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macaw

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MICROSOFT IN A DAY PROGRAM
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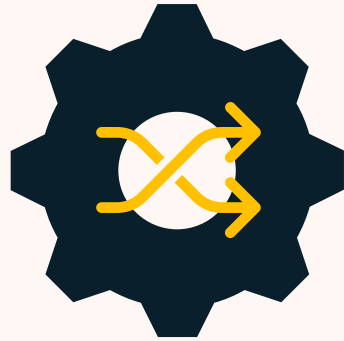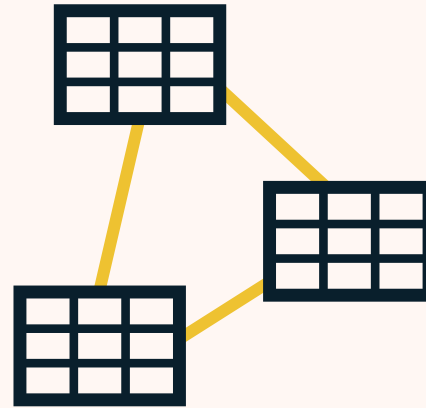DutchFabricUsergroup.com
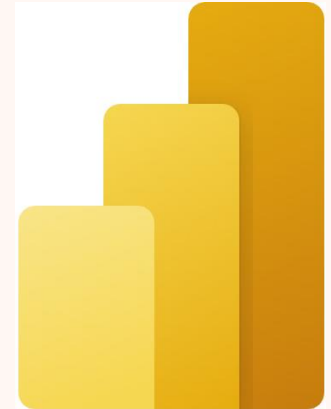
FAVORITE STUFF:

GATHER   CLEAN   MODEL   VISUALIZE

Visual Calcs vs 'regular' DAX (2/2)

Goal: given a list of states and number of restaurants per state, for each state calculate the difference in number of restaurant in that state vs the one above.

```
DiffNumRestaurants =
VAR _temp =
    SUMMARIZE (
        ALLSELECTED ( Pizza_data ),
        Pizza_data[state],
        "NumRestaurants", [# restaurants]
    )
VAR _currentState =
    SELECTEDVALUE ( Pizza_data[state] )
VAR _previousState =
    TOPN (
        1,
        FILTER ( _temp, Pizza_data[state] < _currentState ),
        Pizza_data[state], DESC
    )
RETURN
    [# restaurants] - SUMX ( _previousState, [NumRestaurants] )
```

```
Diff =
VAR PreviousStateRestaurants =
    CALCULATE (
        [# restaurants],
        OFFSET ( -1, ALLSELECTED ( Pizza_data[state] ),
        ORDERBY ( Pizza_data[state] ) )
    )
RETURN
    [# restaurants] - PreviousStateRestaurants
```

```
Diff = [# restaurants] – PREVIOUS( [# restaurants] )
```

How most of us write DAX today
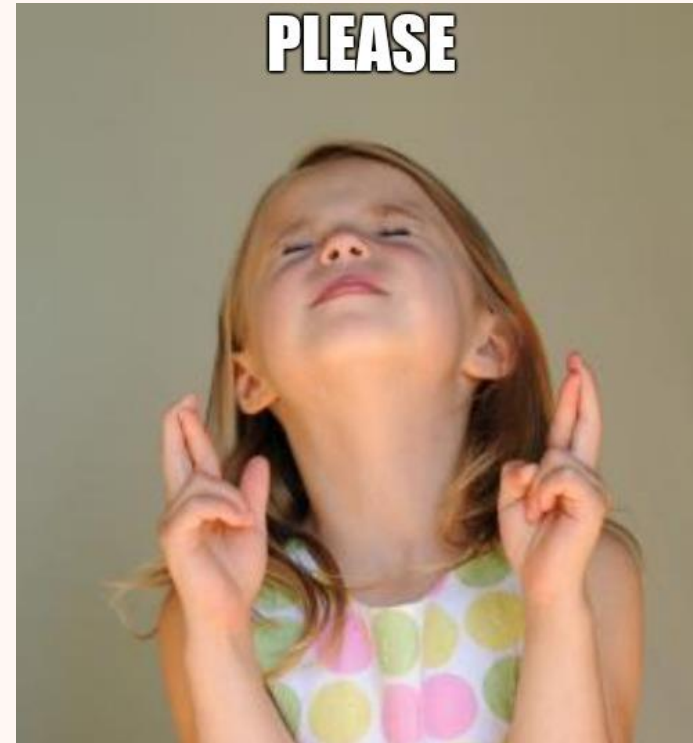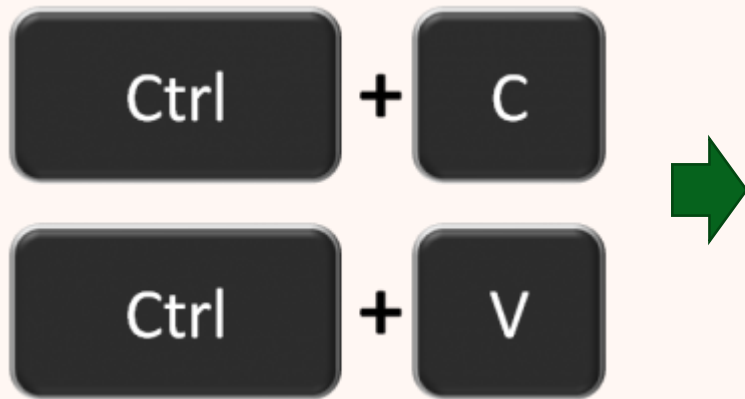
Ever tried to do a running total in DAX?

