Spotfire Bootcamp

Advanced Data Visualisation

Day 1 & Day 2

Objectives

Spotfire User Interface

Data access

Spotfire data canvas and transformation

Filters Panel

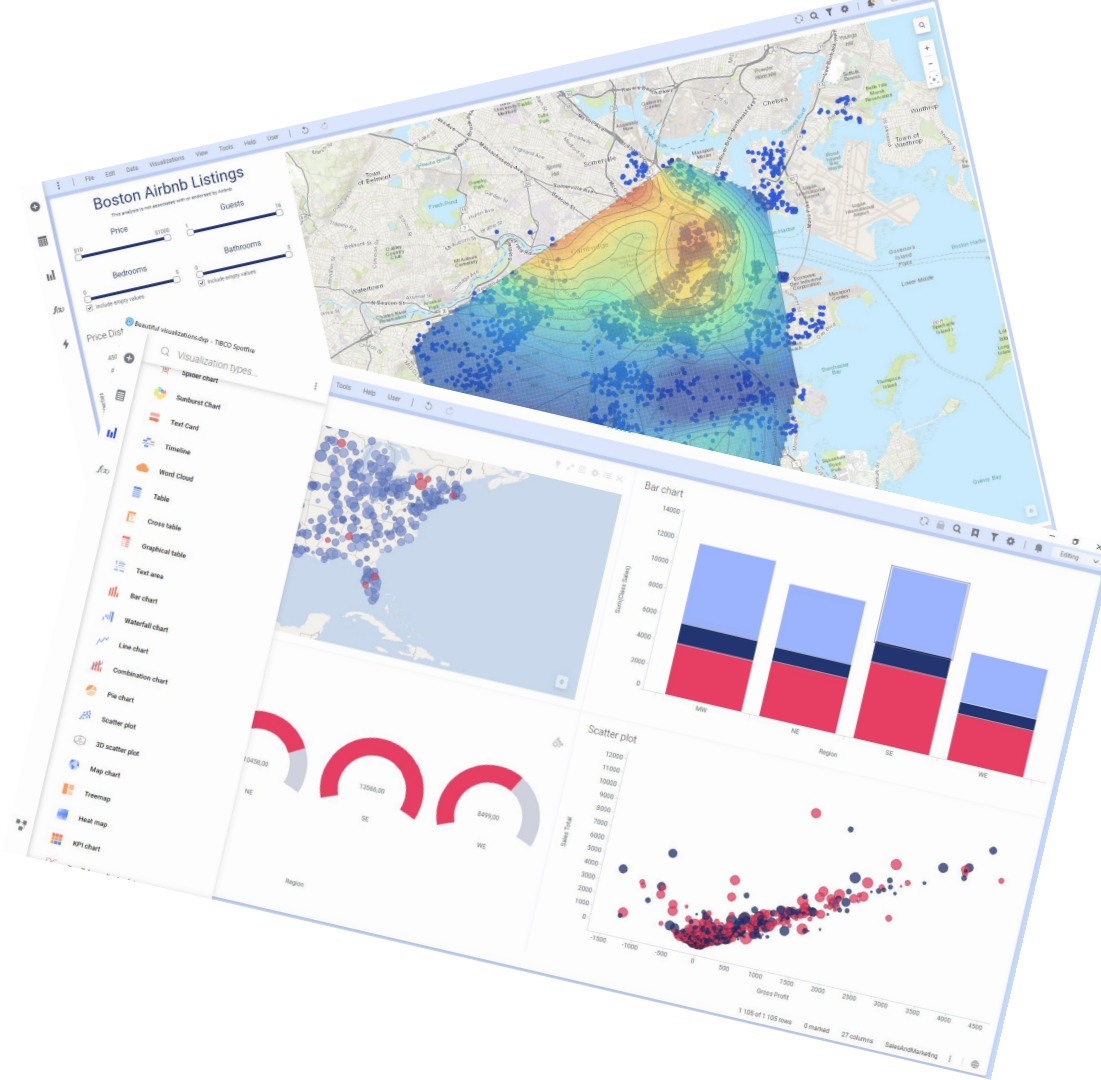
Bookmarks

Scripting intro

Spotfire User Interface

Spotfire Analyst

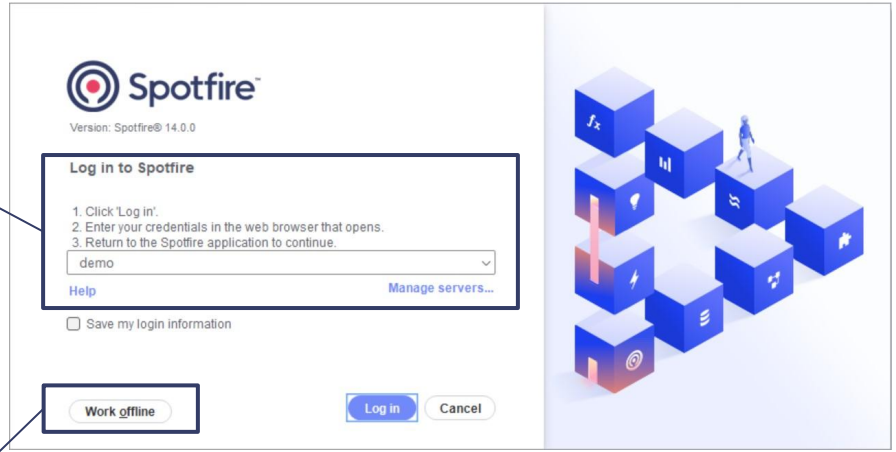
- Windows based fully featured client for creating simple to complex analysis
- Installed on user's machine



