Introduction to LOD Expressions and FIXED

CALCULATIONS IN TABLEAU

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Granularity of the data

> **Data granularity** is the level of detail in a model or decision making process. It tells you how detailed your data is (1)

e.g. Time-series analysis: per second | minute | hour | day | week | month | (...)

Sleep per day

User ID	Sleep Date	Minutes Asleep	Time in Bed
1503960366	09-May-2016	338	342
1644430081	29-Apr-2016	119	127
1844505072	30-Apr-2016	722	961
1927972279	12-Apr-2016	750	775
2026352035	17-Apr-2016	503	546

Heart Rate per minute

User ID	Date	Time	Heart Rate
2026352035	17-Apr-2016	5:30 AM	68
2026352035	17-Apr-2016	5:31 AM	68
2026352035	17-Apr-2016	5:32 AM	67
2026352035	17-Apr-2016	5:33 AM	65
2026352035	17-Apr-2016	5:34 AM	64
2026352035	17-Apr-2016	5:35 AM	64
2026352035	17-Apr-2016	5:36 AM	65
2026352035	17-Apr-2016	5:37 AM	65
2026352035	17-Apr-2016	5:38 AM	65

[1] Ponniah, P. (2004). Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals. Wiley.

Granularity of the view

- Granularity and aggregation
- Aggregate = **decrease** the data granularity. e.g. Total `SUM(Sales)`