Power BI Running Total
https://www.wallstreetmojo.com/power-bi-running-total/

Examples of Running Total in Power BI

- 1: Similar stuff can be arrived in Power BI as well but not as easy as in excel. ...
- Step #2: For this table, we can arrive running totals in three ways. First, we will arrive through New Measure, right-click on the table and choose New Measure.
- Step #3: Name the measure as RT Measure. (RT= Running Total).
- Step #4: Open the CALCULATE function first.
- Step #5: The kind of Expression that we need to do with the CALCULATE function is Summation of Sales Value, so open the SUM function and choose the Sales column.
- Step #6: After applying the kind of calculation to be done next, we need to apply the filter to decide the criteria to be matched for calculation.
- Step #7: Before we apply FILTER first, we need to release any kind of filter applied to the Date column, so open the ALL function to remove the filter from ...
- Step #8: In this function, choose the Table or Column Name for which we need to remove the filter for, so choose the Date column.
- Step #9: Once the filter is removed, then we need to apply fresh filter criteria in Filter Expression, so for this again, choose the date column.
- Step #10: Once the Date column has been selected, we need to apply the kind of filter to be applied. ...
- Step #11: MAX function will find the last date in the column of date, so supply the date column.
- Step #12: Ok, we are done. Close three brackets and hit the enter key to get the result.
- Step #13: Now insert the table visually and add Date and Sales columns first.
- Step #14: This is the overall summary, now add a newly created measure to the table to get the Running Total column.
- Step #15: Name this measure as RT Measure 1.
- Step #16: Open the CALCULATE function.
- Step #17: As we did in the previous method, we need to do a summation of the sales column, so open the SUM function and choose the Sales column to ...
- Step #18: This time for filter criteria, we will use the DATESYTD function.
- Step #19: Choose the Date column for this function.
- Step #20: Close two brackets and hit the enter key to complete the formula.
- Step #21: Ok, now add this new measure to our existing table visual and see the result. We have got two different sets of running totals.

Similar search: running total excel

21 steps!

How would you want to write DAX?

Let's face it

- DAX is hard. (to be exact, filter context is hard)
- DAX calculations (measures) are scoped to the model and independent of each other
- Typical business type calculations are surprisingly hard to do.
  - Quick measures help – but the DAX it generates is hard to comprehend / edit

What if you could…

- Define a calculation on exactly what's on your visual without having to worry about what makes DAX hard?

- *Easily write and read* the DAX statement needed for your business calculation?

- Define a calculation with no to minimal typing, but instead use point-and-click if you wanted to?

Enter: Visual Calculations
*(Visual Calcs for short)*

- DAX calculations defined on a visual

- Can refer to any field that's on the visual, including other visual calcs

- Are executed in scope of the visual only, not the model

- Can refer to the visual structure as well, instead of just referencing fields

- Most of the time you don't have to worry about the complexity of filter context