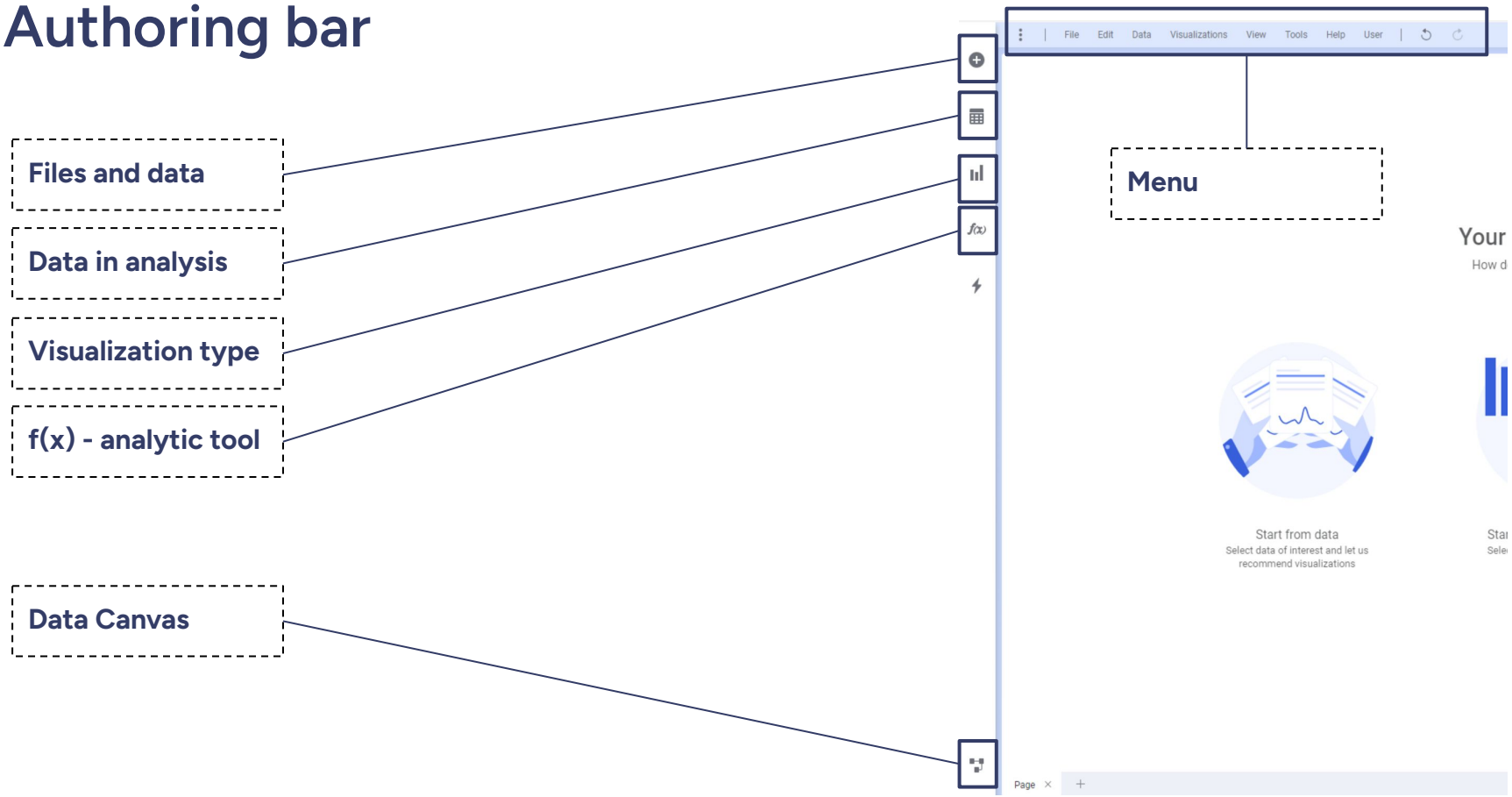
Spotfire Analyst Modes

- Online Mode
  - Access server library
  - Get software updates from server
  - Access information links