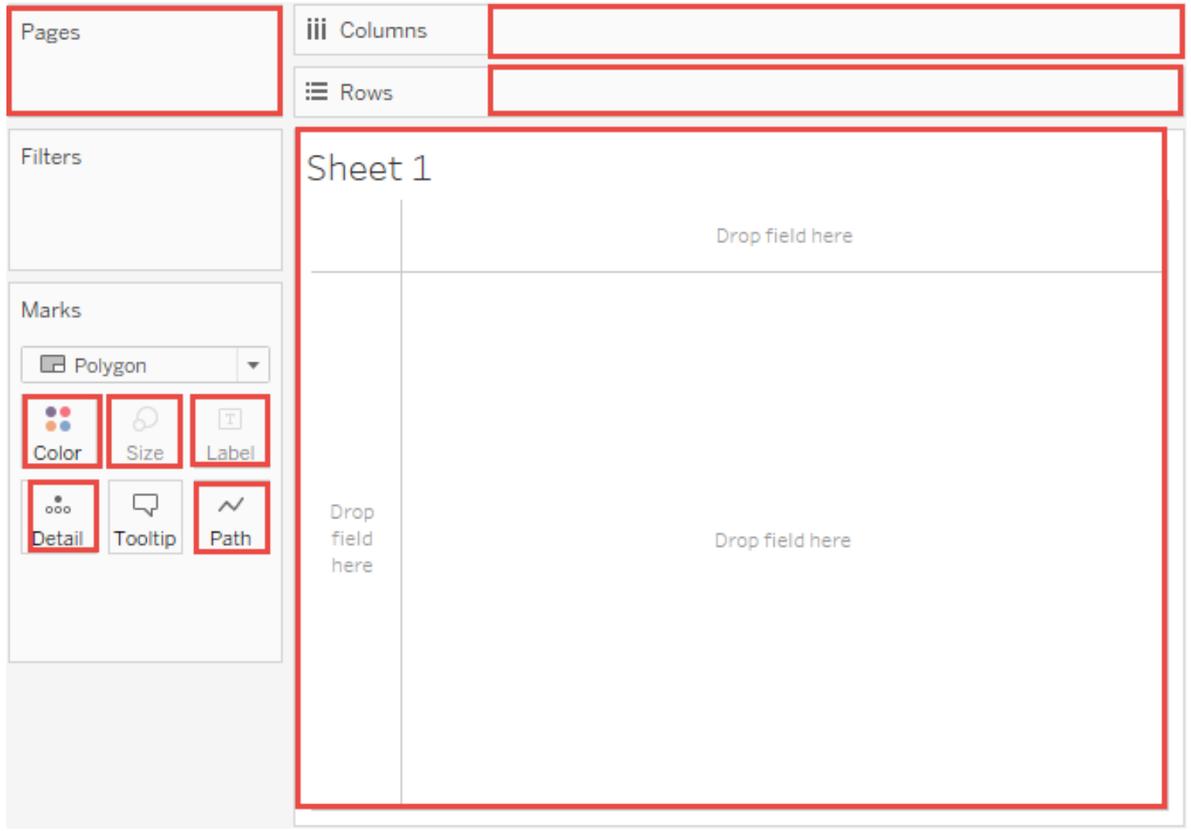
Sales per region and year

	2018	2019	2020	2021	REGION TOTAL
EMEA	€ 14 K	€ 22 K	€ 15 K	€ 17 K	€ 68 K
Americas	€ 16 K	€ 18 K	€ 17 K	€ 21 K	€ 73 K
Asia	€ 13 K	€ 19 K	€ 15 K	€ 22 K	€ 69 K
Australia	€ 13 K	€ 13 K	€ 13 K	€ 19 K	€ 58 K
YEAR TOTAL	€ 56 K	€ 73 K	€ 60 K	€ 79 K	€ 268 K

- Add dimensions = **increase** the data granularity, e.g. `SUM(Sales)` *per region and per year*

Managing granularity in Tableau worksheet

- Adding dimensions to the Shelves
- Adding dimensions on the Marks:
  - Detail
  - Color
  - Shape
  - Size
  - Path
  - Label
- More dimensions = more data points
- It becomes more difficult to visualize



LOD Expressions in Tableau

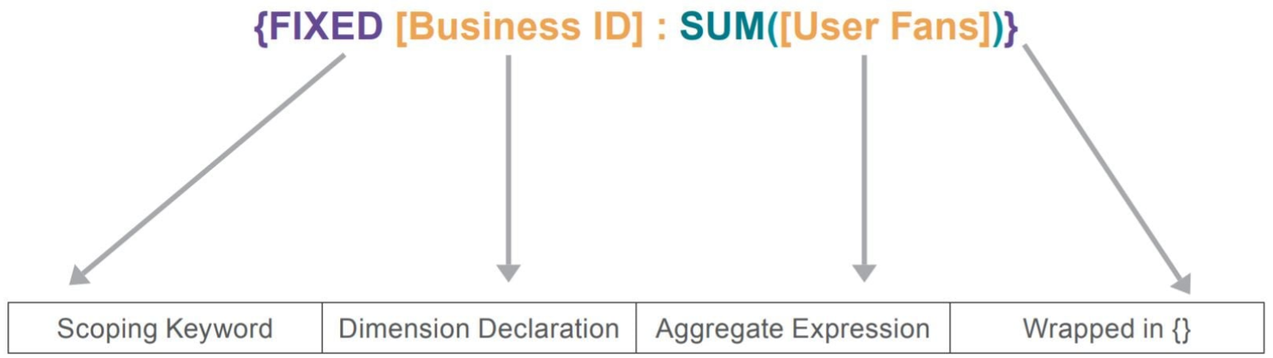
> LOD Expressions provide a way to easily compute aggregations that are **NOT** at the level of detail of the visualization

Family of 3 functions:

- `INCLUDE` : calculating at a **lower level of detail**
- `EXCLUDE` : calculating at a **higher level of detail**
- `FIXED` : calculating at an **exactly specified level of detail**

FIXED LOD Expressions

FIXED level of detail expressions compute a value using the **specified dimensions**, without reference to the dimensions in the view.