Visual calcs vs measures vs calc columns
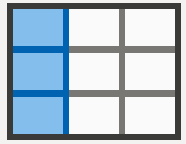
Calculated column
- Defined on a table
- Works on a row-by-row basis (row context)
- Computed at dataset refresh (for import tables) or query refresh (for DirectQuery tables)
- Result persisted (for import tables)
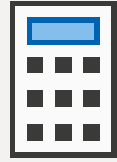
Measure
- Defined in the data model
- Works on sets of rows (filter context)
- Computed at query execution
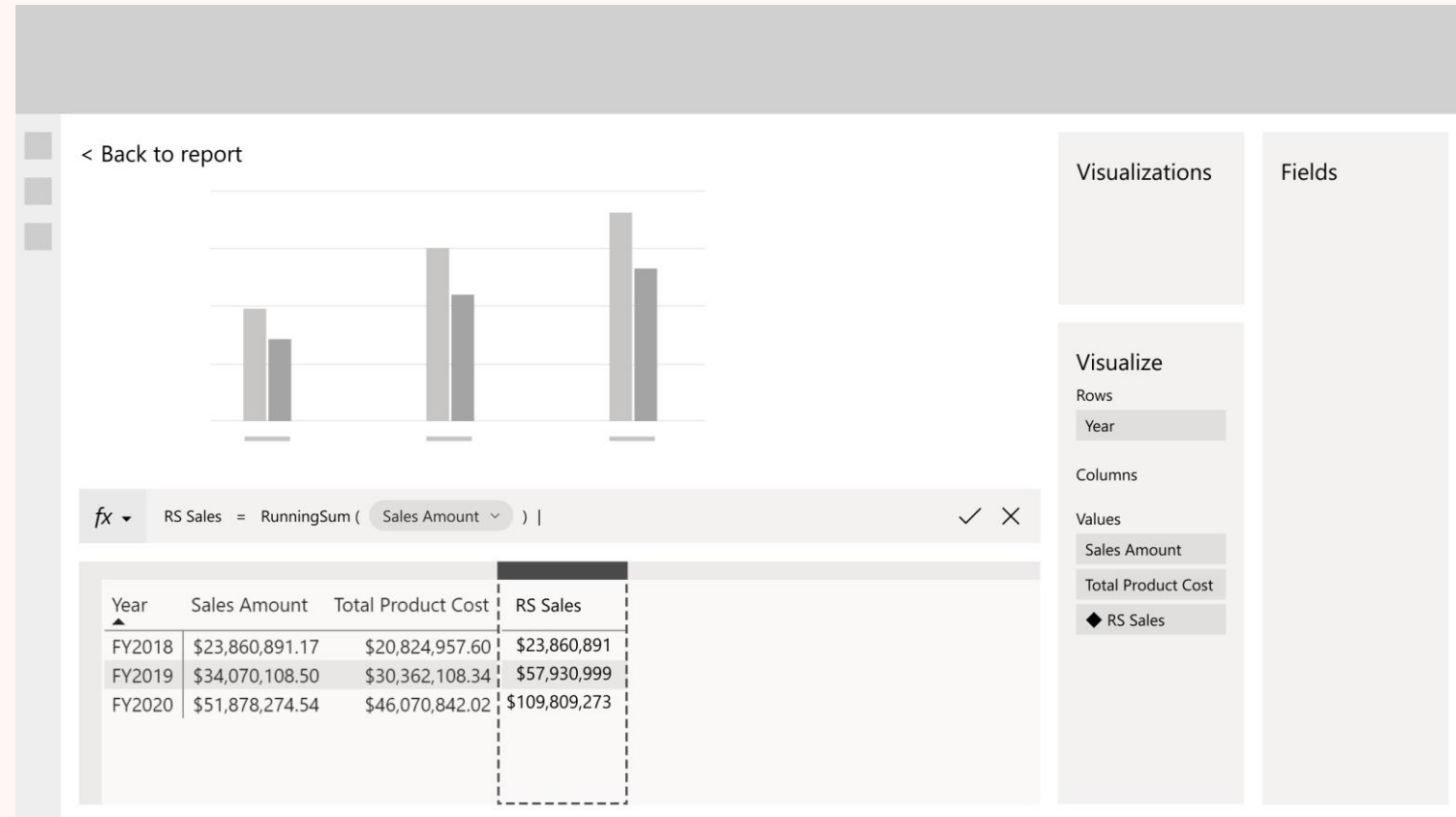
Visual calculations
- Defined on a visual
- "Visible context"
- Computed at query execution
- Can refer to visual structure

Visual calculations are easy and flexible

- WYSIWYG
- Point-and-click provided, if you want
- Just "visible context"
- High-level functions for common business calculations
- Refer to visual structure

Mental model

- Any visual can be represented as a matrix

- A visual calculation adds a column on that matrix

- A visual calculation is added to the matrix but can be hidden from the visual itself

- A visual calculation can refer to any field / visual calculation on the visual

DEMO

#Mindblown #PowerBI

What are Visual Calcs?

DAX calculations in the scope of a visual.

