

**TABLEAU**

**CONFERENCE**



#CalcMeMaybe

# Calc Me Maybe

## An Overview of All Tableau Calculations

**David A Spezia**

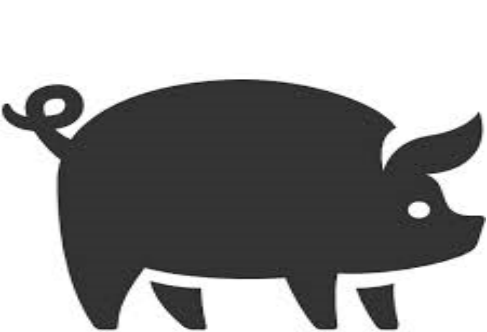
Strategic Solutions Architect

Tableau Software





**TABLEAU  
CONFERENCE**



# Agenda

**Understand the Calculation Types in Tableau**

**Breakdown how to use most of the Calculation Types**

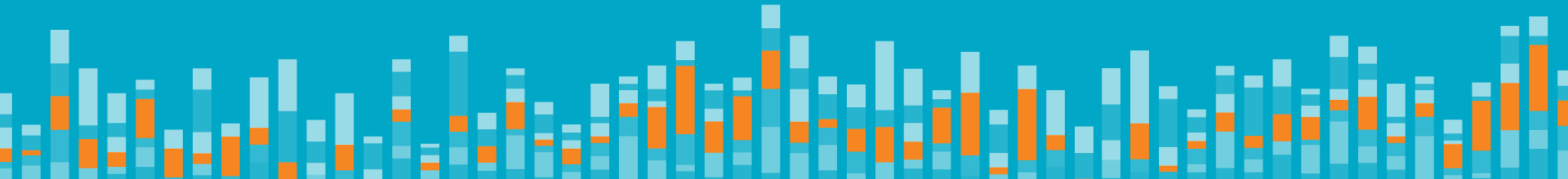
**Overview of Complex Calculation Types**

**Equip with a Decision Tree of When to Use What Calculation Type**

**Understand How to Combine Calculation Types for Analytics**

**Demonstrate Useful Examples & Tricks from the Field**

# Calculation Types



# Calculations in Tableau

Aggregations

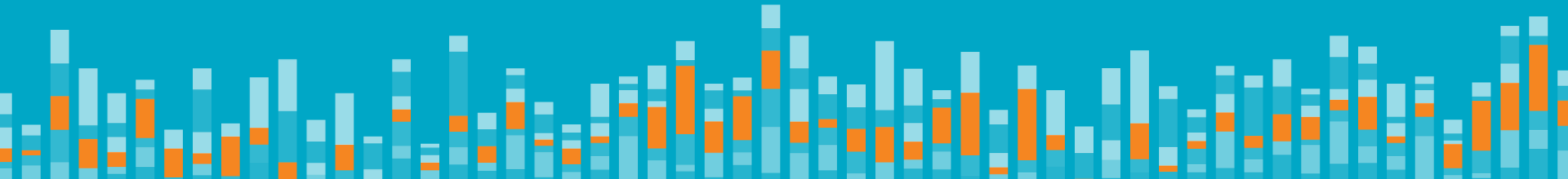
Basic  
Expressions

Table  
Calculations

Level Of  
Detail  
Expressions

User Defined  
Functions  
(Passthrough  
& Script)

# Aggregations



# Why Aggregations?

## Useful For

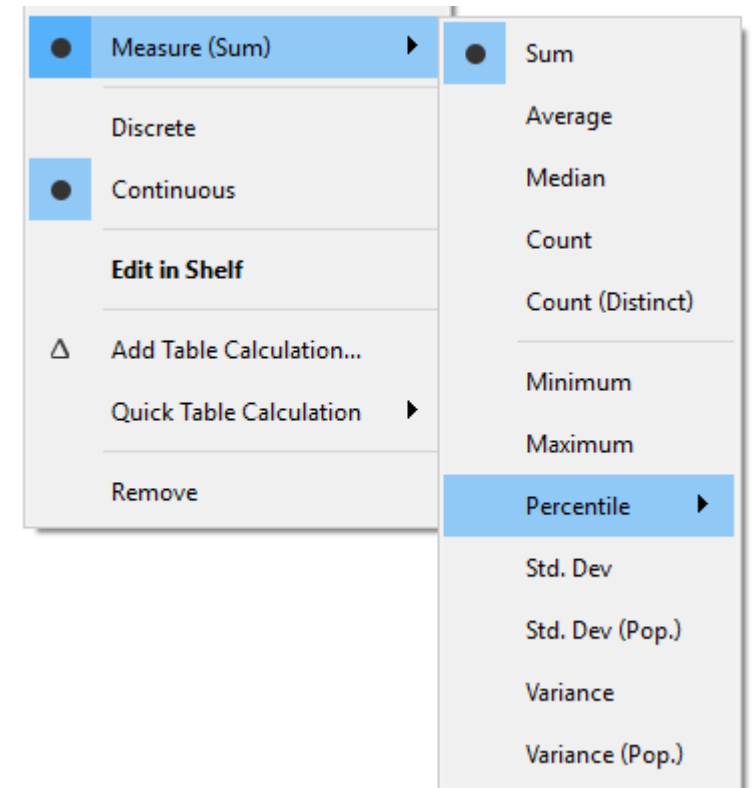
- Everyone, fundamental building block to understanding Tableau
- Tableau Operates as a SQL Aggregation Engine
- Instructing Tableau How to Roll Up Data
- Operate at the Row Level then Add Up

## Fall Down When

- You need Logic
- More than a Single Column of Data ( $[Col1] + [Col2] / [Col3]$ )
- Need to do Calculations to answer Deeper Questions

## Tricks

- Understand Partitioning (Group By / Compute At LOD))
- $SUM([Profit]/[Sales]) \neq SUM([Profit])/SUM([Sales])$
- Data Types will Limit Aggregations Available
- Mode()





# Overview of Aggregation Components

- Simple Aggregations
- Statistical Aggregations
- Other Aggregations
- Defaults
- Aggregations in Totals

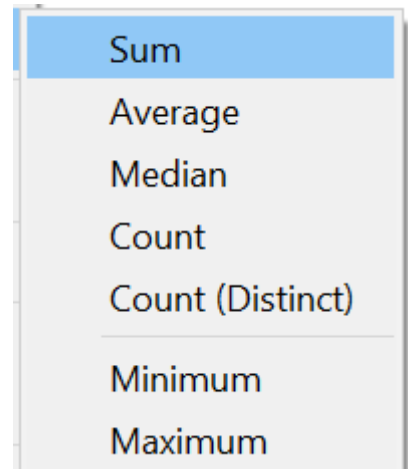
# Simple Aggregations

## Considerations

- Fundamental Building Blocks of Tableau
- Understand What is Returned by Each Function

## Function Library

- Sum | SUM()
  - Default Default for Measures
- Average | AVG()
- Median | MEDIAN()
  - Not Supported by All Connections (See XL)
- Count | COUNT()
- Count Distinct | COUNTD()
  - Default Dimensional Aggregation
- Minimum | MIN()
- Maximum | MAX()



Sum
Average
Median
Count
Count (Distinct)
Minimum
Maximum

# Statistical Aggregations

## Considerations

- Slightly Analytically Deeper than Simple Aggregations
- Understand What is Returned By Each Function
- Understand When/How to Use These for Analytics

## Function Library

- Percentile | PERCENTILE([Measure],N%(0.00 to 1.00))
  - PCT5()
  - PCT95()
- Standard Deviation | STDEV()
- Standard Deviation Population | STDEVP()
- Variance | VAR()
- Variance Population | VARP()

Percentile	5
Std. Dev	10
Std. Dev (Pop.)	25
Variance	50
Variance (Pop.)	75
	90
	95

