

OLAP - Querying the DW

With Tableau Desktop

What is Tableau Desktop

Tableau Desktop is a commercial tool that is part of the Tableau suite

It provides a simple GUI to formulate queries on any kind of data source

- Not exactly an OLAP tool
- Besides advanced BI software (e.g., Oracle, SAP), similar commercial alternatives are PowerBI and Qlik
- Open-source alternatives
 - [Saiku](#)
 - [Apache Superset](#)
- Tableau Desktop is easy to use and provides appealing visualizations
 - Renewable one-year academic license is provided to all students and academic staff

What we are going to do

Guided exercises

- Data source initialization
- Multidimensional model setup
- OLAP basics
- Advanced querying options

Individual exercises

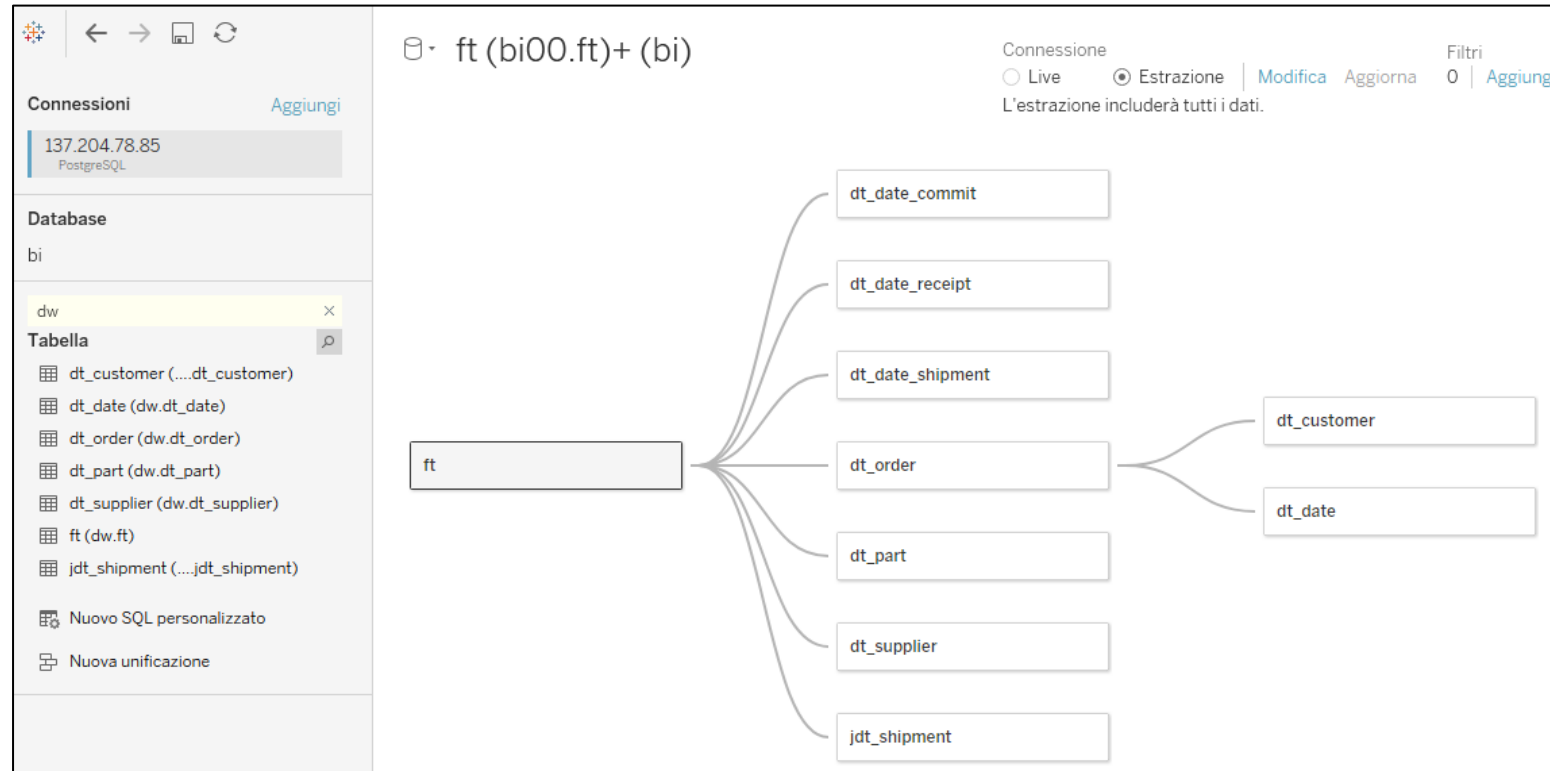
- Define OLAP queries from requirements in natural language

Data source initialization

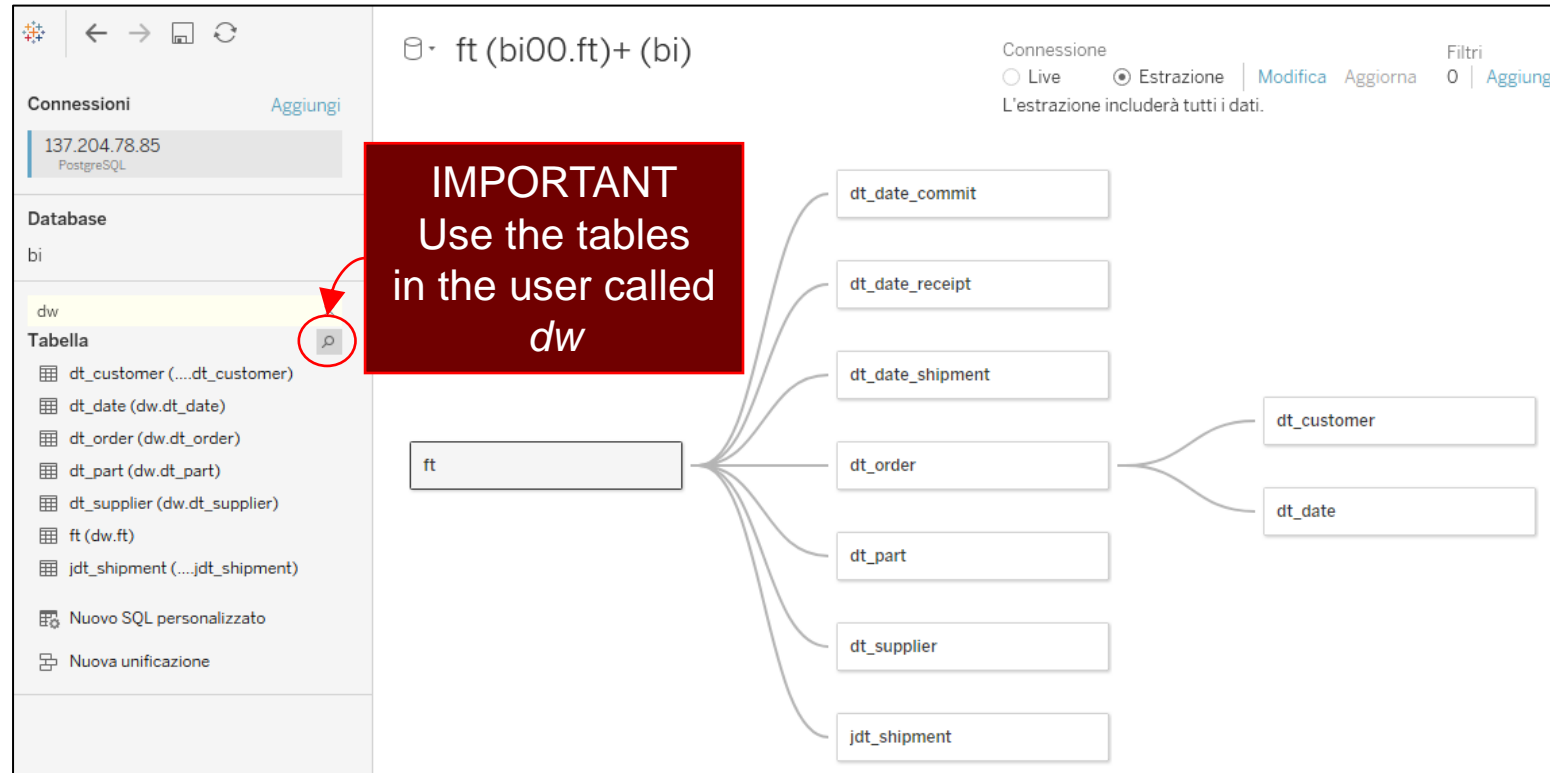
First, we must "tell" Tableau *which* data we want to query

- Connect to the database
- Drag & drop the tables
- Setup join connections
- Check fields
 - Hide unnecessary fields
 - Verify data types