In support thereof:

       - new functions

       - new concepts

New functions

- We are introducing multiple new functions, divided in levels.
- Higher-level functions are easier-to-use shortcuts to lower-level functions

Level	Functionality offered	Included functions	Flexibility	Complexity
Low	Returning a single item, a set of items or an index number	Window functions	High	High
Medium	Returning a single item, a set of items	Movement functions Hierarchical functions	Medium	Medium-High
High	Business-type calculations	Calculation functions	Medium	Low

Low level functions
(aka window functions)

OFFSET	INDEX	WINDOW	RANK	ROWNUMBER
• Relative movement	• Absolute movement	• Define slice	• Return rank	• Return unique ranking

ORDERBY

PARTITIONBY

MATCHBY

Medium level functions

Previous: move up / left in *direction*

Next: move down/right in *direction*

First: move to beginning in *direction*

Last: move to end in *direction*

Range: define slice

Expand: add detail level

ExpandAll: add all detail levels

Collapse: remove detail level

CollapseAll: remove all detail levels

High level functions

RunningSum: add running sum in direction

MovingAverage: add moving average in direction

New concepts

Visual matrix: the matrix that represents the data in a visual

Axis: defines how a calculation traverse the *visual matrix* on which it's being executed.

Reset: defines when a calculation restarts while traversing the *axis*

Direction: combines <u>*axis*</u> and *reset*
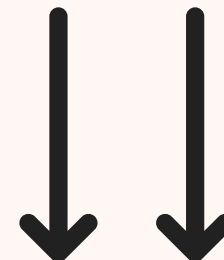
Hidden: a field that is on the *visual matrix* but not shown on the visual
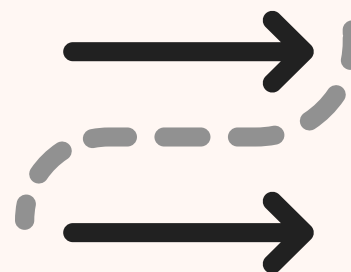
Concept: axis

- Think of axis as how the calculation traverses the visual matrix on which it's being executed
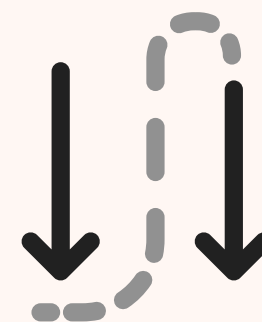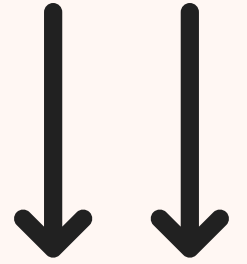- Default: Rows

Columns

Rows

Columns Rows

Rows Columns

Example: Axis

`FIRST([Sales Amount], Rows) →`
for each *Row*, retrieve the first Sales Amount from the first *Row*)

```
1 Calculation = FIRST([Sales Amount], Rows)
```

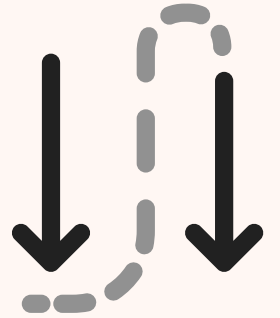| Fiscal Year	FY2018		FY2019		FY2020		Total	
Category	Sales Amount	Calculation	Sales Amount	Calculation	Sales Amount	Calculation	**Sales Amount**	**Calculation**
Accessories	$36,814.85	36,814.85	$138,901.55	138,901.55	$1,096,341.49	1,096,341.49	**$1,272,057.89**	1,272,057.89
Bikes	$22,590,983.47	36,814.85	$28,544,881.62	138,901.55	$43,484,661.12	1,096,341.49	**$94,620,526.21**	1,272,057.89
Clothing	$66,327.53	36,814.85	$757,224.19	138,901.55	$1,294,061.73	1,096,341.49	**$2,117,613.45**	1,272,057.89
Components	$1,166,765.32	36,814.85	$4,629,101.14	138,901.55	$6,003,210.20	1,096,341.49	**$11,799,076.66**	1,272,057.89
Total	**$23,860,891.17**	**23,860,891.17**	**$34,070,108.50**	**34,070,108.50**	**$51,878,274.54**	**51,878,274.54**	**$109,809,274.20**	**109,809,274.20**

Example: Axis
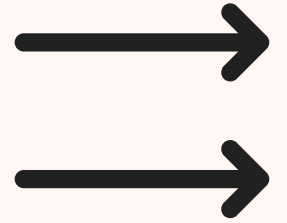
`FIRST([Sales Amount], Columns)` →
for each *Column*, retrieve the first Sales Amount from the first *Column*)

```
1 Calculation = FIRST([Sales Amount], Columns)
```