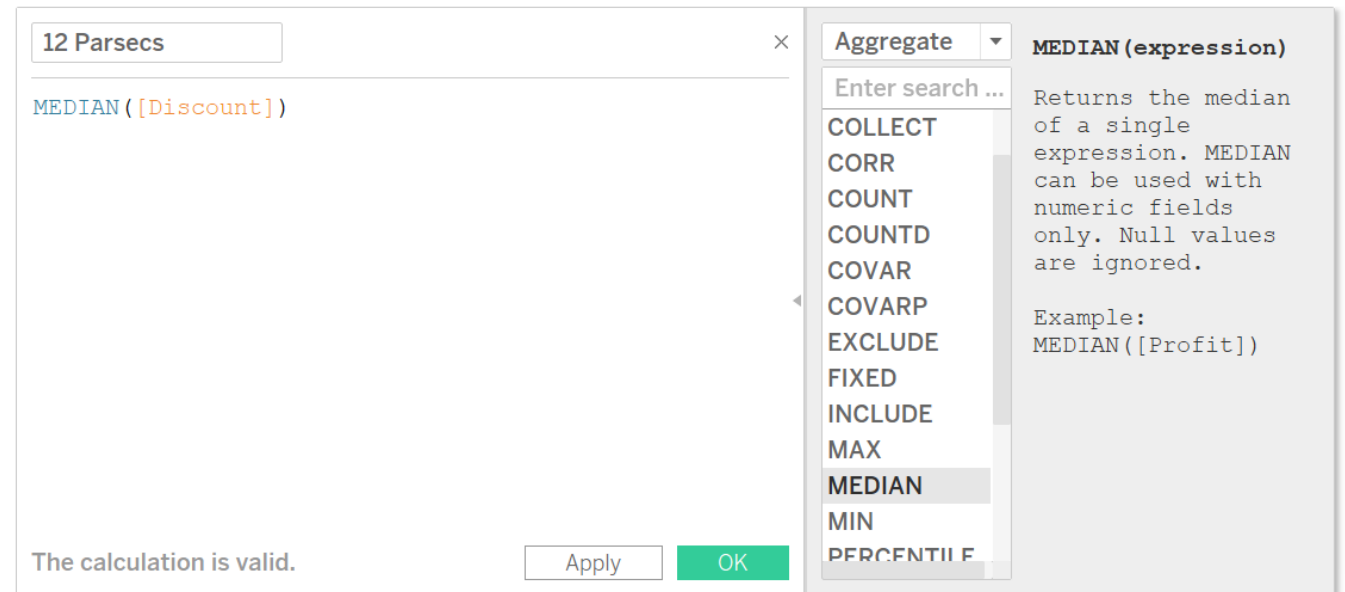
# Other Aggregations

## Considerations

- Can't Find the Aggregation You are Looking For?
- In the Calculation Dialogue (More on this Later)
- Understand What is Returned By Each Function
- Still Can't Find it? There are Sith Tricks...

## Function Library

- Attribute | ATTR()
  - Break Glass in Case of Emergency
  - Useful with Date Parts and Dimensions
- Collect | COLLECT()
  - Geocoding Specific
- Covariance | COVAR()
- Covariance Population | COVARP()



# Defaults

## Default Defaults

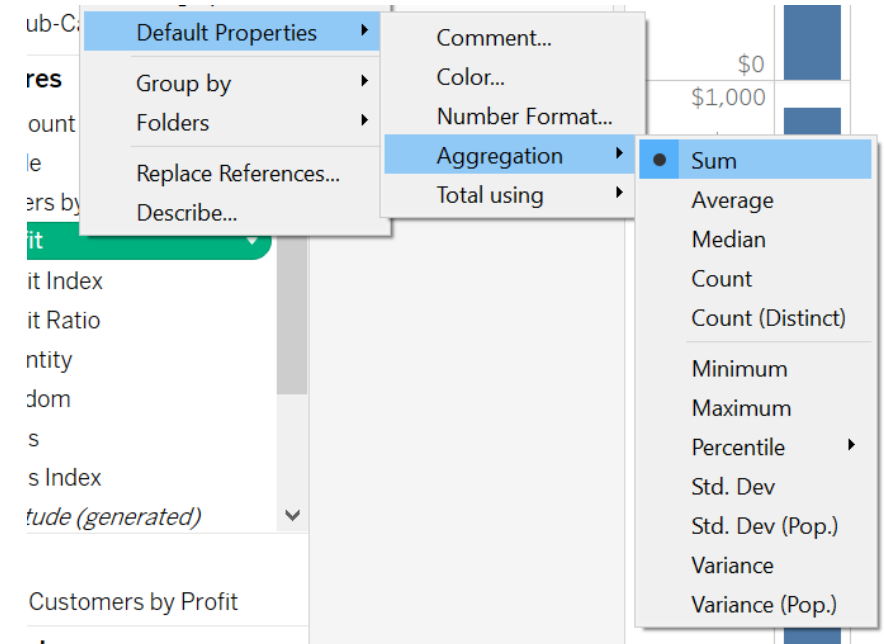
- Sum for Measures
- Count Distinct for Dimensions

## Easily Change

- Right Click Drag to Shelf
- Change Aggregation Type with the Pill Dialogue

## Things to Remember

- Set Defaults for Ease of Use
- Default Defined in Calculations
- Published Data Sources Retain Defaults



# Aggregations in Totals

## Set Defaults

- Sum for Measures
- Count Distinct for Dimensions

## Easily Change

- Change Aggregation Type with the Pill Dialogue

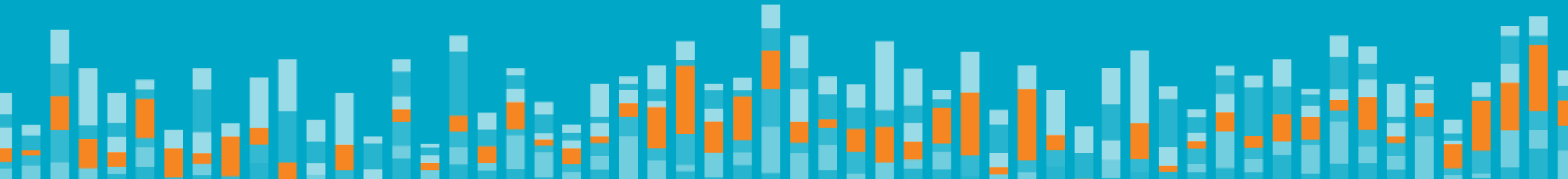
## Things to Remember

- Set Defaults for Ease of Use
- Defined Default in Calculations
- Published Data Source Retains Defaults

Category	Sub-Catego..	Region				Grand Total
		Central	East	South	West	
Furniture	Bookcases	\$24,157	\$43,819	\$10,899	\$36,004	\$28,720
	Chairs	\$85,231	\$96,261	\$45,176	\$101,781	\$82,112
	Furnishings	\$15,254	\$29,071	\$17,307	\$30,073	\$22,926
	Tables	\$39,155	\$39,140	\$43,916	\$84,755	\$51,741
	Total	\$40,949	\$52,073	\$29,325	\$63,153	\$46,375
Office Supplies	Appliances	\$23,582	\$34,188	\$19,525	\$30,236	\$26,883
	Art	\$5,765	\$7,486	\$4,656	\$9,212	\$6,780
	Binders	\$56,923	\$53,498	\$37,030	\$55,961	\$50,853
	Envelopes	\$4,637	\$4,376	\$3,346	\$4,118	\$4,119
	Fasteners	\$778	\$820	\$503	\$923	\$756
	Labels	\$2,451	\$2,603	\$2,353	\$5,079	\$3,122
	Paper	\$17,492	\$20,173	\$14,151	\$26,664	\$19,620
	Storage	\$45,930	\$71,613	\$35,768	\$70,533	\$55,961
	Supplies	\$9,467	\$10,760	\$8,319	\$18,127	\$11,668
	Total	\$18,558	\$22,835	\$13,961	\$24,539	\$19,974
Technology	Accessories	\$33,956	\$45,033	\$27,277	\$61,114	\$41,845
	Copiers	\$37,260	\$53,219	\$9,300	\$49,749	\$37,382
	Machines	\$26,797	\$66,106	\$53,891	\$42,444	\$47,310
	Phones	\$72,403	\$100,615	\$58,304	\$98,684	\$82,502
	Total	\$42,604	\$66,243	\$37,193	\$62,998	\$52,260
Grand Total		\$29,485	\$39,928	\$23,042	\$42,674	\$33,782

# 01 | Demo Time

# Basic Expressions





# Sidebar – BASIC

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B	Beginner's
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A	All-purpose
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S	Symbolic
---	----------

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I	Instruction
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C	Code
---	------

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# Why Basic Expressions?

## Useful For

- Adding new Dimensions and Measure to Your Data
- Use Dimensions and Measures to do Additional Analytics Beyond Aggregations
- Building Mathematical Formulas
- Using Parameters and User Inputs to Drive Behavior
- Filtering Data, Sheets, Dashboards & Sets

## Fall Down When

- Need to be Calculated at a Level of Detail different than the Sheet
- Need logic or Math post Aggregation on the Numbers in the Sheet
- UDF - Take this Value go off do Instructions and Return New Value based on Complex Rules

## Tricks

- Understand Partitioning (Group By / Compute At LOD))
- Use in Filters at the Data Source, Sheet, Sets and Calculation (SUM IF) Level
- Break Complex Functions into Components
- Custom Formatting with 4-4-5
- RANDOM() Question?