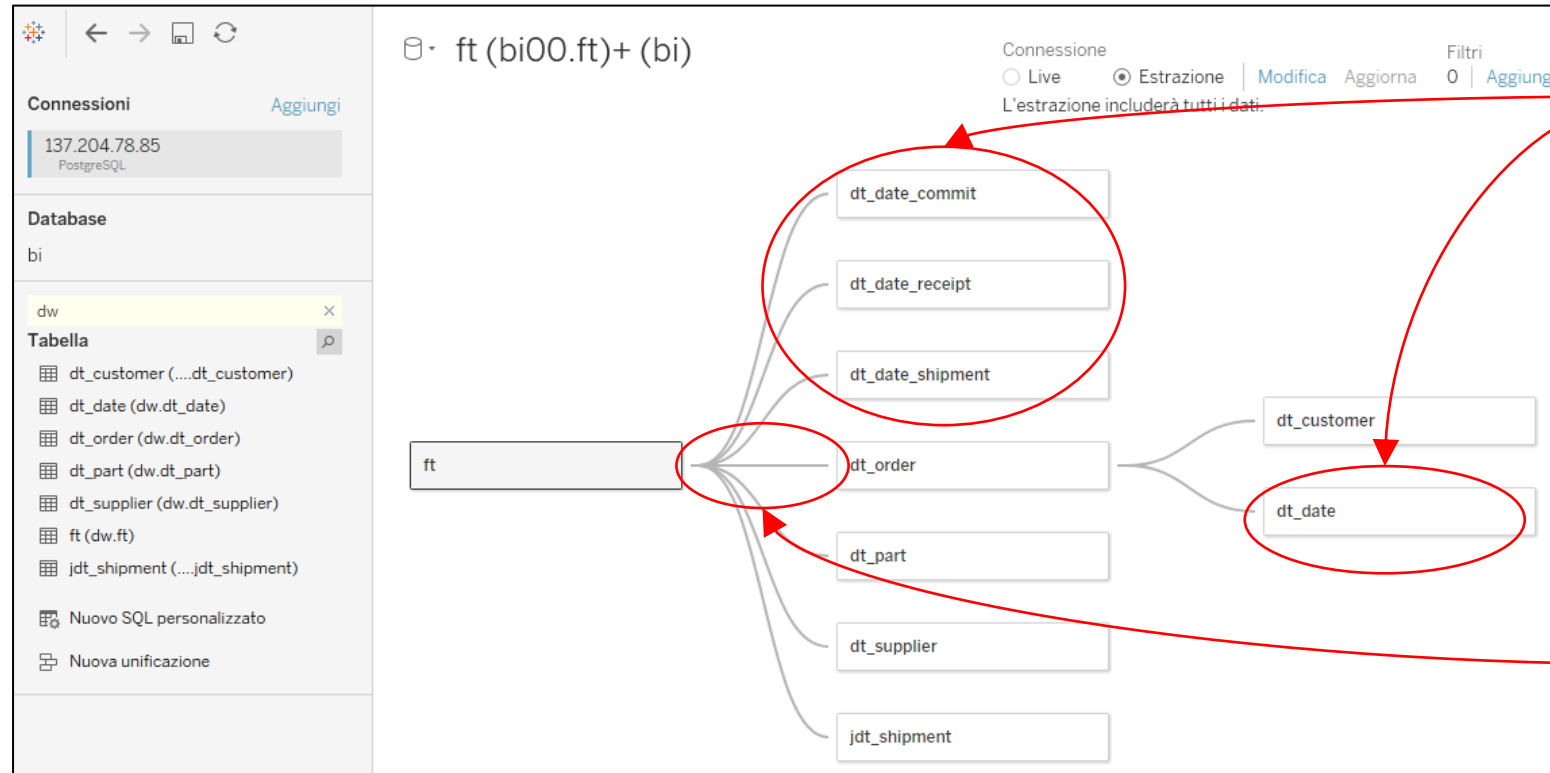
Data source initialization



Data source initialization



Data source initialization

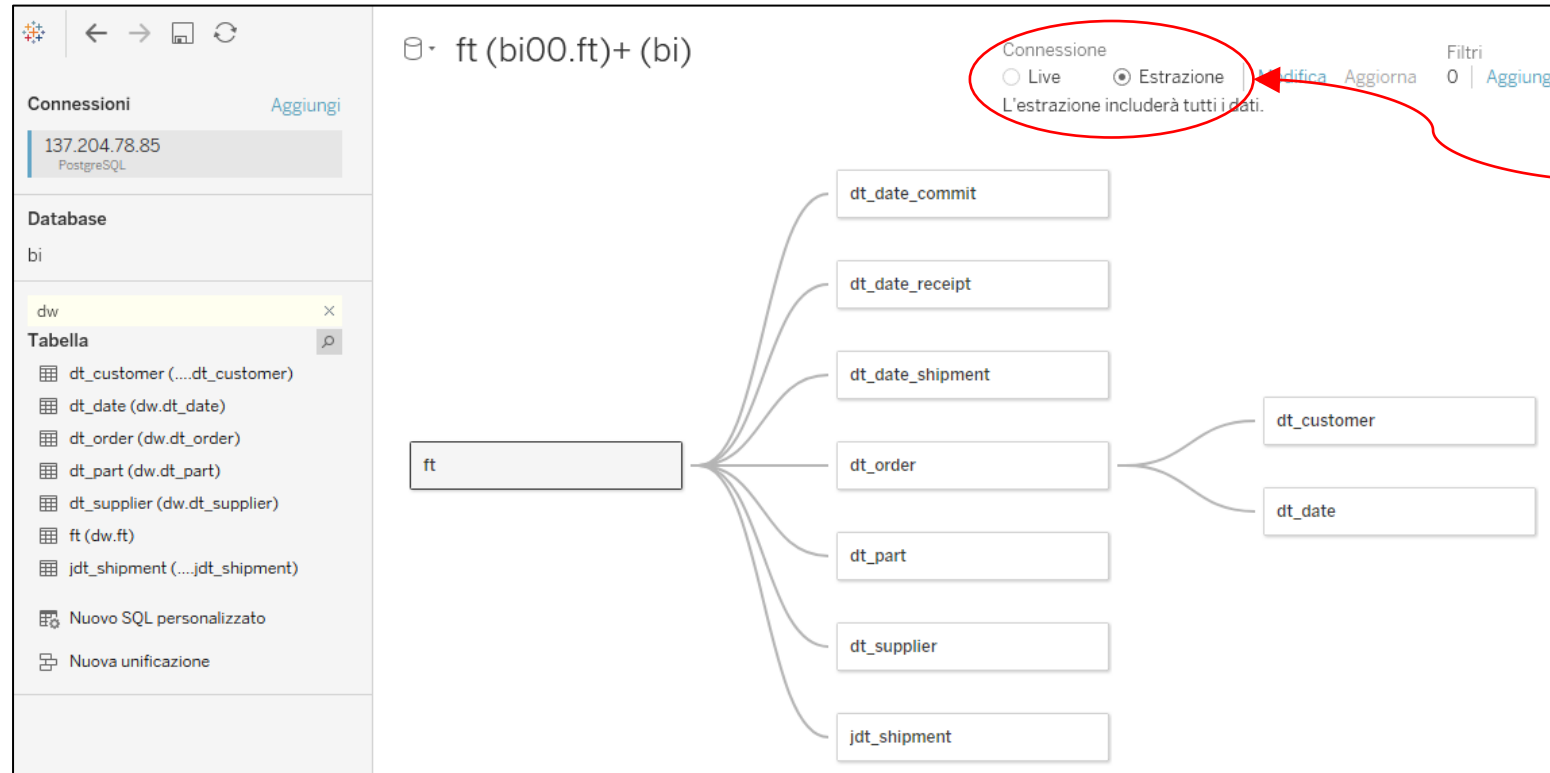


Shared hierarchy must be repeated

Links must be in the -to-one direction from left right

Click links to setup join predicates

Data source initialization



Extract the data (and save a snapshot on your machine) to improve efficiency

Multidimensional model setup

Tableau infers only few things

- Numeric fields are interpreted as measures, String/Date fields as dimensional attributes
- Hierarchies are not recognized (if not for few exceptions)

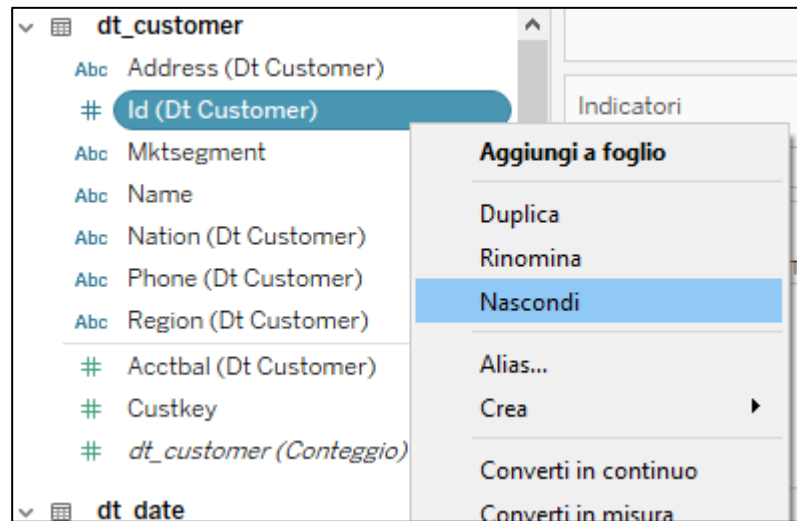
Most of the setup is manual

- Remove unnecessary fields (e.g., IDs)
- Correct measures and attributes
- Define hierarchies
- Extend hierarchies with new fields
 - E.g., binning, groups