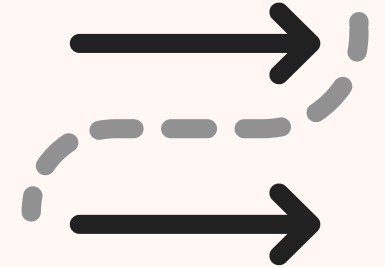| Fiscal Year	FY2018		FY2019		FY2020		Total	
Category	Sales Amount	Calculation	Sales Amount	Calculation	Sales Amount	Calculation	**Sales Amount**	**Calculation**
Accessories	$36,814.85	36,814.85	$138,901.55	36,814.85	$1,096,341.49	36,814.85	**$1,272,057.89**	**1,272,057.89**
Bikes	$22,590,983.47	22,590,983.47	$28,544,881.62	22,590,983.47	$43,484,661.12	22,590,983.47	**$94,620,526.21**	**94,620,526.21**
Clothing	$66,327.53	66,327.53	$757,224.19	66,327.53	$1,294,061.73	66,327.53	**$2,117,613.45**	**2,117,613.45**
Components	$1,166,765.32	1,166,765.32	$4,629,101.14	1,166,765.32	$6,003,210.20	1,166,765.32	**$11,799,076.66**	**11,799,076.66**
Total	**$23,860,891.17**	**23,860,891.17**	**$34,070,108.50**	**23,860,891.17**	**$51,878,274.54**	**23,860,891.17**	**$109,809,274.20**	**109,809,274.20**

Example: Axis

```
PREVIOUS([Sales Amount], Rows Columns) →
```
for each cell, retrieve the previous Sales Amount from the *Row* above it or from the last cell in the previous *Column*

X ✓ ƒx `1 Calculation = PREVIOUS([Sales Amount], Rows Columns)`

Fiscal Year	FY2018		FY2019		FY2020		Total	
Category	Sales Amount	Calculation	Sales Amount	Calculation	Sales Amount	Calculation	Sales Amount	Calculation
Accessories	$36,814.85		$138,901.55	1,166,765.32	$1,096,341.49	4,629,101.14	$1,272,057.89	
Bikes	$22,590,983.47	36,814.85	$28,544,881.62	138,901.55	$43,484,661.12	1,096,341.49	$94,620,526.21	1,272,057.89
Clothing	$66,327.53	22,590,983.47	$757,224.19	28,544,881.62	$1,294,061.73	43,484,661.12	$2,117,613.45	94,620,526.21
Components	$1,166,765.32	66,327.53	$4,629,101.14	757,224.19	$6,003,210.20	1,294,061.73	$11,799,076.66	2,117,613.45
Total	$23,860,891.17		$34,070,108.50	23,860,891.17	$51,878,274.54	34,070,108.50	$109,809,274.20	

Example: Axis

`PREVIOUS([Sales Amount], Columns Rows)` →
for each cell, retrieve the previous Sales Amount from the *Column* to the left of it or from the last cell of the previous *Row*
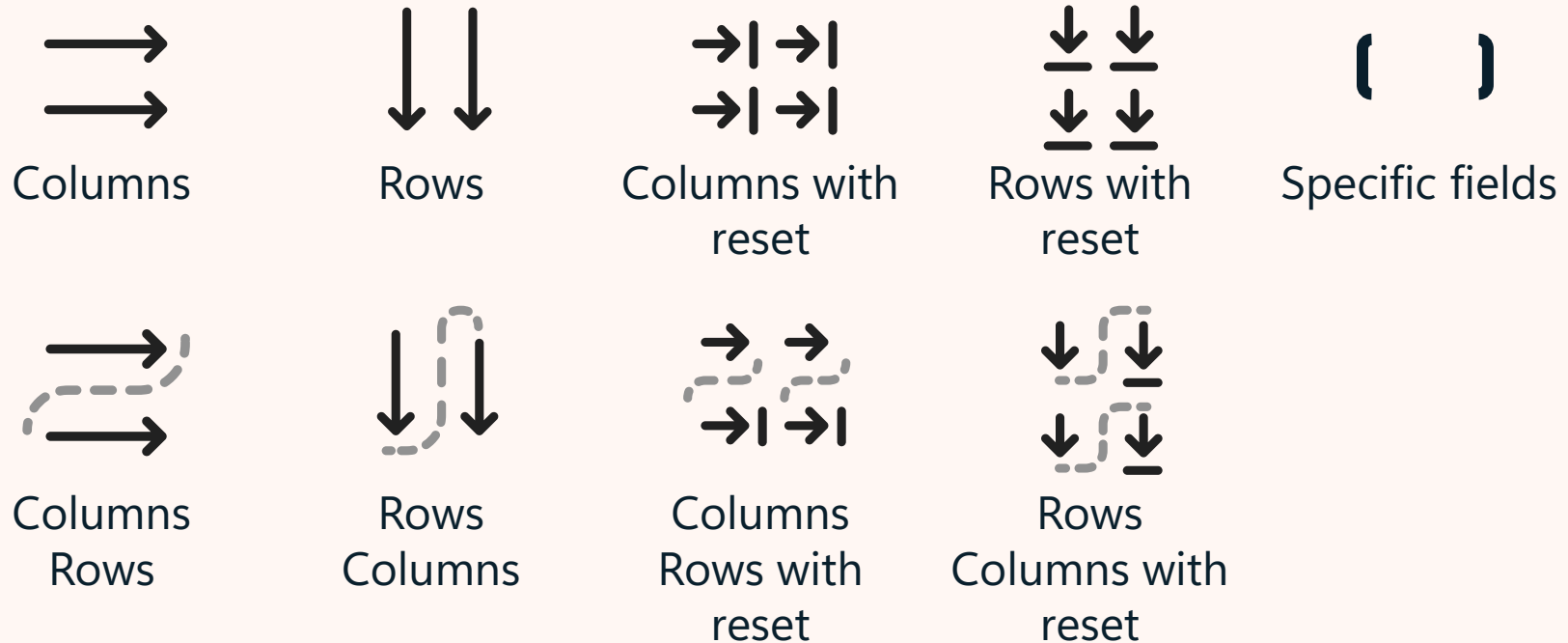

```
X ✓ fx    1 Calculation = PREVIOUS([Sales Amount], Columns Rows)
```

