Show experience and their dashboards

Company intro

- Show scope and case studies

Adventure works intro

- Columns, data types, table relations

Module intro

- Explain structure of course
- Highlight what the course will accomplish
- Show a finished report from previous lecture



#1 DATA SHAPING & TRANSFORMATION

Desktop, Service und Reporting Server

POWER QUERY

Data preparation & transformation

DATA SOURCE

Power BI supports integration with all popular data sources. This means that if your data is stored in a SQL Server or a .csv you can still import and use your data in Power BI.

The screenshot shows the Power BI Desktop interface. The ribbon at the top has tabs: File, Home (which is selected), Insert, Modeling, View, and Help. Below the ribbon is a toolbar with various icons. A callout arrow points from the text "Click Get Data to connect your Power BI Desktop to a new Data Source" to the "Get data" icon in the toolbar. The main area shows a "Get Data" dialog box. On the left of the dialog is a sidebar with categories: All, File, Database, Power Platform, Azure, Online Services, and Other. Under "All", "Excel Workbook" is selected. A callout arrow points from the text "Then this pops up. It lets you choose from many different data sources. Anything from .csv to SQL Server, to Oracle Database." to the list of data source types. Another callout arrow points from the text "After choosing a data source you get this window. This opens up Power Query." to the preview window on the right. The preview window shows a table titled "NetflixOriginals.csv" with columns: Id, Title, Genre, Premiere, Runtime, IMDB Score, and Language. The table contains 20 rows of movie data. At the bottom of the preview window, there are buttons for "Load", "Transform Data", and "Cancel".

File Home Insert Modeling View Help

Get data | Refresh | New visual | Filters | Visualizations | Fields

Connect to data | Connect to multiple sources.

Click Get Data to connect your Power BI Desktop to a new Data Source

Get Data

All

- Excel Workbook
- Text/CSV
- XML
- JSON
- Folder
- PDF
- Parquet
- SharePoint folder
- SQL Server database
- Access database
- SQL Server Analysis Services database
- Oracle database
- IBM Db2 database
- IBM Informix database (Beta)
- IBM Netezza
- MySQL database

Certified Connectors | Template Apps

Connect Cancel

Then this pops up. It lets you choose from many different data sources. Anything from .csv to SQL Server, to Oracle Database.

After choosing a data source you get this window. This opens up Power Query.

NetflixOriginals.csv

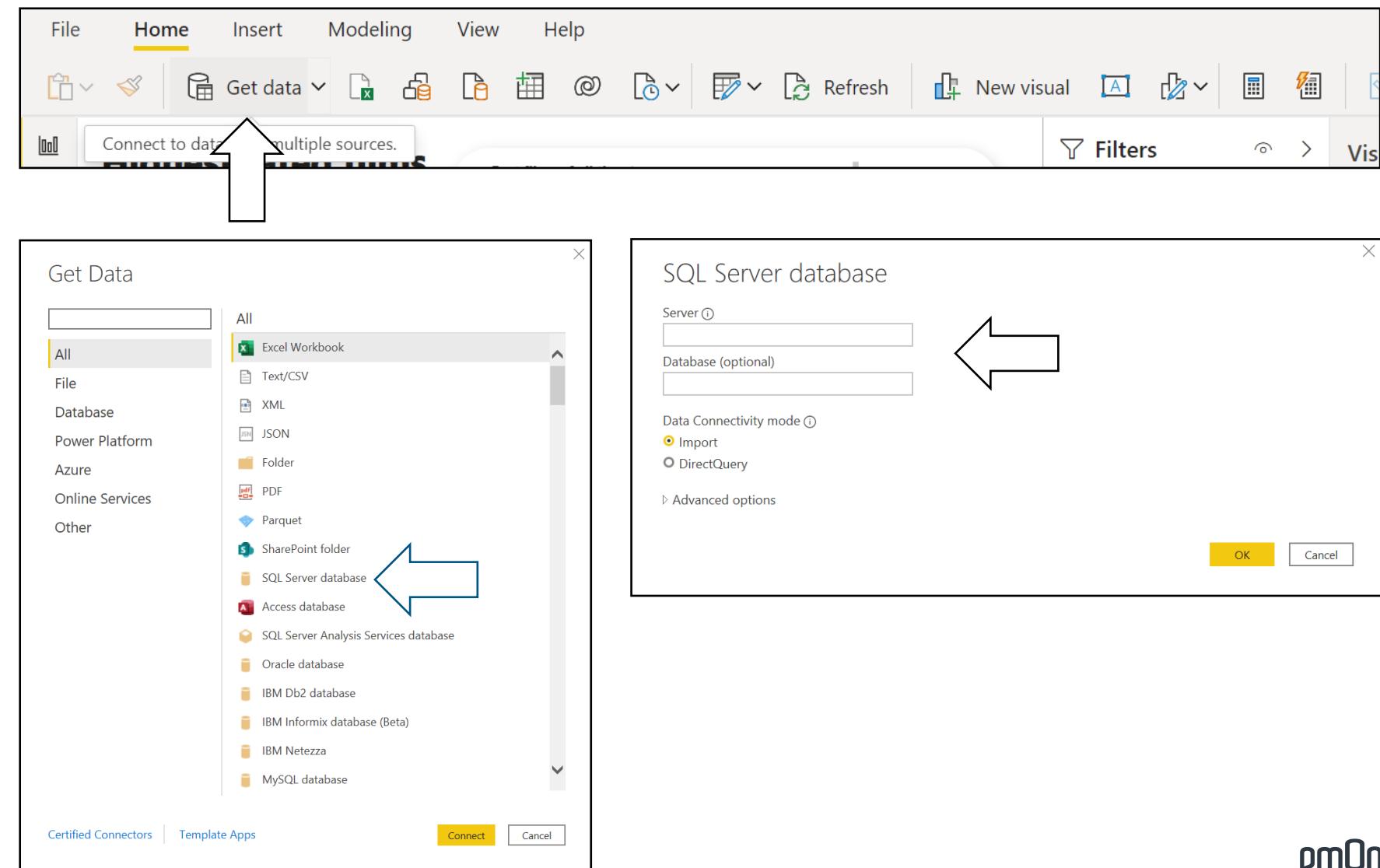
ID	Title	Genre	Premiere	Runtime	IMDB Score	Language
1	Enter the Anime	Documentary	8/5/2019	58	2.5	English/Japanese
2	Dark Forces	Thriller	8/21/2020	81	2.6	Spanish
3	The App	Science fiction/Drama	12/26/2019	79	2.6	Italian
4	The Open House	Horror thriller	1/19/2018	94	3.2	English
5	Kaal Khuhi	Mystery	10/30/2020	90	3.4	Hindi
6	Drive	Action	11/1/2019	147	3.5	Hindi
7	Leyla Everlasting	Comedy	12/4/2020	112	3.7	Turkish
8	The Last Days of American Crime	Heist film/Thriller	6/5/2020	149	3.7	English
9	Paradox	Musical/Western/Fantasy	3/23/2018	73	3.9	English
10	Sardar Ka Grandson	Comedy	5/18/2021	139	4.1	Hindi
11	Searching for Sheela	Documentary	4/22/2021	58	4.1	English
12	The Call	Drama	11/27/2020	112	4.1	Korean
13	Whipped	Romantic comedy	9/18/2020	97	4.1	Indonesian
14	All Because of You	Action comedy	10/1/2020	101	4.2	Malay
15	Mercy	Thriller	11/22/2016	90	4.2	English
16	After the Raid	Documentary	12/19/2019	25	4.3	Spanish
17	Ghost Stories	Horror anthology	1/1/2020	144	4.3	Hindi
18	The Last Thing He Wanted	Political thriller	2/21/2020	115	4.3	English
19	What Happened to Mr. Cha?	Comedy	1/1/2021	102	4.3	Korean
20	Death Note	Horror thriller	8/25/2017	100	4.4	English

Data in the preview has been truncated due to size limits.

Extract Table Using Examples Load Transform Data Cancel

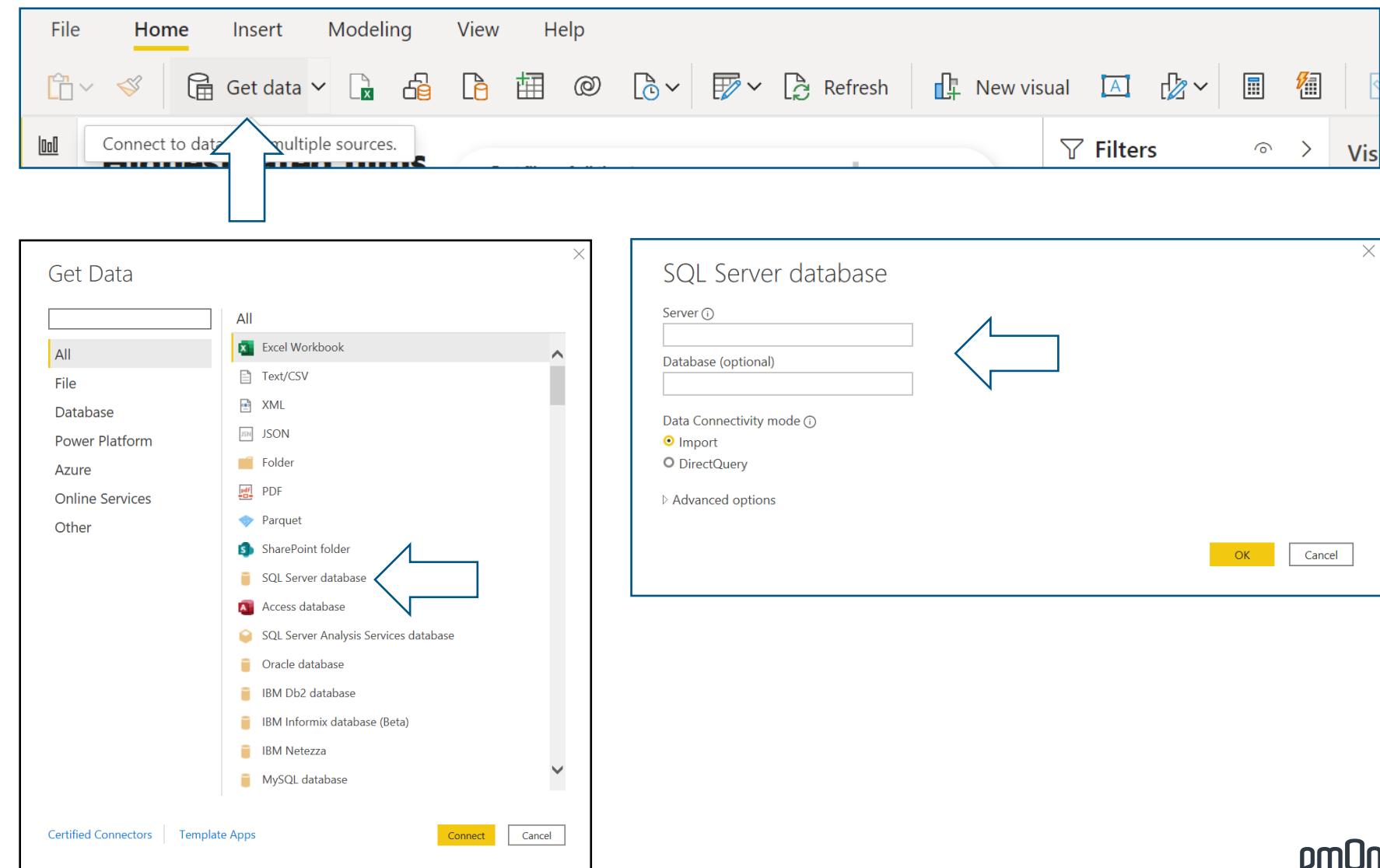
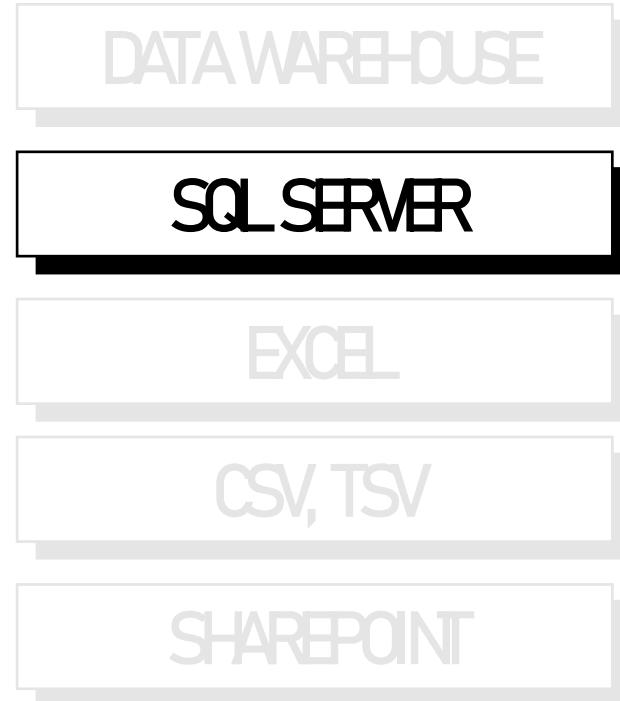
DATA CONNECTIONS

Database Normalization is a technique of organizing the data in the database. Normalization is a systematic approach of decomposing tables to eliminate data redundancy. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.



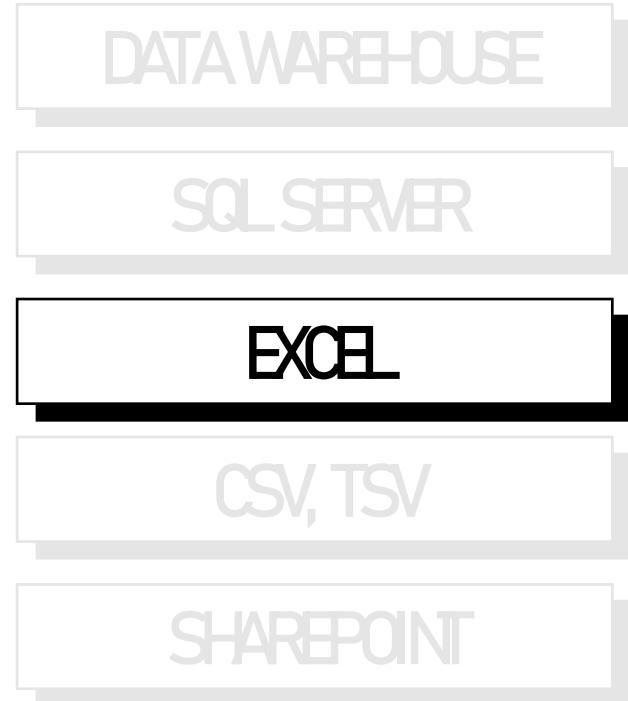
DATA CONNECTIONS

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DATA CONNECTIONS

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The screenshot illustrates the "Get Data" feature in Power BI. The main interface shows the "Home" tab selected in the ribbon, with a tooltip "Connect to data from multiple sources." displayed over the "Get data" button. Below the ribbon, there is a search bar and a "Filters" button. The "Get Data" dialog box is open, showing a list of data sources under the "All" category. The "Excel Workbook" option is highlighted with a blue arrow. Other options include Text/CSV, XML, JSON, Folder, PDF, Parquet, SharePoint folder, SQL Server database, Access database, SQL Server Analysis Services database, Oracle database, IBM Db2 database, IBM Informix database (Beta), IBM Netezza, and MySQL database. At the bottom of the dialog, there are buttons for "Certified Connectors" and "Template Apps", and "Connect" and "Cancel" buttons. To the right of the dialog, a file explorer window titled "Open" shows the file path "This PC > Desktop > Training Files". The search bar in the file explorer contains "Search Training Files". The results list includes "Quick access", "Desktop", "Documents", "Downloads", "Pictures", "NBU", "Power BI Schuler", "Training Files", "Wallpapers", and "OneDrive". The "File name:" field is empty, and there are "Open" and "Cancel" buttons at the bottom of the file explorer window.

DATA CONNECTIONS

Database Normalization is a technique of organizing the data in the database. Normalization is a systematic approach of decomposing tables to eliminate data redundancy. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.



The screenshot shows the Power BI interface with the 'Home' tab selected. A blue arrow points upwards from the 'Get Data' button in the ribbon to the text 'Connect to data from multiple sources.' Below the ribbon, a modal window titled 'Get Data' is open. On the left, a sidebar lists categories: All, File, Database, Power Platform, Azure, Online Services, and Other. The 'All' category is selected. On the right, a list of data sources is shown, with 'Excel Workbook' highlighted. Another blue arrow points from the 'File' category in the sidebar to the 'Excel Workbook' item. To the right of the modal, a file explorer window titled 'Open' shows the file path 'This PC > Desktop > Training Files'. The search bar at the top contains 'Search Training Files'. The results list includes 'Quick access', 'Desktop', 'Documents', 'Downloads', 'Pictures', 'NBU', 'Power BI Schuler', 'Training Files', 'Wallpapers', and 'OneDrive'. The 'This PC' folder is also listed. At the bottom of the 'Get Data' modal, there are buttons for 'Certified Connectors' and 'Template Apps', and 'Connect' and 'Cancel' buttons at the bottom right.

File Home Insert Modeling View Help

Get data Refresh New visual Filters

Connect to data from multiple sources.

