

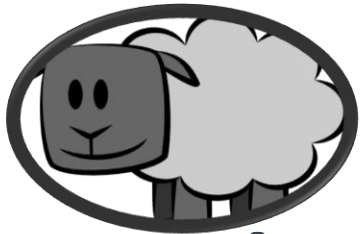


# Calculation Groups

Jason Romans

# Jason Romans

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**The Dax Shepherd**

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*Live in Nashville, TN*



*Started as SQL Server DBA*



*Transitioned to the Microsoft BI Stack*



*Work on everything from SQL Server Integration Services, SQL Server Database, Analysis Services, and Power BI*

# Agenda

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1. Why Calculation Groups
2. Creating Calculation Groups
3. Multiple Calculation Groups
4. DAX Code
5. Best Practices
6. Conclusion

# Agenda

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**1. Why Calculation Groups**

2. How to Create

3. Calculation Item Order

4. Calculation Group Precedence

5. Best Practices

6. Conclusion

It starts with one measure...

Sales Amount

Now, need to create a version for different time periods

Sales Amount MTD – Month to Date

Sales Amount QTD – Quarter to Date

Sales Amount YTD – Year to Date

Sales Amount SPLY – Same Period Last Year

Can you do the  
same for this  
measure?

---

Total Cost

- Total Cost QTD
- Total Cost MTD
- Total Cost YTD
- Total Cost SPLY



And Now These...

- Margin
- Margin %
- Volume
- EBITDA



It starts to get a  
little tangled





# Difficult to Manage Variations

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For each measure

--you may have at least 5  
variations

# Not easy to switch between on visual

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If you have YTD measures

- want to see Same Period Last Year

**We need a better way**

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# The Pattern is the Same

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- Sales Amount
- Total Cost
- Margin

YTD

YTD

YTD

# It is the measure that changes



Sales Amount	YTD
Total Cost	YTD
Margin	YTD




# Placeholder for the Measure



<div data-bbox="155 406 1116 1156"></div> <div>Sales Amount</div> <div>Total Cost</div> <div>Margin</div>	<div>YTD</div> <div>YTD</div> <div>YTD</div>
---	--

Measure\_Variable??




# Rest of the Code is the Same



Sales Amount	YTD
Total Cost	YTD
Margin	YTD

`CALCULATE (`  
    `Measure_Variable,`  
    `DATESYTD ('Date'[Date]))`



# Only Need to Write Pattern One Time

YTD =

```
CALCULATE (
    Measure_Variable,
    DATESYTD ( 'Date'[Date] )
)
```

# Introducing SELECTEDMEASURE()

---



YTD =

```
CALCULATE (
    SELECTEDMEASURE(),
    DATESYTD ( 'Date'[Date] )
)
```

---

This is the business use case  
Calculation Groups are designed to  
solve



---

# Less measures to maintain

---

But there is more – you can use them in unique ways like a slicer for the user to choose between

# Calculation Groups

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- Reuse already established Measures
- Apply it to multiple measures
- Control formatting

# What Does this Look Like

---

# Time Intelligence – 1 Measure

## Sales Amount

Year	Current	QTD	YTD	SPLY	Time Intelligence
2018	4,984,304.80	1,237,622.62	4,984,304.80	3,033,305.02	<div>Current</div> <div>MTD</div> <div>QTD</div> <div>YTD</div> <div>SPLY</div>
Jan	636,983.88	636,983.88	636,983.88		
Feb	788,062.88	1,425,046.76	1,425,046.76		
Mar	269,320.40	1,694,367.17	1,694,367.17		
Apr	27,644.10	27,644.10	1,722,011.26		
May	510,486.78	538,130.88	2,232,498.04	168,392.56	
Jun	413,325.23	951,456.11	2,645,823.27	263,600.69	
Jul	348,977.82	348,977.82	2,994,801.09	204,281.19	
Aug	392,499.67	741,477.49	3,387,300.76	312,793.50	
Sep	359,381.42	1,100,858.91	3,746,682.18	334,423.50	
Oct	394,691.65	394,691.65	4,141,373.83	402,067.05	
Nov	329,846.47	724,538.12	4,471,220.30	438,804.70	
Dec	513,084.50	1,237,622.62	4,984,304.80	908,941.83	
<b>Total</b>	<b>4,984,304.80</b>	<b>1,237,622.62</b>	<b>4,984,304.80</b>	<b>3,033,305.02</b>	



# Time Intelligence – 2 Measures

## Sales Amount & Total Cost

Time Intelligence YTD			SPLY	
Year	Sales Amount	Total Cost	Sales Amount	Total Cost
☐ 2018	4,984,304.80	2,193,394.99	3,033,305.02	1,335,411.56
Jan	636,983.88	278,700.85		
Feb	1,425,046.76	618,998.60		
Mar	1,694,367.17	737,421.60		
Apr	1,722,011.26	748,655.63		
May	2,232,498.04	969,453.25	168,392.56	69,007.25
Jun	2,645,823.27	1,154,001.07	263,600.69	116,482.16
Jul	2,994,801.09	1,304,716.63	204,281.19	89,144.35
Aug	3,387,300.76	1,477,938.90	312,793.50	143,531.77
Sep	3,746,682.18	1,639,576.74	334,423.50	147,223.18
Oct	4,141,373.83	1,813,779.76	402,067.05	182,879.12
Nov	4,471,220.30	1,962,431.50	438,804.70	197,499.12
Dec	4,984,304.80	2,193,394.99	908,941.83	389,644.61
Total	4,984,304.80	2,193,394.99	3,033,305.02	1,335,411.56

Time Intelligence

☐ Current

☐ MTD

☐ QTD

■ YTD

■ SPLY

Time Intelligence

☐ Current

☐ MTD

☐ QTD

☒ YTD

☒ SPLY

# 2 Measures with Time Intelligence and Statistics (MAX, MIN, AVG)

Both MAX Time Intelligence Year	No Time Intelligence		YTD	
	Current		YTD	
	Sales Amount	Total Cost	Sales Amount	Total Cost
☐ 2018	<b>788,062.88</b>	<b>340,297.75</b>	<b>788,062.88</b>	<b>340,297.75</b>
Jan	636,983.88	278,700.85	636,983.88	278,700.85
Feb	788,062.88	340,297.75	788,062.88	340,297.75
Mar	269,320.40	118,423.00	788,062.88	340,297.75
Apr	27,644.10	11,234.03	788,062.88	340,297.75
May	510,486.78	220,797.62	788,062.88	340,297.75
Jun	413,325.23	184,547.82	788,062.88	340,297.75
Jul	348,977.82	150,715.56	788,062.88	340,297.75
Aug	392,499.67	173,222.27	788,062.88	340,297.75
Sep	359,381.42	161,637.84	788,062.88	340,297.75
Oct	394,691.65	174,203.02	788,062.88	340,297.75
Nov	329,846.47	148,651.74	788,062.88	340,297.75
Dec	513,084.50	230,963.49	788,062.88	340,297.75
<b>Total</b>	<b>788,062.88</b>	<b>340,297.75</b>	<b>788,062.88</b>	<b>340,297.75</b>

# Are Calculation Groups New

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- Since about 2019
- Needed to use Tabular Editor
- Power BI Desktop October 2023 Release (Preview)
  - Will increase the adoption rate

# Agenda

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1. Why Calculation Groups
- 2. Creating Calculation Groups**
3. Calculation Item Order
4. Calculation Group Precedence
5. Best Practices
6. Conclusion