# Overview of Basic Expression Components



The Calculation Dialogue Box

Number Functions

String Functions

Type Conversion Functions

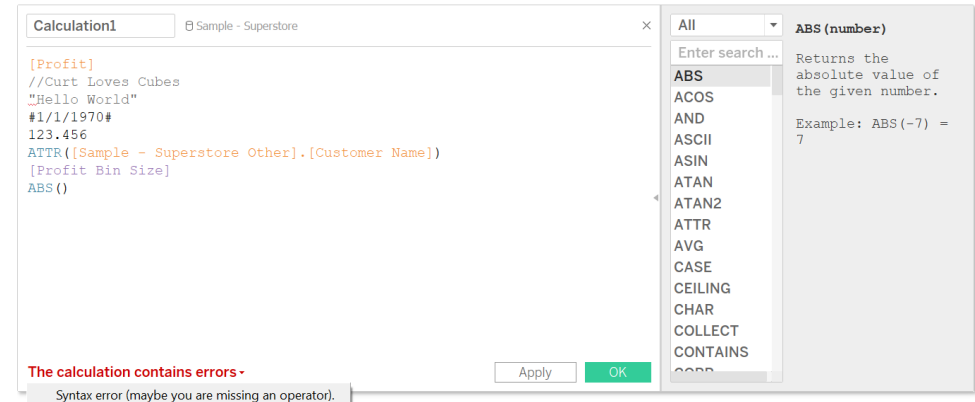
Logical Functions

User Functions

# The Calculation Dialogue Box

Death by Syntax (alternate title, Syntaxual Healing)

- Intellitype!
- Drop and Drop!
  - Drag and Drop Fields into Dialogue
  - Create Function on Shelves and Drag into Data Pane
- Functions in **BLUE()**
- Operators are +, -, \*, /, %, ==, =, >, <, >=, <=, !=, <>, ^, AND, OR, NOT, ()
- Parameters **[Parameters].Parameter** in **[PURPLE]** and are **[CaSe SeNsAtIvE]**
- Columns **[Data Source (O)].[Name]** in **[ORANGE]** and are **[CaSe SeNsAtIvE]**
- Address Columns from Other Data Sources with **AGG([Data Source].[Field])**
- Strings with Quotes “”
- Dates with Pounds ##
- true, false and null are literal expressions
- Comments with // in **GREY**
- Numbers are just typed in 123.456
- Error Checking is very helpful and in **RED**



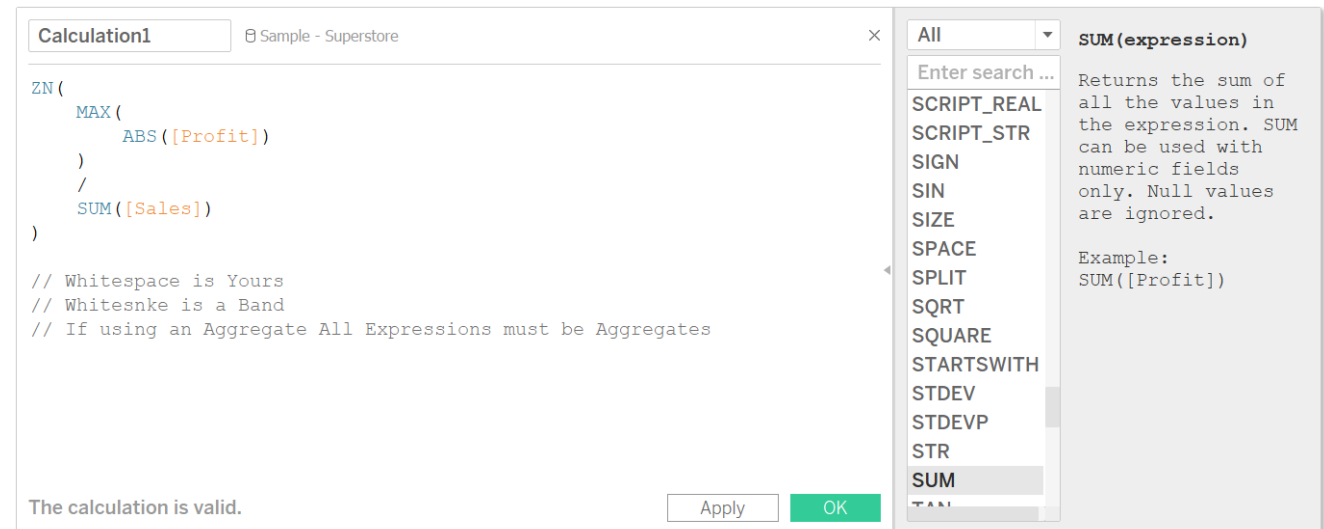
# Number Functions

## Considerations

- Pay Attention to Expected Input Data Types
- Some Functions need Multiple Input Fields
- If one Expression is an Aggregation you need All Aggregations

## Function Library (see Documentation for full list)

- Some Arithmetic Operators have Functions Too
  - Square Root has the Function SQRT() and Operator  $\wedge$
- Additional Arithmetic Operators
  - Absolute Value | ABS()
- Number Rounding
  - Round | ROUND()
- Trigonometry Functions
  - Tangent | TAN()
- Others
  - Zero Null | ZN()



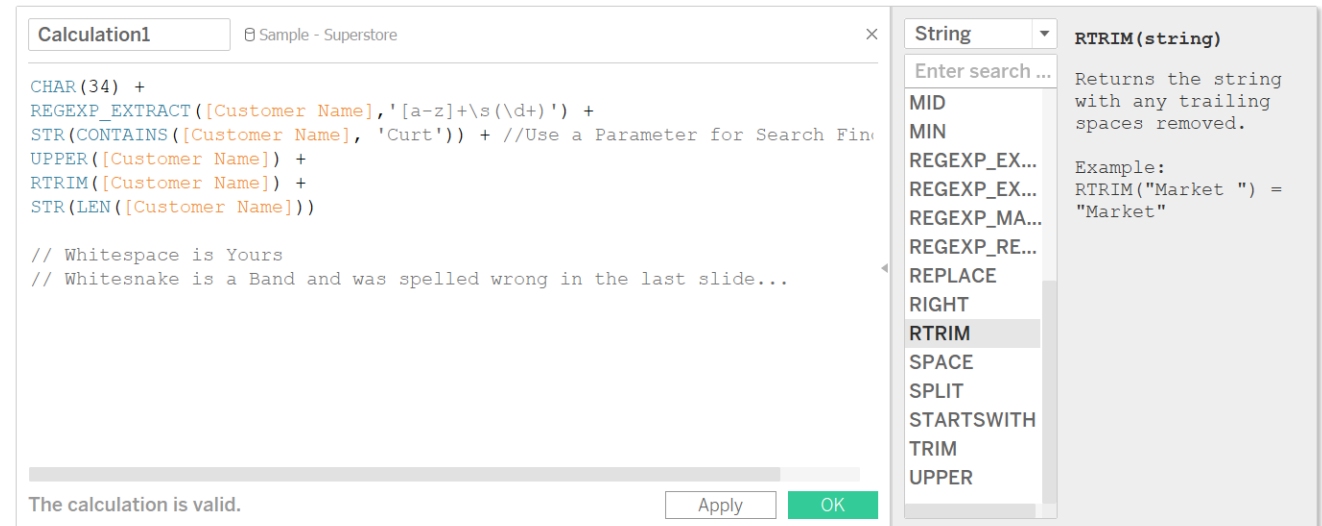
# String Functions

## Considerations

- Pay Attention to Expected Input Data Types
- Some Functions need Multiple Input Fields
- You can use Type Conversion to use String Functions on other Data Types STR()
- Concatenate with +

## Function Library (see Documentation for full list)

- ASCII Functions
  - Return Specific Character | CHAR()
- Regular Expressions
  - Regular Expression Extract | REGEX\_EXTRACT()
- Finding Literal Substrings
  - Contains Substring | CONTAINS()
- Case Conversion
  - Convert to Upper Case | UPPER()
- Deal with Trailing and Leading Spaces
  - Trim from the Right | RTRIM()
- Return Length and Specific Characters
  - Length | LEN()



# Type Conversion Functions

## Considerations

- For When you need to Pay Attention to Expected Input Data Types
- Create Dates from Parts or Literals
- Necessary for Functions with Multiple Outputs (Logical Foreshadowing)
- Sometimes you can just swap the data type in the UI