Get Data

All

All

File

Database

Power Platform

Azure

Online Services

Other

Excel Workbook

Text/CSV

XML

JSON

Folder

PDF

Parquet

SharePoint folder

SQL Server database

Access database

SQL Server Analysis Services database

Oracle database

IBM Db2 database

IBM Informix database (Beta)

IBM Netezza

MySQL database

Certified Connectors | Template Apps

Connect Cancel

Open

File name: Excel Files (*.xl;*.xlsx;*.xlsm;*.xlst)

Open Cancel

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DATA CONNECTIONS

Database Normalization is a technique of organizing the data in the database. Normalization is a systematic approach of decomposing tables to eliminate data redundancy. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.



Home

Get data

Connect to data from multiple sources.

Filters

Vis

Get Data

All

All

File

Database

Power Platform

Azure

Online Services

Other

SparkPost (Beta)

SweetIQ (Beta)

Planview Enterprise One - CTM (Beta)

Twilio (Beta)

Zendesk (Beta)

Web

SharePoint list

OData Feed

Active Directory

Microsoft Exchange

Hadoop File (HDFS)

Spark

Hive LLAP

R script

Python script

ODBC

Certified Connectors

Template Apps

Connect

Cancel

SharePoint lists

Site URL

OK

Cancel

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A screenshot of the Microsoft Power BI 'Get Data' feature. On the left, a sidebar shows categories like All, File, Database, etc., with 'All' selected. A main pane lists various data connectors. A blue arrow points upwards from the 'Get Data' button in the ribbon to the 'All' category in the sidebar. Another blue arrow points left from the 'SharePoint lists' dialog box back to the 'Get Data' sidebar.

POWER QUERY

Before we stick our data in a chart, we want to clean it up a bit. Upon loading a new data source, we see Power Query - a data manipulation environment built-in all of Microsoft's Data products.

The screenshot shows the Microsoft Power Query Editor interface. At the top, there are two boxes: "Column manipulation tools" pointing to the "Manage Columns" ribbon tab, and "Data type manipulation" pointing to the "Transform" ribbon tab. On the left, a box labeled "Active tables in Power BI" points to the "Queries [1]" pane where "NetflixOriginals" is listed. On the right, a box labeled "History of applied steps for this table in current session" points to the "Query Settings" pane, specifically the "APPLIED STEPS" section which lists "Source", "Promoted Headers", and "Changed Type". The main area displays a table of 22 rows of movie data with columns: Id, Title, Genre, and Premiere. The bottom status bar indicates "7 COLUMNS, 584 ROWS" and "Column profiling based on top 1000 rows".

Id	Title	Genre	Premiere
1	Enter the Anime	Documentary	8/5/2019
2	Dark Forces	Thriller	8/21/2020
3	The App	Science fiction/Drama	12/26/2019
4	The Open House	Horror thriller	1/19/2018
5	Kaali Khushi	Mystery	10/30/2020
6	Drive	Action	11/1/2019
7	Leyla Everlasting	Comedy	12/4/2020
8	The Last Days of American Crime	Heist film/Thriller	6/5/2020
9	Paradox	Musical/Western/Fantasy	3/23/2018
10	Sardar Ka Grandson	Comedy	5/18/2021
11	Searching for Sheela	Documentary	4/22/2021
12	The Call	Drama	11/27/2020
13	Whipped	Romantic comedy	9/18/2020
14	All Because of You	Action comedy	10/1/2020
15	Mercy	Thriller	11/22/2016
16	After the Raid	Documentary	12/19/2019
17	Ghost Stories	Horror anthology	1/1/2020
18	The Last Thing He Wanted	Political thriller	2/21/2020
19	What Happened to Mr. Cha?	Comedy	1/1/2021
20	Death Note	Horror thriller	8/25/2017
21	Hello Privilege. It's Me, Chelsea	Documentary	9/13/2019
22	Secret Obsession	Thriller	7/18/2019

7 COLUMNS, 584 ROWS Column profiling based on top 1000 rows

PREVIEW DOWNLOADED AT 12:37 PM

TYPES OF KEYS

Keys are an attribute or set of attributes which help you to identify a row in a table

PRIMARY KEY

It is a key that can uniquely identify each record in a table. It is both UNIQUE and NOT NULL.

student_id	name	age	teacher_id

COMPOSITE KEY

Key that uses two or more attributes to uniquely identify any record in a table is called **Composite key**.

student_id	subject_id	marks	exam_name

FOREIGN KEY

A primary key from another table

student_id	name	age	<u>teacher_id</u>

NORMALIZ

Database Normalization is a technique of organizing the data in the database.
ables to eliminate data
tabular form, removing duplicated

FRS

1. It should only have single (atomic)
valued attributes/columns.

2. Values stored in a column should be of
the same domain

3. All the columns in a table should have
unique names.

4. And the order in which data is stored,
does not matter.



Why cant you just be normal?

teacher_id



Screams

TRANSFORMATIONS

Power Query allows us to manipulate data in several ways to achieve a more cohesive view of our data and perform analyses. Below are listed some of the basic transformations to get started with Power Query.

SELECT COLUMN

Keep only the columns that meet the report requirements

ID	Title	Genre	Premiere
1	Enter the Anime	Documentary	8/5/2019
2	Dark Forces	Thriller	8/21/2020
3	The App	Science fiction/Drama	12/26/2019
4	The Open House	Horror thriller	1/19/2018
5	Kaali Khuhi	Mystery	10/30/2020
6	Drive	Action	11/1/2019
7	Leyla Everlasting	Comedy	12/4/2020
8	The Last Days of American Crime	Heist film/Thriller	6/5/2020
9	Paradox	Musical/Western/Fantasy	3/23/2018

FILTERING ROWS

Filter the data to only what is needed for the report

ID	Title	Genre	Premiere
1	Enter the Anime	Documentary	8/5/2019
2	Dark Forces	Thriller	8/21/2020
3	The App	Science fiction/Drama	12/26/2019
4	The Open House	Horror thriller	1/19/2018
5	Kaali Khuhi	Mystery	10/30/2020
6	Drive	Action	11/1/2019
7	Leyla Everlasting	Comedy	12/4/2020
8	The Last Days of American Crime	Heist film/Thriller	6/5/2020
9	Paradox	Musical/Western/Fantasy	3/23/2018

CHANGING DATA TYPES

Change the columns to the appropriate data types

Text

Number

Date & Time

Boolean

297 MORE..

QUERY FOLDING

Query folding is the ability for a Power Query query to generate a single query statement to retrieve and transform source data. The Power Query mashup engine strives to achieve query folding whenever possible for reasons of efficiency.

A FOLDED QUERY

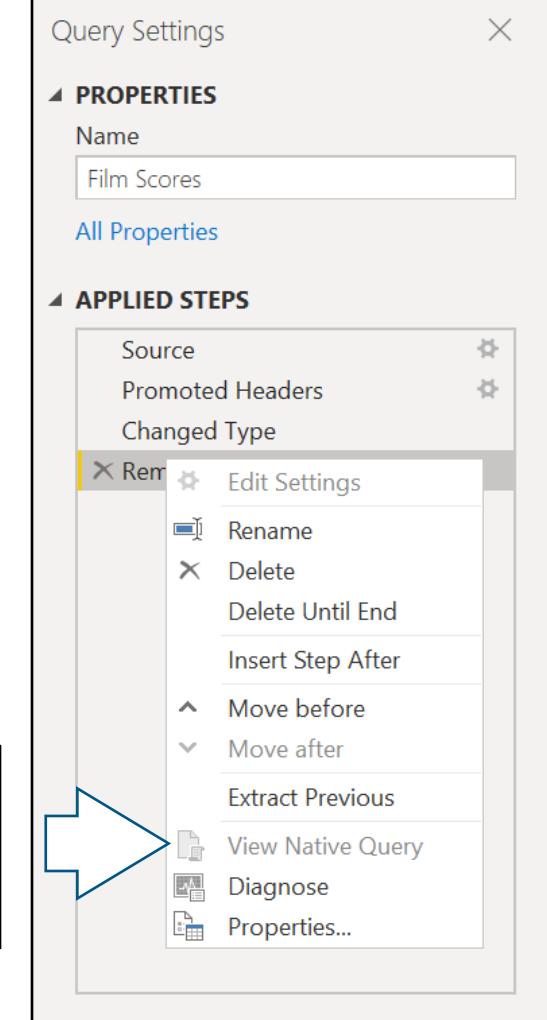
Each time you perform ETL functions on your data, a query is sent to your DBMS. It does that because your DBMS is optimized to do so, while Power Query isn't.

This process is called query folding.

A NONFOLDED QUERY

There are some Power Query transformations that simply can't be pushed to a SQL database engine.

If the View Native Query button is not available to click this means your **query is not folding**.



UNION & JOINS

Power Query allows you to quickly combine tables in various ways using different types of the so-called Join and Union functions.

CASE

Two tables with different values

UNION

Combines the rows of two or more tables.

JOINS

Combines the columns and values of two or more tables based on a related column between them

Table 1

1		
2		



Table 2

1		
3		
4		



+



1		
2		
1		
3		
4		

Inner Join

1				
2				



Left Outer Join

1				
2				



Outer Join

1				
2				
3				
4				



Right Outer Join

1				
3				
4				



COMMENTS

After your report is finished you will probably collaborate with others to analyze and present the data. This is where comments can be helpful. They can hold up to 500 characters, including @ mentions of users.

When you add a comment to a report, Power BI captures the current filter and slicer values and creates a bookmark. This means that when you select or respond to a comment, the report page or report visual may change to show you the filter and slicer selections that were active when the comment was first added.

The screenshot shows a Power BI report titled "Highest rated films" on Netflix. The report displays three main cards representing the highest rated films from 2019, 2020, and 2021. Each card includes a bar chart and a table of top-rated films with their IMDB scores. The Power BI interface includes a left sidebar with navigation options like Home, Favorites, Recent, Create, Datasets, Goals, Apps, Shared with me, Deployment pipelines, Learn, Workspaces, and My workspace. The top right corner shows a "Comment" button with a blue callout arrow pointing to it. The overall theme is dark with orange highlights for the charts.

Best films of all time

Title	IMDB Score
David Attenborough: A Life...	9.0
Emicida: AmarElo - It's All ...	8.6
Springsteen on Broadway	8.5
Ben Platt: Live from Radio ...	8.4
Taylor Swift: Reputation St...	8.4
Winter on Fire: Ukraine's F...	8.4

2019

Title	Amount of films released in 2019
Klaus	125
Marriage Story	
The Irishman	

2020

Title	Amount of films released in 2020
David Attenborough: A Life on Our Planet	183
Emicida: AmarElo - It's All For Yesterday	
Ben Platt: Live from Radio City Music Hall	

2021

Title	Amount of films released in 2021
Seaspiracy	71
The Disciple	
Ferry	





#2 DATA MODELLING

Desktop, Service und Reporting Server

DIMENSIONS AND FACTS

To achieve better performance and clarity in your workflow data is often modelled using dimension tables and fact tables to store different types of data. Dimension tables tend to store entity definition data, while fact tables tend to store entity performance data.

Dimension Table

	Key
	Attribute

DIMENSION

A table that usually stores data which defines your entities – products, partners, employees, stores.

DATA STORED

Start date, department, names, etc. But also includes a **surrogate key** and an **alternate key**.

Fact Table

FACT

A table that usually stores data used to track your entities.
Transactions, Sales Volume, Dates, Leads, etc.

DATA STORED

A table that usually stores data which evaluate your entities. This in some ways can be called metadata.

STAR SCHEMA

In computing, the star schema is the simplest schema style and is the approach most widely used to develop data warehouses

ProductDimension

	Key
	Attribute

SalesTerritoryDimension

	Key
	Attribute

SalesFact

DateDimension

	Key
	Attribute

EmployeeDimension

	Key
	Attribute

ResellerDimension

	Key
	Attribute

SURROGATE KEY

A key that uniquely identifies a row, but whose data does not hold value outside the table.

ALTERNATE KEY

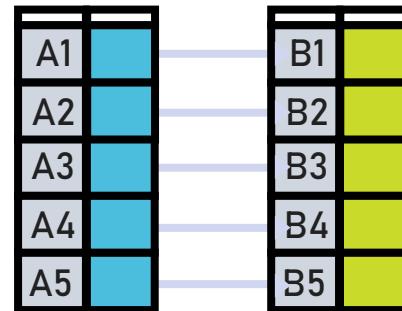
A key that could be the primary key but isn't

CARDINALITY

When working with a database schema you'd need to be aware of the model's cardinality. In simple terms, cardinality refers to the type of relations different entities have between each other. Relations can either be one-to-one, one-to-many, many-to-one and many-to-many.

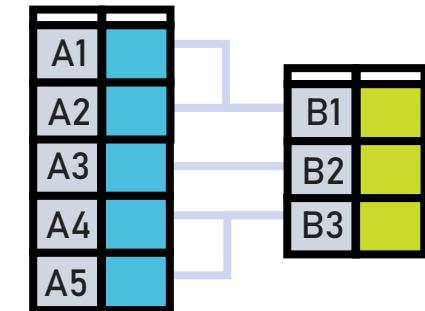
ONE-TO-ONE

An entity in A is associated with at most **one** entity in B and B is associated with at most **one** entity in A



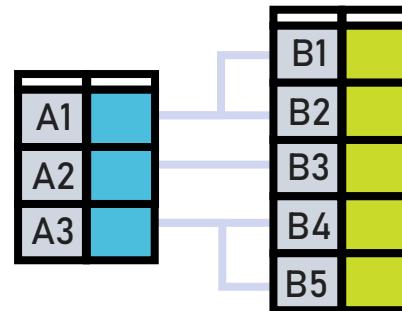
MANY-TO-ONE

An entity in A is associated with at most **one** entity in B and B is associated with **any number** of entities in A



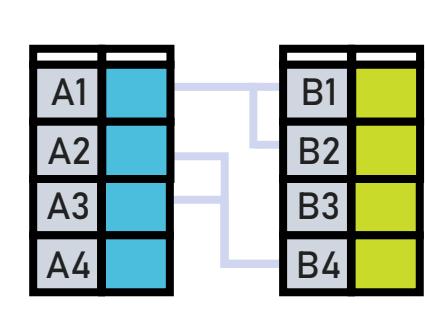
ONE-TO-MANY

An entity in A is associated with **any number** of entities in B and B is associated with at most **one** entity in A



MANY-TO-MANY

An entity in A is associated with **any number** of entities in B and B is associated with **any number** of entities in A



ALTERING

Data filtering is the process of choosing a smaller part of your data set and using that subset for viewing or analysis. Filtering is generally (but not always) temporary – the complete data set is kept, but only part of it is used for the calculation.

TOP X

If you are doing top visual, you can filter based on the top 100 or top 5 results

BEFORE | AFTER

If you are working with dates, you can select data which is before or after a certain period

GREATER THAN

If working with integer data, you could filter based on column values.

AND MANY MORE

...