# Two Ways

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## Tabular Editor

- Up till the October 2023 release - only way

## Power BI Desktop (Preview)

- October 2023 release or newer

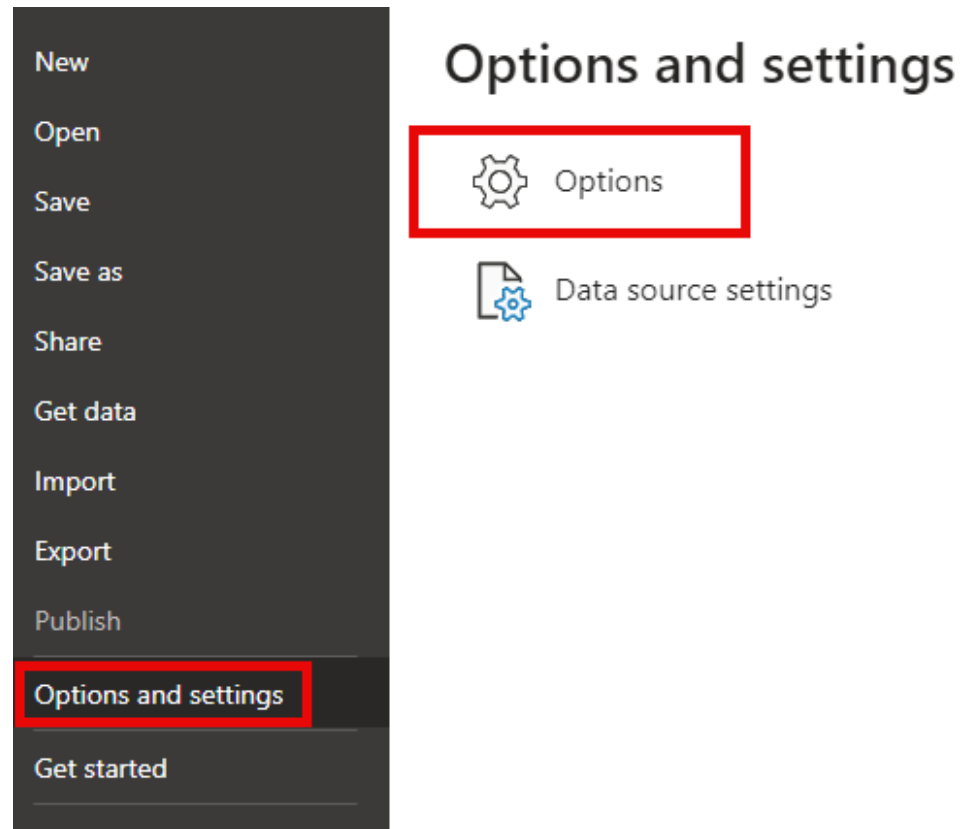


# Creating in Power BI Desktop

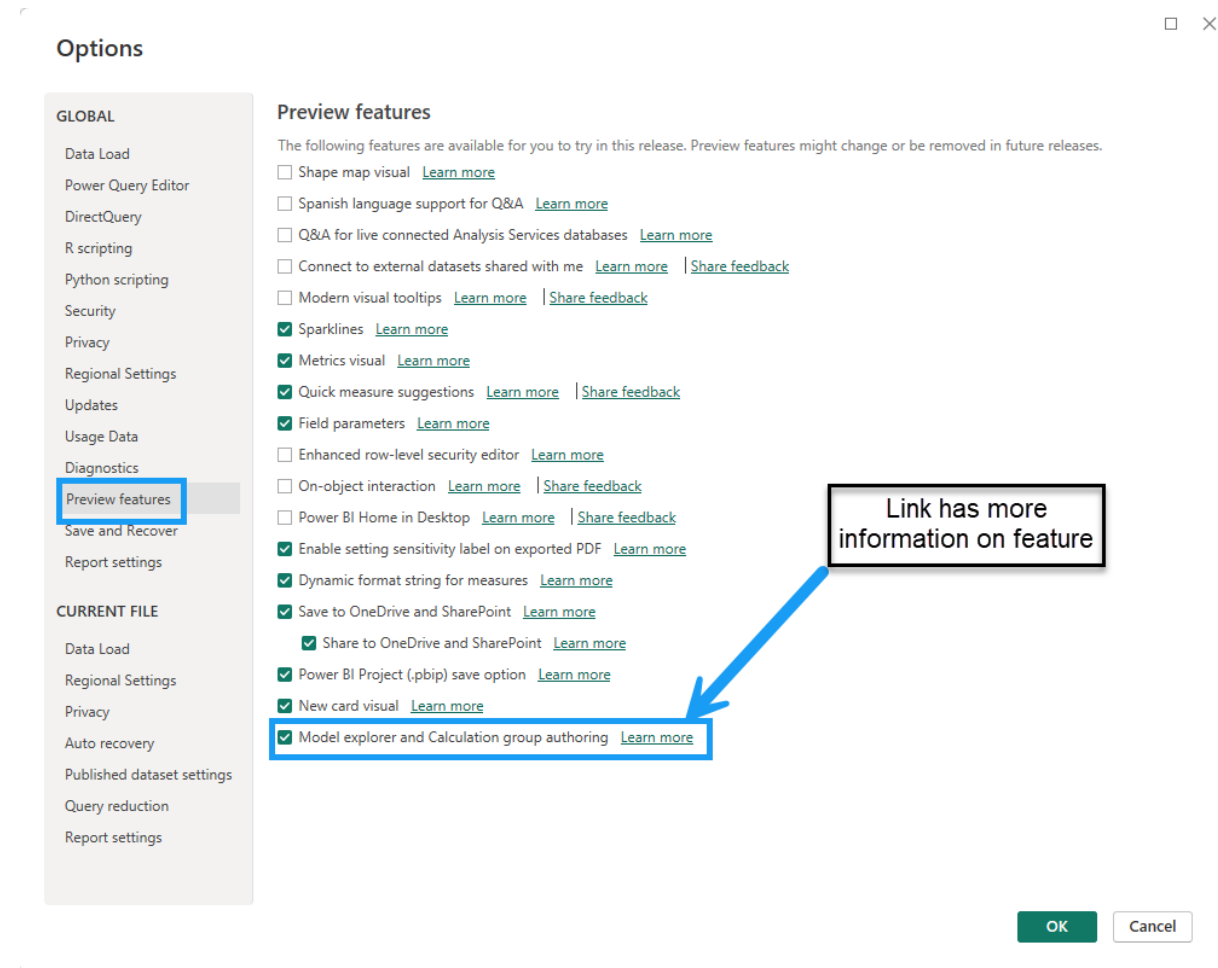
---

# Power BI Desktop Enable Preview - Options

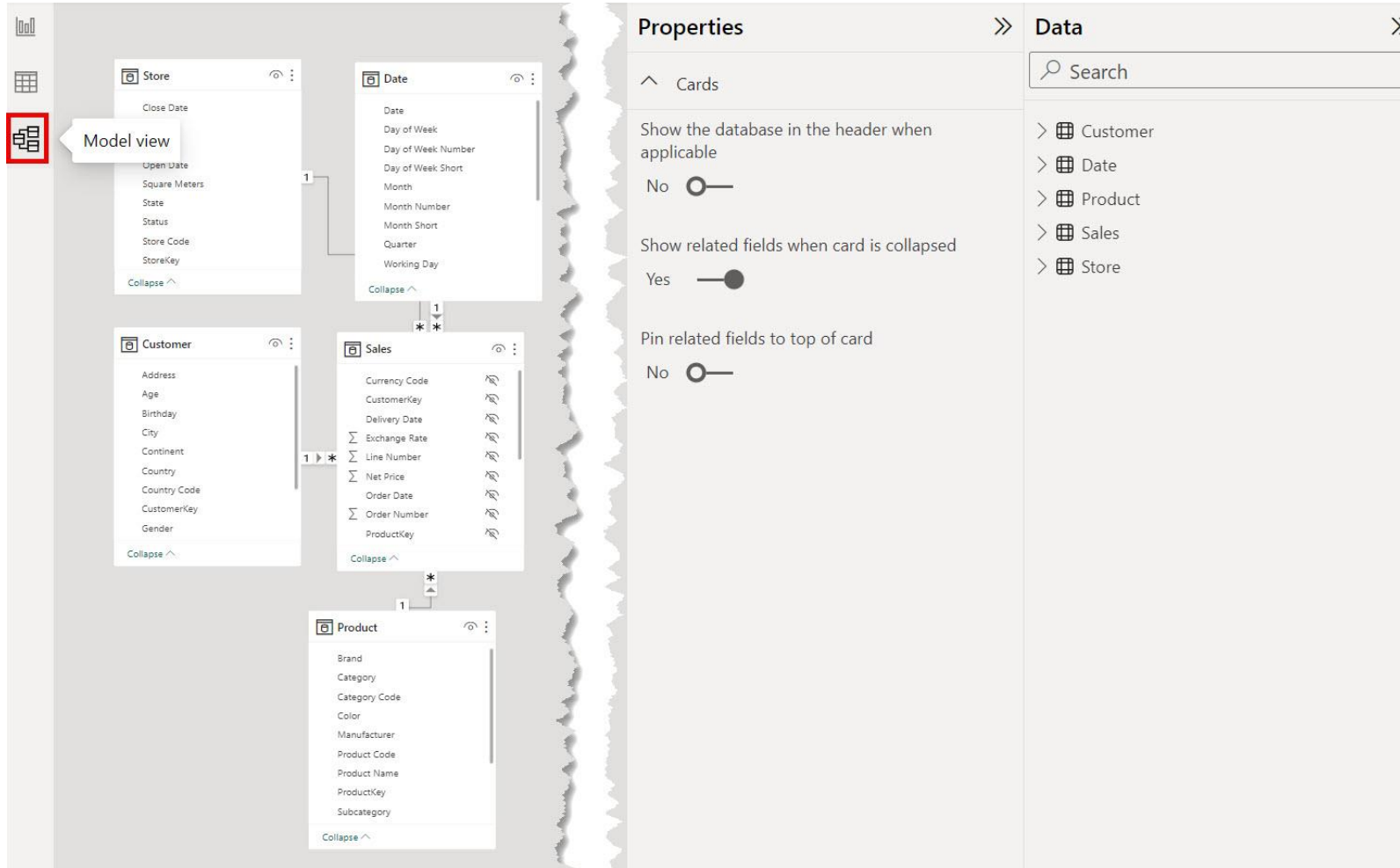
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# Power BI Enable Preview



# Power BI – Model Explorer Not Enabled



# Power BI – Model View - Tables

The screenshot displays the Power BI Model View interface. On the left, a list of tables is shown: Store, Date, Customer, Sales, and Product. Each table is represented by a card with its fields listed below. The Store card includes fields like Close Date, Open Date, Square Meters, State, Status, Store Code, and StoreKey. The Date card includes Date, Day of Week, Day of Week Number, Day of Week Short, Month, Month Number, Month Short, Quarter, and Working Day. The Customer card includes Address, Age, Birthday, City, Continent, Country, Country Code, CustomerKey, and Gender. The Sales card includes Currency Code, CustomerKey, Delivery Date, Exchange Rate, Line Number, Net Price, Order Date, Order Number, and ProductKey. The Product card includes