Multidimensional model setup

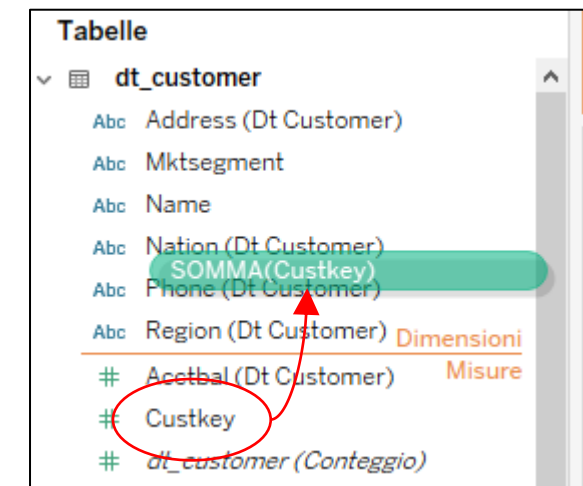
Remove unnecessary fields

- IDs and measures to count rows (*Conteggio*)



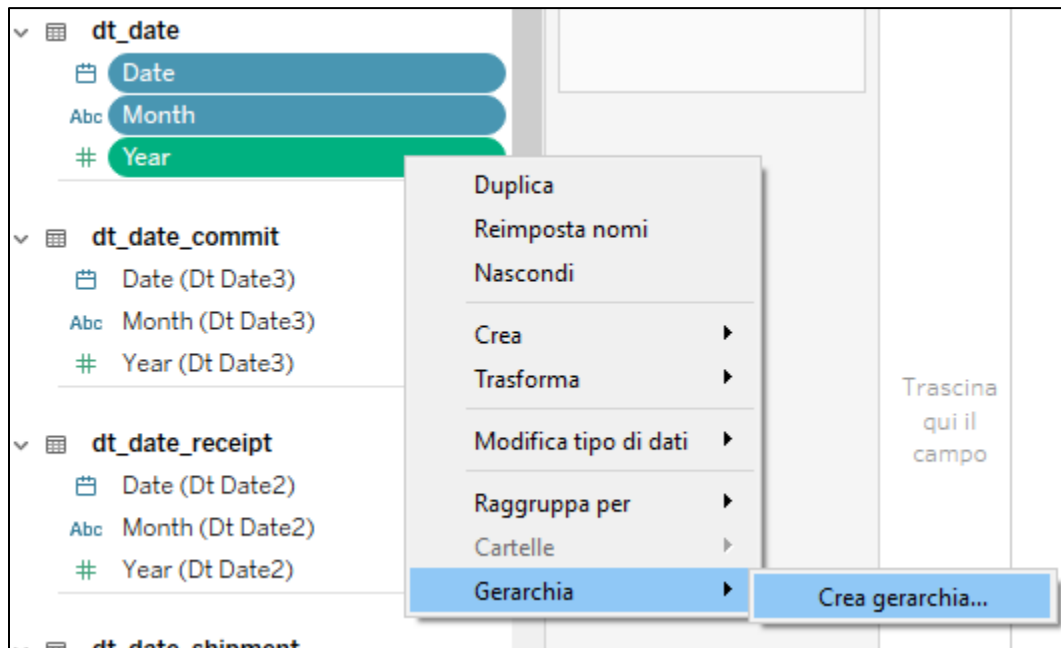
Fix measures and attributes

- Natural keys (e.g., *custkey*) are attributes
- Some numeric fields (e.g., *year*) are attributes

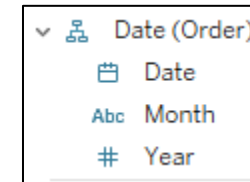


Multidimensional model setup

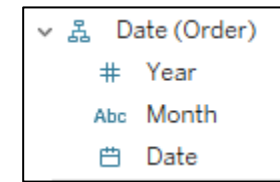
Define hierarchies



- Attributes in hierarchies must be listed **always from the coarsest (top) to the finest (bottom)** to ensure drill-down correctness



Wrong

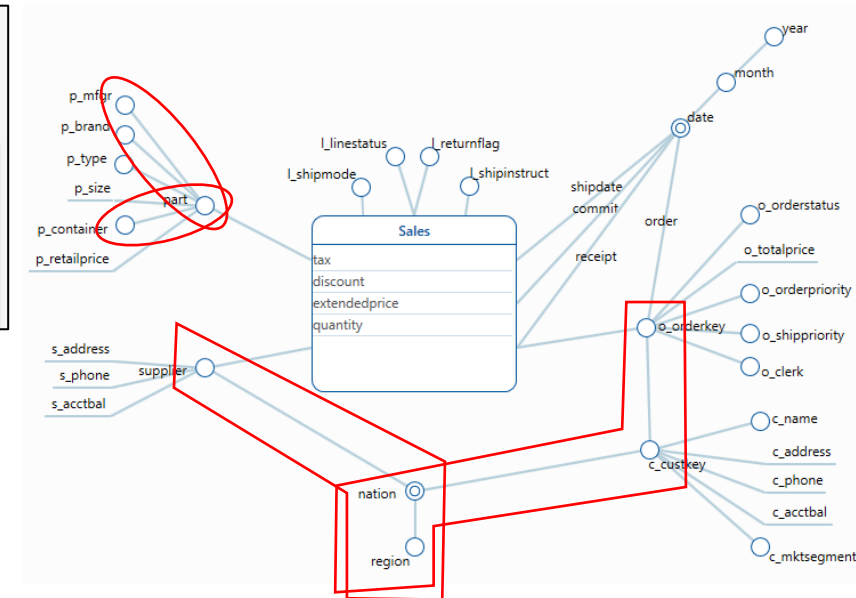
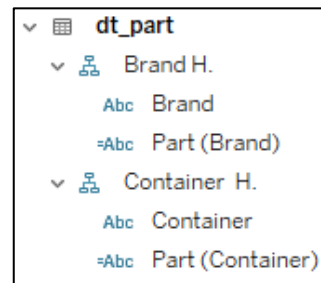
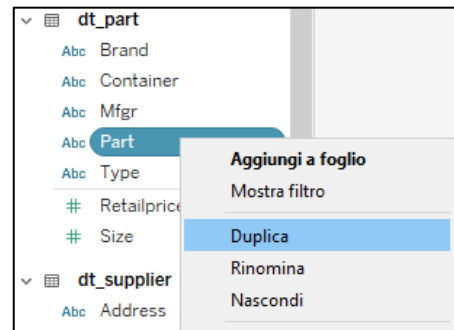


Correct

Multidimensional model setup

A hierarchy must be defined for every linear root-to-leaf path

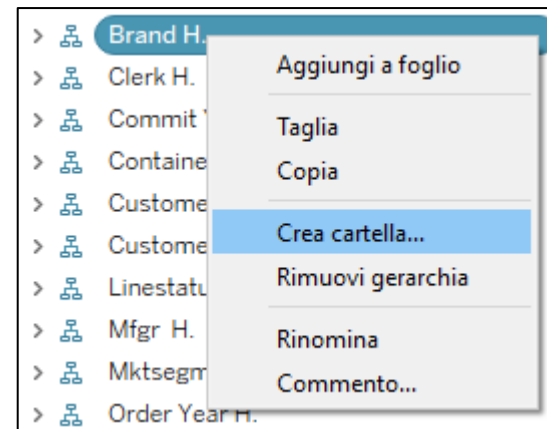
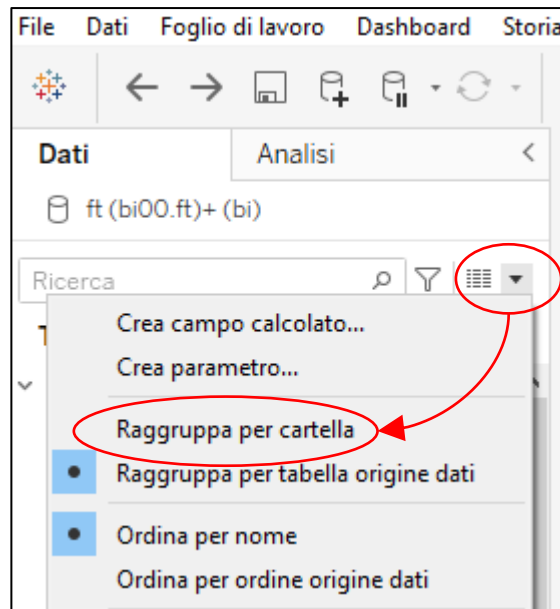
- Attributes involved in branches or shared hierarchies must be replicated for every existing linear path
- Name hierarchies after the coarsest attribute
- For replicated attributes, put the hierarchy name between parenthesis