Id	Title	Genre.1	Genre.2	Genre.3	Premiere	Runtime	IMDB Score	Language.1	Language.2		
										X	V
11	Searching for Sheela	Documentary			Thursday, April 22, 2021	58	4.1	English			
21	Hello Privilege. It's Me, Chelsea	Documentary			Friday, September 13, 2019	64	4.4	English			
81	Strip Down, Rise Up	Documentary			Friday, February 5, 2021	112	5.2	English			
112	Ghosts of Sugar Land	Documentary			Wednesday, October 16, 2019	21	5.5	English			
141	Why Did You Kill Me?	Documentary			Wednesday, April 14, 2021	83	5.6	English			
153	Out of Many, One	Documentary			Wednesday, December 12, 2018	34	5.7	English			
200	Notes from Dunblane: Lesson from a School Shooting	Documentary			Friday, September 28, 2018	23	5.9	English			
203	The Minimalists: Less Is Now	Documentary			Friday, January 1, 2021	53	5.9	English			
224	Casting JonBenet	Documentary			Friday, April 28, 2017	80	6.1	English			
229	Hot Girls Wanted	Documentary			Friday, May 29, 2015	84	6.1	English			
260	The Rachel Divide	Documentary			Friday, April 27, 2018	104	6.2	English			
261	Voyuer	Documentary			Friday, December 1, 2017	95	6.2	English			
276	Nail Bomber: Manhunt	Documentary			Wednesday, May 26, 2021	72	6.3	English			
287	The Legend of Cocaine Island	Documentary			Friday, March 29, 2019	87	6.3	English			
291	Travis Scott: Look Mom I Can Fly	Documentary			Wednesday, August 28, 2019	85	6.3	English			
302	John Was Trying to Contact Aliens	Documentary			Thursday, August 20, 2020	16	6.4	English			
304	Murder to Mercy: The Cyntoia Brown Story	Documentary			Wednesday, April 29, 2020	97	6.4	English			
305	My Own Man	Documentary			Saturday, December 13, 2014	81	6.4	English			
309	Strong Island	Documentary			Friday, September 15, 2017	107	6.4	English			
311	Take Your Pills	Documentary			Friday, March 16, 2018	87	6.4	English			
313	The Mars Generation	Documentary			Friday, May 5, 2017	97	6.4	English			
327	Chadwick Boseman: Portrait of an Artist	Documentary			Saturday, April 17, 2021	21	6.5	English			
330	Dolly Parton: A MusiCares Tribute	Documentary			Wednesday, April 7, 2021	55	6.5	English			
340	Nobody Sneak: Trials of the Free Press	Documentary			Friday, June 23, 2017	95	6.5	English			

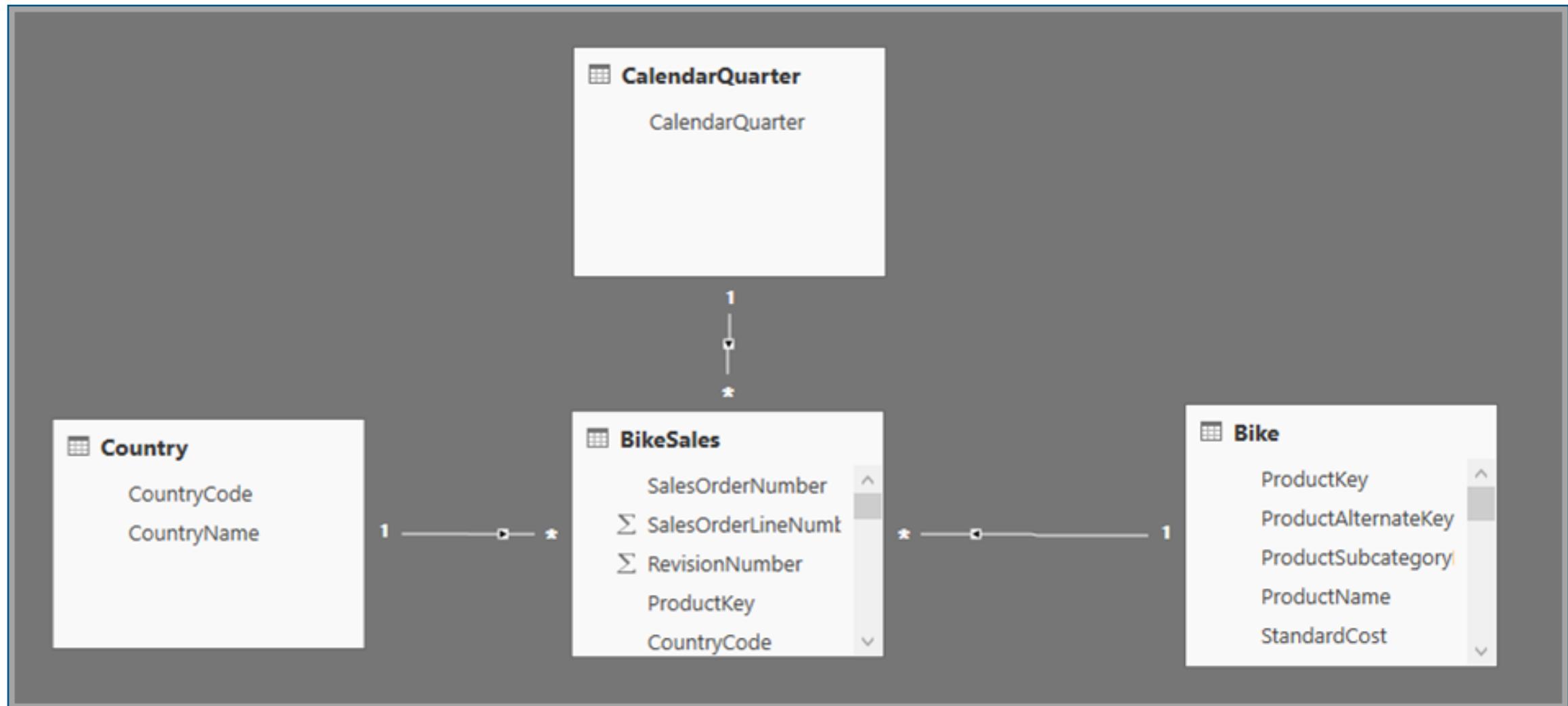
Table: NetflixOriginals (584 rows)

CROSS-FILTERING

With cross-filtering, users can click a data point in one dashboard tile to have all dashboard tiles automatically filter on that value.

COMPOSITE MODEL

With composite models, you can connect to different kinds of data sources when you use Power BI. This means that you can establish relationships between tables from different sources, which allows you to build better analyses.



COMPOSITE MODEL

With composite models, you can connect to different kinds of data sources when you use Power BI. This means that you can establish relationships between tables from different sources, which allows you to build better analyses.

Create relationship

Select tables and columns that are related.

ProductKey	ProductAlternateKey	ProductSubcategoryKey	ProductName	StandardCost	FinishedGoodsFlag
310	BK-R93R-62		2 Road-150 Red, 62	\$2,171.2942	1
311	BK-R93R-44		2 Road-150 Red, 44	\$2,171.2942	1
312	BK-R93R-48		2 Road-150 Red, 48	\$2,171.2942	1

ProductName	Product Manager	Priority
Mountain-200 Black, 38	Andersen	M
Mountain-200 Black, 42	Andersen	L
Mountain-200 Black, 46	Bell	L

Cardinality Cross filter direction

Many to Many (*:*) Single (ProductManagers filters Bike)

Make this relationship active Apply security filter in both directions

Assume referential integrity

Warning: The cardinality of this relationship is Many-Many

OK Cancel

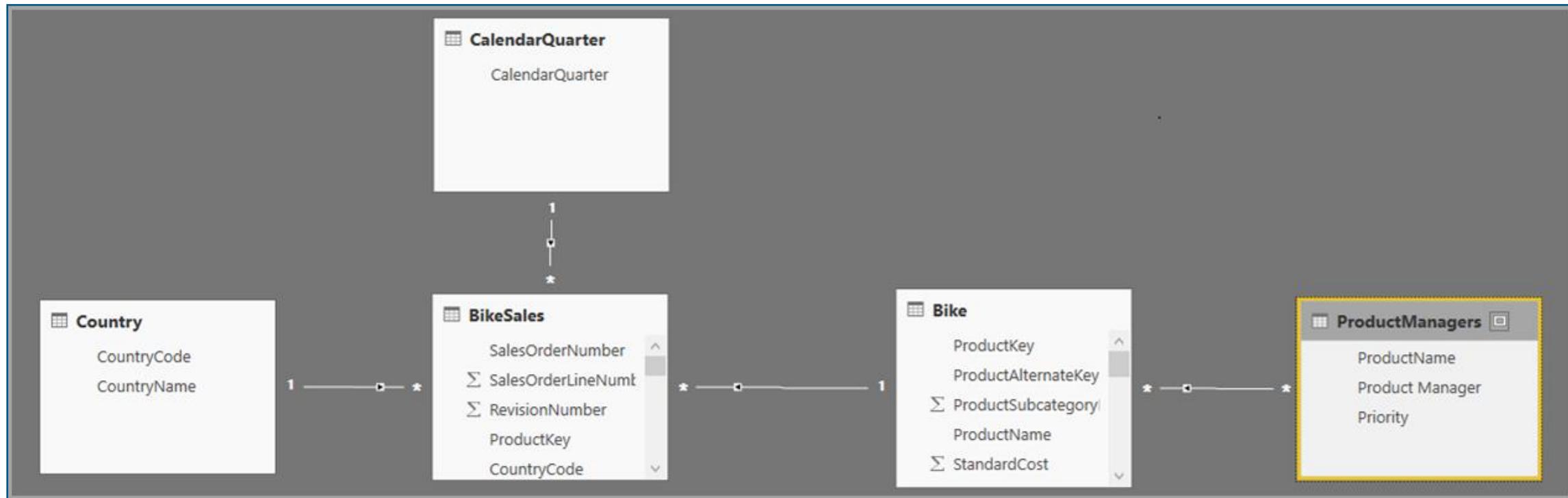
Fields >

Search

- Bike
- BikeSales
- CalendarQuarter
- Country
- ProductManagers
 - Priority
 - Product Mana...
 - ProductName
 - Σ Size
 - Style
- SalesTargets
- TopSales

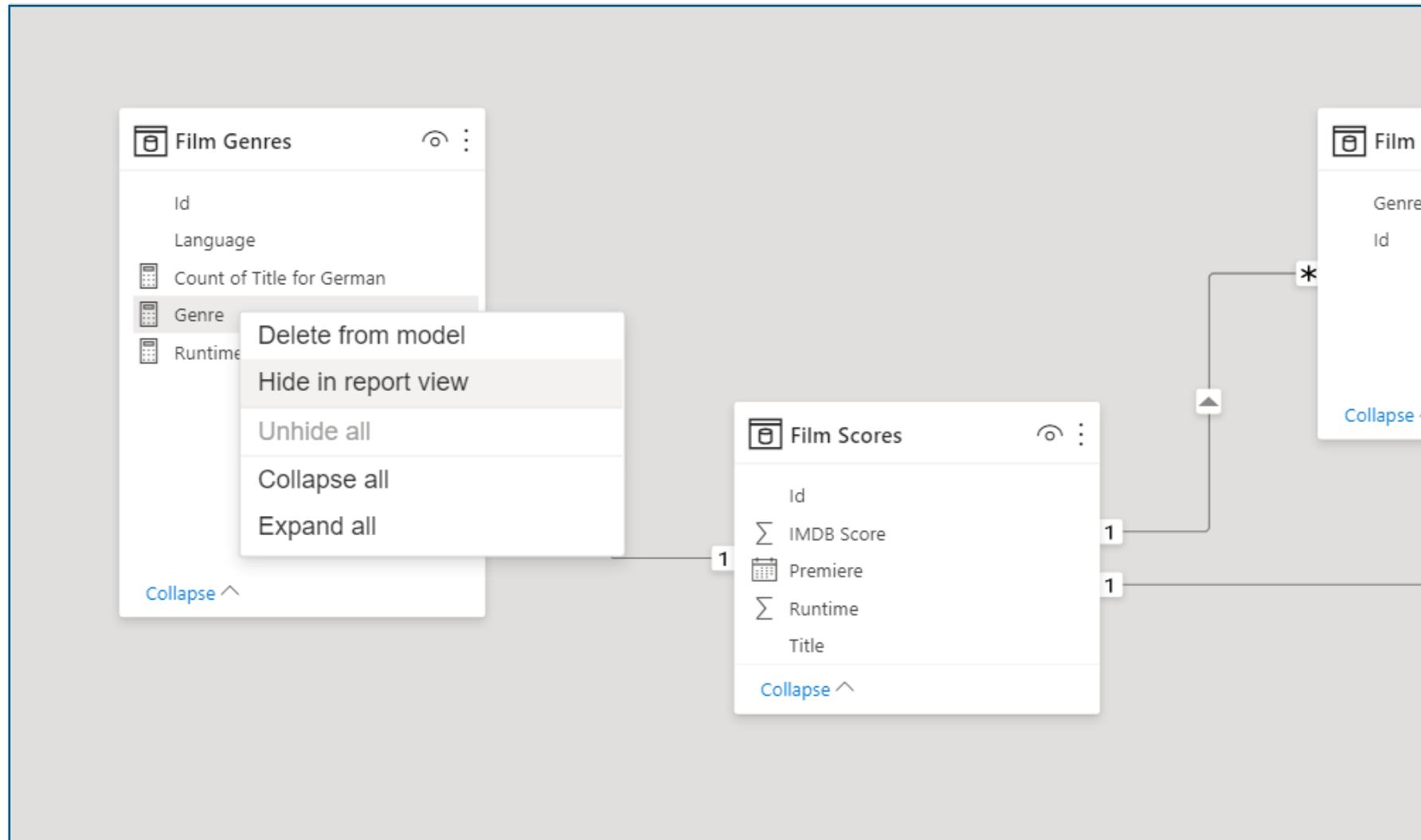
COMPOSITE MODEL

With composite models, you can connect to different kinds of data sources when you use Power BI. This means that you can establish relationships between tables from different sources, which allows you to build better analyses.



HIDE COLUMNS

To achieve clarity in your data model often you'd want to alter your tables non-destructively. One way to do that is by simply hiding the columns from the report view.



INCREMENTAL REFRESH

Usually, when you refresh your dataset, you basically have to ask the data source to send you its current version of its data. With large datasets this can cost a lot of time and resources. Incremental refreshes just part of the data that you expect to have changed.

SCALABILITY

For most datasets, this is one or more tables that contain transaction data that changes often and can grow exponentially, like a fact table in a relational or star database schema.

Fact Table

Refresh history

Scheduled OneDrive

Details	Type	Start	End	Status
	On demand	4/30/2018 7:42:46 AM	4/30/2018 7:58:41 AM	Completed
	On demand	4/29/2018 10:35:47 PM	4/29/2018 11:44:31 PM	Completed

A second refresh loads just data from the last 5 days.
Takes: 0.15 Hours

A first refresh loads all 2 billion rows of data.

Takes: 1.15 Hours

PERFORMANCE

If you have a 5-year dataset when you do a hard refresh the dataset will have to re-load the full 5 years' worth of data. This is inefficient since change in data can usually only occur in the last few weeks. This is why you refresh only the last few weeks worth of data instead of the whole set.

GET DATA IN POWER BI

You can use different ways to get your data in Power BI. Depending on which one you choose you might improve performance or enable

IMPORT MODE

Most common mode. It basically brings your data inside Power BI as a copy of your data (a.k.a *cached data*)



Benefits:

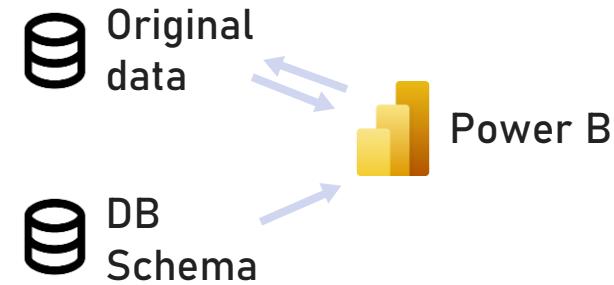
- Super fast
- No restrictions on source

Restrictions:

- Limited to 1GB publish

DIRECT QUERY

Power BI copies the DB schema and feeds the data directly from the source. This is best for massive datasets.



Benefits:

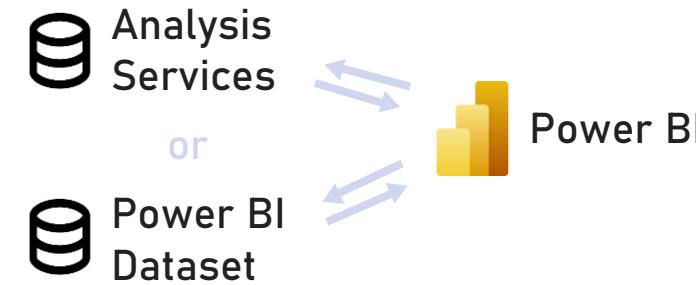
- Great for billions of rows

Restrictions:

- Not all sources support direct query

LIVE MODE

All of the data is kept in the source, and everything is streamed live into Power BI



Benefits:

- Super fast
- Great for billions of rows

Restrictions:

- You can't make changes to the model

*COMPOSITE

You can have an imported table connected with a live mode table



#3 DAX

Data Analysis Expressions for Power BI

WHAT IS DAX?

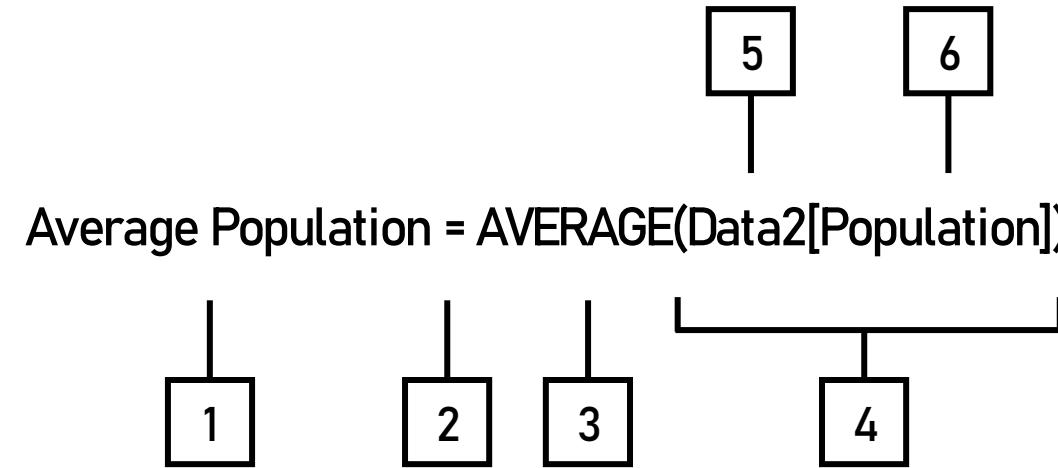
Data Analysis Expressions is a collection of FUNCTIONS, OPERATORS, and CONSTANTS that can be used in a formula or to calculate or return one or more values.

PRE-REQUISITES

- Be familiar with MS Excel formulas
- Basic knowledge of Power BI Desktop
- Basic knowledge of concepts of **measures** and **calculated columns**

SIMPLE SYNTAX

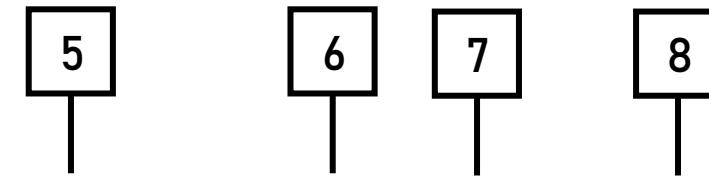
Data Analysis Expressions is a collection of FUNCTIONS, OPERATORS, and CONSTANTS that can be used in a formula or to calculate or return one or more values.