- Works with 0, 1, 2 or more dimensions, in any order
- Result of the LOD calculation can be either a dimension **or** a measure
- Dimensions of interest are contained in the calculation and do not clutter the view

Practical applications of FIXED LOD expressions

Calculating measures between various time dimensions:

e.g Swapping between daily and weekly calculations `{ FIXED [Day] : SUM(Sales)}`

Calculating (sub) totals per categories:

e.g. % of Total `{ FIXED [Product] : SUM(Costs) } / { FIXED : SUM(Costs) }`

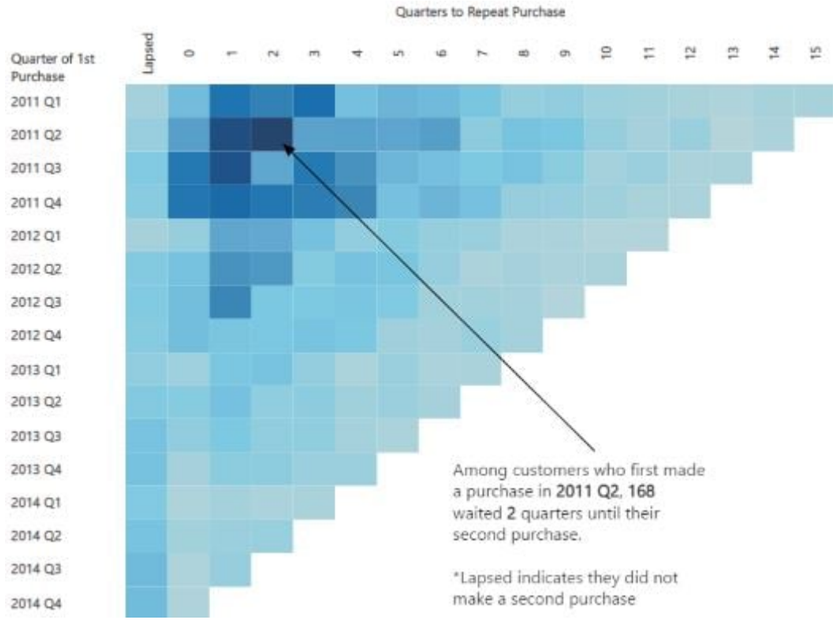
Computing first or last data point per data subject:

e.g. First order date per customer `{ FIXED [Customer] : MIN([Order Date]) }`

Cohort and survival analysis

Cohort analysis:

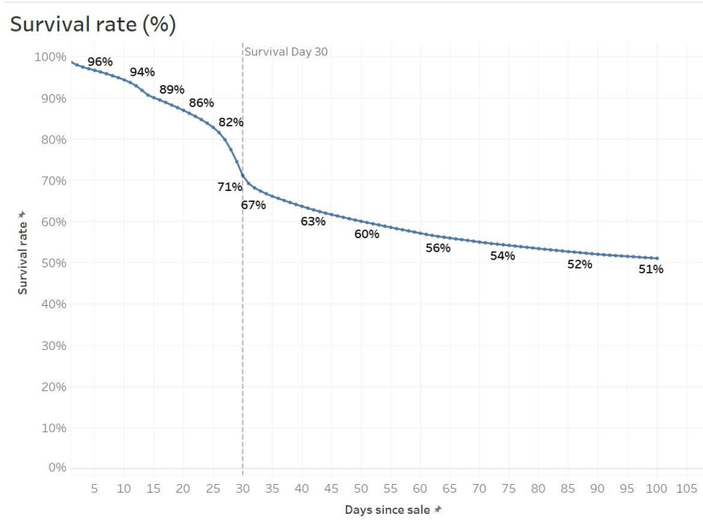
- Analyzing repetitive behavior of a group



- e.g. Usage of a product by various client groups (cohorts)

Survival analysis:

- Analyzing how many subject remain in dataset on a given day



- e.g. Who still keeps the New Year resolutions in February?