Multidimensional model setup

Organize hierarchies into folders

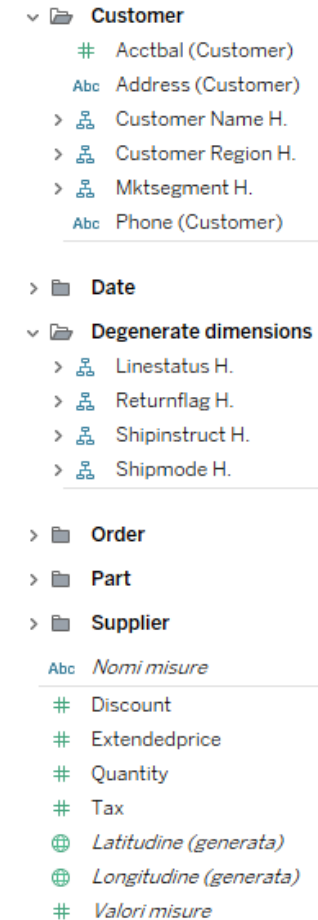
- One folder per dimension



Multidimensional model setup

Organize hierarchies into folders

- One folder per dimension
- Include descriptive attributes in the folders
 - Descriptive attributes must NOT be in hierarchies
 - Numeric descriptive attributes should be continuous (green icon)
- Degenerate dimensions can be collapsed into a single folder
- Verify which measures are left at the bottom



Exercise 3

Complete the multidimensional setup for the Sales cube

Do the same for the Orders cube

OLAP basics

Queries are formulated by drag&dropping attributes and measures onto rows, columns, filters, and marks

- SELECT d.year, s.region, p.mfgr,
sum(ft.quantity)
FROM ft, dt_part p, dt_supp s,
dt_order o, dt_date d
WHERE ft.idpart = p.id
AND ft.idsupp = s.id
AND ft.idorder = o.id
AND o.iddate = d.id
AND p.type = 'ECONOMY ...'
GROUP BY d.year, s.region, p.mfgr



OLAP basics

The same query can be issued in different ways, where only the visualization changes (but the data is the same)

- SELECT d.year, s.region, p.mfgr,
sum(ft.quantity)
FROM ft, dt_part p, dt_supp s,
dt_order o, dt_date d
WHERE ft.idpart = p.id
AND ft.idsupp = s.id
AND ft.idorder = o.id
AND o.iddate = d.id
AND p.type = 'ECONOMY ...'
GROUP BY d.year, s.region, p.mfgr

Pagine

Filtri

Type: ECONOMY ANODIZED BRASS

Indicatori

Automatico

Colore

Dimensione

Testo

Dettagli

Informazioni

SOMMA(Quantity)

Colonne

Year (Order)

Righe

Region (Supplier)

Mfgr

Foglio 1

| | | Year (Order) | | | | | | |
|--------------|----------------|--------------|-------|-------|-------|-------|-------|-------|
| Region (Su.. | Mfgr | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| AFRICA | Manufacturer#1 | 52,0 | 118,0 | | 201,0 | | 74,0 | 26,0 |
| | Manufacturer#2 | 105,0 | 40,0 | 95,0 | 70,0 | 73,0 | 50,0 | 45,0 |
| | Manufacturer#3 | 93,0 | 124,0 | 47,0 | 70,0 | 21,0 | 184,0 | |
| | Manufacturer#4 | 36,0 | 168,0 | 72,0 | 115,0 | | 78,0 | 24,0 |
| | Manufacturer#5 | 198,0 | 282,0 | 66,0 | 90,0 | 16,0 | 103,0 | 36,0 |
| AMERICA | Manufacturer#1 | 154,0 | 259,0 | 205,0 | 126,0 | 74,0 | 23,0 | 10,0 |
| | Manufacturer#2 | 194,0 | 191,0 | 105,0 | 241,0 | 133,0 | 80,0 | 72,0 |
| | Manufacturer#3 | 100,0 | 110,0 | 93,0 | | 100,0 | 100,0 | 66,0 |
| | Manufacturer#4 | 167,0 | 125,0 | | 81,0 | 111,0 | 91,0 | 93,0 |
| | Manufacturer#5 | 134,0 | 155,0 | 188,0 | 47,0 | 210,0 | 152,0 | 92,0 |
| ASIA | Manufacturer#1 | 32,0 | 123,0 | 124,0 | 85,0 | 84,0 | 92,0 | 78,0 |
| | Manufacturer#2 | 60,0 | 49,0 | 8,0 | 37,0 | 54,0 | 61,0 | 124,0 |
| | Manufacturer#3 | 92,0 | 106,0 | 199,0 | 81,0 | 47,0 | 21,0 | |
| | Manufacturer#4 | 126,0 | 270,0 | 75,0 | 122,0 | 71,0 | 77,0 | 53,0 |
| | Manufacturer#5 | 39,0 | 49,0 | 90,0 | 179,0 | 67,0 | 123,0 | 63,0 |
| EUROPE | Manufacturer#1 | 112,0 | 98,0 | 9,0 | 125,0 | 23,0 | 74,0 | 59,0 |
| | Manufacturer#2 | 22,0 | 127,0 | 55,0 | 61,0 | 148,0 | 121,0 | 112,0 |
| | Manufacturer#3 | 107,0 | 41,0 | 206,0 | 16,0 | 49,0 | 63,0 | 88,0 |
| | Manufacturer#4 | 103,0 | 121,0 | 246,0 | 13,0 | 80,0 | 50,0 | 134,0 |
| | Manufacturer#5 | 206,0 | 38,0 | 1,0 | 184,0 | 63,0 | 232,0 | 43,0 |
| MIDDLE EAST | Manufacturer#1 | 97,0 | 130,0 | 27,0 | 53,0 | 28,0 | 87,0 | |
| | Manufacturer#2 | 85,0 | 119,0 | 139,0 | 113,0 | 131,0 | 210,0 | 46,0 |
| | Manufacturer#3 | 79,0 | 120,0 | 71,0 | 89,0 | 55,0 | 102,0 | 5,0 |
| | Manufacturer#4 | 125,0 | 214,0 | 74,0 | 60,0 | 104,0 | 200,0 | 8,0 |
| | Manufacturer#5 | 174,0 | 123,0 | 3,0 | 116,0 | 114,0 | 238,0 | |

OLAP basics

Descriptive attributes should never be put on rows, columns

- Only as additional information, that becomes visible upon cell hovering

The screenshot shows a BI tool interface with a table named 'Foglio 4'. The table has two columns: 'Supplier (Supplier)' and a numerical column. A tooltip is displayed over the cell containing 'Supplier#000000111' and '23,0', showing details for that supplier. In the left sidebar, the 'Informazioni' icon is circled in red.

| Supplier (Supplier) | |
|---------------------|------|
| Supplier#000000022 | 24,0 |
| Supplier#000000039 | 12,0 |
| Supplier#000000049 | 34,0 |
| Supplier#000000081 | 12,0 |
| Supplier#000000085 | 50,0 |
| Supplier#000000095 | 39,0 |
| Supplier#000000099 | 27,0 |
| Supplier#000000111 | 23,0 |
| Supplier#000000160 | |
| Supplier#000000178 | 4 |
| Supplier#000000194 | 2 |
| Supplier#000000205 | 4 |
| Supplier#000000218 | 83,0 |

Supplier (Supplier): Supplier#000000111
Address (Supplier): BBhSB234LQnNg MQIM mlxCCw
Quantity: 23,0

OLAP basics

Drill-down: just hit the (+) button

- Beware: a wrong hierarchy setup leads to hardly readable results

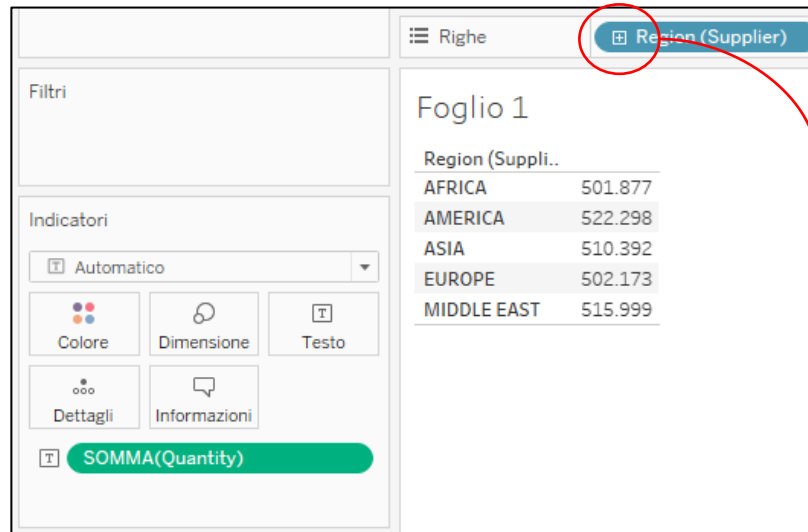


Diagram illustrating the initial OLAP state. The interface shows a table with columns 'Region (Supplier)' and 'SOMMA(Quantity)'. The 'Region (Supplier)' column is highlighted with a red circle, indicating the target for a drill-down operation.