## Function Library (see Documentation for full list)

- Strings
  - Convert Anything into a String | `STR()`
- Dates
  - Make a Date from a String | `DATE()`
- Times
  - In Tableau you Can | `MAKETIME()`
- DateTimes
  - You can also Einstein and | `MAKEDATETIME()`
- Numbers
  - You can Float | `FLOAT()`



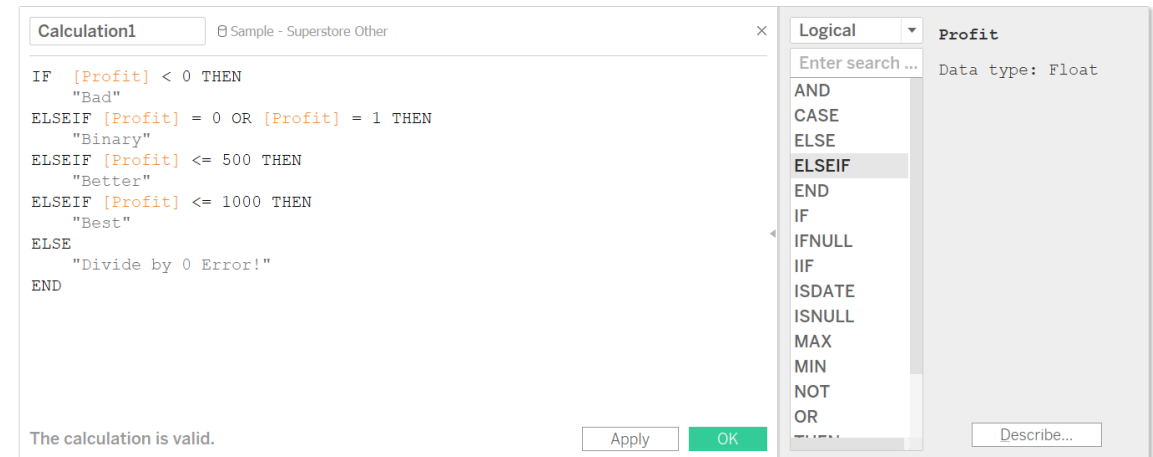
# Logical Functions

## Considerations

- Great for Creating Custom Bucket or Bins
- Create New Dimensions based on Measure Values
- Create Interactive Elements with Parameters
- IF you need Logic THEN you need these to meet the END, well just in CASE

## Function Library (see Documentation for full list)

- Boolean Comparators
  - OR, AND, NOT
- If Statements
  - IF, ELSEIF, ELSE, END
- Case Statements
  - CASE, WHEN, WHEN, ELSE, END





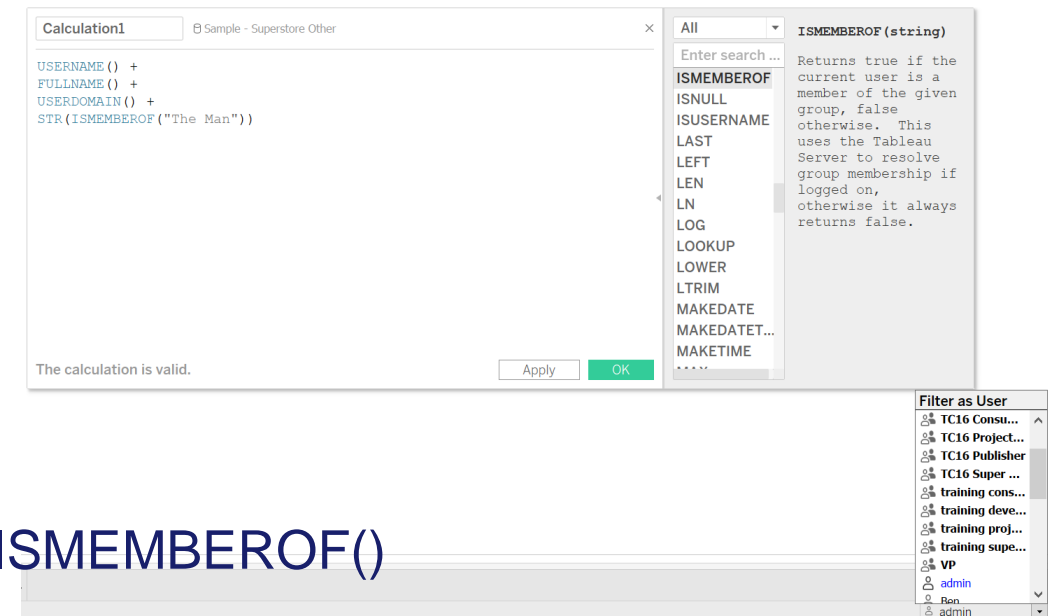
# User Functions

## Considerations

- Not User Defined Functions
- Returns Context About the Current Logged-in User
- Great for Creating User Filters and Column Entitlements
- User Switcher is Provided in Tableau Desktop for Testing

## Function Library (see Documentation for full list)

- Name Functions
  - System name of logged in User | USERNAME()
- Domain
  - Domain of logged in User | USERDOMAIN()
- Is Comparisons
  - Is the Current logged in User member of a Domain | ISMEMBEROF()



# 02 | Demo Time

# Basic Expressions – Deeper Dive

## Intro to Calculations – Hands on Training

- Oct 23 Tuesday 10:45am-1:15pm MCCNO L2 271
- Oct 23 Tuesday 2:15pm-4:45pm MCCNO L2 271
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L2 217

## Advanced Calculations – Hands on Training

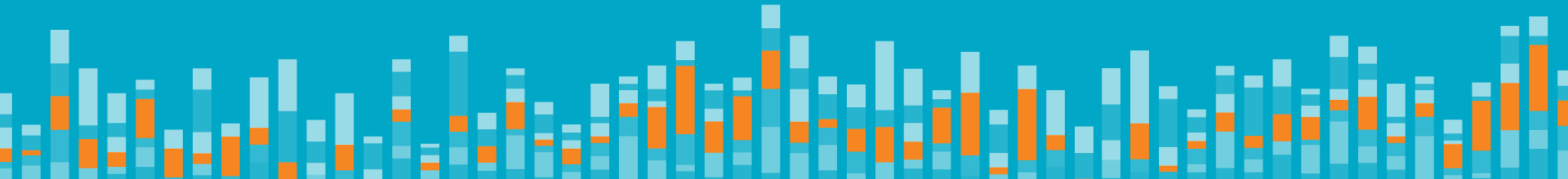
- Oct 23 Tuesday 2:15pm-4:45pm MCCNO L1 Great Hall D
- Oct 24 Wednesday 10:15am-12:45pm MCCNO L1 Great Hall D
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L1 Great Hall D

# WARNING!

## Difficulty Increase



# Table Calculations



# Why Table Calculations?

## Useful For

- Post Aggregation Formulas
- Calculating Specific Totals and Sub Totals
- Getting “Absolute References” for Formulas
- Answering Deeper Questions at Second Tier Analytics beyond Aggregations and Basic Expressions

## Fall Down When

- UDF - Take this Value go off do Instructions and Return New Value based on Complex Rules
- You think can you can address Tableau Cells with Cell Reference
- Many Complex Table Calcs and be Explicitly Controlled by LODs
- Large Crosstabs with many functions

## Tricks

- Ranking & Window Sizes
- How to Filter in a Table Calculation
- Index Calculation and Quadrants