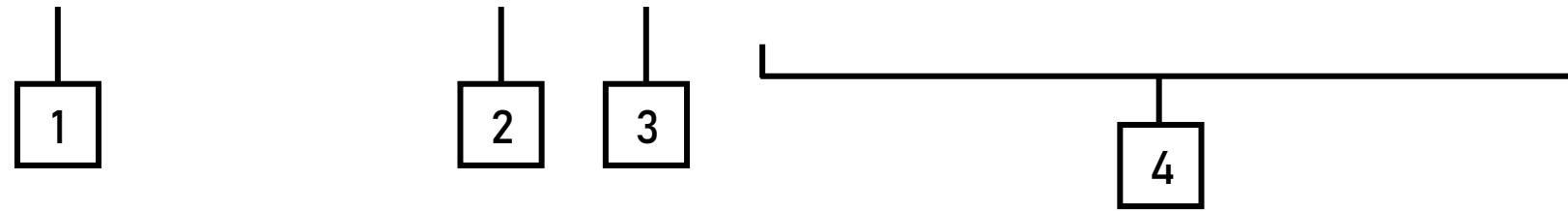
1. The measure name
2. The equal sign operator
3. The DAX function, AVERAGE
4. Parenthesis `()` that surround an expression containing arguments
5. The referenced table, Data 2
6. The referenced column, Population

Data Analysis Expressions is a collection of FUNCTIONS, OPERATORS, and CONSTANTS that can be used in a formula or to calculate or return one or more values.

Average Population = AVERAGE(Data2[Population])



AVG POPULATION GREATER THAN YEAR 2000 = CALCULATE([Average Population] , Data 2[Year]>2000)



1. The measure name
2. The equal sign operator that includes the beginning of the formula
3. The CALCULATE function
4. Parenthesis () that surround an expression containing arguments
5. A measure, [Average Population], in the same table as an expression
6. A comma (,) that separates the first “expression argument” from the “filter argument”
7. The fully qualified referenced column, Data2[Year]
8. The particular value, 2000, as filter

FUNCTIONS

They are predefined formulas that perform calculations by using specific values, called arguments, in a particular order or structure

Important: A DAX function always references a complete column or table

DATE AND TIME	Datediff, now, today, etc.
TIME INTELLIGENCE	Datesbetween, firstdate, etc.
INFORMATION	Contains, lookupvalue, etc.
LOGICAL	And, or, if, iferror, etc.
MATHEMATICAL	Abs, Acos, degrees, etc.
STATISTICAL	Average, count, max, etc.
TEXT	Concatenate, combinevalues, etc.
PARENT-CHLD	Path, pathcontains, etc.
OTHER	Datable, groupby, error, etc.
TABLE	Filter, values, distinct, etc.

EXAMPLES

Seeing calculated columns and measures in practice



#4 DATA VISUALIZATION

Main visuals in Power BI

MAIN PRINCIPLES

Effective visualizations communicate complex statistical and quantitative information facilitating insight, understanding, and decision making. But what is an effective graph?

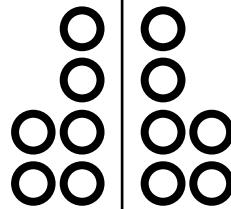
COLOR

select colors that present enough contrast to make the graph legible



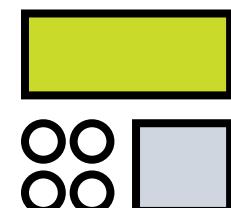
SYMMETRY

Symmetrical visuals guide the user's eyes through the report



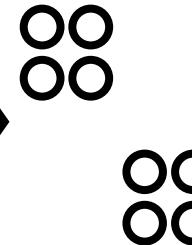
SIZE

Big objects should also be more important than smaller objects



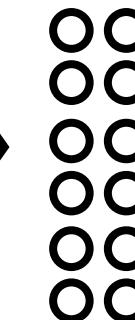
PROXIMITY

group related elements together



ALIGNMENT

elements on the same vertical or horizontal plane are perceived as having similar properties



LEGIBILITY

sans serif fonts are easier to read, use color for emphasis instead of a new typeface

SANS SERIF
SERIF

WHITE SPACE

White space can often make a report seem unfinished.



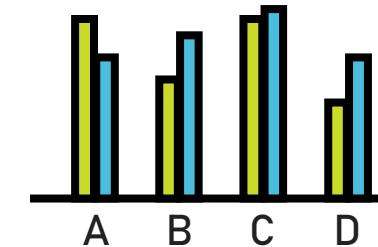
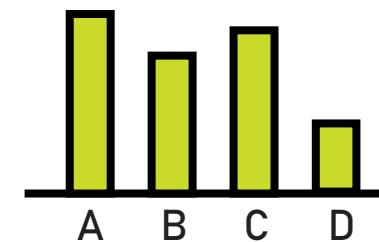
WHITE
SPACE

BASE GRAPHS

Effective visualizations communicate complex statistical and quantitative information facilitating insight, understanding, and decision making. But what is an effective graph?

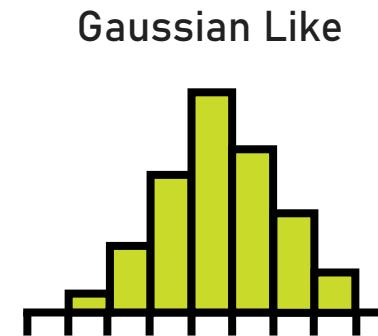
COLUMN PLOT

Compare data across different groups

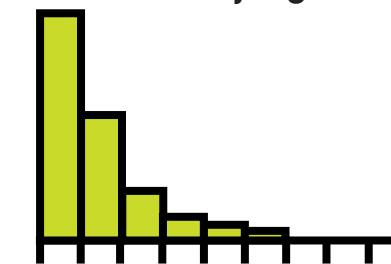


HISTOGRAM

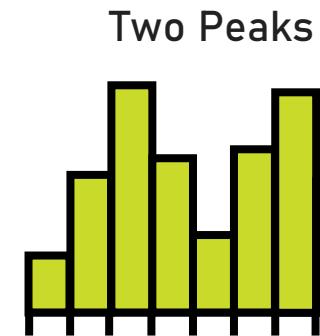
Distributes data into user-specified ranges (or buckets)



Gaussian Like



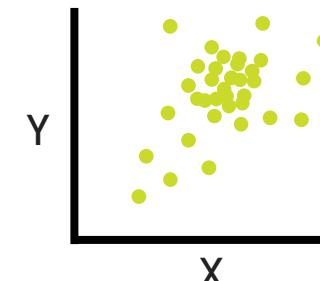
Exponentially Decaying



Two Peaks

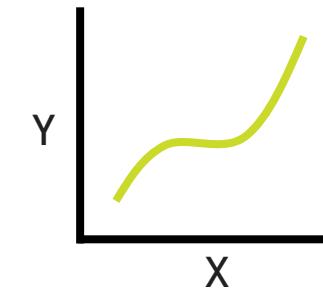
SCATTER PLOT

Shows all data points on a two-axis diagram



LINE GRAPH

Averages all data points into a curve

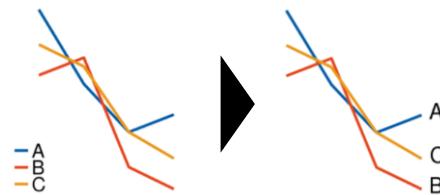


COMPARISONS

Effective visualizations communicate complex statistical and quantitative information facilitating insight, understanding, and decision making. But what is an effective graph?

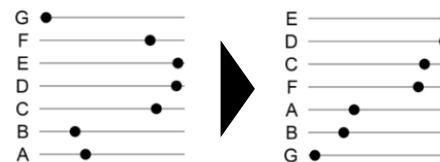
PROXIMITY

Place labels next to data instead of using legends



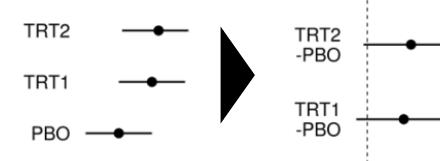
SORTING

Order values to help compare across many categories



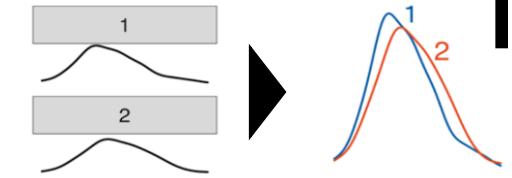
ARITHMETICS

Plot the final comparisons e.g. mean difference, not two means



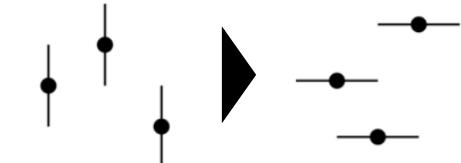
GROUPING

Group together elements to be directly compared. Many entries not recommended



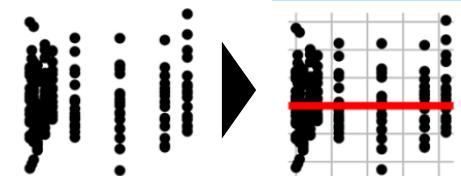
VERTICAL

Judgements are easier to make on a common vertical scale



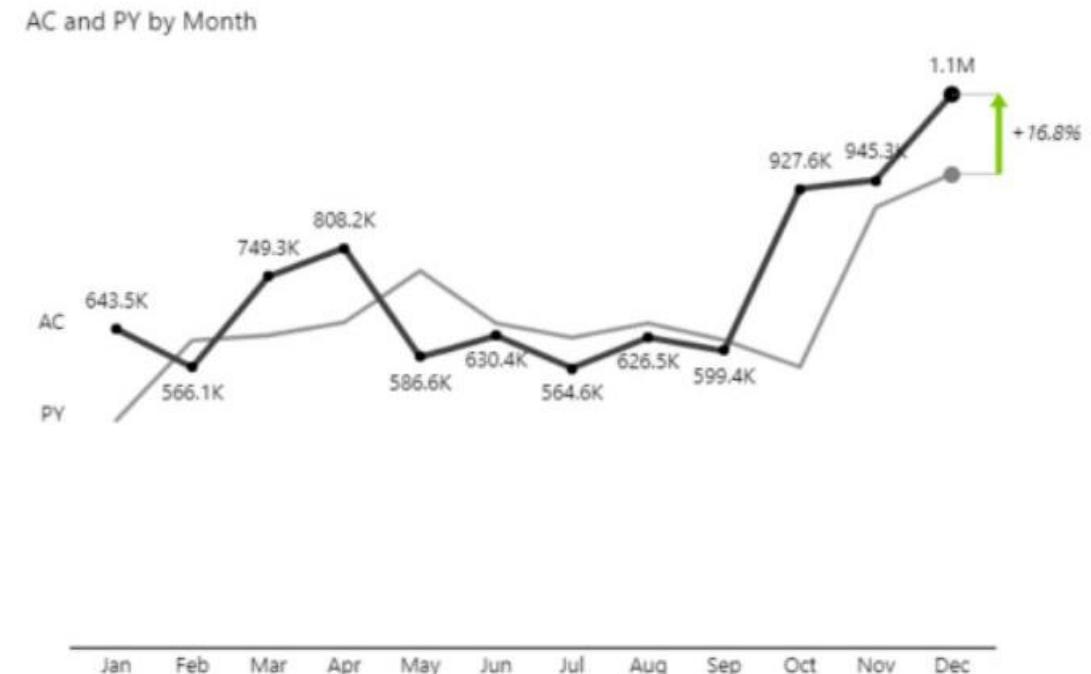
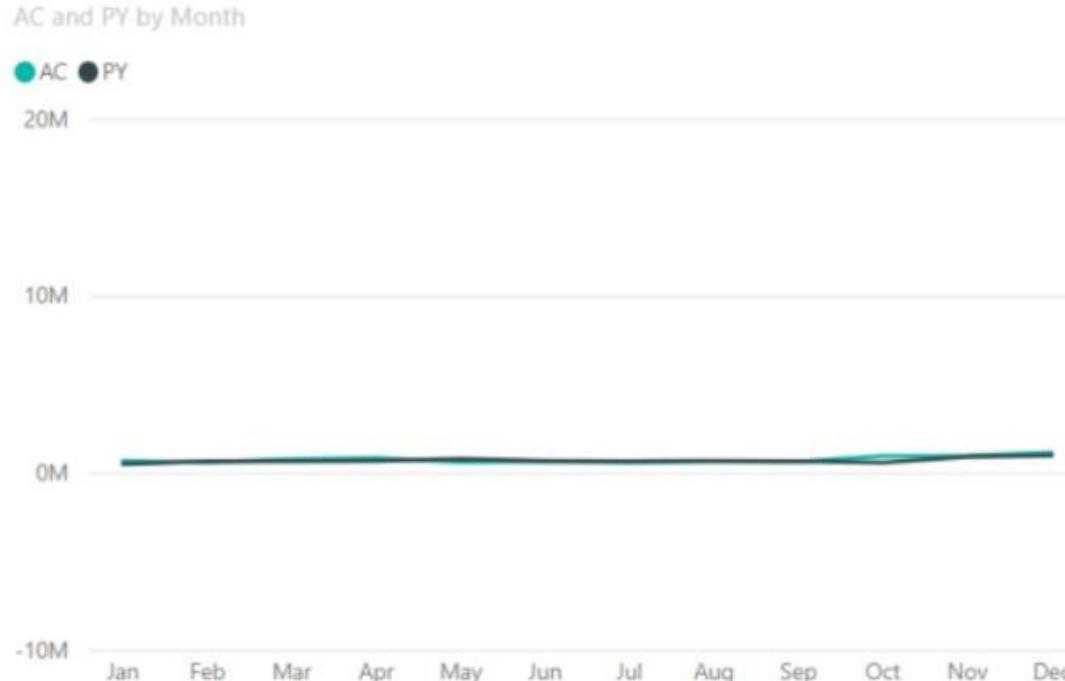
ANCHORS

Use visual anchors like user reference lines.



NEW

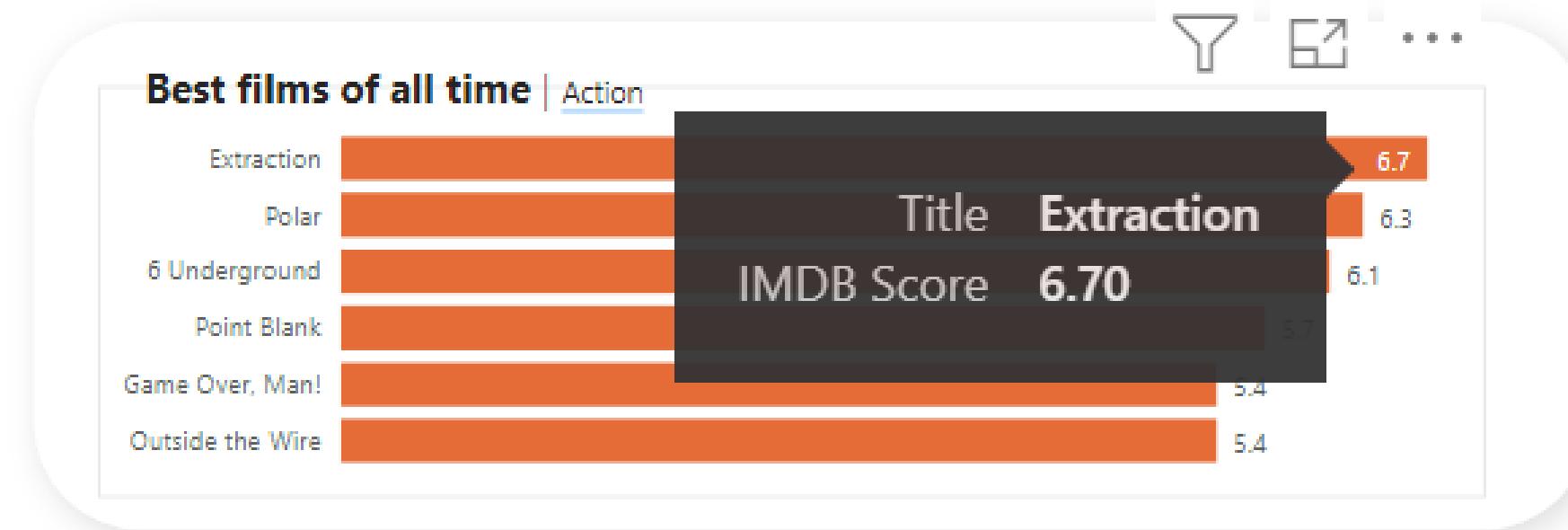
CAN YOU POINT OUT THE VISUALIZATION ERRORS ON THE LEFT CHART?



SAME DATA SAME CHART TYPES. DIFFERENT STORY.

TOOLTIPS

A provider of additional information without cluttering the main visual.