| Region (Supplier) | SOMMA(Quantity) |
|-------------------|-----------------|
| AFRICA | 501.877 |
| AMERICA | 522.298 |
| ASIA | 510.392 |
| EUROPE | 502.173 |
| MIDDLE EAST | 515.999 |

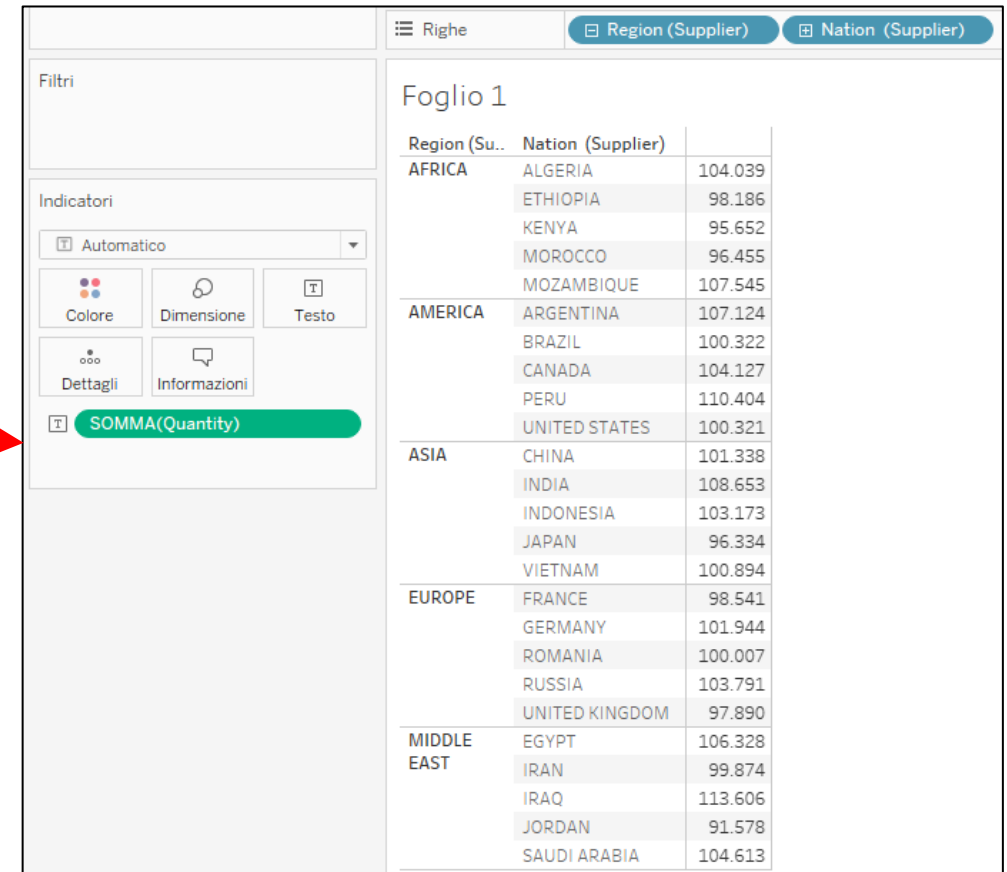


Diagram illustrating the result of a drill-down operation. The 'Region (Supplier)' column is expanded, showing a detailed view of the data, including the 'Nation (Supplier)' column. The 'SOMMA(Quantity)' column remains visible.

| Region (Supplier) | Nation (Supplier) | SOMMA(Quantity) |
|-------------------|-------------------|-----------------|
| AFRICA | ALGERIA | 104.039 |
| | ETHIOPIA | 98.186 |
| | KENYA | 95.652 |
| | MOROCCO | 96.455 |
| | MOZAMBIQUE | 107.545 |
| AMERICA | ARGENTINA | 107.124 |
| | BRAZIL | 100.322 |
| | CANADA | 104.127 |
| | PERU | 110.404 |
| | UNITED STATES | 100.321 |
| ASIA | CHINA | 101.338 |
| | INDIA | 108.653 |
| | INDONESIA | 103.173 |
| | JAPAN | 96.334 |
| | VIETNAM | 100.894 |
| EUROPE | FRANCE | 98.541 |
| | GERMANY | 101.944 |
| | ROMANIA | 100.007 |
| | RUSSIA | 103.791 |
| | UNITED KINGDOM | 97.890 |
| MIDDLE EAST | EGYPT | 106.328 |
| | IRAN | 99.874 |
| | IRAQ | 113.606 |
| | JORDAN | 91.578 |
| | SAUDI ARABIA | 104.613 |

OLAP basics

Roll-up: either remove the finer attribute or replace it with a coarser one

The diagram illustrates a roll-up operation in OLAP. The left panel shows a detailed table with columns 'Region (Supplier)' and 'Nation (Supplier)'. The right panel shows the same data rolled up to the 'Region (Supplier)' level. A red arrow points from the left panel to the right panel, indicating the transformation.

Left Panel (Detailed View):

| Region (Supplier) | Nation (Supplier) | Value |
|-------------------|-------------------|---------|
| AFRICA | ALGERIA | 104.039 |
| | ETHIOPIA | 98.186 |
| | KENYA | 95.652 |
| | MOROCCO | 96.455 |
| | MOZAMBIQUE | 107.545 |
| AMERICA | ARGENTINA | 107.124 |
| | BRAZIL | 100.322 |
| | CANADA | 104.127 |
| | PERU | 110.404 |
| | UNITED STATES | 100.321 |
| ASIA | CHINA | 101.338 |
| | INDIA | 108.653 |
| | INDONESIA | 103.173 |
| | JAPAN | 96.334 |
| | VIETNAM | 100.894 |
| EUROPE | FRANCE | 98.541 |
| | GERMANY | 101.944 |
| | ROMANIA | 100.007 |
| | RUSSIA | 103.791 |
| | UNITED KINGDOM | 97.890 |
| MIDDLE EAST | EGYPT | 106.328 |
| | IRAN | 99.874 |
| | IRAQ | 113.606 |
| | JORDAN | 91.578 |
| | SAUDI ARABIA | 104.613 |

Right Panel (Rolled-up View):

| Region (Supplier) | Value |
|-------------------|---------|
| AFRICA | 501.877 |
| AMERICA | 522.298 |
| ASIA | 510.392 |
| EUROPE | 502.173 |
| MIDDLE EAST | 515.999 |

OLAP basics

Slice: either add an attribute/measure in the filters panel or right-click a pre-existing attribute/measure to add a filter

The diagram illustrates the process of creating a slice in a BI tool. It shows two states of the interface, connected by a red arrow indicating a transition.

Initial State (Left):

- Filtri:** Empty.
- Indicatori:** Includes a dropdown set to 'Automatico' and buttons for 'Colore', 'Dimensione', 'Testo', 'Dettagli', and 'Informazioni'. A green bar at the bottom shows the measure 'SOMMA(Quantity)'.
- Righe:** A button labeled 'Region (Supplier)'.
- Foglio 1:** A table showing data for 'Region (Suppli..)' with columns for region and a measure.

| Region (Suppli.. | |
|------------------|---------|
| AFRICA | 501.877 |
| AMERICA | 522.298 |
| ASIA | 510.392 |
| EUROPE | 502.173 |
| MIDDLE EAST | 515.999 |

Final State (Right):

- Filtri:** Now contains the filter 'Mfgr: Manufacturer#1'.
- Indicatori:** Same as the initial state.
- Righe:** Same as the initial state.
- Foglio 1:** The table now shows filtered data.

| Region (Suppli.. | |
|------------------|---------|
| AFRICA | 102.019 |
| AMERICA | 105.714 |
| ASIA | 100.963 |
| EUROPE | 99.488 |
| MIDDLE EAST | 101.346 |

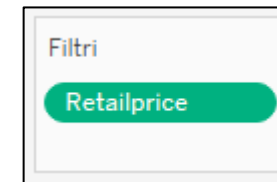
OLAP basics

Slice: either add an attribute/measure in the filters panel or right-click a pre-existing attribute/measure to add a filter

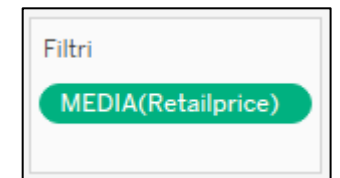
Filters depend on the field type

- Discrete fields: one or more categorical values can be chosen
- Continuous fields (either attributes or measures), a range can be specified and a different filtering level can be chosen

- Pre-aggregation; e.g., "SELECT [...] WHERE *retailprice* > 1000 [...]"