	FY2018		FY2019		FY2020		Total	
Fiscal Year								
Category	Sales Amount	Calculation	Sales Amount	Calculation	Sales Amount	Calculation	**Sales Amount**	**Calculation**
Accessories	$36,814.85		$138,901.55	36,814.85	$1,096,341.49	138,901.55	**$1,272,057.89**	
Bikes	$22,590,983.47	1,096,341.49	$28,544,881.62	22,590,983.47	$43,484,661.12	28,544,881.62	**$94,620,526.21**	1,272,057.89
Clothing	$66,327.53	43,484,661.12	$757,224.19	66,327.53	$1,294,061.73	757,224.19	**$2,117,613.45**	94,620,526.21
Components	$1,166,765.32	1,294,061.73	$4,629,101.14	1,166,765.32	$6,003,210.20	4,629,101.14	**$11,799,076.66**	2,117,613.45
Total	**$23,860,891.17**		**$34,070,108.50**	23,860,891.17	**$51,878,274.54**	34,070,108.50	**$109,809,274.20**	

Concept: Reset

- None: continue counting, never restart
- `LowestParent`: start over for each parent of the lowest level on the specified axis
- `HighestParent`: start over on the highest level on the specified axis
- [n]: start over on the nth level on the specified axis
- [Field reference] (example: `reset([Year])`

Concept: Direction

- Direction is the combination of *Axis* and *Reset*
- The 'specific fields' "direction" does not rely on *Axis* but instead references fields