# Overview of Table Calculation Components



Simple Table Calculations



The Table Calculation Dialogue Box



Compute Using



Nested Table Calculations

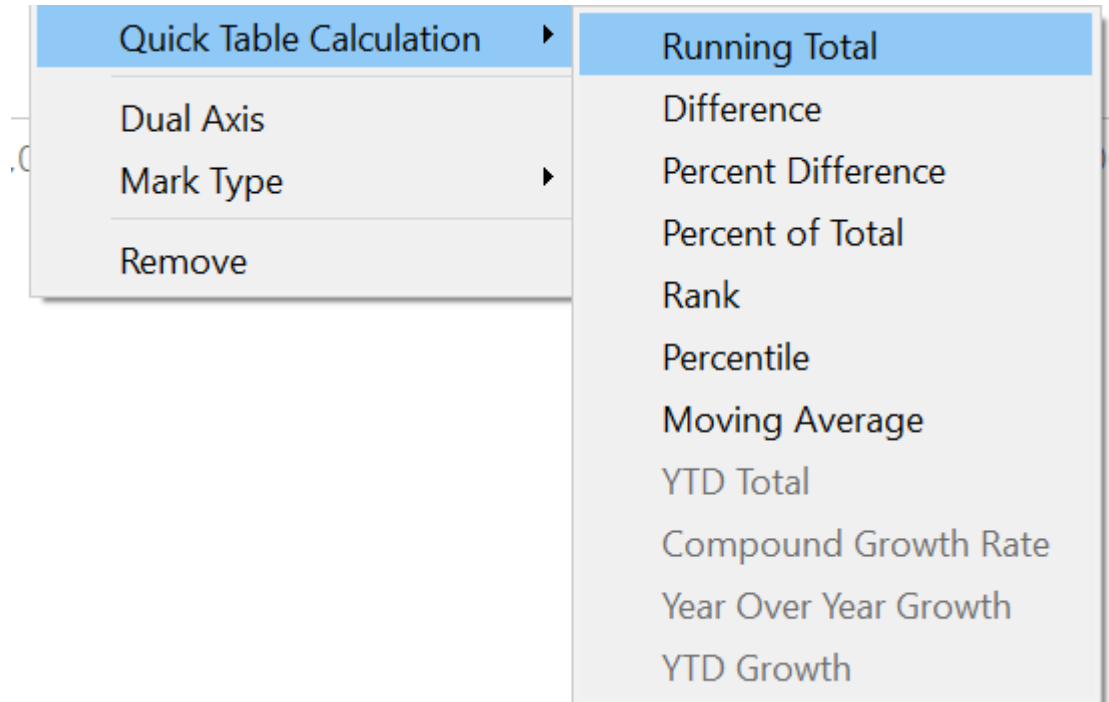
# Simple Table Calculations

## Considerations

- Post Aggregate Extension of Tableau Analytical Functionality
- Accessible from the Pill Dialogue
- Simple Tableau Calculations do not need Compute Using
- Run on Aggregate Measures
- Once you Get to These you are Becoming a Dangerous Tableau Analyst

## Function Library (see Documentation for full list)

- Running Total
  - Great for Keeping Score
- Difference
  - Subtract 2 Numbers in a Moving Fashion
- Rank
  - So Many Uses
- YTD Total
  - Needs a Date on the Sheet
- YoY Growth
  - Fancy % Difference





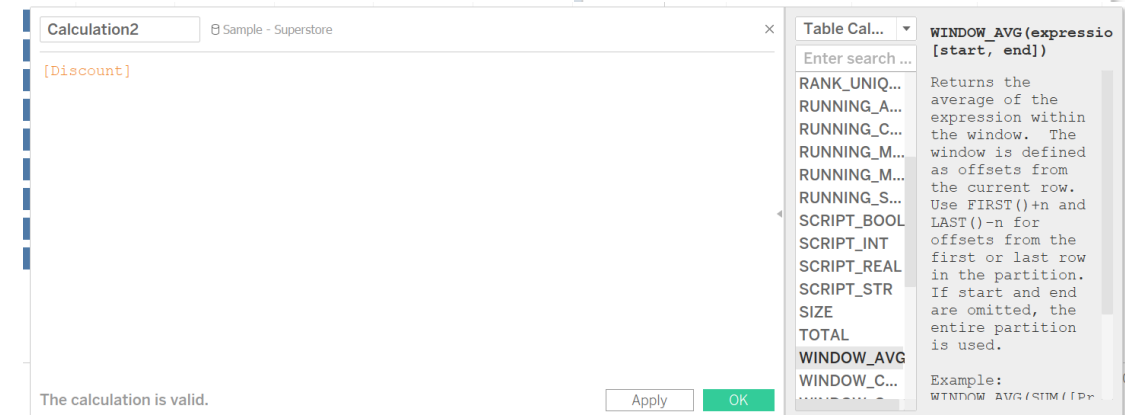
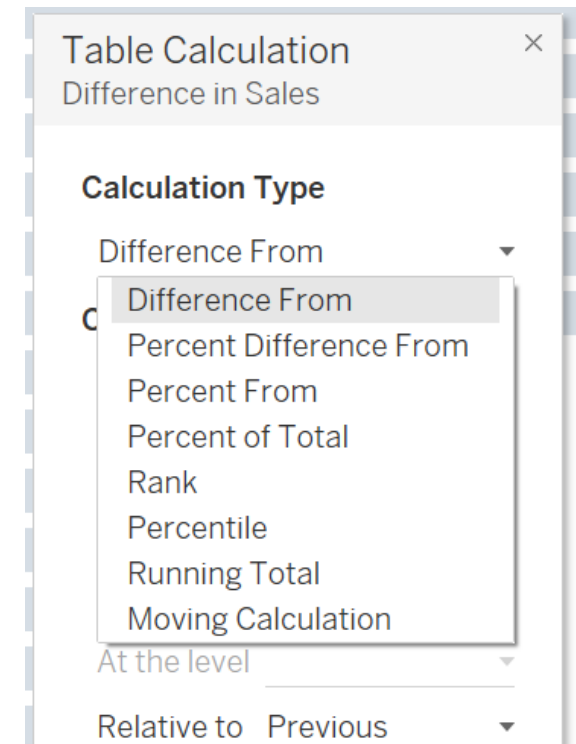
# The Tableau Calculation Dialogue Box

## Considerations

- When you want to get specific about the arithmetic
- Access to Compute Using

## You Can Also Use the Calculation Dialogue Box

- When you want to get very specific about the arithmetic
- Start with a Automatically Created Table Calc and Edit
- RANK
- RUNNING
- WINDOW



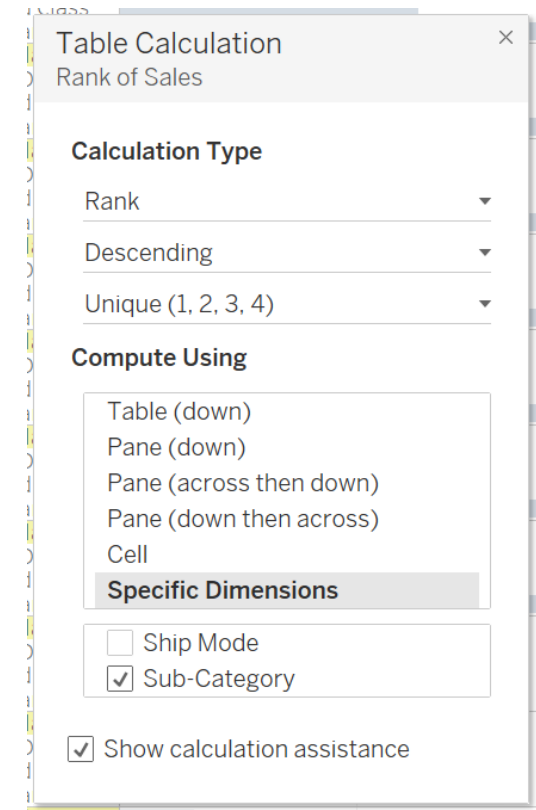
# Compute Using

## Considerations

- When you want to get specific about where to address the execution of the arithmetic
- Can be Confusing so use the calculation assistance

## Compute Using Types

- Table | Computes for all values in the result set
- Pane | Computes for the natural partition in the result set
  - Think Gridlines
- Cell | Computes for every row in the result set
- Specific Dimensions | Computes for a partition different than the natural partition in the result set



# Nested Table Calculations

## Considerations

- When you want to get very specific about where to address the execution of the arithmetic for a “second pass”
- Can be Very Confusing so use the calculation assistance

## Nesting

- Only available for MOVING and RUNNING
- Select the Add secondary calculation checkbox
- Choose the Secondary Calculation
  - Limited to Difference, Percent, Rank or Percentile functions
- Set the Compute Using
- Hide the Indicator for Cleaner Charts

# 03 | Demo Time

# Table Calculations – Deeper Dive

Pick Your Poison – LOD or Table Calc

- Oct 23 Tuesday 2:15pm-3:15pm MCCNO L1 Great Hall A

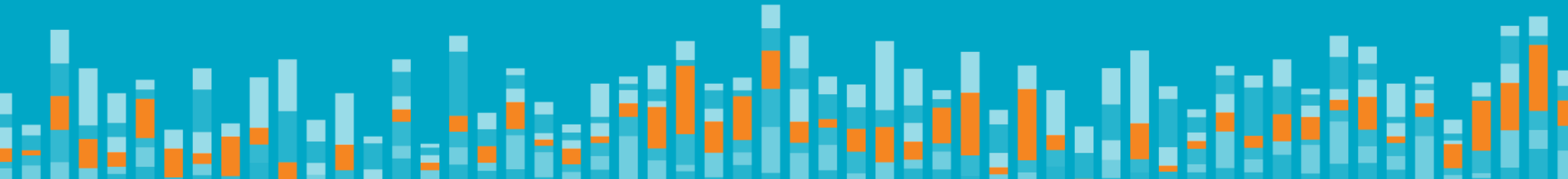
Table Calcs for the Advanced Analyst– Hands on Training