- Post-aggregation; e.g., "SELECT [...] GROUP BY [...] HAVING AVG(*retailprice*) > 1000"



OLAP basics

Pivot: just hit the pivot button

The image shows a transition from a standard data view to a pivoted view in a Business Intelligence tool. On the left, the 'Standard' view shows a table with 'Region (Supplier)' as rows and 'Year (Order)' as columns. A red circle highlights the pivot button in the top toolbar. A red arrow points from this button to the pivot button in the right-hand view. On the right, the 'Pivot' view shows the same data with 'Year (Order)' as rows and 'Region (Supplier)' as columns.

Standard View Data:

| Region (Suppli.. | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|------------------|--------|--------|--------|--------|--------|--------|--------|
| AFRICA | 75.600 | 75.962 | 75.595 | 76.238 | 79.170 | 77.375 | 41.937 |
| AMERICA | 79.336 | 81.070 | 77.517 | 79.561 | 77.982 | 81.177 | 45.655 |
| ASIA | 78.707 | 75.398 | 76.397 | 76.529 | 77.742 | 81.508 | 44.111 |
| EUROPE | 75.654 | 72.953 | 75.047 | 76.202 | 77.255 | 81.640 | 43.422 |
| MIDDLE EAST | 77.636 | 78.026 | 75.334 | 79.570 | 80.723 | 79.733 | 44.977 |

Pivoted View Data:

| Year (Order) | AFRICA | AMERIC.. | ASIA | EUROPE | MIDDLE EAST |
|--------------|--------|----------|--------|--------|-------------|
| 1992 | 75.600 | 79.336 | 78.707 | 75.654 | 77.636 |
| 1993 | 75.962 | 81.070 | 75.398 | 72.953 | 78.026 |
| 1994 | 75.595 | 77.517 | 76.397 | 75.047 | 75.334 |
| 1995 | 76.238 | 79.561 | 76.529 | 76.202 | 79.570 |
| 1996 | 79.170 | 77.982 | 77.742 | 77.255 | 80.723 |
| 1997 | 77.375 | 81.177 | 81.508 | 81.640 | 79.733 |
| 1998 | 41.937 | 45.655 | 44.111 | 43.422 | 44.977 |

OLAP basics

Ordering: right click on an attribute > Order

- In case of multiple criteria, each attribute must be set independently
- There are different ordering types
 - Alphabetical (intuitive)
 - Manual (intuitive)
 - Data Source Order: the order is the same as on the datasource
 - Computed: the order is based on a computation (e.g., the sum of specific measure)
 - Nested: useful in the presence of two (or more) independent fields

| Region (S.. | |
|-------------|---------|
| AMERICA | 442.962 |
| MIDDLE EAST | 438.363 |
| ASIA | 431.685 |
| EUROPE | 426.519 |
| AFRICA | 426.277 |

Computed order
Regions are ordered based on their global evaluation (the same ordering applies in every year)

| Year (Order) | Region (S.. | |
|--------------|-------------|--------|
| 1993 | AMERICA | 81.070 |
| | MIDDLE EAST | 78.026 |
| | ASIA | 75.398 |
| | EUROPE | 72.953 |
| | AFRICA | 75.962 |
| 1994 | AMERICA | 77.517 |
| | MIDDLE EAST | 75.334 |
| | ASIA | 76.397 |
| | EUROPE | 75.047 |
| | AFRICA | 75.595 |

| Year (Order) | Region (S.. | |
|--------------|-------------|--------|
| 1993 | AMERICA | 81.070 |
| | MIDDLE EAST | 78.026 |
| | AFRICA | 75.962 |
| | ASIA | 75.398 |
| | EUROPE | 72.953 |
| 1994 | AMERICA | 77.517 |
| | ASIA | 76.397 |
| | AFRICA | 75.595 |
| | MIDDLE EAST | 75.334 |
| | EUROPE | 75.047 |

Nested order
Each year has its own ordering, based on actual cell values

More functionalities: visualization

Marks

- Play around with marks to understand how they work
- Each chart can have multiple marks

Show me panel (top-right corner)

- Useful to get suggestions and to generate special charts (e.g., boxplots)

Analysis > View data

- Useful to export results and to check the original values before the aggregation

Analysis > Grand totals

- Activates totals by rows and/or columns

More functionalities: new fields

Right-click on an attribute > Create > ...

- > Group
 - Manually take some members from an attribute and put them in a new attribute
- > Set
 - Like groups, but based on dynamic criteria
- > Set > TopN
 - A special set to select the top/bottom members based on some criteria
 - E.g., the customers who spent the most
- > Bin
 - Useful to discretize numerical descriptive attributes (e.g., the account balance of customers)
 - Support only for equi-width binning
- > Calculated fields
 - Create a new field based on a custom formula

More functionalities: calculated fields

Can be defined at different granularities

- Line granularity: e.g., *[Extendedprice]*[Quantity]*
- Aggregated granularity: e.g., *SUM(IF ([Tax]>0) THEN 1 ELSE 0 END)/COUNT([Quantity])*

Categorical fields can be defined as well

- E.g., *IF ([Tax]>0) THEN 'Taxed' ELSE 'Not taxed' END*

Level-of-detail (LOD) expressions: fix the reference group-by attributes

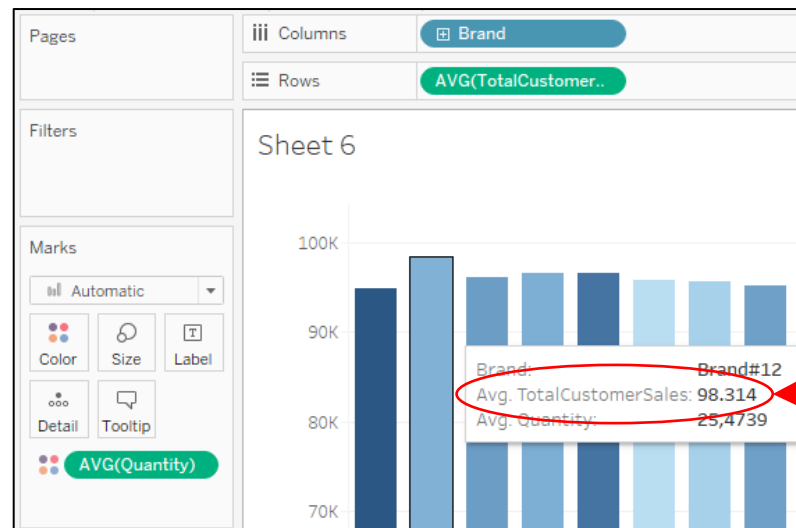
- Define reference aggregated values
- Useful to create more advanced queries combining more aggregations

More functionalities: LOD fields

Nested aggregation

- Further aggregate the results of a query
- For instance:
 - Calculate the sum(Quantity) by Brand and Nation
 - Calculate the average of the result by Brand
 - **TotalCustomerSales = {INCLUDE [Nation (Customer)]: SUM([Quantity])}**

TotalCustomerSales is defined at a *finer* aggregation level



The screenshot shows a Tableau interface with 'Brand' on the Columns shelf and 'Nation (Customer)' on the Rows shelf. The main view is a table titled 'Sheet 6 (2)' showing 'TotalCustomerSales' for various nations and brands. A red circle highlights the 'TotalCustomerSales' column, and a red arrow points from the tooltip in the previous screenshot to this column.