Columns

Rows

Columns with reset

Rows with reset

Specific fields

Columns
Rows

Rows
Columns

Columns
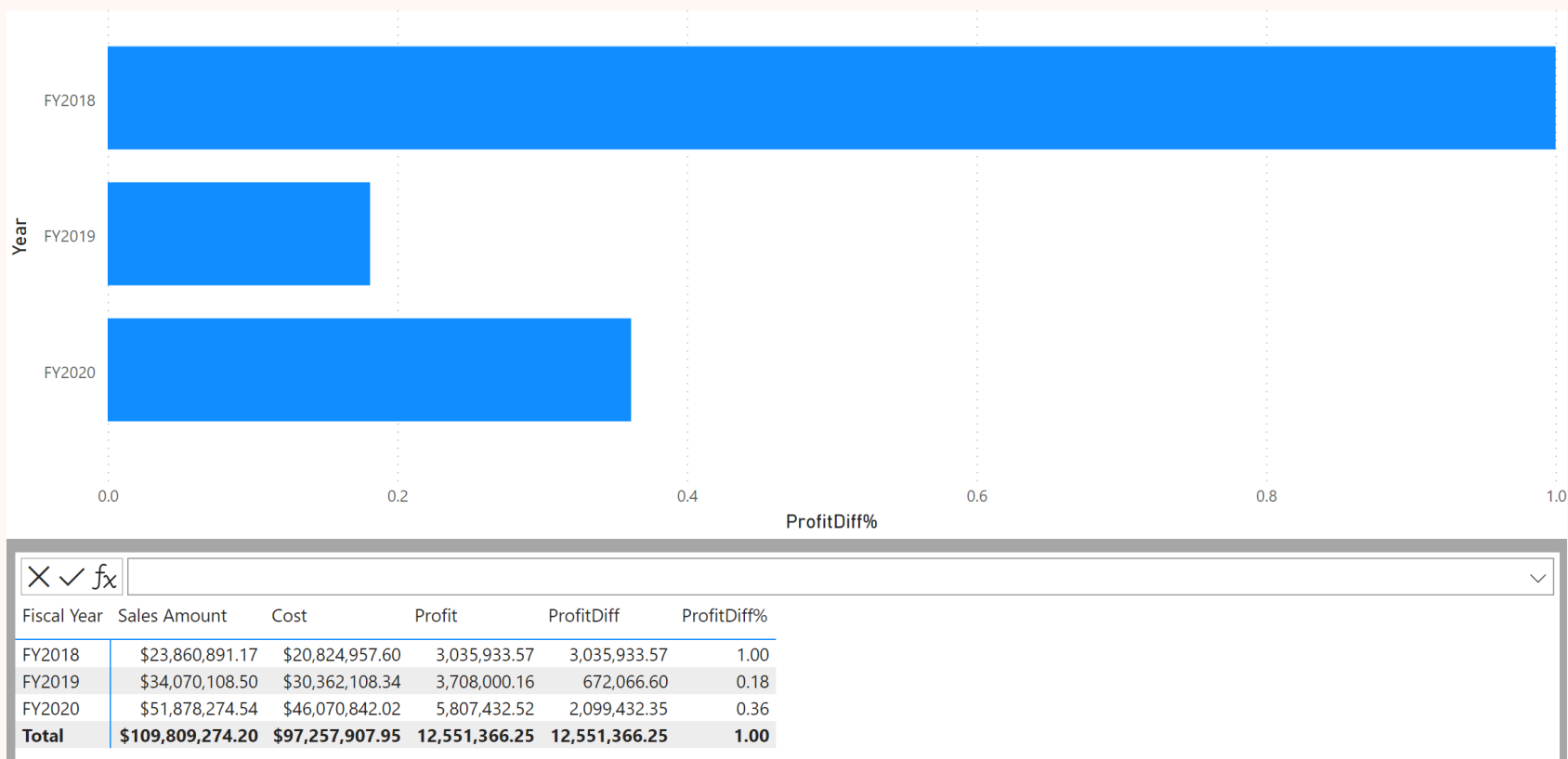Rows with reset

Rows
Columns with reset

Concept: Hidden

- All fields on the visual are on the visual matrix, but not all fields on the visual matrix are visible on the visual.

- Remember: visual calcs can refer to what's on the visual matrix, not to anything else.

- Allows for "partial results"

Example: Hidden

- Profit = [Sales Amount] – [Cost] (hidden)
- ProfitDiff = [Profit] – Previous([Profit]) (hidden)
- ProfitDiff% = DIVIDE([ProfitDiff], [Profit])

Fiscal Year	Sales Amount	Cost	Profit	ProfitDiff	ProfitDiff%
FY2018	$23,860,891.17	$20,824,957.60	3,035,933.57	3,035,933.57	1.00
FY2019	$34,070,108.50	$30,362,108.34	3,708,000.16	672,066.60	0.18
FY2020	$51,878,274.54	$46,070,842.02	5,807,432.52	2,099,432.35	0.36
Total	**$109,809,274.20**	**$97,257,907.95**	**12,551,366.25**	**12,551,366.25**	**1.00**

DEMO

But where is `calculate`?

We aim to "fatten the donut":

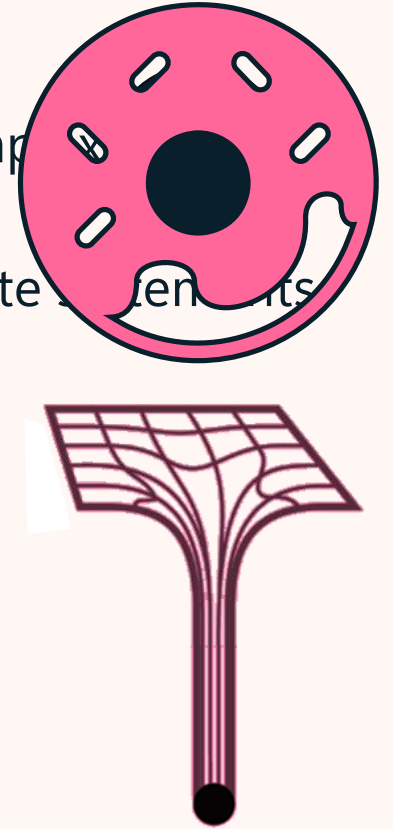> Only in the **center** the user is exposed to `calculate` and worry about comp[...] such as context transition

Higher-level (medium and high) functions have signatures that expand into calculate [...]en[...]s