- Oct 23 Tuesday 10:45am-1:15pm MCCNO L1 Great Hall D
- Oct 24 Wednesday 10:15am-12:45pm MCCNO L2 265
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L2 265

Calculation Methods – Hands on Training

- Oct 23 Tuesday 10:45am-1:15pm MCCNO L3 394
- Oct 23 Tuesday 2:15pm-4:45pm MCCNO L3 394
- Oct 24 Wednesday 10:15am-12:45pm MCCNO L2 294

# Level of Detail Expressions (LODs)



# Why LODs?

## Useful For

- Calculating Values at a Predetermined Grouping of Dimensions
- Running Calculations at a Different Filter Level than the Sheet
- Getting “Absolute References” for Formulas for Specific Dimensions
- Answering Deeper Questions at Second Tier Analytics beyond Aggregations and Basic Expressions

## Fall Down When

- UDF - Take this Value go off do Instructions and Return New Value based on Complex Rules
- Must use Aggregates
- Confused about Tableau Order of Operations

## Tricks

- How to Filter in a LOD
- Days Since First Purchase

# Overview of LOD Components



What is LOD?



FIXED LOD



LOD vs Table Calculation



INCLUDE (Skipped)



EXCLUDE (Skipped)



# What is LOD? – Data Source

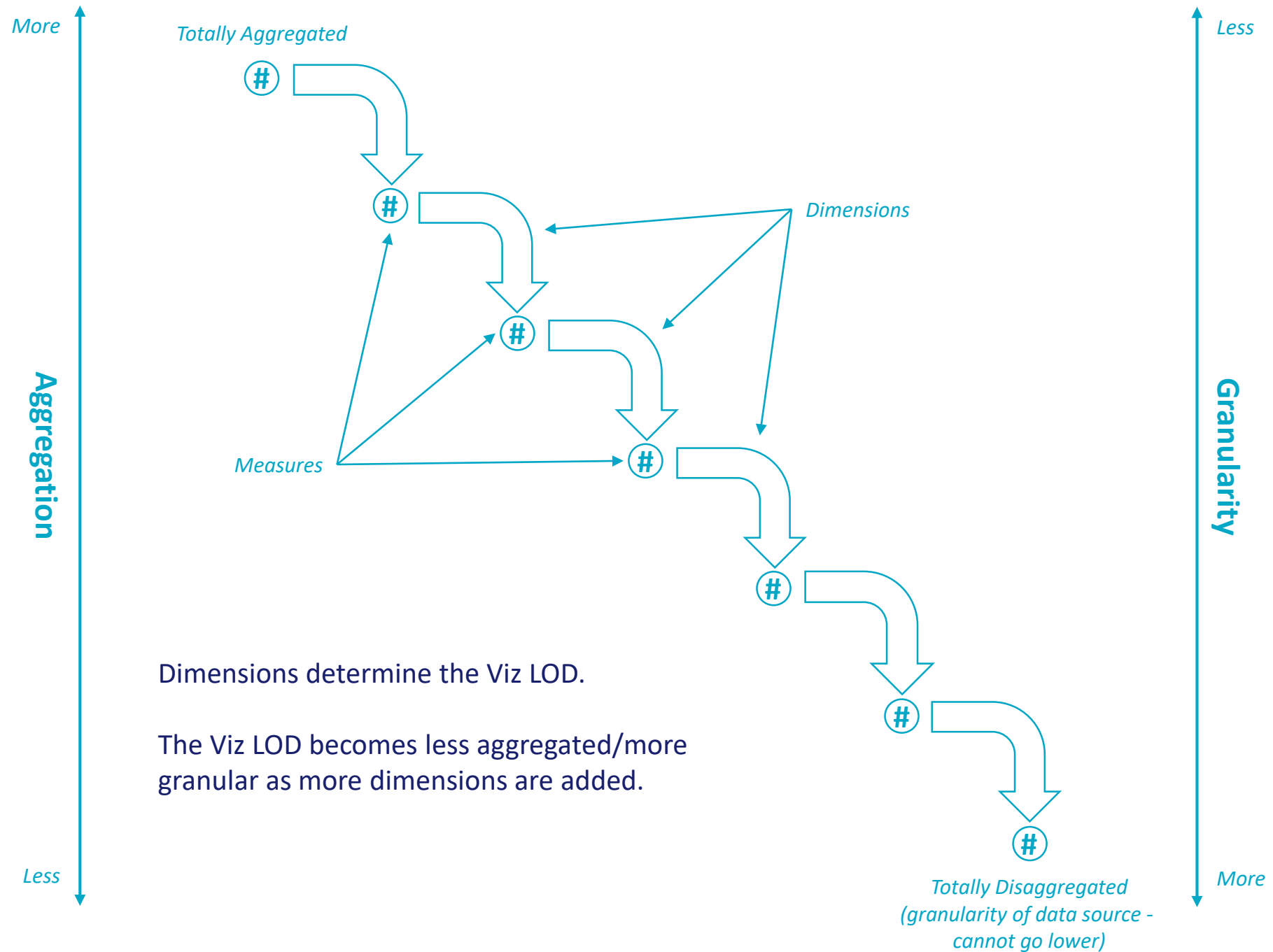
Tableau - Calculation Demos - Tableau license expires in 13 days

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

The screenshot shows the Tableau interface with the 'Data' pane on the left. The 'Dimensions' section is highlighted with a blue box, showing a list of fields: Customer (Customer Name, Segment), Order (Order Date, Order ID, Ship Date, Ship Mode), Calculation1, Location (Country, State, City, Postal Code), and Product (Category, Sub-Category). The 'Measures' section below it lists fields like Discount, Mode, Orders by Customer, Profit, Profit Index, and Profit Ratio. The main workspace is labeled 'Sheet 10' and contains the text 'Drop field here'.

The dimension fields represent the LOD of the data source.

You cannot drill down further than this.





By default, Tableau will aggregate the data LOD to match the Viz LOD.

# What is LOD? – Shelves Not Effecting LOD

Tableau - Calculation Demos - Tableau license expires in 13 days

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Data

Analytics

Sample - Superstore

Sample - Superstore Other

Dimensions

Customer

Customer Name

Segment

Order

Order Date

Order ID

Ship Date

Ship Mode

Calculation1

Location

Country

State

City

Postal Code

Product

Category

Sub-Category

Measures

Discount

Mode

Orders by Customer

Profit

Profit Index

Profit Ratio

Pages

Filters

Marks

Automatic

Color

Size

Text

Detail

Tooltip

Columns

Rows

Sheet 10

Drop field here

Drop field here

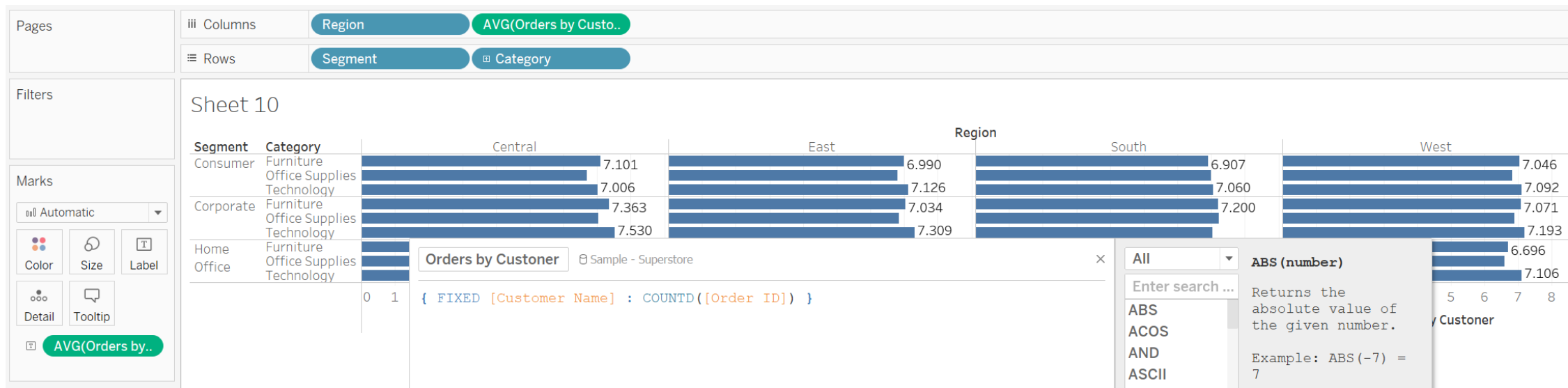
Dropping dimensions on these shelves does not add them to the Viz LOD.