Brand, Category, Category Code, Color, Manufacturer, Product Code, Product Name, ProductKey, and Subcategory. Relationships are indicated by lines connecting the tables: Store to Date (1 to 1), Store to Customer (1 to \*), Customer to Sales (1 to \*), and Product to Sales (1 to \*). A red box highlights the 'Model view' icon in the top left corner.

**Properties**

Cards

Show the database in the header when applicable

No ☐

Show related fields when card is collapsed

Yes ☒

Pin related fields to top of card

No ☐

**Data**

**Tables** Model

Search

- > Sales
- > Customer
- > Date
- > Product
- > Store

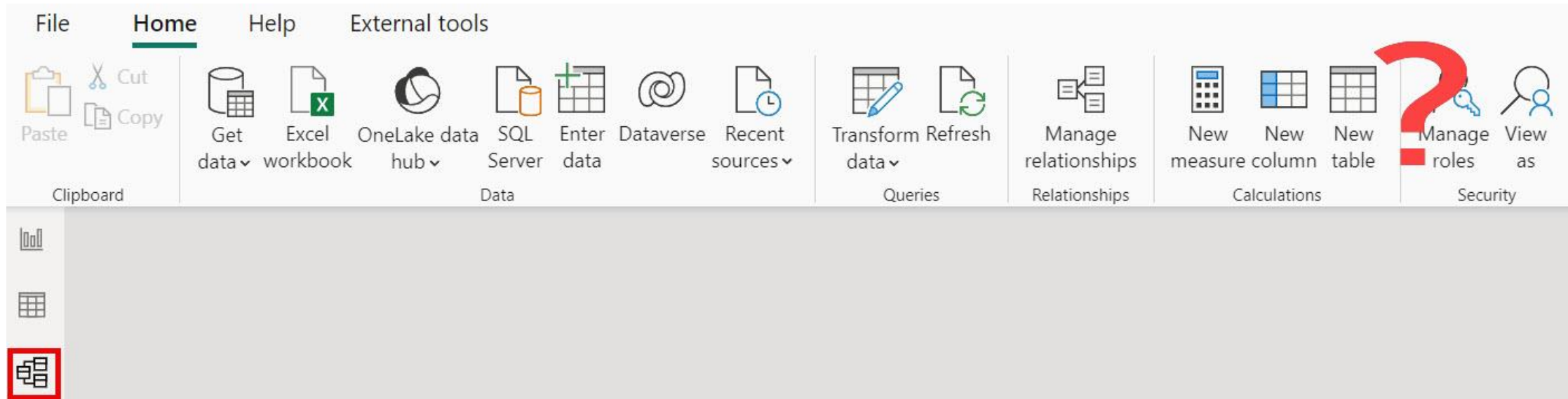
# Power BI – Model View – Model Explorer

The screenshot displays the Power BI interface in the Model View. On the left, a navigation pane shows icons for Reports, Tables, and the Model View (highlighted with a red box and a 'Model view' tooltip). The main area shows a data model with four tables: Store, Date, Customer, and Sales. The Store table is connected to the Date table (1 to 1 relationship). The Date table is connected to the Sales table (1 to \* relationship). The Customer table is connected to the Sales table (1 to \* relationship). The Product table is connected to the Sales table (1 to \* relationship). Each table has a list of columns and a 'Collapse' button.

