#CalcMeMaybe

Calc Me Maybe
An Overview of All Tableau Calculations

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Strategic Solutions Architect
Tableau Software
David A Spezia

GSI
- Most Traveled Consultant (28)
- Strategic Solutions Architect

Detroit
- Independant BI Consultant
- 3rd Services Architect
- Pig Farm

London
- 1st International Channel & OEM Pre-Sales
- Strategic Product Architect
- 4.5 Years of IT

Seattle
- Big Data Product Manager
- Home Office Too
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]) != SUM([Profit])/SUM([Sales])
• Data Types will Limit Aggregations Available
• Mode()
Overview of Aggregation Components

1. Simple Aggregations
2. Statistical Aggregations
3. Other Aggregations
4. Defaults
5. 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()
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()
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

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Central</th>
<th>East</th>
<th>Region</th>
<th>South</th>
<th>West</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Furniture</strong></td>
<td>Bookcases</td>
<td>$24,157</td>
<td>$43,819</td>
<td>$10,899</td>
<td>$36,004</td>
<td>$28,720</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chairs</td>
<td>$85,231</td>
<td>$96,261</td>
<td>$45,176</td>
<td>$101,781</td>
<td>$82,112</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Furnishings</td>
<td>$15,254</td>
<td>$29,071</td>
<td>$17,307</td>
<td>$30,073</td>
<td>$22,926</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tables</td>
<td>$39,135</td>
<td>$39,140</td>
<td>$43,916</td>
<td>$84,755</td>
<td>$51,741</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$40,549</td>
<td>$52,073</td>
<td>$29,325</td>
<td>$63,153</td>
<td>$46,375</td>
<td></td>
</tr>
<tr>
<td><strong>Office Supplies</strong></td>
<td>Appliances</td>
<td>$23,582</td>
<td>$34,188</td>
<td>$19,525</td>
<td>$30,236</td>
<td>$26,883</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Art</td>
<td>$5,765</td>
<td>$7,486</td>
<td>$4,656</td>
<td>$9,212</td>
<td>$6,780</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binders</td>
<td>$56,923</td>
<td>$53,498</td>
<td>$37,030</td>
<td>$55,961</td>
<td>$50,853</td>
<td></td>
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<tr>
<td></td>
<td>Envelopes</td>
<td>$4,637</td>
<td>$4,376</td>
<td>$3,346</td>
<td>$4,118</td>
<td>$4,119</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fasteners</td>
<td>$778</td>
<td>$820</td>
<td>$503</td>
<td>$923</td>
<td>$756</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labels</td>
<td>$2,451</td>
<td>$2,603</td>
<td>$2,353</td>
<td>$5,079</td>
<td>$3,122</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paper</td>
<td>$17,492</td>
<td>$20,173</td>
<td>$14,151</td>
<td>$26,664</td>
<td>$19,620</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td>$45,930</td>
<td>$71,613</td>
<td>$35,768</td>
<td>$70,533</td>
<td>$55,961</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplies</td>
<td>$9,467</td>
<td>$10,760</td>
<td>$8,319</td>
<td>$18,127</td>
<td>$11,668</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$18,558</td>
<td>$22,835</td>
<td>$13,961</td>
<td>$24,539</td>
<td>$19,974</td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Accessories</td>
<td>$33,956</td>
<td>$45,033</td>
<td>$27,277</td>
<td>$61,114</td>
<td>$41,845</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copiers</td>
<td>$37,260</td>
<td>$53,219</td>
<td>$9,300</td>
<td>$49,749</td>
<td>$37,382</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machines</td>
<td>$26,797</td>
<td>$66,106</td>
<td>$53,891</td>
<td>$42,444</td>
<td>$47,310</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phones</td>
<td>$72,403</td>
<td>$100,615</td>
<td>$58,304</td>
<td>$98,084</td>
<td>$82,502</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$42,604</td>
<td>$66,243</td>
<td>$37,193</td>
<td>$62,998</td>
<td>$52,260</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td>$29,485</td>
<td>$39,928</td>
<td>$23,042</td>
<td>$42,674</td>
<td>$33,782</td>
<td></td>
</tr>
</tbody>
</table>
01 | Demo Time
Basic Expressions
## Sidebar – BASIC

<table>
<thead>
<tr>
<th>B</th>
<th>Beginner’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All-purpose</td>
</tr>
<tr>
<td>S</td>
<td>Symbolic</td>
</tr>
<tr>
<td>I</td>
<td>Instruction</td>
</tr>
<tr>
<td>C</td>
<td>Code</td>
</tr>
</tbody>
</table>
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 \textcolor{blue}{BLUE()}
- Operators are 
  \texttt{+}, \texttt{-}, \texttt{\ast}, \texttt{\div}, \texttt{\%}, \texttt{==}, \texttt{=}, \texttt{>, <, >=, <=, !>, <>}, \texttt{^}, \texttt{AND}, \texttt{OR}, \texttt{NOT}, \texttt{()}
- Parameters \texttt{[Parameters].Parameter} in \textcolor{purple}{[PURPLE]} and are \textcolor{orange}{[CaSe SeNsAtIvE]}
- Columns \texttt{[Data Source (O)].[Name]} in \textcolor{orange}{[ORANGE]} and are \textcolor{orange}{[CaSe SeNsAtIvE]}
- Address Columns from Other Data Sources with AGG([\texttt{Data Source}.[\texttt{Field}])
- Strings with Quotes “”
- Dates with Pounds 
  \texttt{##}
- true, false and null are literal expressions
- Comments with // in \textcolor{grey}{GREY}
- Numbers are just typed in 123.456
- Error Checking is very helpful and in \textcolor{red}{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 ^
• 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 they 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 in 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

YOU TRIED YOUR BEST AND FAILED Miserably.

THE LESSON IS, NEVER TRY.
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

Quick Table Calculation

<table>
<thead>
<tr>
<th>Run on Aggregate</th>
<th>Running Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute Using</td>
<td>Difference</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
</tr>
<tr>
<td></td>
<td>YTD</td>
</tr>
<tr>
<td></td>
<td>Year</td>
</tr>
<tr>
<td></td>
<td>Over Year</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
</tr>
</tbody>
</table>
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

The dimension fields represent the LOD of the data source.

You cannot drill down further than this.
Dimensions determine the Viz LOD.

The Viz LOD becomes less aggregated/more granular as more dimensions are added.
What is LOD? – Shelves Effecting LOD

Dropping dimensions on these shelves adds them to the Viz LOD.

By default, Tableau will aggregate the data LOD to match the Viz LOD.
What is LOD? – Shelves Not Effecting LOD

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

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

* 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 You 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

Does my question require ranking, recursion, moving calculations, or inter-row calculations to answer it?

Yes

Do I already have all the data values I need on the visualization?

No

Use a table calculation

No

Does the granularity of the question match either the granularity of the visualization or the granularity of the data source?

Yes

Use a basic expression

No

Use a Level of Detail (LOD) expression
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.
Are you sure the data you gave me is correct?

I've been giving you incorrect data for years. This is the first time you've asked.

What?

I said the data is totally accurate.
Thank you!

https://www.linkedin.com/in/davidspezia/