TOOLTIPS

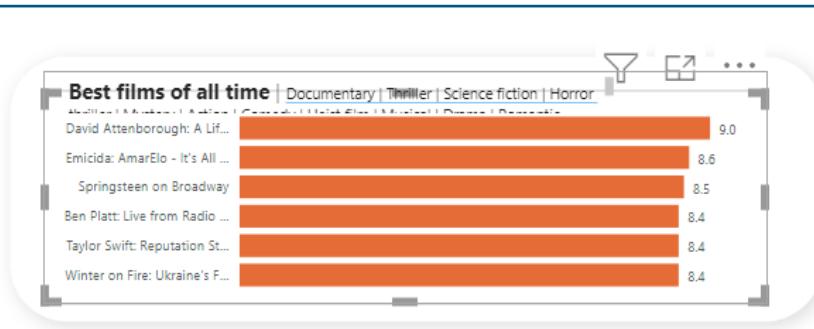
A provider of additional information without cluttering the main visual.

The screenshot shows the Power BI desktop interface. On the left, there's a navigation pane with icons for Home, Insert, Modeling, View, and Help. The main area has a large dotted rectangular placeholder for a visual. To the right of the placeholder is a 'Filters' pane and a 'Visualizations' pane. A tooltip configuration dialog is open over the visual area, containing sections for 'Filters' and 'Visualizations'. It includes search fields, dropdown menus for 'Type' (set to 'Tooltip'), and input fields for 'Width' (320 pixels) and 'Height' (240 pixels). A callout arrow points from the bottom right of the slide towards this dialog. At the bottom, there are page navigation buttons for 'Page 1' and 'Page 2' (which is highlighted with a yellow box), and a footer indicating 'Page 2 of 2'.

To make custom tooltips you have to create a new page and under Type select Tooltip

TOOLTIPS

A provider of additional information without cluttering the main visual.



highest rated films from **2019**

highest rated films from **2020**

highest rated films from **2021**

Filters

Visualizations

Search

Filters on this visual

Title
top 5 by IMDB Score

IMDB Score
is (All)

Title
is (All)

Add data fields here

Filters on this page

Add data fields here

Filters on all pages

Add data fields here

Tooltip On

Type Report page

Page Auto

Page 2

Page 2

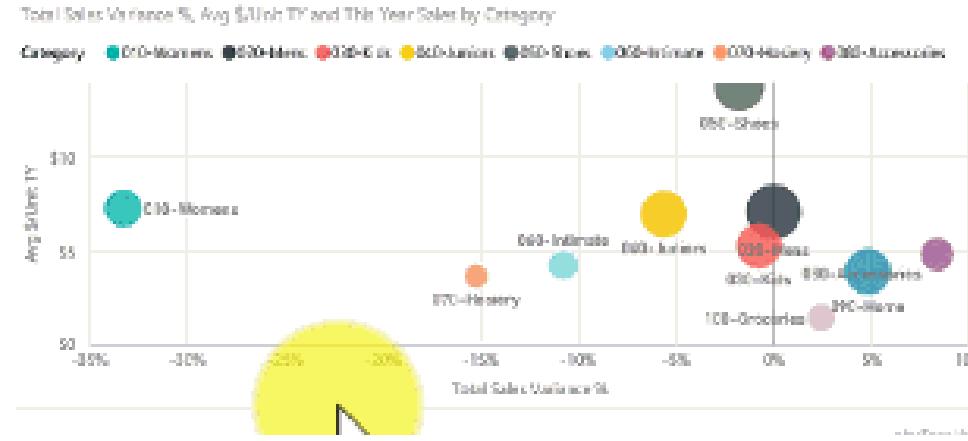
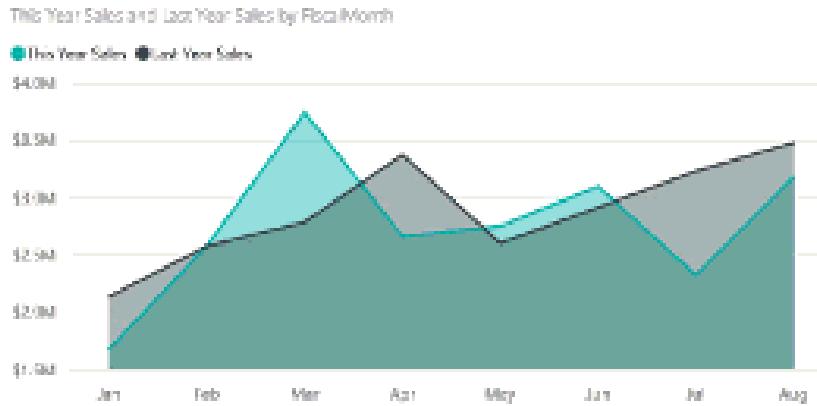
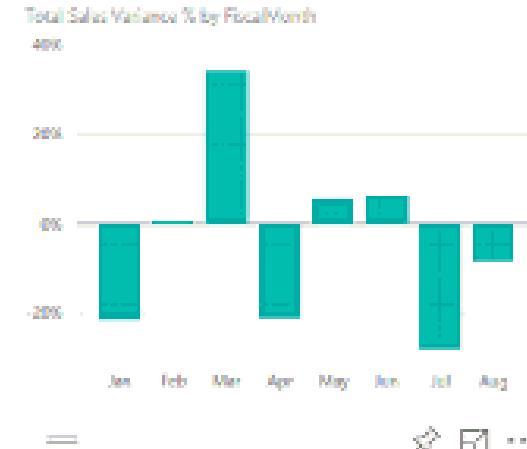
You then go back to your main report page and select the visual you want to apply custom tooltip to.

Then you go down to tooltip, and under page select your tooltip page

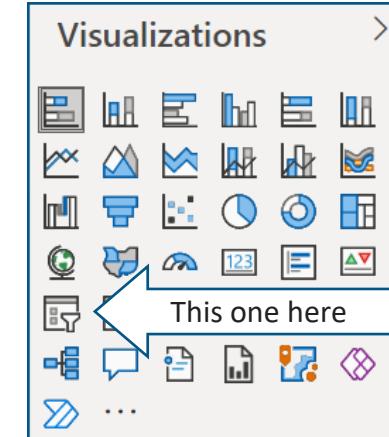
SLICERS

When you want the viewer of the report to manually filter through data you can't really let them add filters from the Filters pane. You should be using Slicers. They are another way of filtering. They narrow the portion of the dataset that is shown in the other report visualizations.

- Device Manager
- Allan Guinot
 - Andress M3
 - Annelie Zubow
 - Brad Sutton
 - Carlos Grillo
 - Chris Gray
 - Chris McGuire
 - Tina Lassila
 - Volody Ushakov



To add a slicer simply click the slicer icon in the visualizations tab on the right side of your screen.



BUTTONS

With buttons in Power BI, you can create reports that behave similar to apps, and create an environment where users can hover, click, and further interact with Power BI content

The screenshot shows the Power BI desktop application. The ribbon at the top has 'Insert' selected, indicated by a blue arrow labeled 'First here'. The main area displays a report titled 'Highest rated films on Netflix'. The report includes a card for 'Best films by genre' (Action, Adventure), a summary card for '12' and '104', and three circular cards for the years 2019, 2020, and 2021, each showing the highest rated films from that year. A bar chart titled 'Best films of all time | Action | Adventure' is also visible. On the right side, there are 'Filters', 'Visualizations', and 'Drill through' sections. A context menu is open over the 'Visualizations' section, with a blue arrow labeled 'Then this' pointing to it. The menu contains options like 'Left arrow', 'Right arrow', 'Reset', 'Back', 'Information', 'Help', 'Q&A', 'Bookmark', and 'Blank'.

To add a button, go to Insert and then click the button button.

A detailed view of the 'Format button' dialog box. It features a search bar and several sections with toggle switches: 'General' (On), 'Button T...' (Off), 'Icon' (On), 'Outline' (On), 'Fill' (Off), 'Title' (Off), 'Background...' (On), and 'Lock asp...' (Off). Each section has a descriptive label and a corresponding toggle switch.

BOOKMARKS

When you edit a report in Power BI Desktop and the Power BI service, you can add report bookmarks to capture the current state of a report page. Bookmarks save the current filters and slicers, cross-highlighted visuals, sort order, and so on. When others view your report, they can get back to that exact state by selecting your saved bookmark.

The screenshot shows a Power BI report titled "Highest rated films" on Netflix. The report displays three cards for the years 2019, 2020, and 2021, each showing the highest rated films from that year along with their IMDB scores. A navigation bar at the bottom includes "Page 1" and a plus sign icon.

A blue arrow points from the text "First here" to the "View" tab in the ribbon. Another blue arrow points from the text "Then this" to the "Bookmarks" button in the ribbon.

The "Bookmarks" pane is open on the right side of the interface. It contains the following sections:

- Bookmarks**: Buttons for "Add" and "View".
- Visualizations**: A grid of icons representing various visual types.
- Fields**: A search bar with the placeholder "Search" and a list of fields:
 - Film Genres
 - Film Languages
 - Film Scores
 - NetflixOriginals
 - Shows_Episodes_Details
- Filters**: A section with "Show Language Slicer", "Hide Language Slicer", "Show Genre Slicer", and "Hide Genre Slicer".
- Values**: A section with "Add data fields here".
- Drill through**: A section with "Cross-report" and "Off" (radio button selected).
- Cross-report**: A section with "Keep all filters" and "On" (radio button selected). Below it is a link "Add drill-through fields here".

At the bottom of the pane, there is a link "Learn how to create and edit bookmarks".

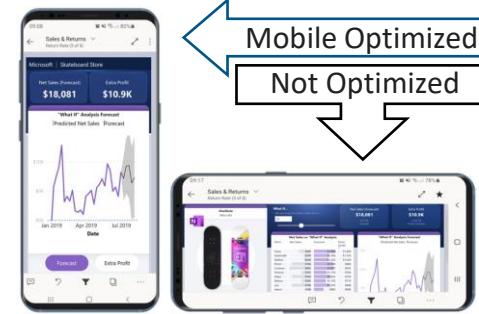
The bookmarks field may not always be visible. You can view it from the View menu and then click Bookmarks.

Bookmarks seem innocent at first but they can be a powerful tool to create pop-ups within a single-page report. This is especially helpful with detailed visuals.

MOBILE VIEW

Mobile users can view any Power BI report page in landscape orientation. However, you can create an additional view that is optimized for mobile devices and displays in portrait orientation. This makes a report Mobile View Optimized.

The screenshot shows the Power BI desktop application. The ribbon at the top has the 'View' tab selected, indicated by a blue arrow pointing to it from the left. Below the ribbon, there's a toolbar with various icons. A second blue arrow points to the 'Mobile' icon in this toolbar, labeled 'Then this'. The main workspace displays a report titled 'Highest rated films' on Netflix. The report includes several visualizations: a bar chart for 'Best films of all time' (Action, Adventure), a table for '2019' (Polar, Extraction, 6 Underground, Point Blank), a table for '2020' (Extraction, Earth and Blood), and a table for '2021' (Extraction). On the right side of the workspace, there's a 'Filters' pane and a 'Fields' pane. The 'Fields' pane lists categories like Film Genres, Film Languages, Film Scores, NetflixOriginals, and Shows_Episodes_Details. At the bottom left, there are navigation buttons for 'Page 1' and a yellow plus sign button.



The first step is to design and create the report in the regular web view. After you've created the report, you can optimize it for phones and tablets.

MOBILE VIEW

Mobile users can view any Power BI report page in landscape orientation. However, you can create an additional view that is optimized for mobile devices and displays in portrait orientation. This makes a report Mobile View Optimized.

The screenshot illustrates a mobile view optimized report in Power BI. The main content area features a smartphone icon displaying a grid-based visualization. To the right, a grid of various Power BI visual components is shown, including cards, charts, and maps. At the bottom, a navigation bar lists several items such as Return Rate, Market Basket Analysis, Net Sales Tooltip, Returns Tooltip, Category Breakdown, Key Influencers, Store Breakdown, Net Sales, What If, RetCategory, RetKeyInfo, RetStoreBre, Q&A1, Q&A2, and Return Rate.

Visuals can be layered one on top of the other to create interactive reports using bookmarks, or to build attractive reports by layering visuals over images. You can change the layering order of the visuals in the Selection pane.

**IF MY DASHBOARD IS “REALLY GREAT” WHY
DO YOU WANT TO EXPORT IT TO EXCEL?**



CLARITY

HOW TO MAKE YOUR REPORTS LOOK BETTER AND READ EASIER

#1
DECLUTTER

#2
MINIMAL
STYLING

#3
CLEAN
LAYOUT

#4
REDUNDANT
INFO

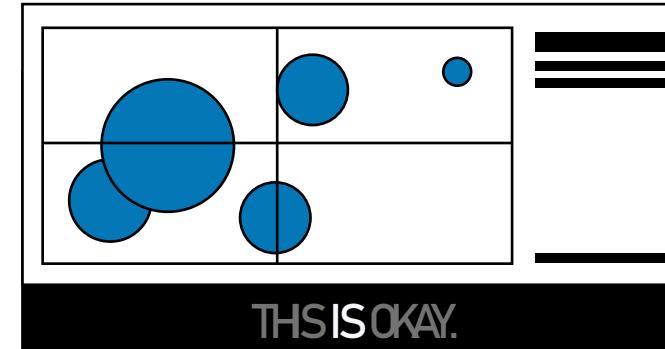
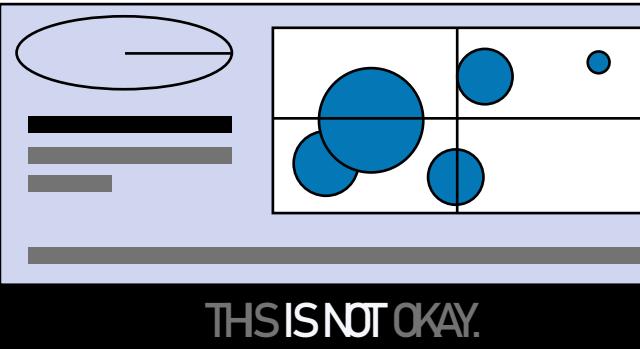
#5
TOO MUCH
DETAIL

#1 DECLUTTERING

The good people at the International Business Communication Standards have provided us with a generalized textbook - found [here](#) – which gives advice on how to convey a message, structure data and declutter visuals. We will focus on decluttering for now.

AVOID CLUTTERED LAYOUTS

Layout concepts often contain elements that lack meaning but merely conform to corporate design or personal taste. Avoid all these elements



AVOID COLOR OR FILLED BACKGROUNDS

Numbers and labels are easiest to read when depicted in black on a white background. Any type of background color or pattern makes something harder to read

SALES	GROWTH
31 056	+412
22 395	+934
8582	-1205

THIS IS NOT OKAY.

SALES	GROWTH
31 056	+412
22 395	+934
8582	-1205

THIS IS OKAY.

AVOID ANIMATION EFFECTS

Animated PowerPoint slides are not useful if the animation has no meaning and does not support the message. They merely distract and confuse.

SALES	GROWTH
31 056	+412
22 395	+934
8582	-1205

THIS IS NOT OKAY.

SALES	GROWTH
31 056	+412
22 395	+934
8582	-1205

THIS IS OKAY.

#2 TOO MUCH STYLE

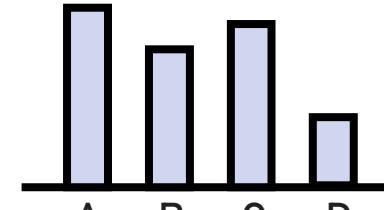
The good people at the International Business Communication Standards have provided us with a generalized textbook - found [here](#) – which gives advice on how to convey a message, structure data and declutter visuals. We will focus on decluttering for now.

AVOID BORDERS, SHADES, 3D

In general, borders, shades, and pseudo-3D convey no meaning and make comprehension more difficult. Shades and pseudo-3D might even give a false visual impression.



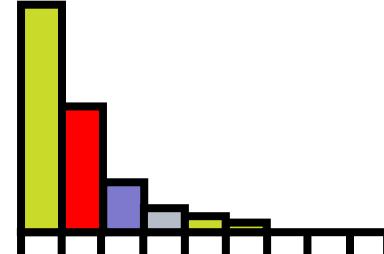
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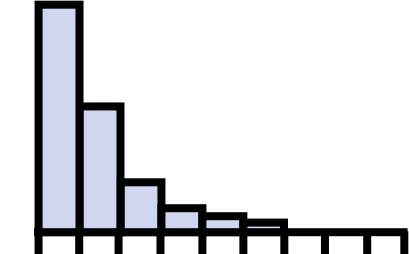
THIS IS OKAY.

AVOID DECORATIVE COLORS

If colors serve merely decorative purpose in one instance, using them for meaning in another instance (e.g. for highlighting) becomes difficult



THIS IS NOT OKAY.



THIS IS OKAY.

AVOID SERIF FONTS

A normal typeface and clear fonts increase legibility. Save bold and cursive fonts for making distinctions

ANNUAL REPORT

ANNUAL REPORT

ANNUAL REPORT

THIS IS NOT OKAY.

**ANNUAL
REPORT**

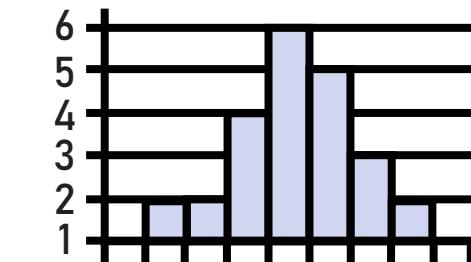
THIS IS OKAY.