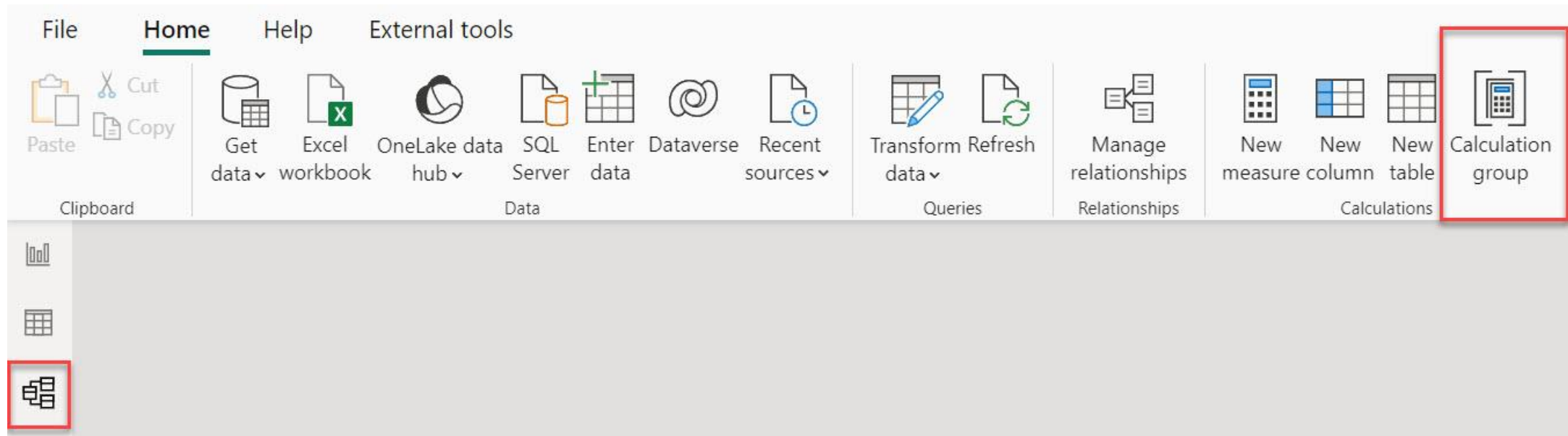
On the right, the 'Properties' pane is visible, showing the 'General' tab. The 'Name' is 'Semantic model' and the 'Description' is 'Enter a description'. The 'Server' is 'localhost:57762' and the 'Compatibility Level' is '1567'. The 'Cultures' section shows 'en-US' and the 'Discourage implicit measures' toggle is set to 'No'.

Below the Properties pane is the 'Data' pane, which shows the 'Model' tab. It displays a search bar and a list of model components: Calculation groups (0), Cultures (1), Measures (5), Perspectives (0), Relationships (4), Roles (0), and Tables (5).

# Model Explorer Off – No Calculation Group



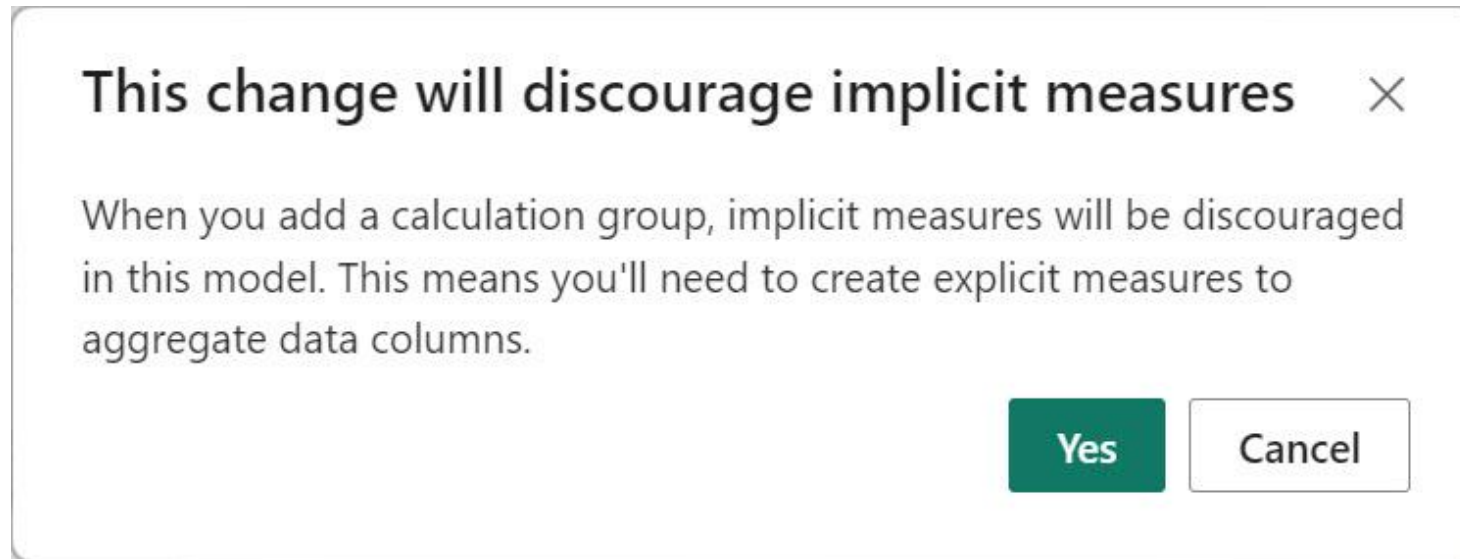
# Click Calculation Group





# Discourage Implicit Measures


---








A little bit to unpack here

# What is an Implicit Measure?

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▼  Sales

- ☐  Margin
- ☐  Margin %
- ☐  $\Sigma$  Quantity
- ☐  Sales Amount
- ☐  Total Cost
- ☐  Total Quantity
- ☐  $\Sigma$  Unit Cost

# Implicit Measure Example

Measure with formatting

Year	Count of Quantity	Count of Quantity	Sum of Unit Cost	Total Quantity
2017	10	2781	\$414,250.11	8,599
May	10	127	\$17,740.371	406
Jun	10	254	\$36,632.162	790
Jul	10	215	\$29,543.376	659
Aug	10	314	\$46,432.916	1,001
Sep	10	330	\$47,392.8505	1,016
Oct	10	350	\$54,882.921	1,116
Nov	10	393	\$60,455.6185	1,179
Dec	10	798	\$121,169.895	2,432
2018	10	5756	\$714,666.855	17,922
Jan	10	616	\$94,177.396	1,904
Feb	10	708	\$106,474.482	2,314
Mar	10	259	\$36,448.617	818
Apr	9	50	\$4,657.09	138
May	10	590	\$66,370.44	1,896
Jun	10	525	\$61,193.05	1,628
Jul	10	422	\$47,152.8	1,407

Distinct Non-Distinct

Sum

Visualizations >>

Build visual

Rows

Year

Month Short

Columns

Add data fields here

Values

Count of Quantity

Count of Quantity

Sum of Unit Cost

Total Quantity

# Implicit Versus Explicit Measures

---

- Implicit – Drag the value column to visual and it automatically aggregates it
  - It is creating the calculation for you
- Explicit
  - Control formatting
  - Only expose measures to developers and users
  - Can change the logic of the measure – Like a SQL View
  - Explicit Measures Podcast

# “Discourage” Implicit Measures

---

This change will discourage implicit measures ×

When you add a calculation group, implicit measures will be discouraged in this model. This means you'll need to create explicit measures to aggregate data columns.

Yes

Cancel

# Discourage Implicit Measures

---

This change will ~~discourage~~ implicit measures ×

When you add a calculation group, implicit measures will be discouraged in this model. This means you'll need to create explicit measures to aggregate data columns.