# FIXED LOD

## Considerations

- The “FIXED” keyword allows you to specify the aggregation/granularity independently to the dimensions used in the Viz LOD.
- Be Sure to Set the Default Aggregation that Makes Sense

## Count of Orders by Customer



# LOD vs Table Calc

LODs Expressions	Table Calculations
Generated as part of the query.	Generated from the query result set.
Can perform calculations that are more granular or less granular than the viz LOD.	Can only produce results that are less granular than the viz LOD.
Dimensions that control the calculation are embedded in the calculation syntax.	Dimensions that control the calculation are separate from the calculation syntax.
Results can be measures, aggregated measures or dimensions*.	Results are always aggregated measures.
Results can be used in other constructs such as bins, groups, etc.	Results cannot be used in other constructs.
Filters act as exclude – removes records from the result set.	Filters act as a hide – does not remove records from the result set.

*\* FIXED expressions create dimensions, INCLUDE and EXCLUDE expressions create measures.*

# 04 | Demo Time

# LODs – Deeper Dive

## Getting Leveled with Level of Detail – Hands on Training

- Oct 23 Tuesday 10:45am-1:15pm MCCNO L2 265
- Oct 24 Wednesday 10:15am-12:45pm MCCNO L3 355
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L2 281

## LODs of Fun

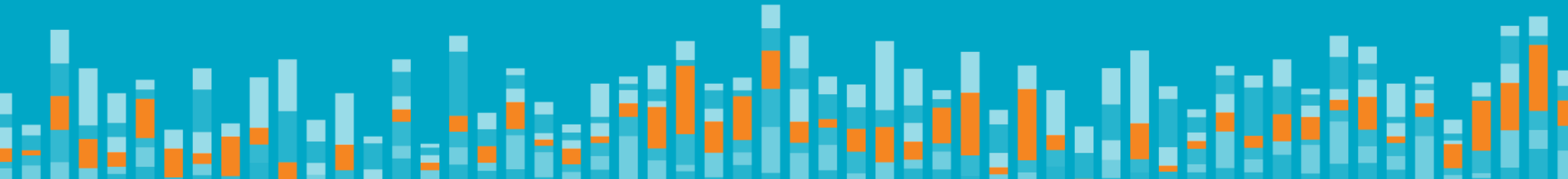
- Oct 24 Wednesday 3:30pm-4:30pm MCCNO L2 New Orleans Theater B
- Oct 25 Thursday 12:30pm-1:30pm MCCNO L2 New Orleans Theater C

## LOD Expression vs the Real World – Hands on Training

- Oct 23 Tuesday 2:15pm-4:45pm MCCNO L2 217
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L3 391
- Oct 25 Thursday 10:45am-1:15pm MCCNO L3 355



# None of These Work? UDFs



# Why UDFs?

## Useful For

- Accessing Functions not Currently in the Tableau Library
- Giving a Function a Value having it do things then Returning a New Value
- Pushing the Limits of Tableau Analytical Functionality
- Getting Deeper Statistical Functionality (R)
- Anything you Can Dream Up (TabPy)
- These Functions Execute within a Cell or Pane in the Tableau Sheet and Can Have Values Passed to Them

## Fall Down When

- You Do Not Understand AGG vs NoAGG Returns
- The Underlying Engine is Slow or Remote
- Get a Return Data Type different than the Expected Data Type
- You Cannot Code in PSQL, Python or R

## Tricks

- Net Workdays

# 05 | Demo Time

# UDFs – Deeper Dive

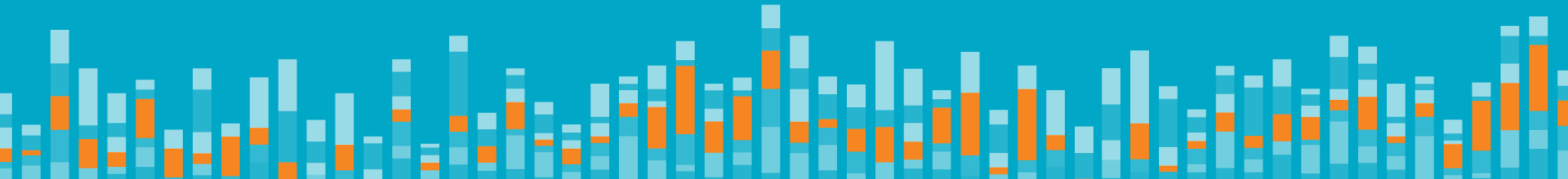
Accelerate Your Advanced Analytics with R, Python and MATLAB

- Oct 23 Tuesday 12:30pm-1:30pm MCCNO L2 La Nouvelle Ballroom C
- Oct 24 Wednesday 10:15am-11:15am MCCNO L2 La Nouvelle Ballroom C

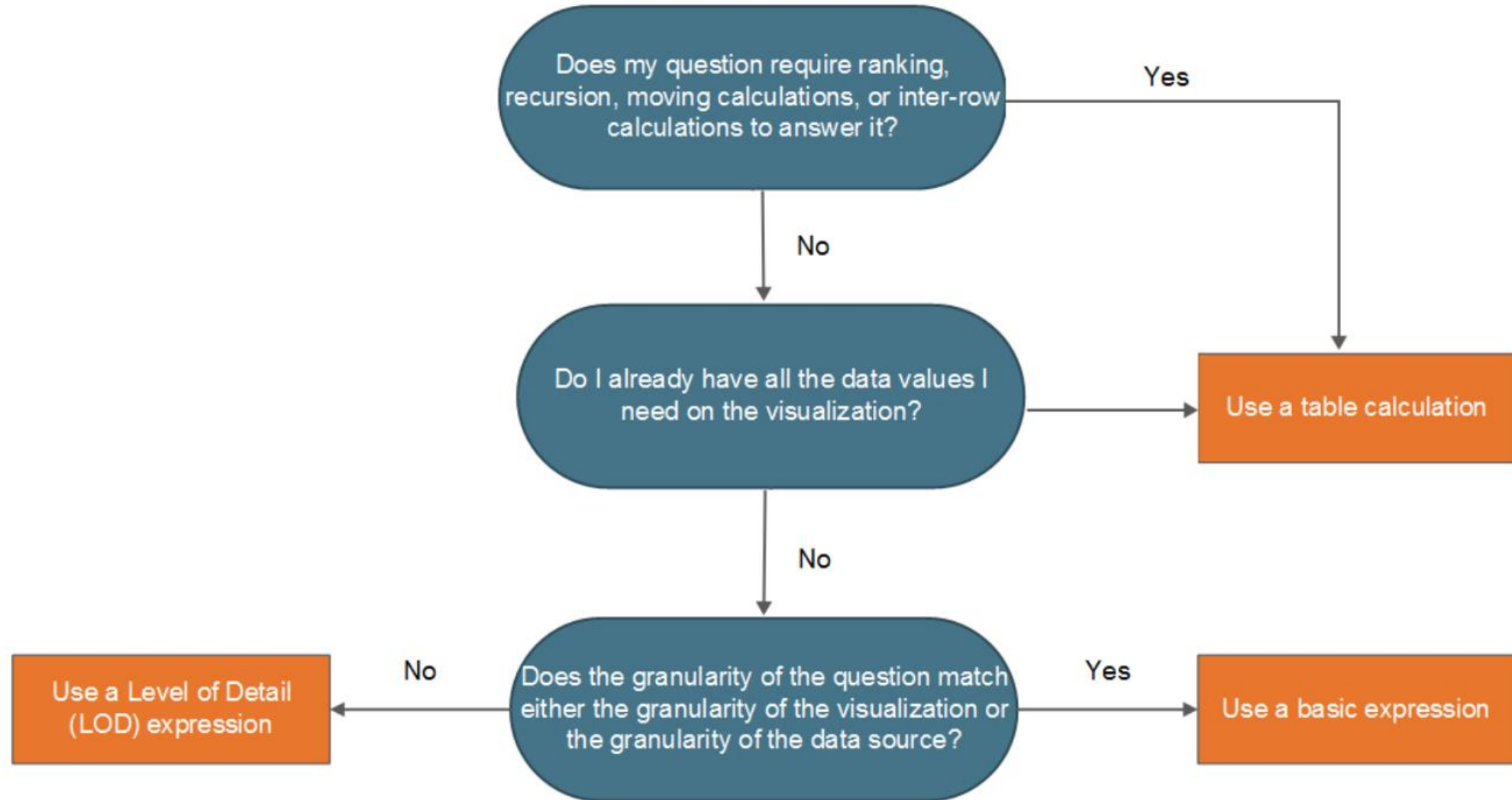
Tableau + Python = Love – Hand On Training