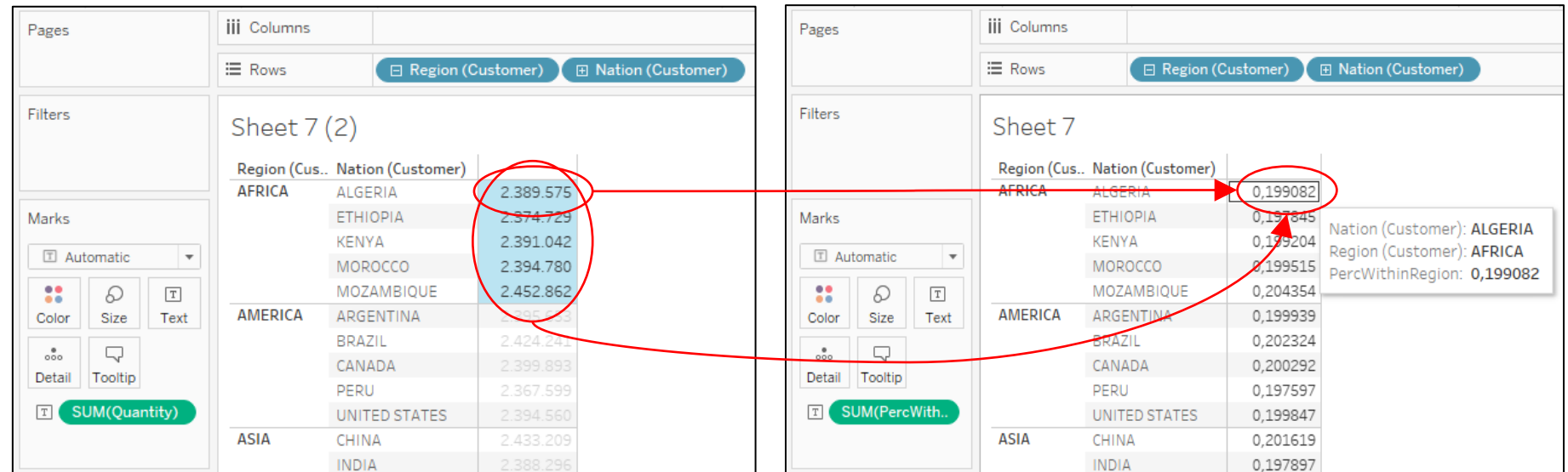
| Nation (Customer) | Brand#12 | Brand#13 | Brand#14 |
|-------------------|----------|----------|----------|
| ALGERIA | 95.170 | 99.180 | 93.347 |
| ARGENTINA | 95.578 | 93.795 | 93.035 |
| BRAZIL | 97.67 | 97.624 | 93.706 |
| CANADA | 95.273 | 98.789 | 94.604 |
| CHINA | 97.149 | 98.115 | 94.966 |
| EGYPT | 92.476 | 91.385 | 93.174 |
| ETHIOPIA | 93.693 | 97.359 | 97.269 |
| FRANCE | 99.013 | 105.375 | 101.966 |
| GERMANY | 91.570 | 96.545 | 94.176 |
| INDIA | 94.667 | 100.471 | 94.781 |
| INDONESIA | 93.652 | 102.805 | 93.692 |
| IRAN | 92.635 | 96.600 | 98.583 |
| IRAQ | 90.790 | 97.213 | 98.228 |
| JAPAN | 94.658 | 95.491 | 98.122 |
| JORDAN | 98.498 | 101.384 | 94.241 |
| KENYA | 93.694 | 97.680 | 94.988 |
| MOROCCO | 95.503 | 96.707 | 97.608 |
| MOZAMBIQ.. | 96.691 | 101.409 | 98.871 |
| PERU | 95.585 | 95.422 | 97.404 |
| ROMANIA | 96.347 | 97.373 | 98.774 |
| RUSSIA | 95.737 | 102.122 | 95.312 |
| SAUDI ARA.. | 91.906 | 97.534 | 95.573 |
| UNITED KIN.. | 94.466 | 96.375 | 98.938 |
| UNITED ST.. | 95.970 | 101.097 | 94.739 |
| VIETNAM | 94.543 | 99.997 | 95.621 |

More functionalities: LOD fields

Use coarser data at a finer aggregation level

- For instance:
 - Calculate the sum(Quantity) by Nation (and Region)
 - Divide the result by the sum(Quantity) by Region
 - $\text{PercWithinRegion} = \frac{\{ \text{FIXED } [\text{Nation (Customer)}]: \text{SUM}([\text{Quantity}]) \}}{\{ \text{FIXED } [\text{Region (Customer)}]: \text{SUM}([\text{Quantity}]) \}}$

PercWithinRegion
embeds a
calculation at a
coarser aggregation
level



More functionalities: LOD fields

Level keywords

- FIXED: aggregates by all-and-only the specified attributes
- INCLUDE: aggregates by the specified attributes + those in columns/rows/marks
- EXCLUDE: aggregates by the attributes in columns/rows/marks - the specified ones
- (no keyword): aggregates all facts

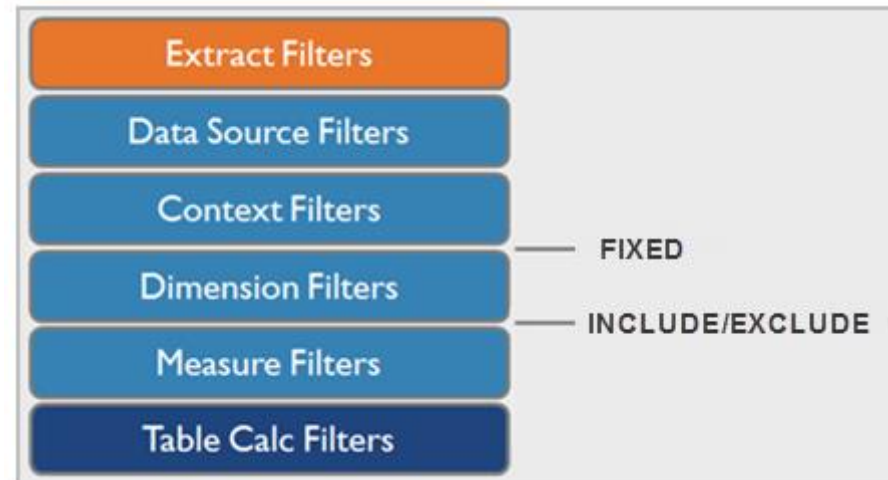
Check the documentation for further info:

- https://help.tableau.com/current/pro/desktop/en-gb/calculations_calculatedfields_lod.htm#include

Order of filter applications

Different types of filter are applied in different order (top-down)

- Use this table as a reference



Exercise 4

Simulate on Tableau the following OLAP sessions

- Produce a new worksheet for every bullet point marked with [W]

Exercise 4.1

- [W] Check the quantity of items sold by supplier nation
 - Are there some nations performing better/worse than the others?
- [W] Drill-down on the suppliers
 - Nations ordered alphabetically, suppliers by decreasing quantities sold
- Isolate the worst 100 suppliers
- [W] Show how the worst 100 are distributed across nations

Exercise 4.2

- Define a *sales* measure as follows
 - $\text{Sales} = \text{Quantity} * \text{Extendedprice} * (1 - \text{Discount}) * (1 + \text{Tax})$
- [W] Visualise yearly sales trend
 - [W] Explain the drop in 1998 with a slice and drill
- [W] Visualise monthly sales trends for every year
 - Use the Tableau's date functions on the Date attribute instead of the Month attribute
 - Help yourself with the "Show me" panel to produce trend lines
 - Is there any interesting pattern?

Exercise 4.3

- [W] Visualize the sum of Sales by Mktsegment in July 1997 through a bar chart
- [W] Add the average Sales as color
 - Average sales in Furniture are higher despite the sum being lower
 - [W] Add a label that explains this

Exercise 5

Produce OLAP queries using advanced functionalities

- Main goal: answering the given query
- Secondary goal: reproducing the given chart

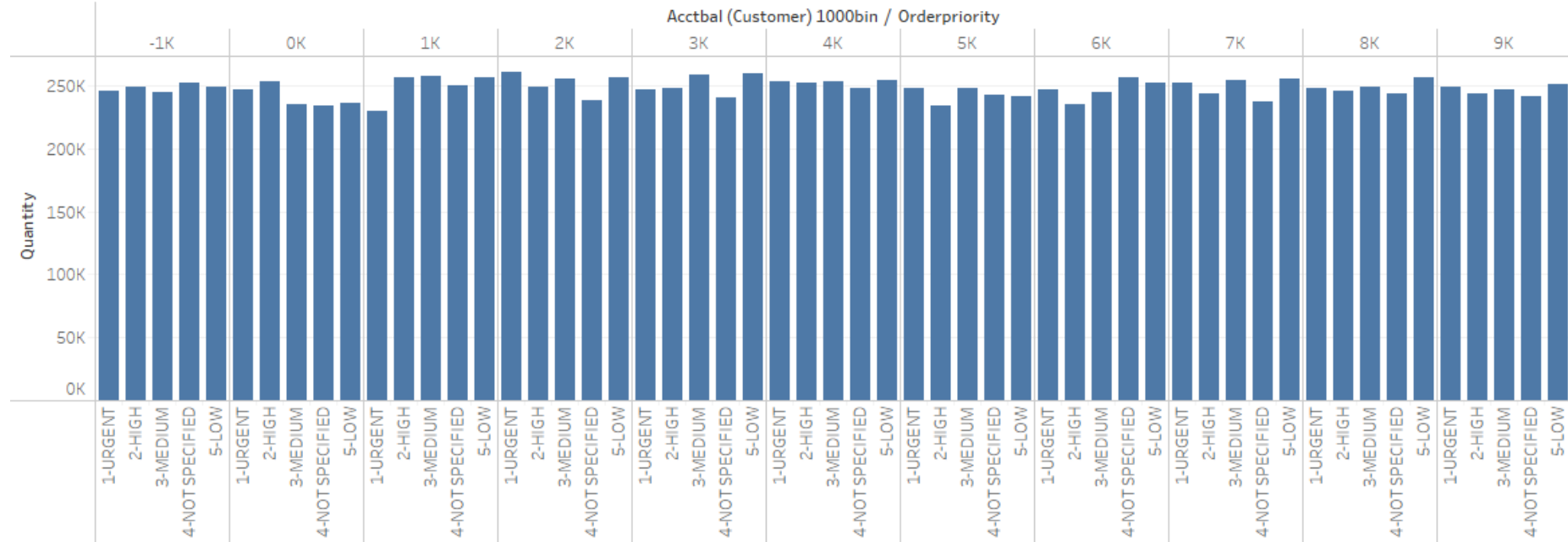
The hints in grey will *not* be given during the exam

Exercise 5.1

Query:

- Measure: sum(Quantity)
- Filter: [Order] Year = 1998
- Group by: [Order] Order priority, [Customer] Account balance
 - [Customer] Account balance must be binned; set bin size to 1000

Chart:



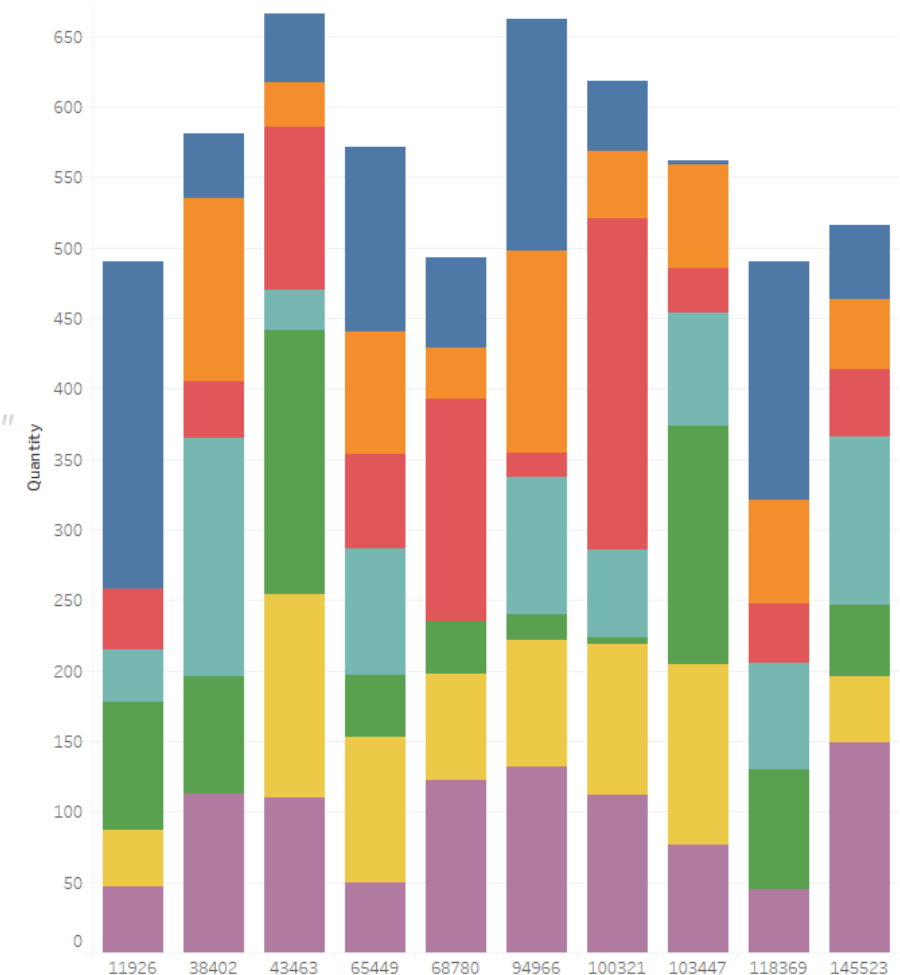
Exercise 5.2

Query:

- Measure: sum(Quantity)
- Filters:
 - [Part] Mfgr = 'Manufacturer#1'
 - Top 10 customers that maximize sum(Sales) considering only the facts associated with the previous filter
 - The filter on [Part] Mfgr must be "*applied to the context*" to make the Top 10 filter depend on its results
- Group by: [JDT] Shipmode, [Customer] Custkey (Top 10 by sum(Sales))

Chart:

- [Customer] Name to be shown on hover
- [JDT] Shipmode to "break down" the bars



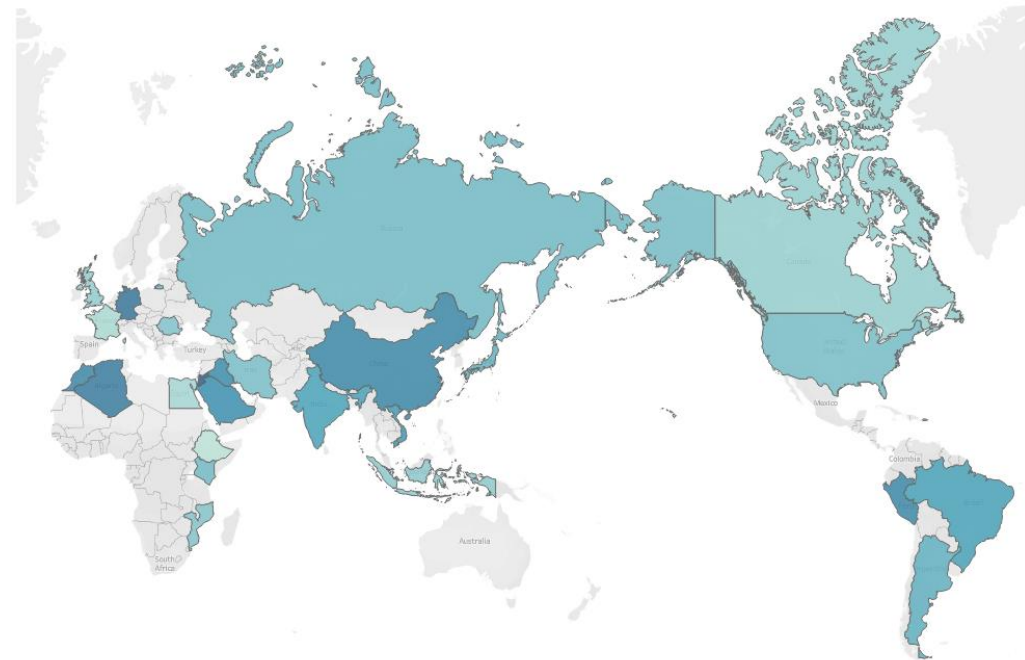
Exercise 5.3

Query:

- Measure: avg(TotSalesPerCustomer)
 - TotSalesPerCustomer is the sum(Sales) calculated by Custkey
`{FIXED [Custkey (Customer Region)]: SUM([Sales])}`
- Filter: -
- Group by: [Customer] Nation

Chart:

- You may need to set the data type of [Customer] Nation to a geographic role

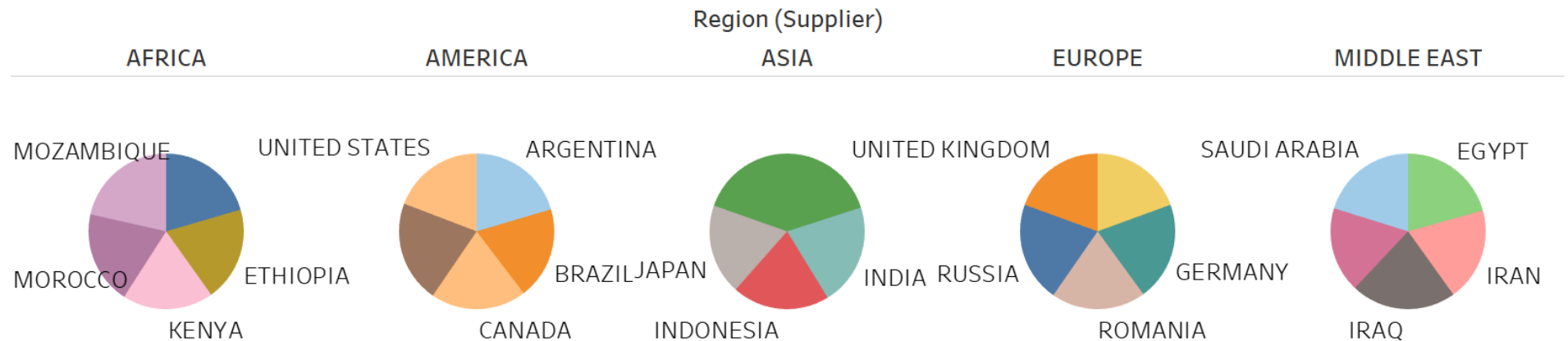


Exercise 5.4

Query:

- Measure: PercentageOfSupplierNationSalesByRegion
 - I.e., the $\text{sum}(\text{Sales})$ by [Supplier] Nation divided by the $\text{sum}(\text{Sales})$ by [Supplier] Region
 - $\{\text{FIXED } [\text{Nation (Supplier)}]: \text{SUM}([\text{Sales}])\} / \{\text{FIXED } [\text{Region (Supplier)}]: \text{SUM}([\text{Sales}])\}$
- Filter: [Order] Orderpriority = 'Urgent'
 - The measure must be calculated on the results of the filter
 - I.e., the filter must be "*applied to the context*"
- Group by: [Supplier] Region, [Supplier] Nation

Chart:



Exercise 5.5

Query:

- Measure: countDistinct(Orderkey), countDistinct(Custkey)
- Filter: [JDT] Shipinstruct != null AND [JDT] Shipmode != null
- Group by: [JDT] Shipinstruct, [JDT] Shipmode

Chart:

- countDistinct(Orderkey) as size
- countDistinct(Custkey) as color
- Use the "Show Me" panel to display the heatmap