Yes

Cancel

# Discourage Implicit Measures

---

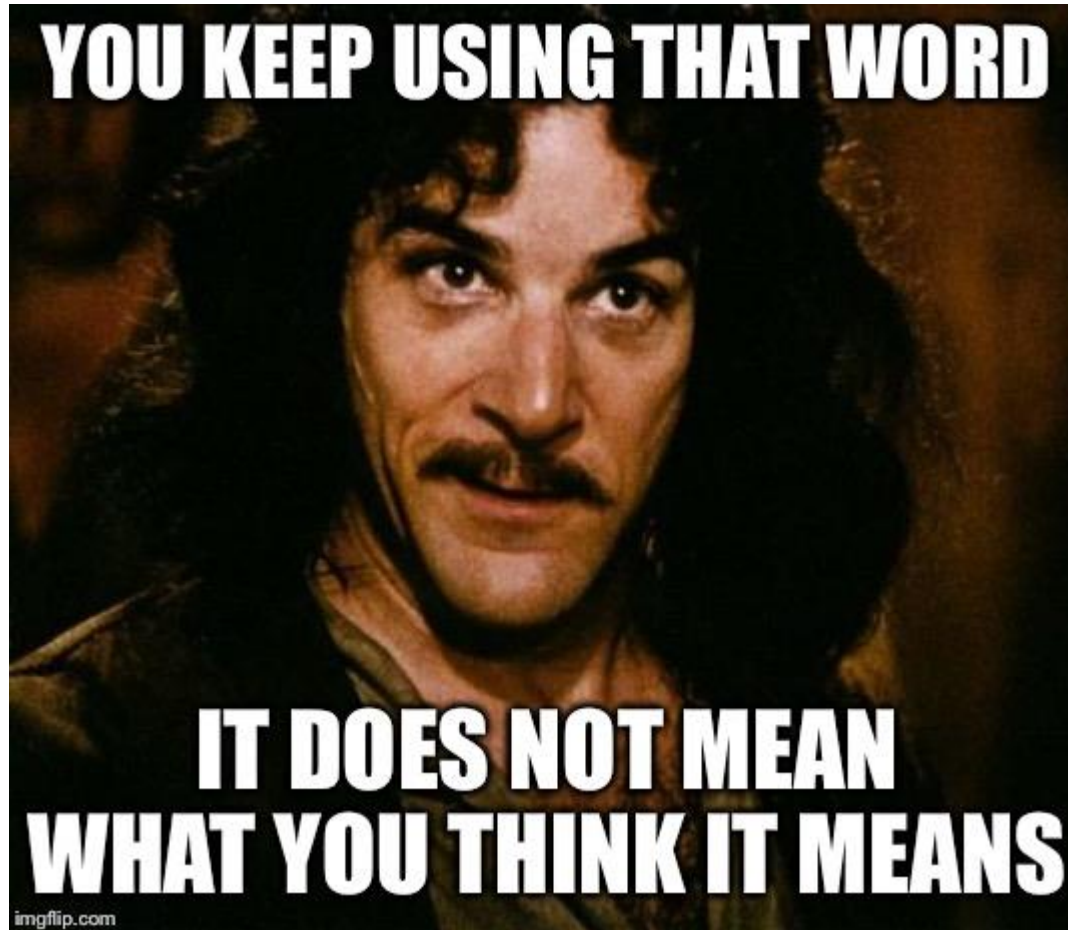
This change will **Prohibit** implicit measures ×

When you add a calculation group, implicit measures will be discouraged in this model. This means you'll need to create explicit measures to aggregate data columns.

Yes

Cancel

# Discourage





# Discourage Implicit Measures Behavior

Year					
\$0.95 \$1.425 \$1.99 \$2.94 \$3.35					
2018	8.24	7.70	5.13	29.40	229.41
Jan					
Feb					
Mar		7.70			
Apr					
May	2.85		5.13		42.21

Visualizations

Build visual

Filters

Rows

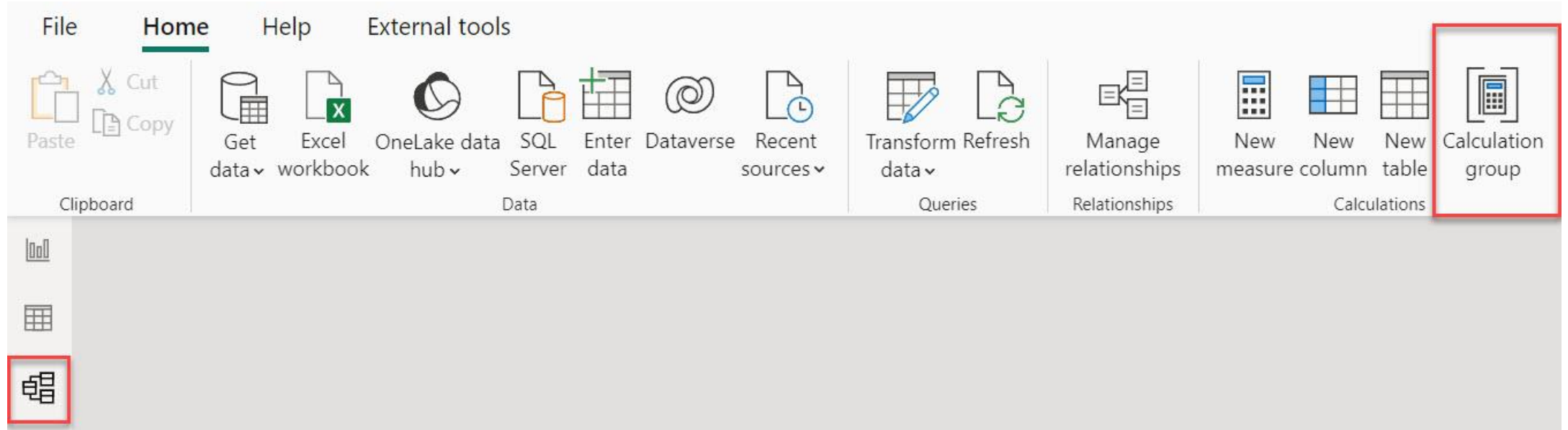
Columns

Values

Cannot put the fields on Values. Must put on Columns, Rows, etc.

# Return to Creating Calculation Group

---



# We accept this change

---

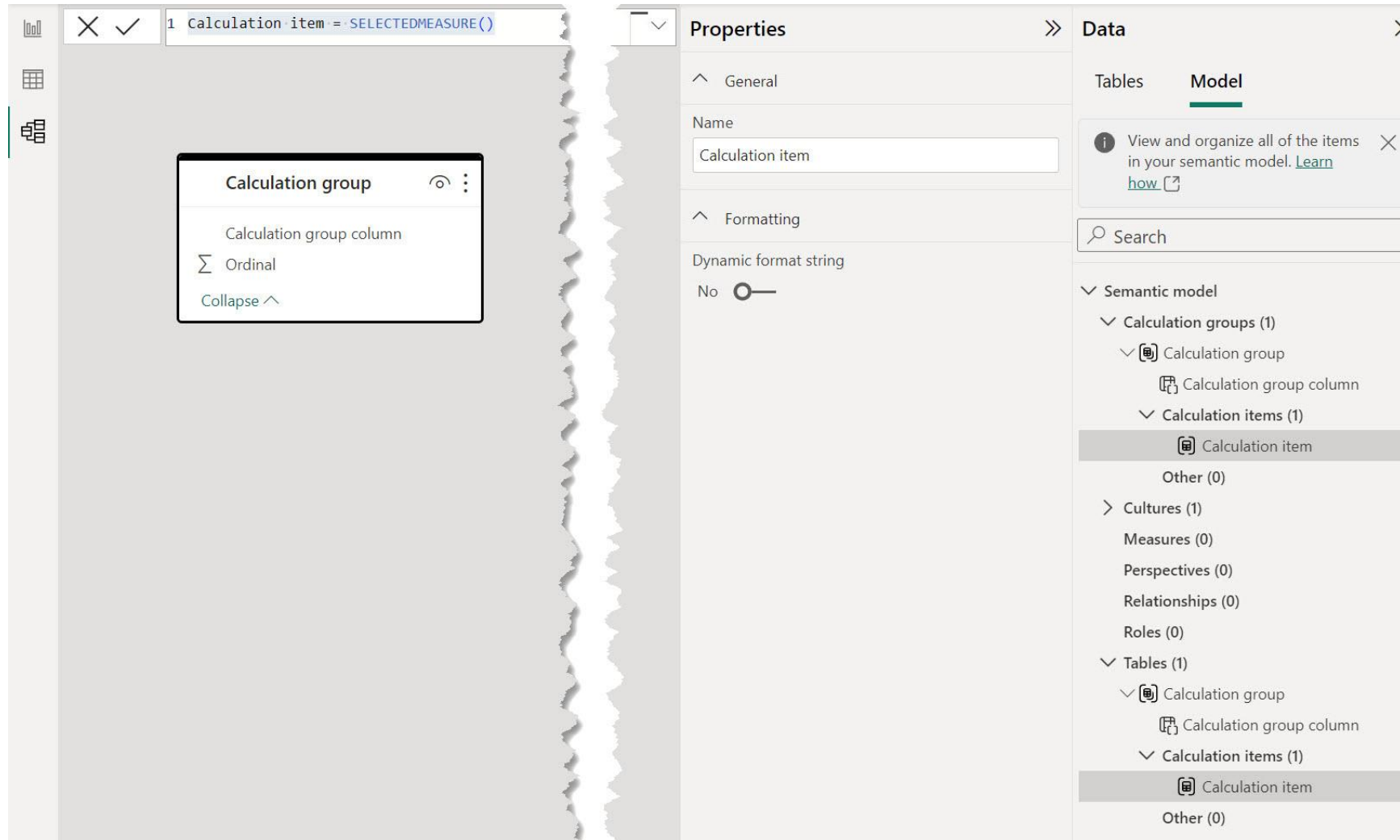
## This change will discourage implicit measures ×