#3 CLEAN LAYOUT

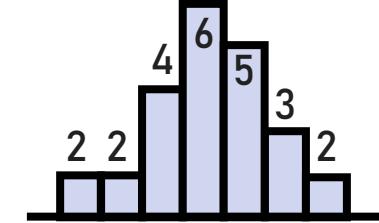
The good people at the International Business Communication Standards have provided us with a generalized textbook - found [here](#) – which gives advice on how to convey a message, structure data and declutter visuals. We will focus on decluttering for now.

AVOID GRID LINES

Using integrated data labels can make value axes, tick marks, and gridlines superfluous. Gridlines, however, can be useful in charts with missing reference points as might be the case in charts with many data series



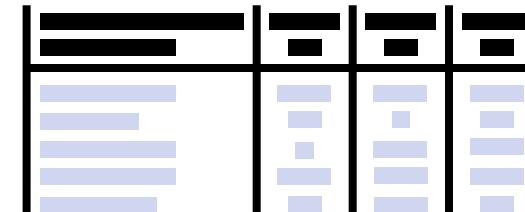
THIS IS NOT OKAY.



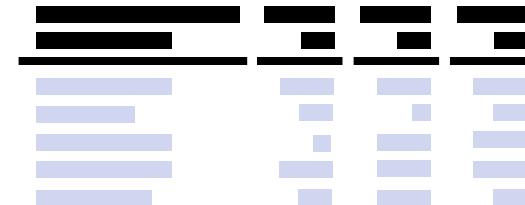
THIS IS OKAY.

AVOID VERTICAL LINES

Omit all avoidable elements to make tables more straightforward. Avoid vertical lines by right-aligning numerical values and the corresponding column headers



THIS IS NOT OKAY.



THIS IS OKAY.

#4 REDUNDANCIES

The good people at the International Business Communication Standards have provided us with a generalized textbook - found [here](#) – which gives advice on how to convey a message, structure data and declutter visuals. We will focus on decluttering for now.

AVOID EXTRA WORDS

Extra words such as “sum” and “total” are redundant because they add no value to the meaning of the term they accompany. No difference exists between “Europe” and “Sum of Europe”.

TOTAL SALES IN EUROPE		Full year 2017
Germany		788
France		34
Italy		122
Rest		345
Sum of Europe		1289

THIS IS NOT OKAY.

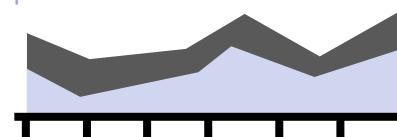
SALES IN EUROPE		2017
Germany		788
France		34
Italy		122
Rest		345
Europe		1289

THIS IS OKAY.

AVOID OBVIOUS TERMS

Terms such as “chart analysis”, “development”, or “comment” are redundant because they name something already shown

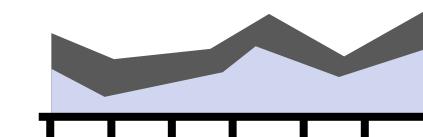
Chart analysis Alpha Corporation Stock development in USD



Comment: Reserved stock not included

THIS IS NOT OKAY.

Alpha Corporation Stock in USD

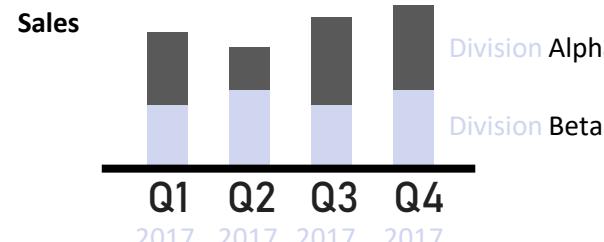


Reserved stock not included

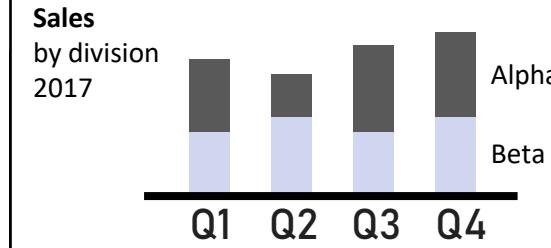
THIS IS OKAY.

AVOID REPEATED WORDS

Repeated words in legends, axis labels, row headers, etc. such as “division” in “division A”, “division B”, etc. or “2017” in “Q1 2017”, “Q2 2017”, etc. should be avoided



THIS IS NOT OKAY.



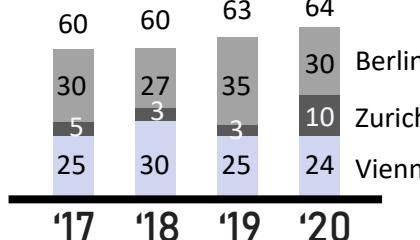
THIS IS OKAY.

#5 TOO MUCH DETAIL

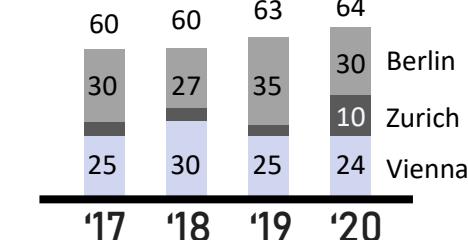
The good people at the International Business Communication Standards have provided us with a generalized textbook - found [here](#) – which gives advice on how to convey a message, structure data and declutter visuals. We will focus on decluttering for now.

AVOID LABELS FOR SMALL VALUES

Labels of small values are often hard to position and rarely contribute to the comprehension of the message. Therefore, they can be avoided in most cases



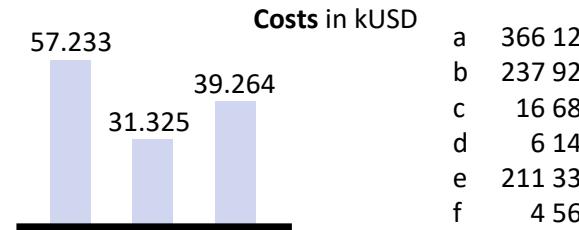
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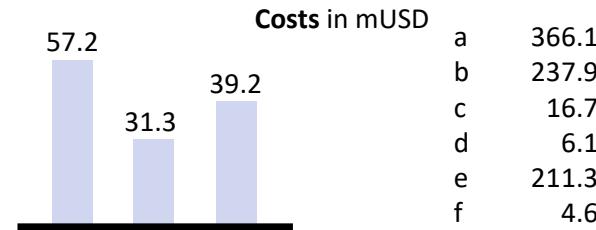
THIS IS OKAY.

AVOID LOOOONG NUMBERS

Numbers with more than three digits in charts and four digits in tables are hard to read; moreover, such precision is seldom necessary to understand the message



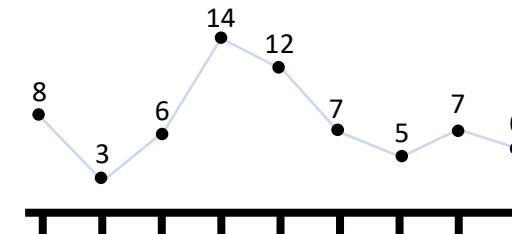
THIS IS NOT OKAY.



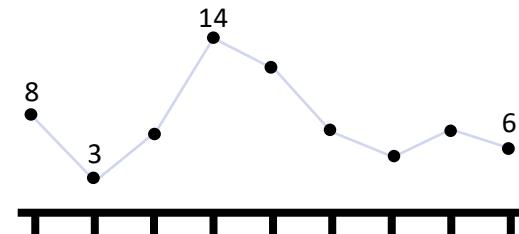
THIS IS OKAY.

AVOID UNNECESSARY LABELS

Omit labels for data points that do not represent extreme values or values of special importance



THIS IS NOT OKAY.



THIS IS OKAY.

CLARITY

HOW TO MAKE YOUR REPORTS LOOK BETTER AND READ EASIER

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#2
MINIMAL
STYLING

#3
CLEAN
LAYOUT

#4
REDUNDANT
INFO

#5
TOO MUCH
DETAIL

BGND

THE SEVEN DEADLY SINS OF DATA VISUALIZATION

#1
SNAKES

#2
NESTED DONUT

#3
SEASHELLS

#4
MOUNTAINS

#5
MINIMAL STYLING

#6
SKYSCRAPERS

#7
BABY CUBES

#1 SNAKES

Have you ever seen a CRM or ERP dashboard design that features juicy 3D tubes as graphs?

Although such visualizations might seem visually appealing, **they are helpless against real data** and — even more important — are difficult to use.

Almost everything is the decoration on the chart, whereas the real data consists of only 10 data points.

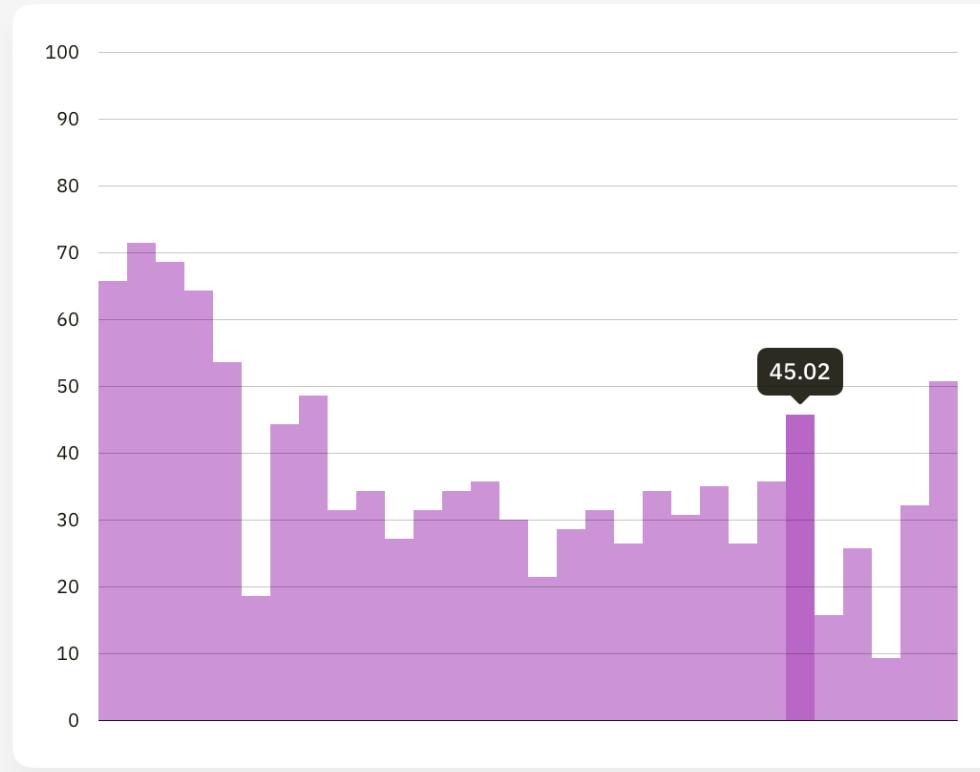
THIS IS NOT OKAY.



#1 SNAKES

How to avoid:

- If there are few data points, use a bar chart
- If there are many data points, meaning the data is continuous, think of a simple thin graph.



THIS IS BETTER

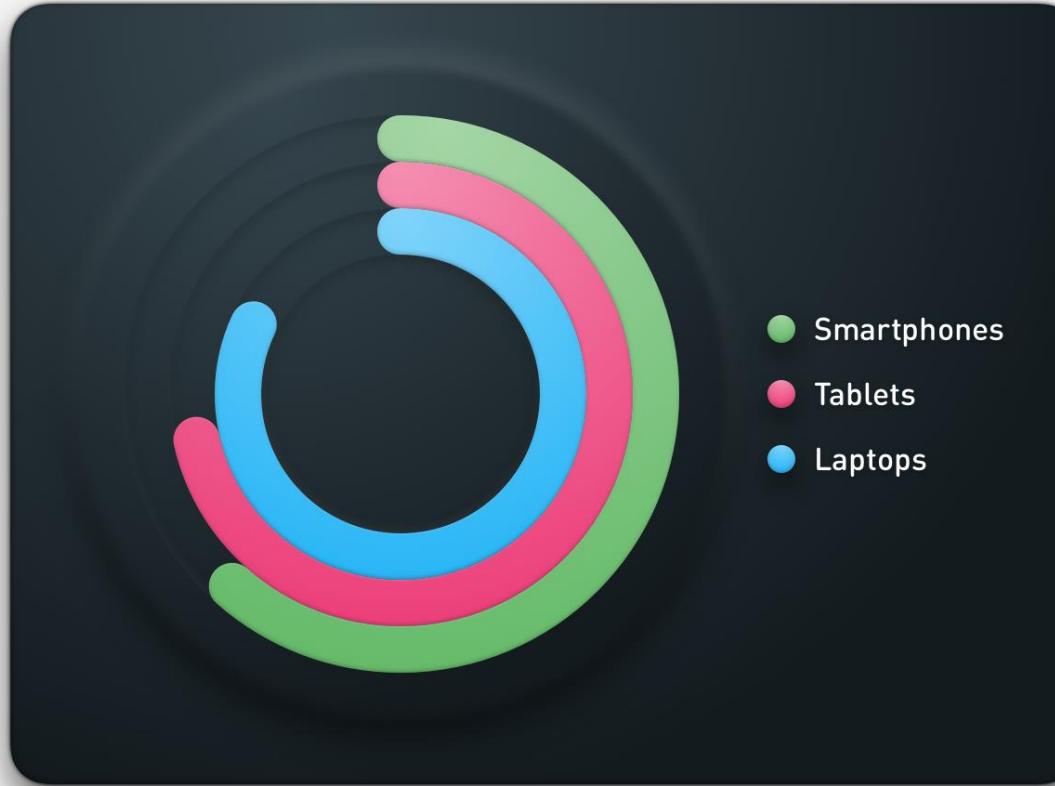
#2 NESTED DONUT

Like the “snakes”, “donuts” also impact accuracy and turn data comparison into hurdling.

People can more or less handle even percentages: full circle = 100%, half a circle = 50%, a quarter = 25.

But what if a circle ends somewhere between the “half” and “three-thirds” — like the green one on the picture? How quickly can you calculate $50 + 25 \div 2$ and assume it should be around 62.5%?

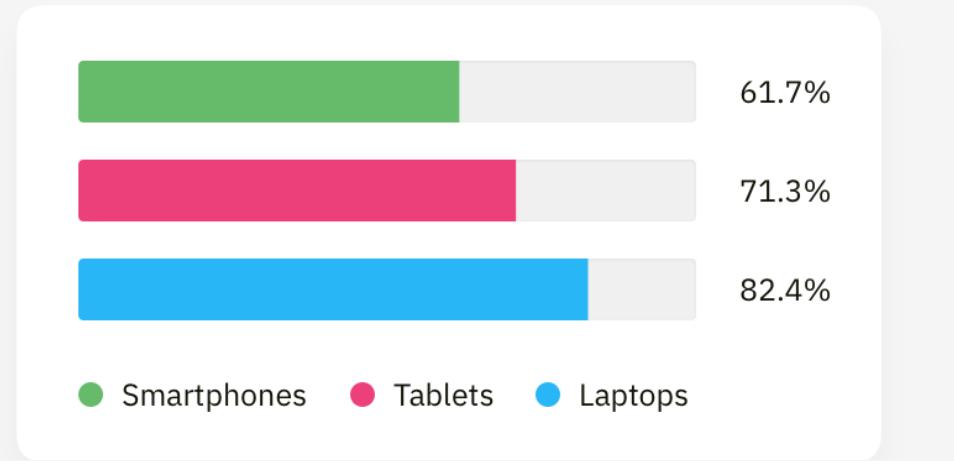
THIS IS NOT OKAY.



#2 NESTED DONUT

The good news is the chart can be much simpler.

Three bars communicate the same information, require less space, and expose numbers without tooltips, which is vital for data-driven interfaces.

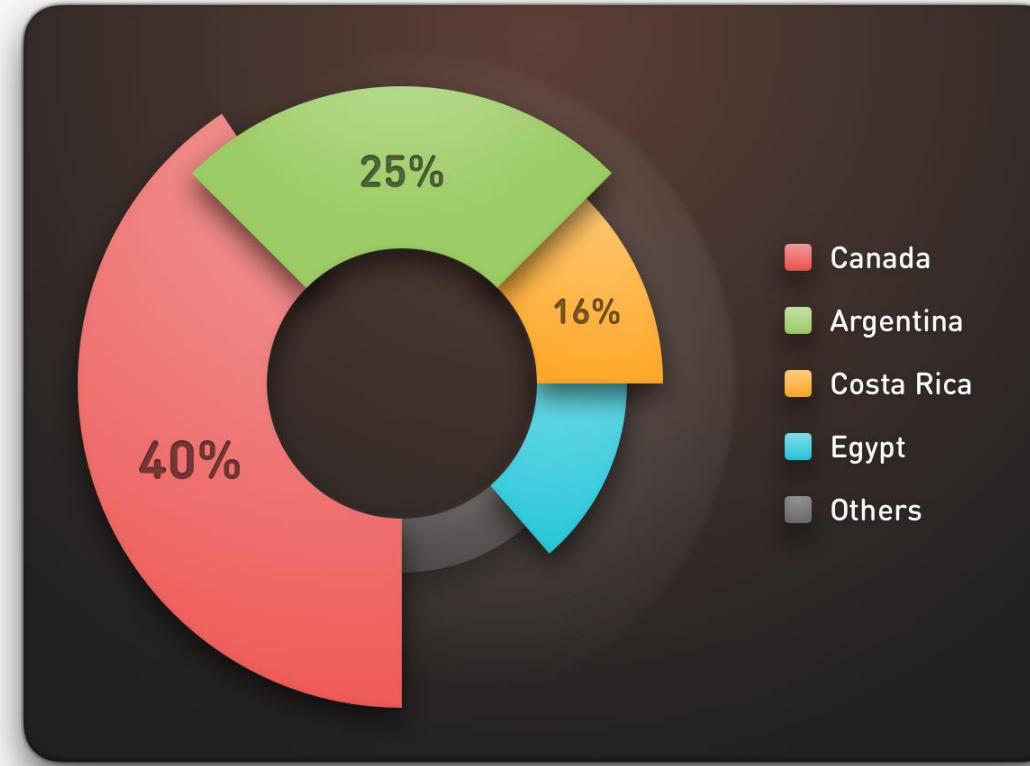


THIS IS BETTER

#3 SEASHELLS

Edward Tufte, a famous statistician and author of fundamental books on data visualization, warned many times that visually appealing charts could lie. “Seashells” are a trendy variation of donut charts, where colored segments have varying width and overlap with each other.