Cohort and Survival analysis - FIXED

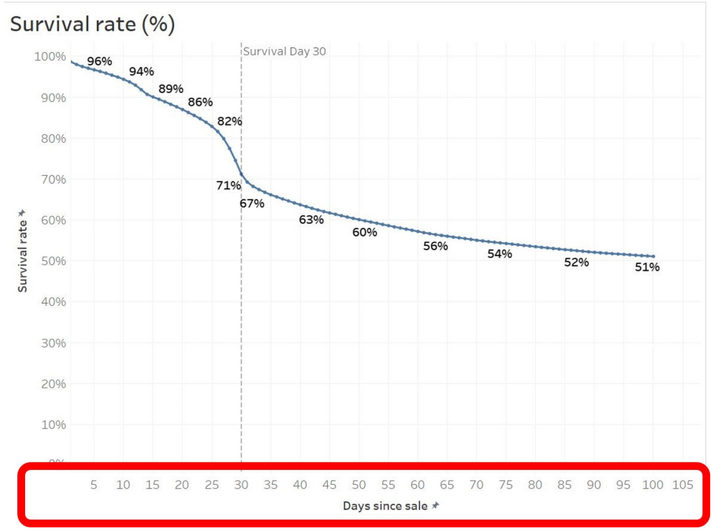
Cohort analysis:

- Analyzing repetitive behavior of a group.

- e.g. Usage of a product by various client groups

Survival analysis:

- Analyzing how many subject remain in dataset on a given day.



- e.g. Who still keeps the New Year resolutions in February?

Let's practice!

CALCULATIONS IN TABLEAU

LOD FIXED in practice

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INCLUDE and EXCLUDE LOD expressions

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LOD expressions - recap

LOD expressions: three powerful formulas that allow us to calculate at a different level of detail than the data in the visualization.

- `FIXED` : calculating at an exactly specified level of detail.
- `EXCLUDE` : calculating at a higher level of detail.
- `INCLUDE` : calculating at a lower level of detail.

INCLUDE LOD syntax

Syntax: `{ INCLUDE [Dimension 1], [Dimension 2], ... : aggregation expression }`

E.g.

```
{ INCLUDE [Product], [Region] : SUM([Sales]) }
```

- Calculate at a finer level of detail than in the database
- Re-aggregate and show it at a coarser level of detail in your visualization

Calculation will change if you add/remove dimensions from the view.

INCLUDE LOD example

Underlying data:

Product Category	Region	Order Id	Profit
Auto	Customer 1	Order 63054	$ 159
	Customer 8	Order 24067	$ 44
		Order 32855	$ 530
		Order 48846	$ 588
		Order 60352	$ 78
		Order 62826	$ 126
Baby	Customer 1	Order 33638	$ 82
		Order 57858	$ 150
		Order 83750	$ 190
	Customer 8	Order 62704	$ 42
		Order 62743	$ 149
	Customer 124	Order 24215	$ 69
		Order 54788	$ 102
Interior design	Customer 124	Order 80647	$ 3,602
		Order 86560	$ 878

Avg. Profit: `AVG(Profit)`

Product Category	Avg. Profit (per order)
Auto	$ 254
Baby	$ 112
Interior design	$ 2,240

Avg. Profit per customer:

```
AVG({INCLUDE [Customer] : SUM(Profit)})
```

Product Category	Avg. Profit (per customer)
Auto	$ 762
Baby	$ 261
Interior design	$ 4,481

EXCLUDE LOD syntax

Syntax: `{ EXCLUDE [Dimension 1], [Dimension 2], ... : aggregation expression }`

E.g.

```
{ EXCLUDE [Product], [Region] : SUM([Sales]) }
```

- Calculating at a higher level of detail than the one present in the view.
- Calculation will change if you add/remove dimensions from the view.

EXCLUDE LOD example

Product Category	Product Id	Sum of Profit	Profit (per Product Category)	% Contibution
Auto	Product 4401	$ 159	$ 1,524	10%
	Product 12551	$ 44	$ 1,524	3%
	Product 15588	$ 530	$ 1,524	35%
	Product 20371	$ 588	$ 1,524	39%
	Product 23362	$ 78	$ 1,524	5%
	Product 23989	$ 126	$ 1,524	8%
	Subtotal	**$ 1,524**	**$ 1,524**	**100%**
Baby	Product 258	$ 190	$ 784	24%
	Product 403	$ 69	$ 784	9%
	Product 3904	$ 150	$ 784	19%
	Product 8254	$ 102	$ 784	13%
	Product 9253	$ 42	$ 784	5%
	Product 11105	$ 149	$ 784	19%
	Product 15831	$ 82	$ 784	10%
	Subtotal	**$ 784**	**$ 784**	**100%**
Interior design	Product 6231	$ 878	$ 4,481	20%
	Product 28024	$ 3,602	$ 4,481	80%
	Subtotal	**$ 4,481**	**$ 4,481**	**100%**