When you add a calculation group, implicit measures will be discouraged in this model. This means you'll need to create explicit measures to aggregate data columns.

Yes

Cancel

# New Calculation Group View



# Calculation Group is Just a table

The image shows a screenshot of the Power BI Desktop interface, illustrating that a Calculation Group is essentially a table. The main view on the left shows a 'Calculation group' in the model view, with a red arrow pointing to it from the word 'Table' written in large red text. The calculation group is defined by the formula '1 Calculation item = SELECTEDMEASURE()'. The Properties pane on the right shows the 'General' tab for the 'Calculation item' table, with the 'Name' field set to 'Calculation item'. The 'Data' pane on the right shows the 'Model' view, where the 'Calculation group' is listed under 'Calculation groups (1)' and 'Calculation items (1)'. The 'Calculation item' is highlighted in the list.

Calculation group

Calculation group column

Σ Ordinal

Collapse ^

Table

1 Calculation item = SELECTEDMEASURE()

Properties

General

Name

Calculation item

Formatting

Dynamic format string

No

Data

Tables

Model

View and organize all of the items in your semantic model. [Learn how](#)

Search

Semantic model

Calculation groups (1)

Calculation group

Calculation group column

Calculation items (1)

Calculation item

Other (0)

Cultures (1)

Measures (0)

Perspectives (0)

Relationships (0)

Roles (0)

Tables (1)

Calculation group

Calculation group column

Calculation items (1)

Calculation item

Other (0)

# Table has a column for Calculation Items

---

Calculation Item is just a value in the table

---

# Formula for new Calculation Item

The screenshot displays the Power BI interface. On the left, a 'Calculation group' context menu is open, showing options: 'Calculation group column', 'Σ Ordinal', and 'Collapse ^'. A red arrow points from the text 'Formula for First Item' to the formula bar at the top, which contains the text '1 Calculation item = SELECTEDMEASURE()'. On the right, the 'Properties' pane is visible, showing the 'Name' field set to 'Calculation item'. Below it, the 'Formatting' section shows 'Dynamic format string' set to 'No'. The 'Data' pane on the far right shows the 'Model' view, with a tree structure under 'Semantic model' that includes 'Calculation groups (1)', 'Calculation items (1)', and 'Other (0)'. The 'Calculation items (1)' node is expanded, showing a single 'Calculation item'.

**Formula for First Item**

1 Calculation item = SELECTEDMEASURE()

Calculation group

- Calculation group column
- Σ Ordinal
- Collapse ^

Properties

General

Name

Calculation item

Formatting

Dynamic format string

No

Data

Tables

Model

View and organize all of the items in your semantic model. [Learn how](#)

Search

Semantic model

- Calculation groups (1)
  - Calculation group
    - Calculation group column
- Calculation items (1)
  - Calculation item
- Other (0)

Cultures (1)

Measures (0)

Perspectives (0)

Relationships (0)

Roles (0)

Tables (1)

- Calculation group
  - Calculation group column
- Calculation items (1)
  - Calculation item
- Other (0)



# Model Explorer Settings

The screenshot displays the Model Explorer interface. On the left, a data model diagram shows tables: Customer, Store, Sales, Date, and Product. Relationships are indicated by lines with cardinalities (1, \*). A 'Calculation group' is also shown. On the right, the 'Data' pane is visible, containing a search bar and a list of items in the semantic model. A red box highlights the 'Model' section of the Data pane, which includes 'Calculation groups (1)', 'Calculation items (1)', and 'Other (0)'. A red arrow points from the text 'Model Explorer' to the highlighted area.

**Model Explorer**

**Data**

Tables **Model**

View and organize all of the items in your semantic model. [Learn how](#)

Search

✓ Semantic model

- ✓ Calculation groups (1)
  - ✓ Calculation group
    - Calculation group column
- ✓ Calculation items (1)
  - Calculation item
- Other (0)

> Cultures (1)

> Measures (5)

Perspectives (0)

> Relationships (4)

Roles (0)

✓ Tables (6)

- > Sales
- ✓ Calculation group
  - Calculation group column
- ✓ Calculation items (1)
  - Calculation item
- Other (0)

> Customer

> Date

> Product

> Store

# Model Properties

Properties

>>

^ General

Name  
Semantic model

Description

Server  
localhost:58371

Compatibility Level  
1567

Cultures  
• en-US

Discourage implicit measures  
No ☐

Data

>>

Tables

Model

i

View and organize all of the items in your semantic model. [Learn how](#) [↗](#)

×

✓ Semantic model

Calculation groups (0)  
    > Cultures (1)  
    > Measures (2)  
        Perspectives (0)  
    > Relationships (4)  
        Roles (0)  
    > Tables (5)

# Discourage Implicit Measures Setting

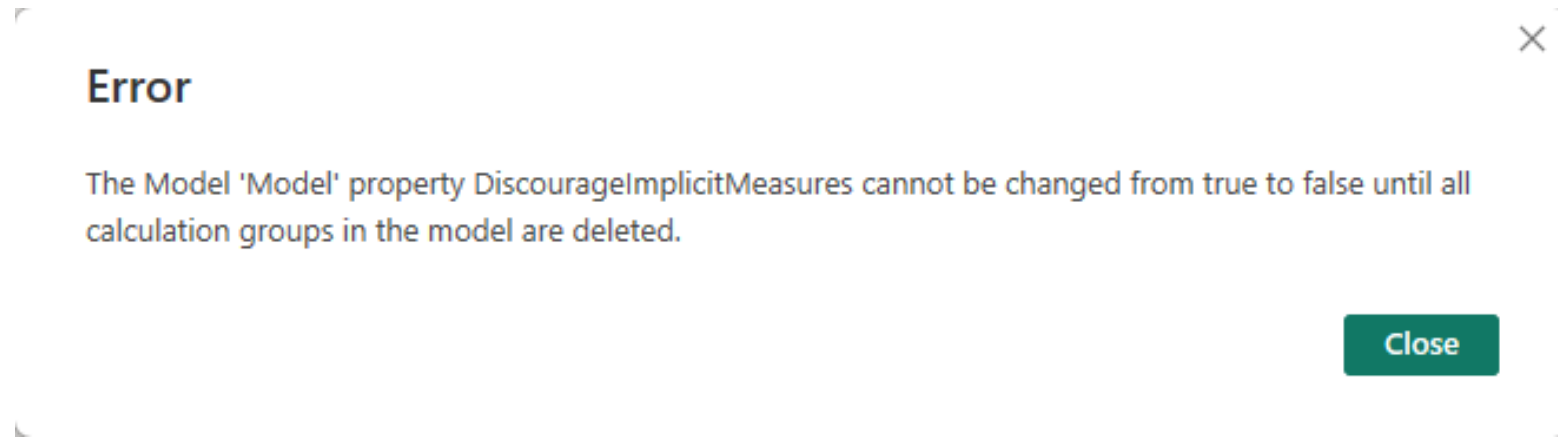
The screenshot displays the SQL Server Enterprise Manager interface. On the left, the 'Properties' pane is open to the 'General' tab for a 'Semantic model'. The 'Name' is 'Semantic model' and the 'Description' field is empty. The 'Server' is 'localhost:63754' and the 'Compatibility Level' is '1567'. Under 'Cultures', 'en-US' is listed. At the bottom of the 'Properties' pane, the 'Discourage implicit measures' toggle switch is set to 'Yes' and is highlighted with a red rectangle. On the right, the 'Data' pane is open to the 'Model' tab, showing a tree view of the semantic model's contents: Calculation groups (1), Cultures (1), Measures (5), Perspectives (0), Relationships (4), Roles (0), and Tables (6).