And what is the logic behind the overlaps and overshoots? How does one interpret this “data”? Does it mean that the chart shows more than 100% and more than 360 degrees?

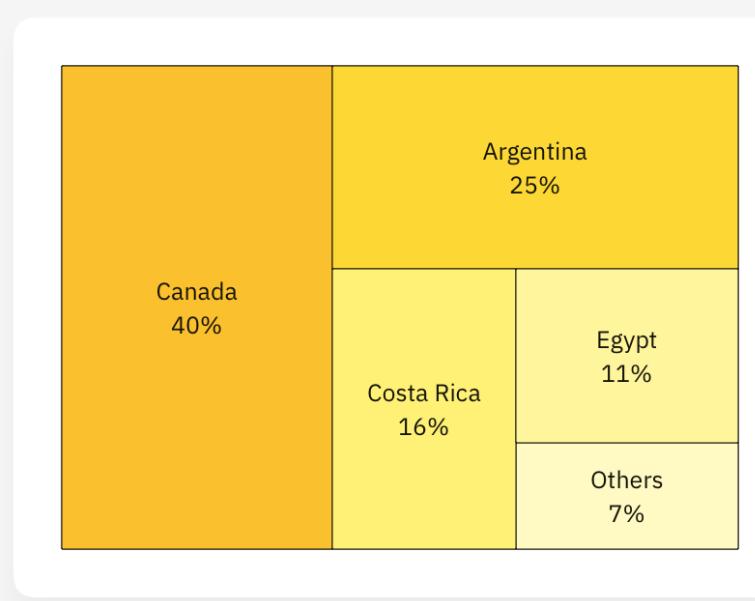


THIS IS NOT OKAY.

#3 SEASHELLS

Besides, you can use such a chart type as a treemap, where rectangles of corresponding areas represent the percentage

Although people are usually the best at comparing lengths — ave bar charts! — areas are well comparable by the eye, too.

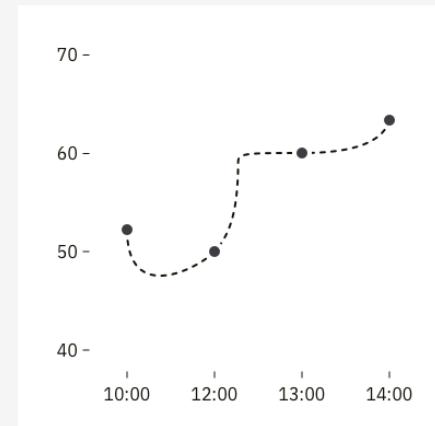
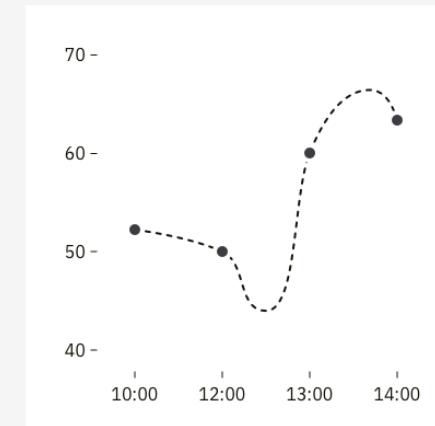
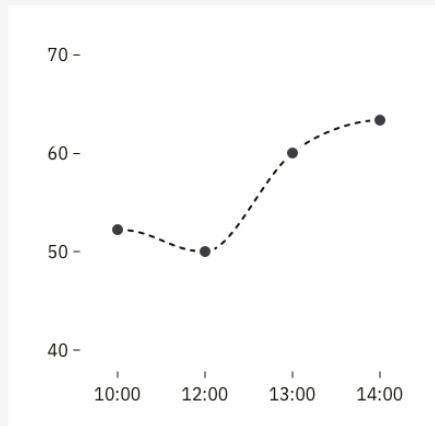
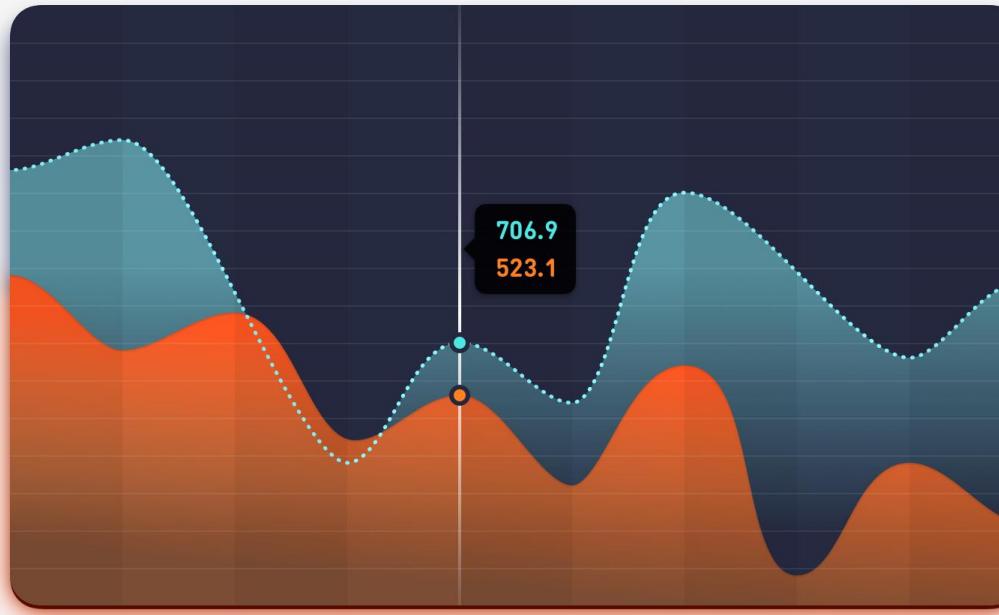


THIS IS BETTER

#4 MOUNTAINS

All the connecting curves have nothing to do with data; they are added artificially. Maybe for a good sake — to unite separate points into a clear trend, or perhaps to fill in the “gaps” and make it look “nicer.”

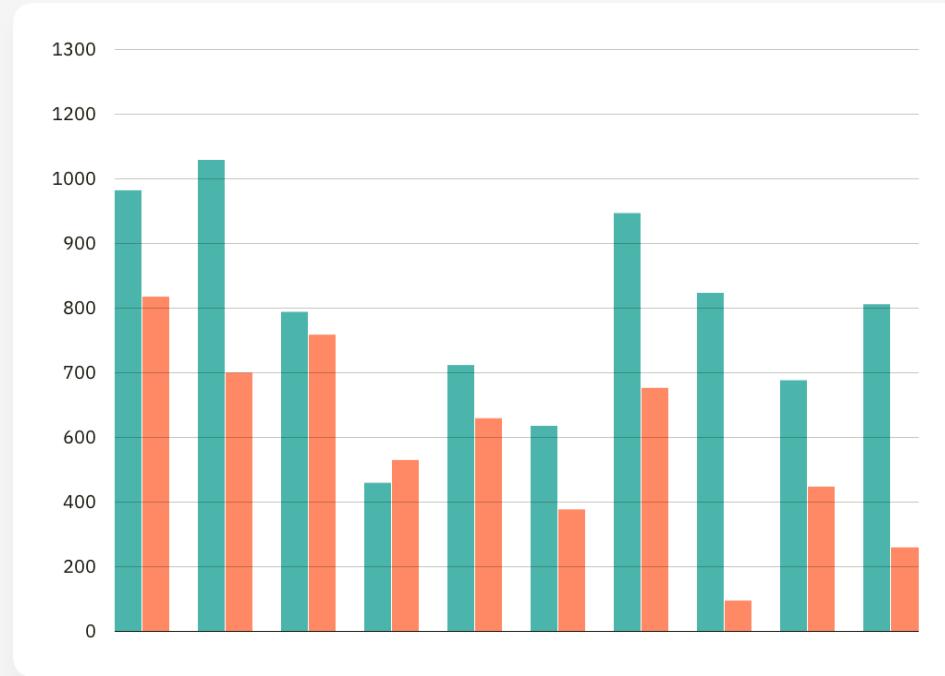
Standard business mountains



THIS IS NOT OKAY.

#4 MOUNTAINS

And the fewer points a chart has, the wider space is left for speculations.



#5 SAUSAGES

Well, what's wrong with this chart? Why cannot we have something more attractive and original than dull rectangles? I should admit 3D "sausages" aren't a good option, and here is why.

Such visualizations have quite a few issues, but the key concern is *stolen* data. "Sausages" are the real thieves of the interface world since they show empty spaces where there is real data.



THIS IS NOT OKAY.

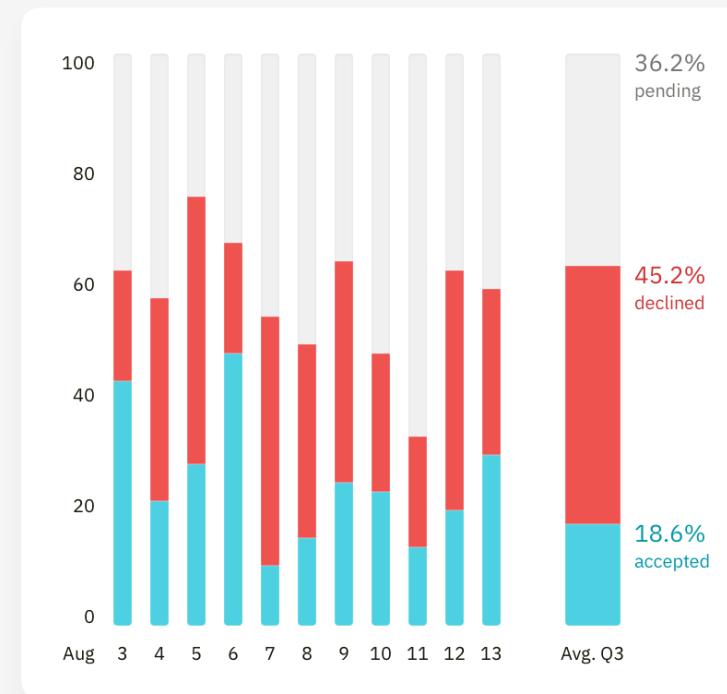
#5 SAUSAGES

I put the missing bar parts back on the suggested variant below and got rid of the legend as a separate item. Besides, the former untitled donut part received a new format and a name (average for the fourth quarter).

How to avoid

- Don't break monolith data by spacing. Typically, don't add gaps between portions, the sum of which should equal 100%.
- Check if the chart edges are reasonably rounded — too much roundness disguises valuable bits of data.

THIS IS BETTER



#6 SKYSCRAPERS

3D charts lack accuracy and are a severe obstacle when users quickly scan through the interface to spot anomalies and tendencies.

However, accuracy is not the only issue. As Master Yoda says in memes, “There is another.” Already guessed? I mean compactness and an ability to reflect natural, subtle fluctuations of data — not this exaggerated rollercoaster with always alternating ups and downs.

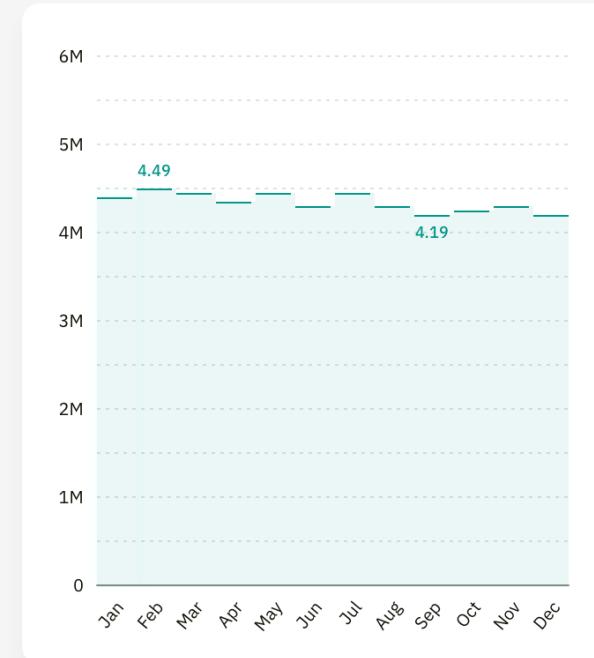
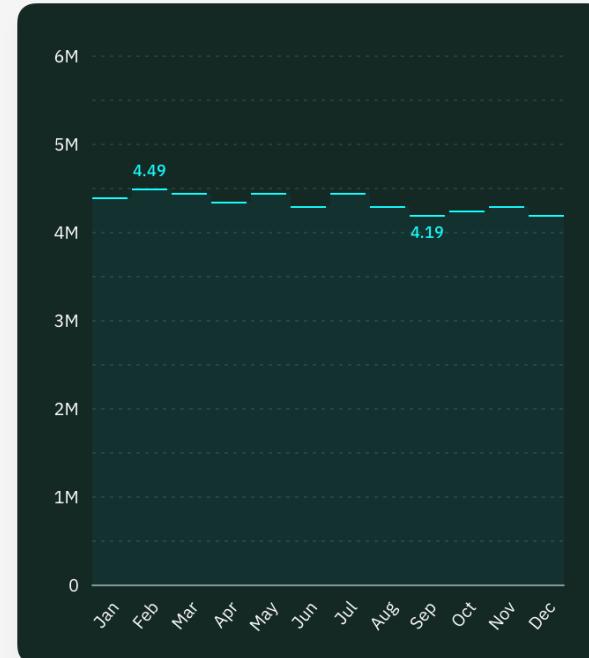


THIS IS NOT OKAY.

#6 SKYSCRAPERS

If you keep it simple, subtle shifts of the measured parameter will be better distinguishable. And it can stay dark-themed if the proper accuracy and highlights are there, for example, the top- and bottom-most values within a selected time range.

By the way, I haven't squeezed the bar width, but the chart now is twice narrower!

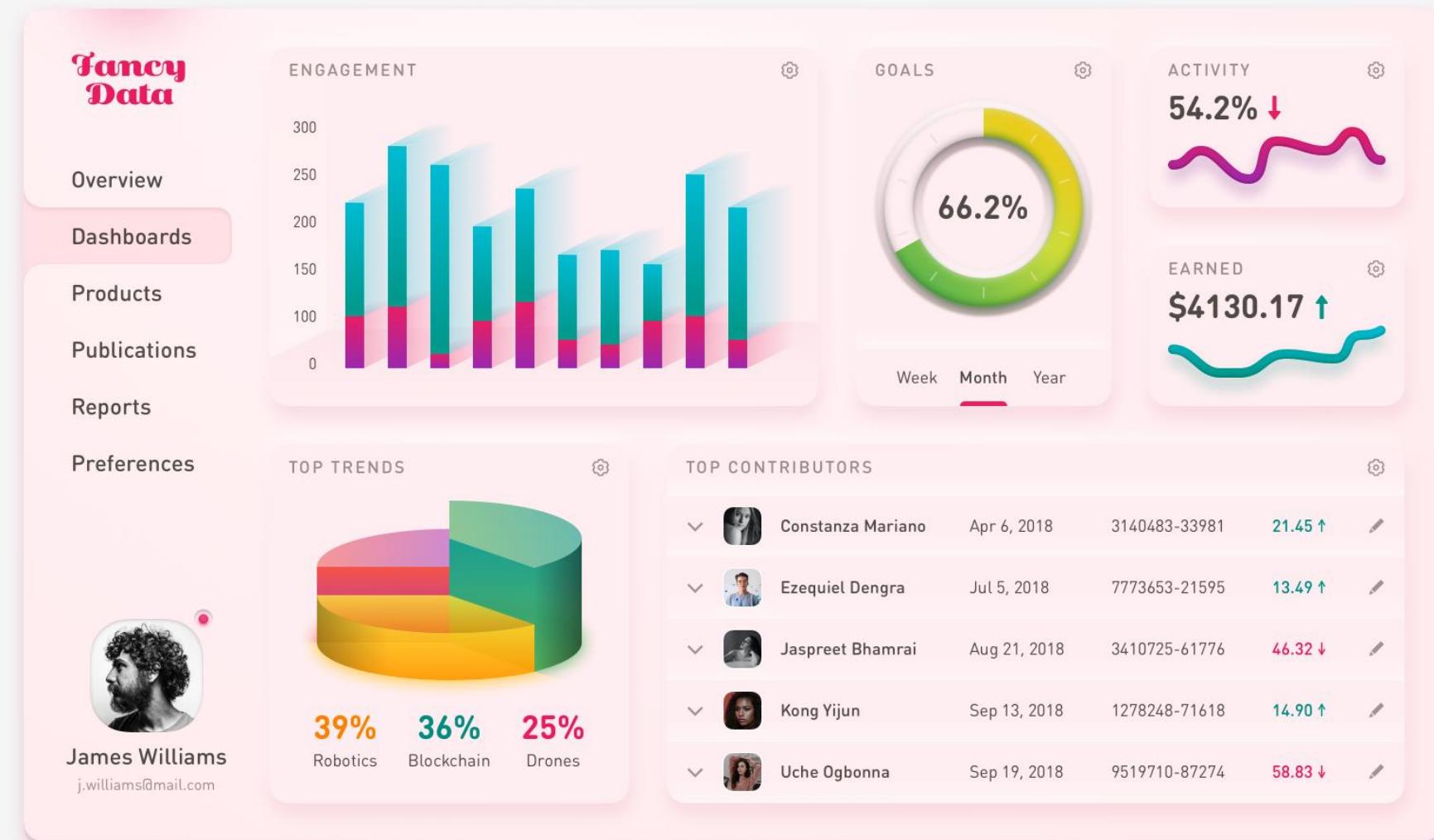


THIS IS BETTER

#7 BABY CUBES

If you have kids, you might know about a toy called baby cube or activity cube. It's a box with various handles, latches, sockets, switches, abacuses, buttons, figures, etc. attached to its sides.