- Oct 23 Tuesday 10:45am-1:15pm MCCNO L2 217
- Oct 24 Wednesday 1:45pm-4:15pm MCCNO L2 220
- Oct 25 Thursday 10:45am-1:15pm MCCNO L2 217

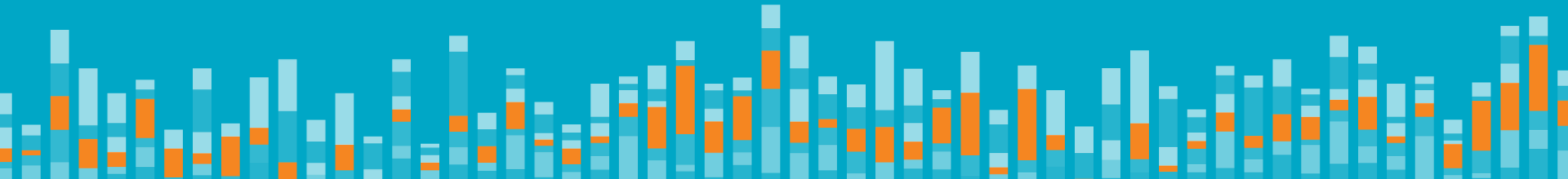
# Decision Tree



# Calculation Decision Tree

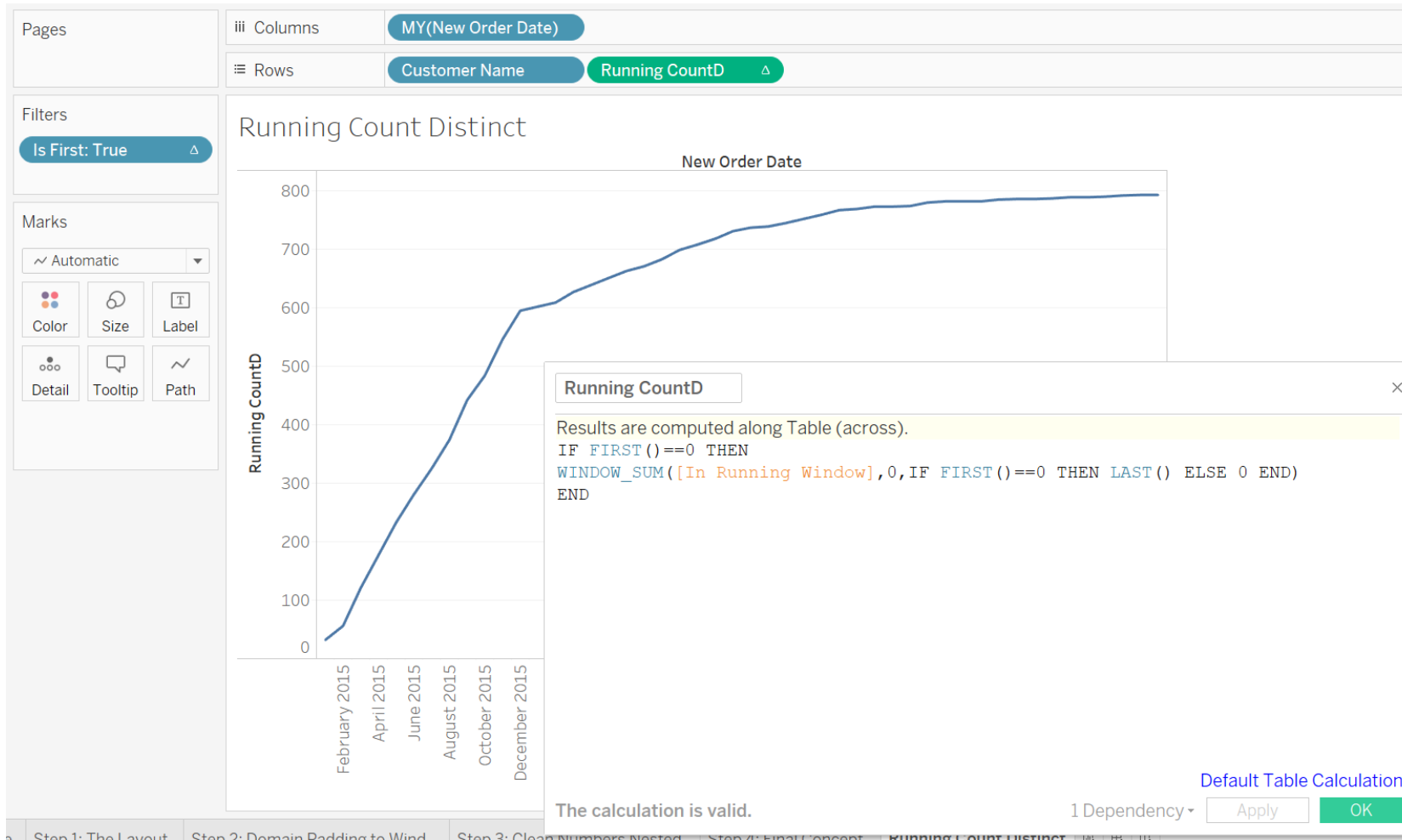


# Showing Off



# Running CountD()

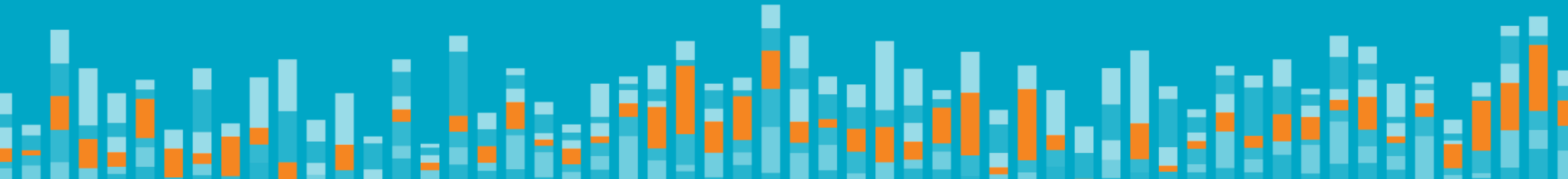
- Combination of Aggregations, Basic Expressions and Table Calculations





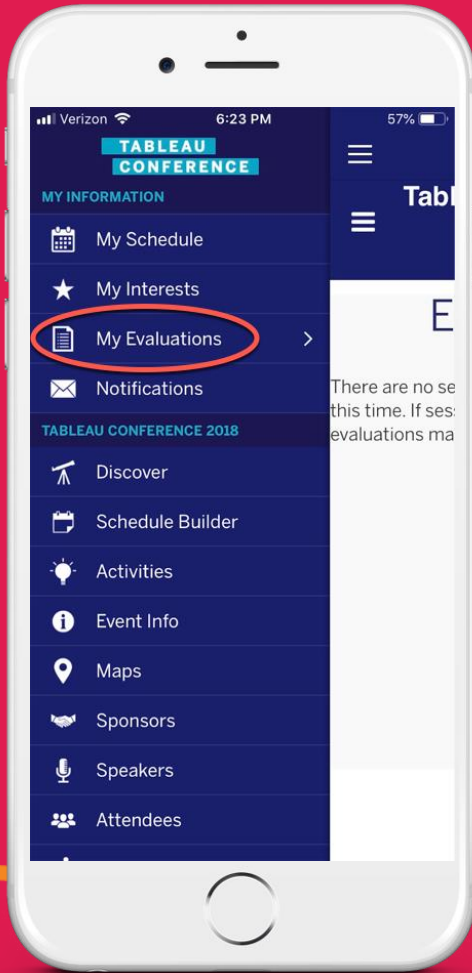
# 06 | Demo Time

# Conclusion



# Conclusion

- Knowledge of Tableau Calculation Types is crucial to becoming an effective analyst
- Having a Good Idea of When to use What Calculation Type Hones with Time
- Some Calculations Have a UX, most New Ones ship with UX
- Understanding Tableau Syntax allows you to speak 60+ Query Syntaxes
- The Same Problem can be solved with multiple approaches
- Break down the problem and build it up
- Try, try and try again, that's how you will learn this
- Watch the free additional eLearning on Tableau's Website
- Watch the deeper TC sessions for areas you want to know more about
- Have fun Calculating



Please complete the  
session survey from the My  
Evaluations menu  
in your TC18 app

# Questions?



#CalcMeMaybe

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# Thank you!

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