Example:

```
first([Sales], [Year]) →

calculate([Sales], first[Year]) →
calculate([Sales], index(1, [Year])
```
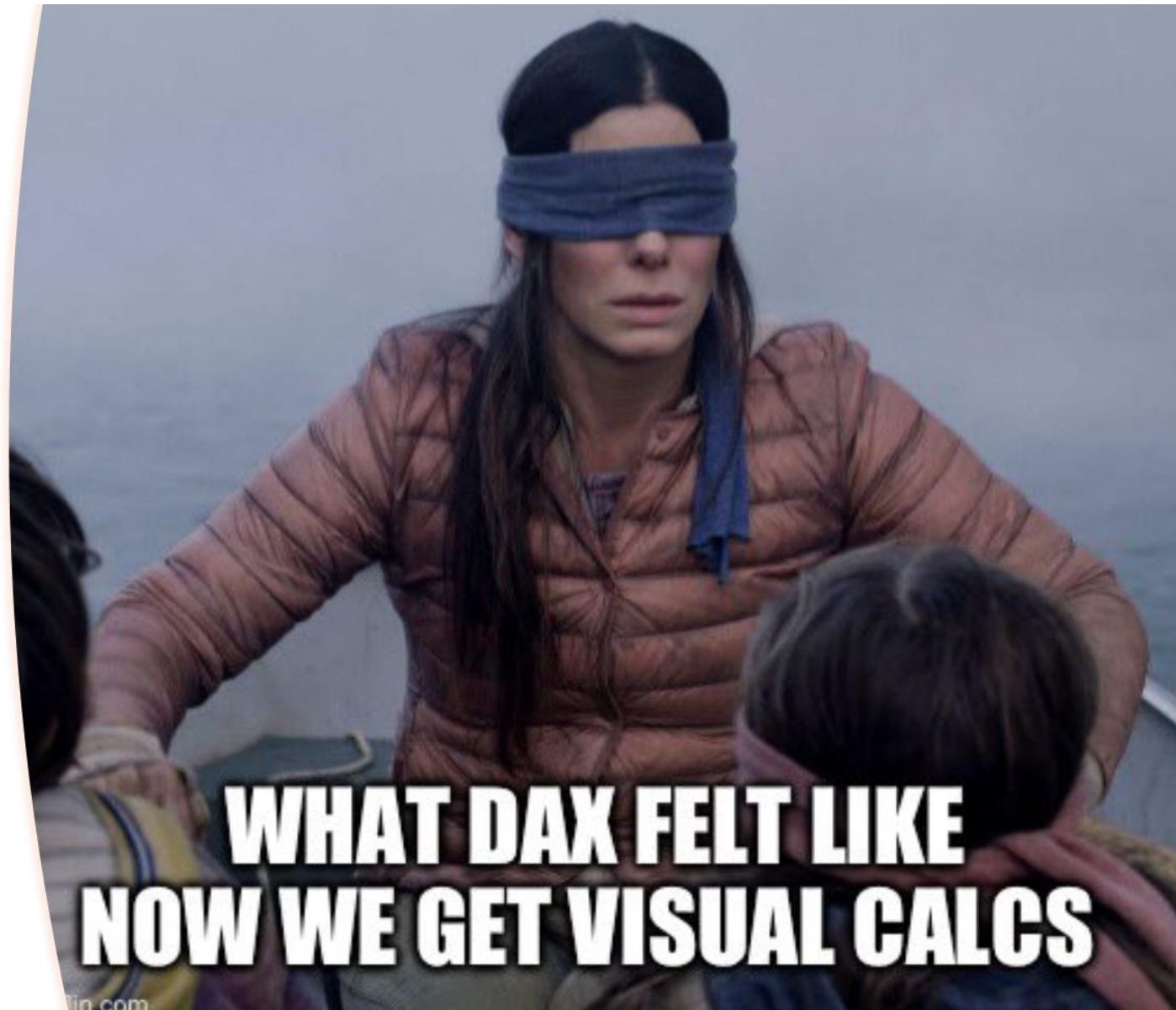
VISUAL CALCULATION

POWER BI GOVERNANCE

Questions?

WHAT DAX FELT LIKE NOW WE GET VISUAL CALCS

Resources

- Documentation of released functions: INDEX, OFFSET, WINDOW, RANK, ROWNUMBER, ORDERBY, PARTITIONBY, MATCHBY

- Understanding ORDERBY, PARTITIONBY and MATCHBY

- Using visual calculations
  https://aka.ms/visual-calculations-docs

- Calculations options
  https://aka.ms/powerbi-calculation-options

- Provide feedback on visual calculations
  https://aka.ms/visual-calculations-feedback

Thank you