Properties	Data
<b>General</b>	<b>Model</b>
Name Semantic model	View and organize all of the items in your semantic model. <a href="#">Learn how</a>
Description Enter a description	Search
Server localhost:63754	▼ Semantic model
Compatibility Level 1567	> Calculation groups (1)
Cultures • en-US	> Cultures (1)
Discourage implicit measures Yes	> Measures (5)
	Perspectives (0)
	> Relationships (4)
	Roles (0)
	> Tables (6)

We can flip this switch back to No if we delete all Calculation Groups

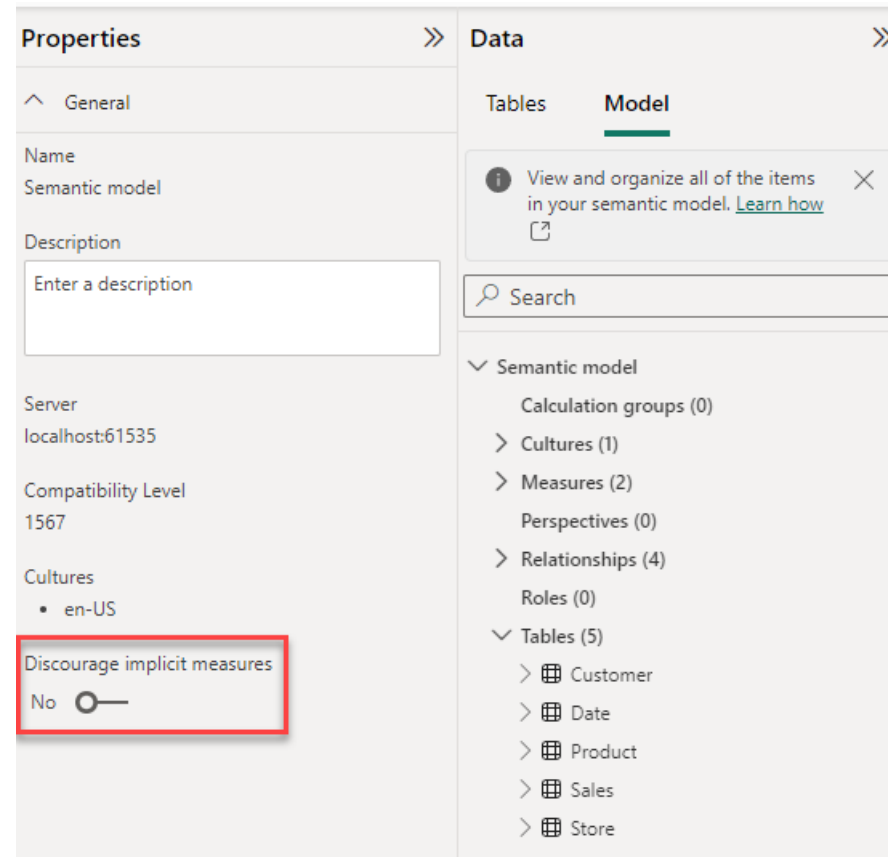
# Discourage Implicit Measures Error

---



# Can reenable if all Calculation Groups Deleted

---



# Power BI Desktop Demo

---

# Ordinal

---

# Who's out of order

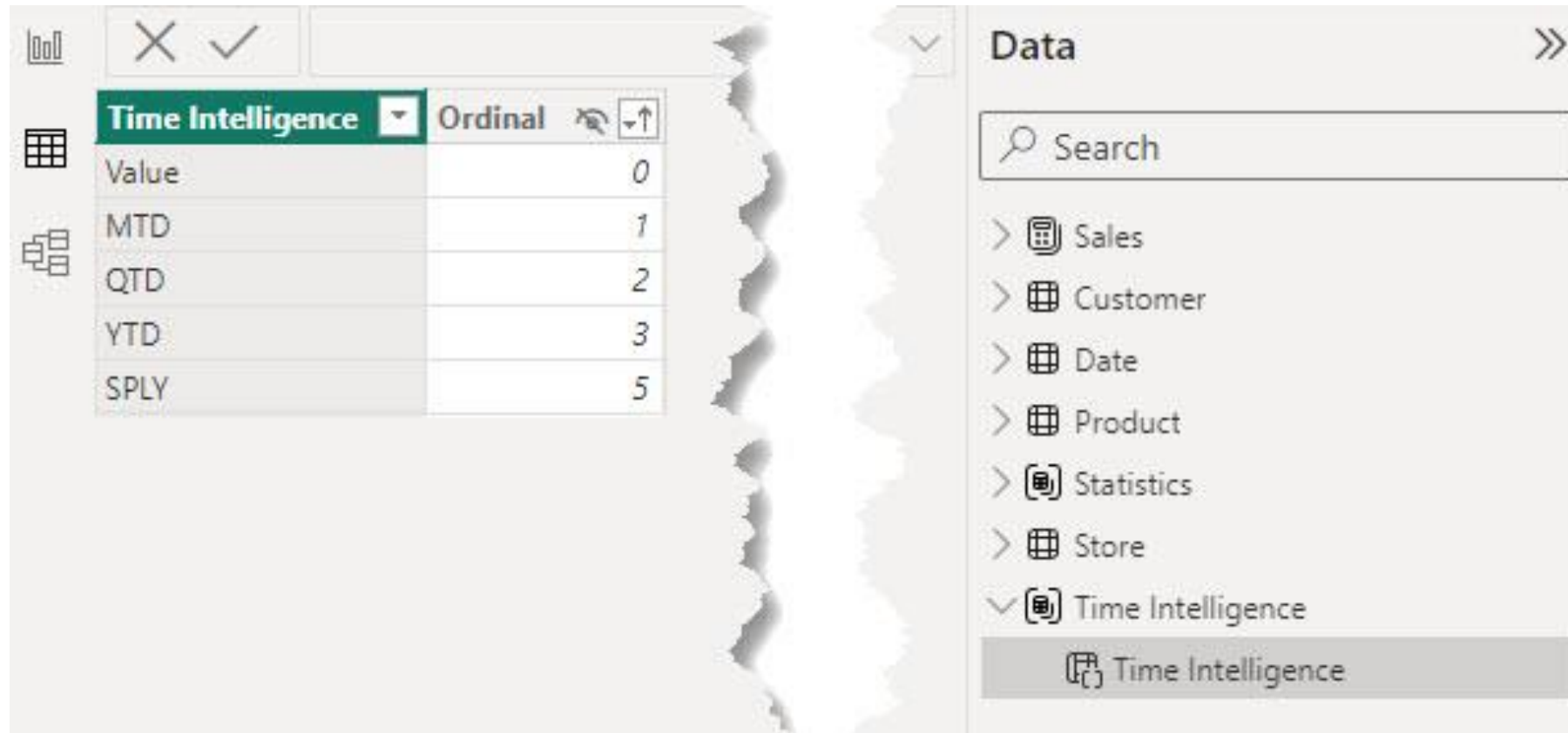
---

- Determines the order that Calculation Items are displayed
- Hidden column
  - Automatically Orders Calculation Items by this column



# Ordinal – Just a hidden column in the table

---



The image shows a screenshot of a BI tool interface, likely Microsoft Power BI. On the left, a table is displayed with a green header row. The first column is labeled 'Time Intelligence' and the second column is labeled 'Ordinal'. The table contains five rows of data. On the right, a 'Data' pane is visible, showing a search bar and a list of data sources. The 'Time Intelligence' source is expanded, and the 'Time Intelligence' table is highlighted at the bottom.