1

2

3

Profit (per Product Category): `{ EXCLUDE [Product Id] : SUM([Profit]) }`

FIXED vs. INCLUDE vs. EXCLUDE?

`FIXED`

- Calculating at a **specified level** of detail
- It will give **the same result regardless of the dimensions visualization**

`INCLUDE`

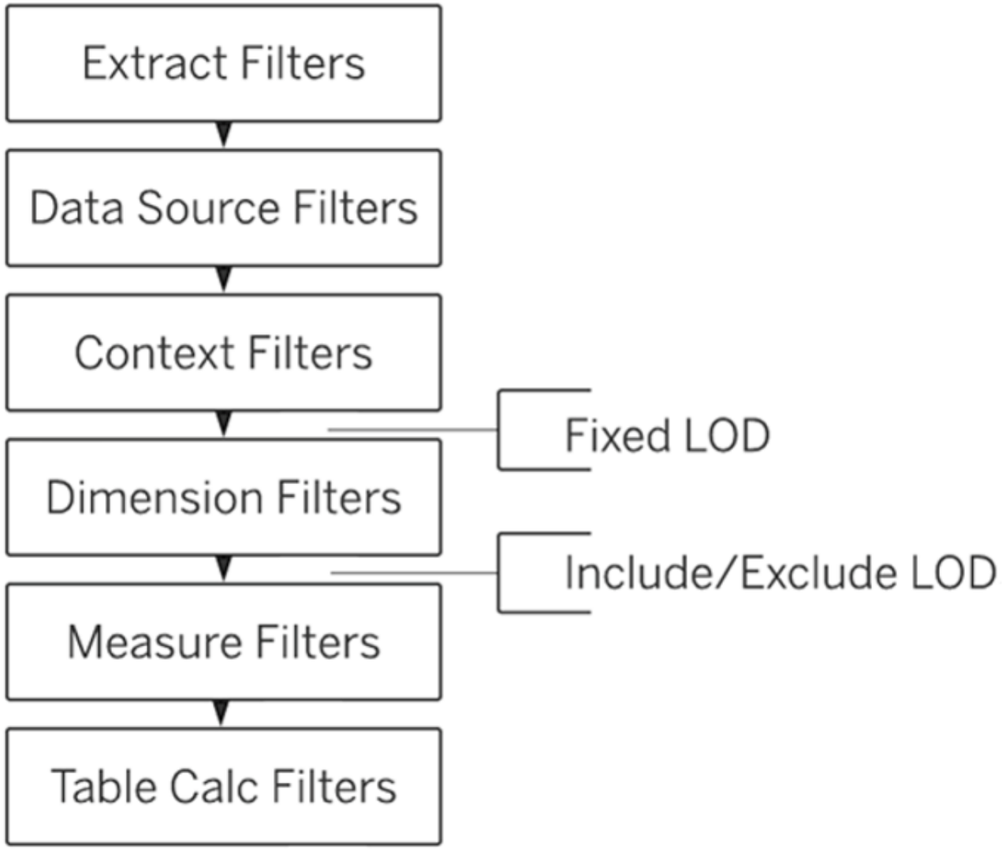
- Calculating at a **lower** level of detail
- Calculation **result will change** when dimensions are added or removed from the canvas

`EXCLUDE`

- Calculating at a **higher** level of detail
- Calculation **result will change** when dimensions are added or removed from the canvas

Order of operations

Tableau executes filters in a specified order:



[1] https://help.tableau.com/current/pro/desktop/en-us/order_of_operations.htm

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INCLUDE and EXCLUDE expressions in practice

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