And how does that relate to data visualization? Nowadays, I see a harmful designers' practice of drawing visually appealing dashboards that, upon closer examination, can bring little value in reality.

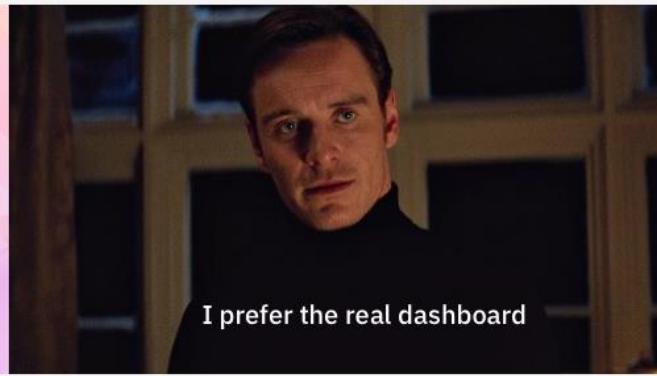


THIS IS NOT OKAY.

#7 BABY CUBES

“Baby cubes” are a junction of all dangerous styles from the previous chapters — a misleading illustration rather than a useful tool. As you can notice in the example, it’s full of trendy details: shadows, transparency, volume, glow, rounding, isometric shapes, etc. However, all the widgets are dumb: they fill in the screen space but provide zero insight.

There won’t be a “correct” example here because we’ve already dwelled on how to fix data visualizations.





#5 SHARING & COLLABORATION

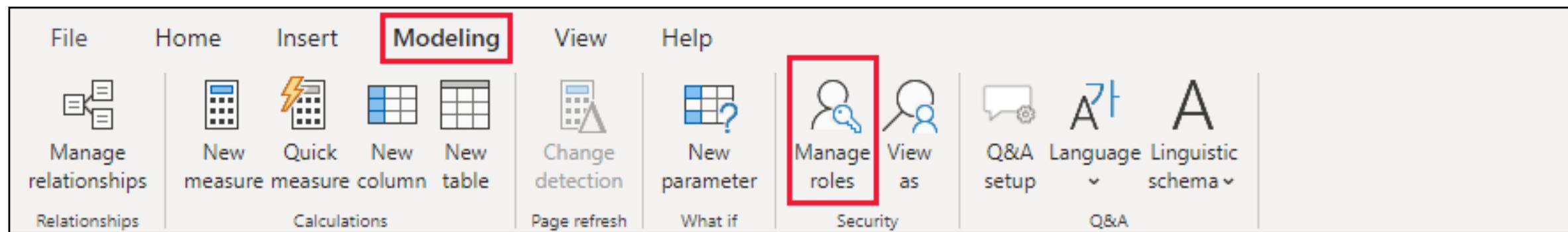
Enabling access and edit rights in a secure way

The Microsoft Power BI service (app.powerbi.com), sometimes referred to as Power BI online, is the SaaS (Software as a Service) part of Power BI

The screenshot shows the Microsoft Power BI Service home page. At the top left is the user profile 'pmOne'. To its right are the 'Power BI' logo and 'Home' link. On the far right, there's a 'Trial: 37 days left' message, a search bar with a magnifying glass icon, and a three-dot menu. The main content area starts with a greeting 'Good afternoon, Kristiyan' and a subtitle 'Find and share actionable insights to make data-driven decisions'. Below this is a 'Recommended' section featuring three placeholder cards with horizontal bars at the top and bottom.

ROW-LEVEL SECURITY

Row-level security (RLS) with Power BI can be used to restrict data access for given users. Filters restrict data access at the row level, and you can define filters within roles. In the Power BI service, members of a workspace have access to datasets in the workspace. RLS doesn't restrict this data access.



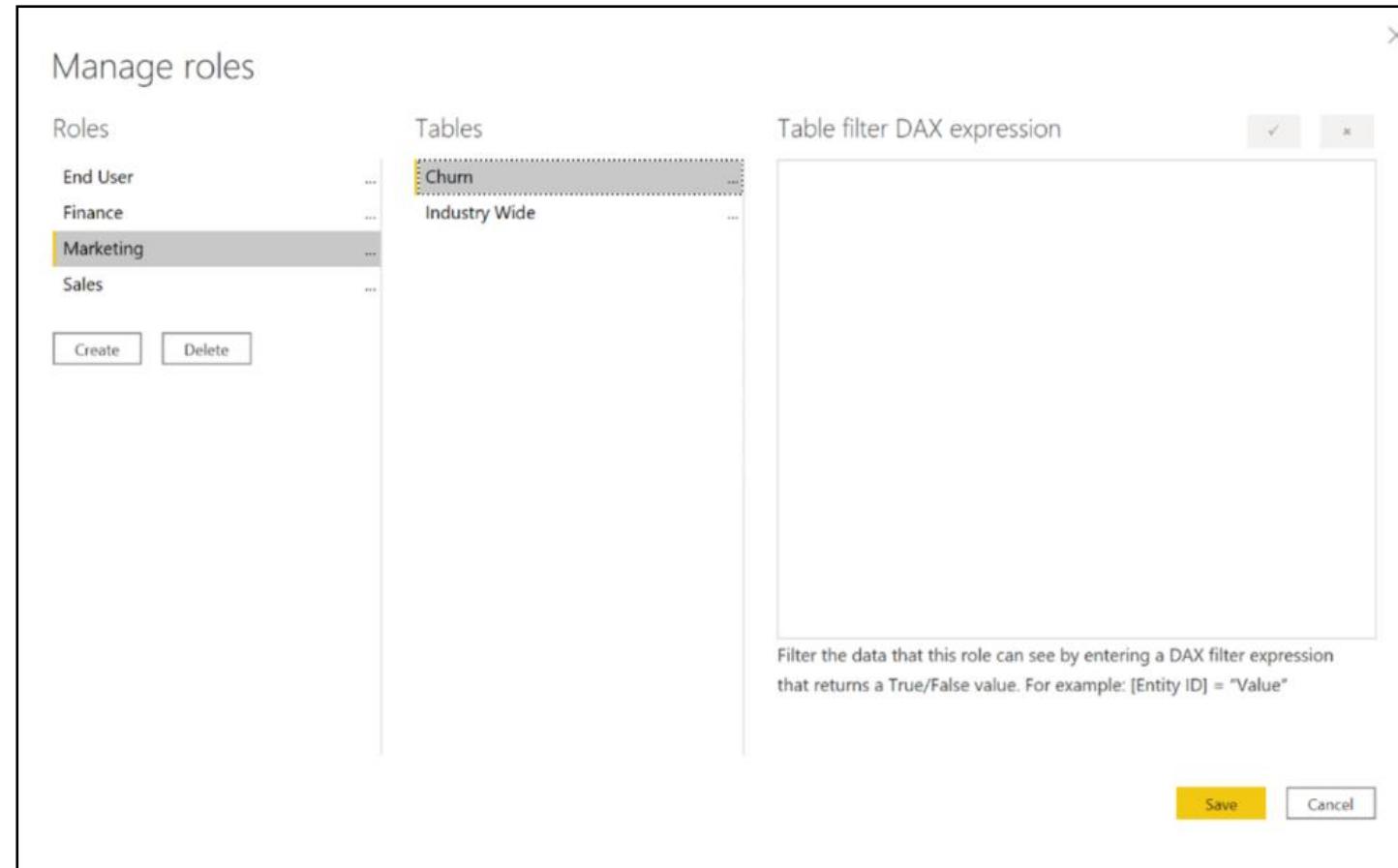
The 'Manage roles' dialog box is open. It has two main sections: 'Roles' and 'Tables'. The 'Roles' section contains a table with one row for 'Eastern US' (highlighted with a yellow background). Below the table are 'Create' and 'Delete' buttons. The 'Tables' section lists several tables: Date, Geo, Manufacturer, Product, SalesFact, and Sentiment. To the right, there is a 'Table filter DAX expression' input field containing '[Region] = "East"', with a red box highlighting the text. There are also checkmark and delete buttons for the DAX expression.

After you've created your roles, test the results of the roles within Power BI Desktop. You need to go to View As to check how shared users will see the report.

The 'View as roles' dialog box is open. It shows three checkboxes: 'None' (checked), 'Other user' (unchecked), and 'Eastern US' (unchecked). To the right, there is a text input field containing 'john@contoso.com'.

OBJECT-LEVEL SECURITY

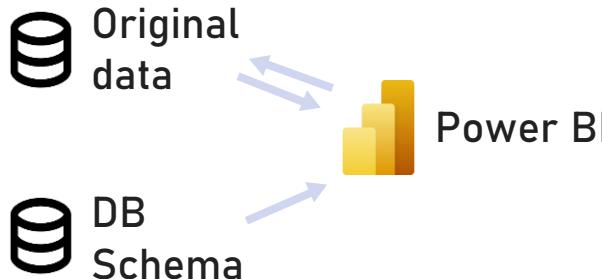
Object-level security (OLS) enables model authors to secure specific tables or columns from report viewers. From a viewer standpoint, the table or column simply does not exist. With object-level security, you can not only restrict access to data, but also sensitive object names.



AUTO-REFRESH

DIRECT QUERY

Power BI copies the DB schema and feeds the data directly from the source. This is best for massive datasets.



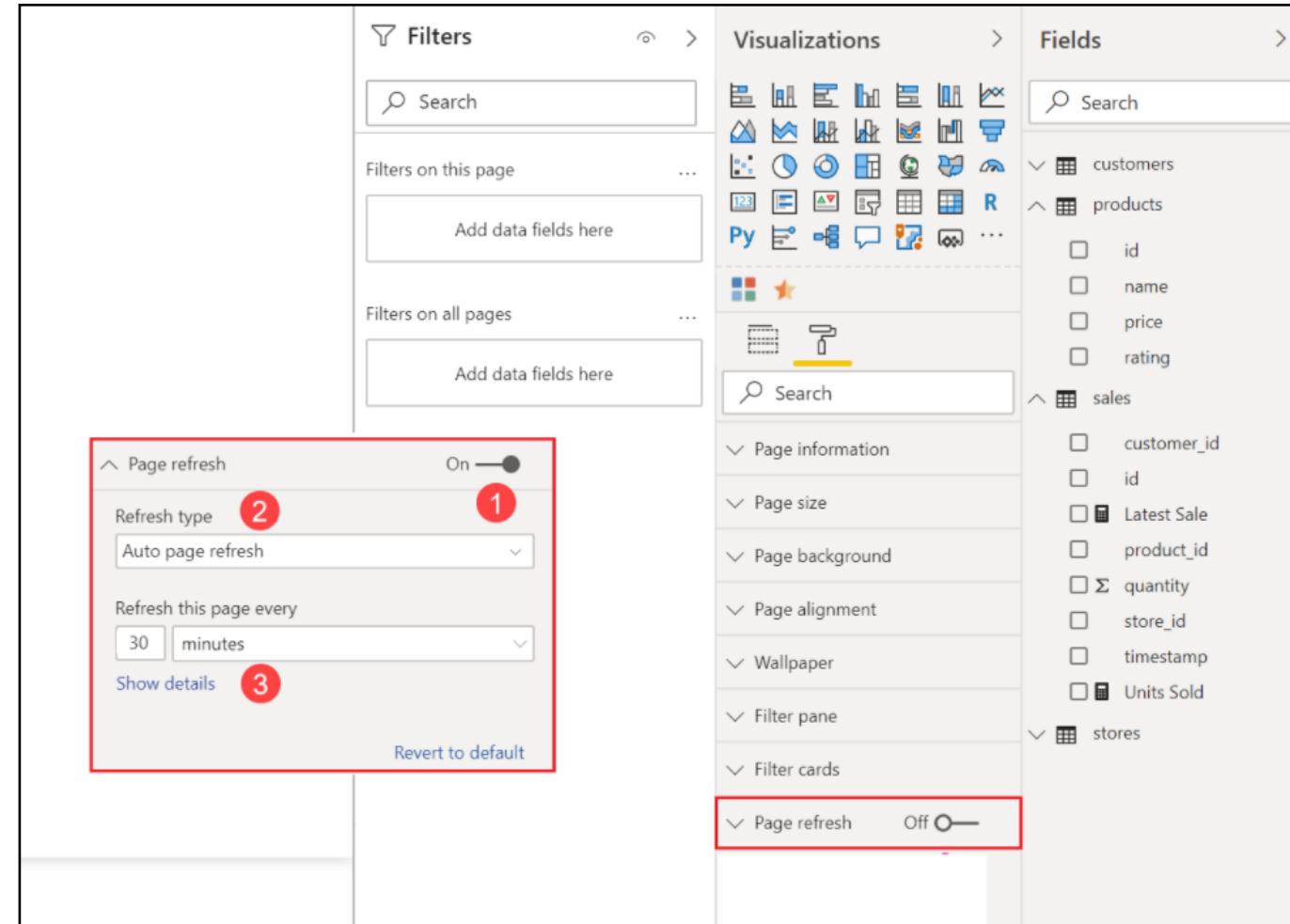
Benefits:

- Great for billions of rows

Restrictions:

- Not all sources support direct query

When you monitor critical events, it's important for data to be refreshed as soon as the source data is updated. For example, in the manufacturing industry, it's critical to know when a machine is malfunctioning or is close to malfunctioning.

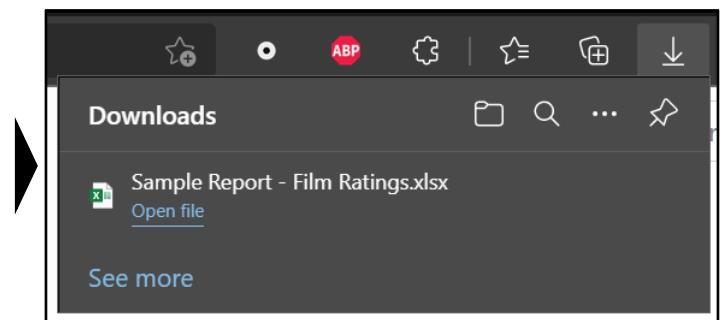


ANALYZE IN EXCEL

With Analyze in Excel, you can bring Power BI datasets into Excel, and then view and interact with them using PivotTables, charts, slicers, and other Excel features. To use Analyze in Excel you must first download the feature from Power BI, install it, and then select one or more datasets to use in Excel.

The screenshot shows the Power BI 'My workspace' interface. On the left is a navigation sidebar with options like Home, Favorites, Recent, Create, Datasets, Goals, Apps, Shared with me, Deployment pipelines, Learn, Workspaces, and My workspace. The main area displays a list of datasets under 'My workspace'. A context menu is open over the fourth dataset in the list, titled 'Analyze in Excel'. The menu includes options such as Create report, Create paginated report, Delete, Get quick insights, Security, Rename, Settings, Download the .pbix, Manage permissions, and View lineage. The dataset list table has columns for Name, Owner, Refreshed, and Next refresh. The dataset 'Adventure Works Revenue Analysis' is listed twice.

Name	Owner	Refreshed	Next refresh
Adventure Works Revenue Analysis	Kristiyan Stefanov	8/19/21, 12:05:52 PM	—
Adventure Works Revenue Analysis	Kristiyan Stefanov	8/19/21, 12:05:52 PM	N/A
Sample Report - Film Ratings	Kristiyan Stefanov	8/18/21, 2:09:04 PM	—
Sample Report - Film Ratings	Kristiyan Stefanov	8/18/21, 2:09:04 PM	N/A



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