Time Intelligence	Ordinal
Value	0
MTD	1
QTD	2
YTD	3
SPLY	5

**Data**

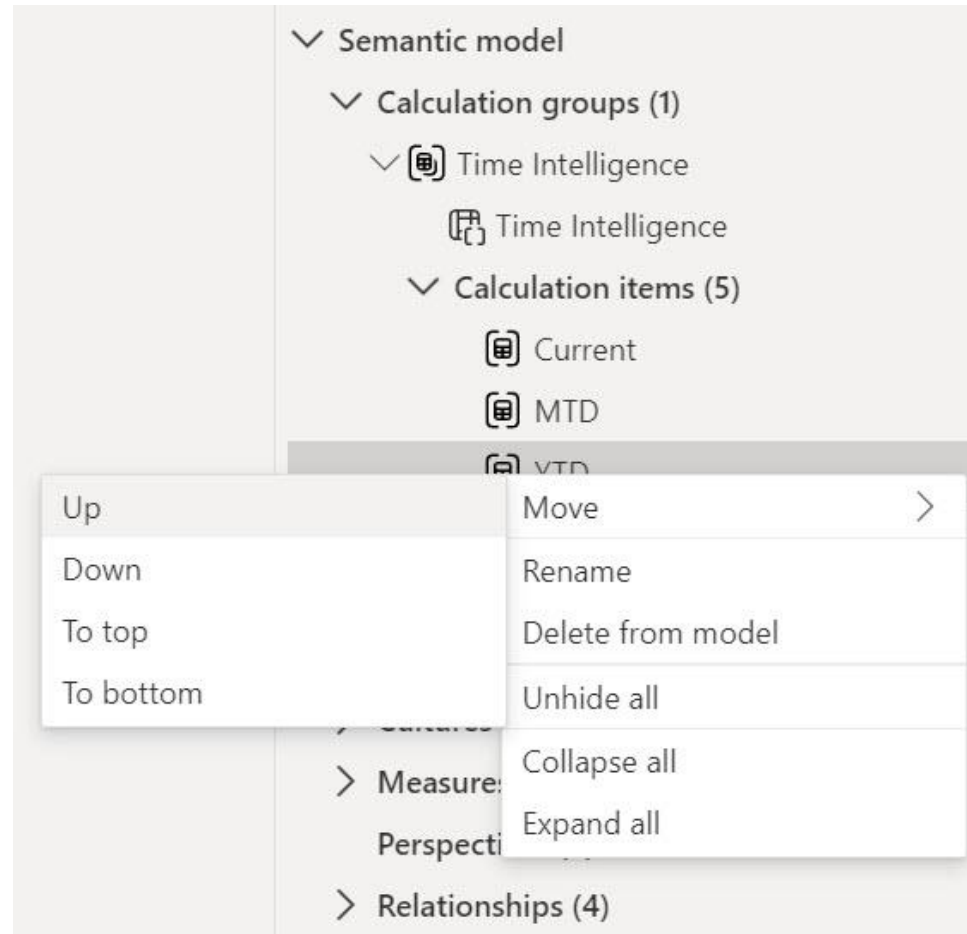
Search

- > Sales
- > Customer
- > Date
- > Product
- > Statistics
- > Store
- Time Intelligence

Time Intelligence

# Power BI Change Ordinal – Right Click

---



# Power BI Change Ordinal – Drag and Drop

The screenshot displays the Power BI interface with two panes: Properties and Data.

**Properties Pane:**

- Section: General
- Section: Calculation item order (highlighted with a red box)
  - Current
  - MTD
  - OTD
  - SPLY
  - YTD
  - + New calculation item
- Reset to default

**Data Pane:**

- Section: Model
- View and organize all of the items in your semantic model. [Learn how](#)
- Search
- Semantic model
  - Calculation groups (1)
    - Time Intelligence
      - Time Intelligence
    - Calculation items (5)
      - Current
      - MTD
      - QTD
      - YTD
      - SPLY

# Custom Format Strings

---

# Custom Format Strings

---

- If we don't want the format of the original measure

# Example Custom Format Strings

---

Example Measure is [Sales Amount]

$CY = SELECTEDMEASURE()$

$PY = SELECTEDMEASURE()$  for SPLY

$YOY = CY - PY$

$YOY \% = DIVIDE(CY-PY, PY)$

YOY % Format String = "0.00 %"



# Dynamic Format String

---

- DAX expression to determine the format string
- `SELECTEDMEASUREFORMATSTRING()`
  - Returns measure format string
- Example Use
  - Only on these measures append this Unit of Measure



**ISSELECTEDMEASURE()**

---

# ISSELECTEDMEASURE()

---

```
IF (  
    NOT ISSELECTEDMEASURE ([Margin %]),  
    DO THIS,  
    Otherwise  
        Maybe SELECTEDMEASURE()  
)
```

# ISSELECTEDMEASURE()

---

Average =

```
IF (
    NOT ISSELECTEDMEASURE ( [Margin %] ),
    AVERAGEX (
        VALUES ( 'Date'[Year Month Number] ),
        SELECTEDMEASURE ()
    ),
    SELECTEDMEASURE ()
)
```

# Multiple Calculation Groups

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# How to Handle Precedence

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# Precedence

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Which Calculation Group gets applied first?

Is it peanut butter surrounded by chocolate or chocolate surrounded by Peanut Butter

# Precedence

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# Precedence

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Higher number has priority

Set at group level

Cant change individual items



# Precedence

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May need to simulate the application of Calculation Items in DAX code

Higher Precedence becomes the shell

Lower Precedence gets inserted

Higher Precedence for Time Intelligence

Lower for Stats

i.e. YTD should be applied first and then the calculation

# Precedence and Dynamic Format Strings

- Precedence also determines which dynamic format string is applied to the combined DAX expression for each measure. The highest precedence calculation group dynamic format string is the only one applied. If a measure itself has a dynamic format string, it's considered a lower precedence to any calculation group in the model.

# Sideway Recursion

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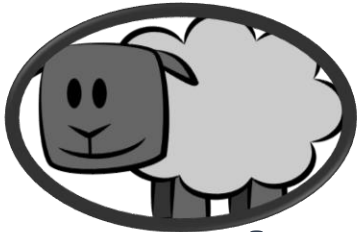
- Each Calculation Item can only be called once
- Benefit code runs
- Negative is that no warning is issued
- Best Practice – Do not use Calculation Groups in Measures

# Applying Multiple Calculation Items

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- If you try to apply multiple Calculation Items it will return the original Measure
- For Example
  - Apple YTD and QTD to Sales Amount

# Thank you



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