  - Connect to multiple servers

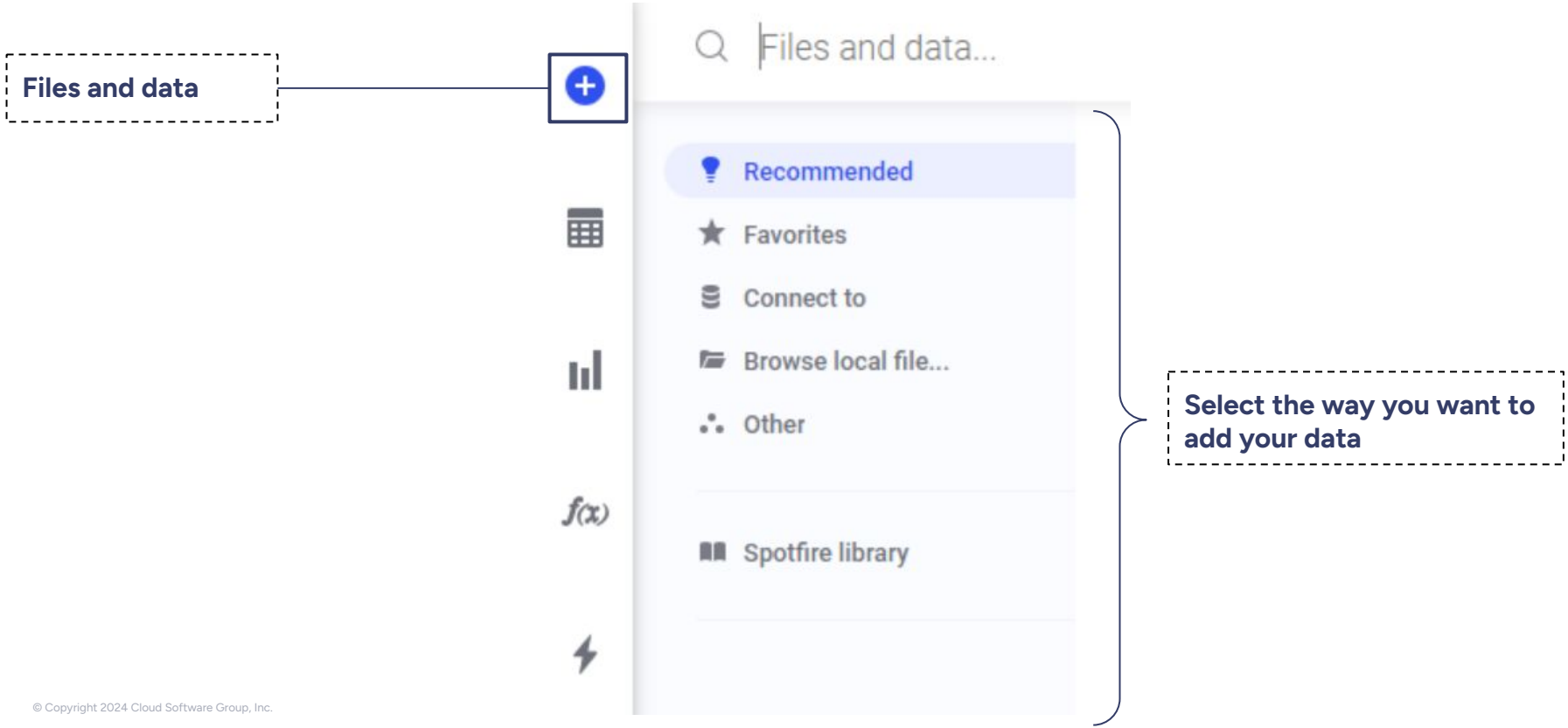
- Offline Mode
  - Work with local storage only
  - Convenient on the go



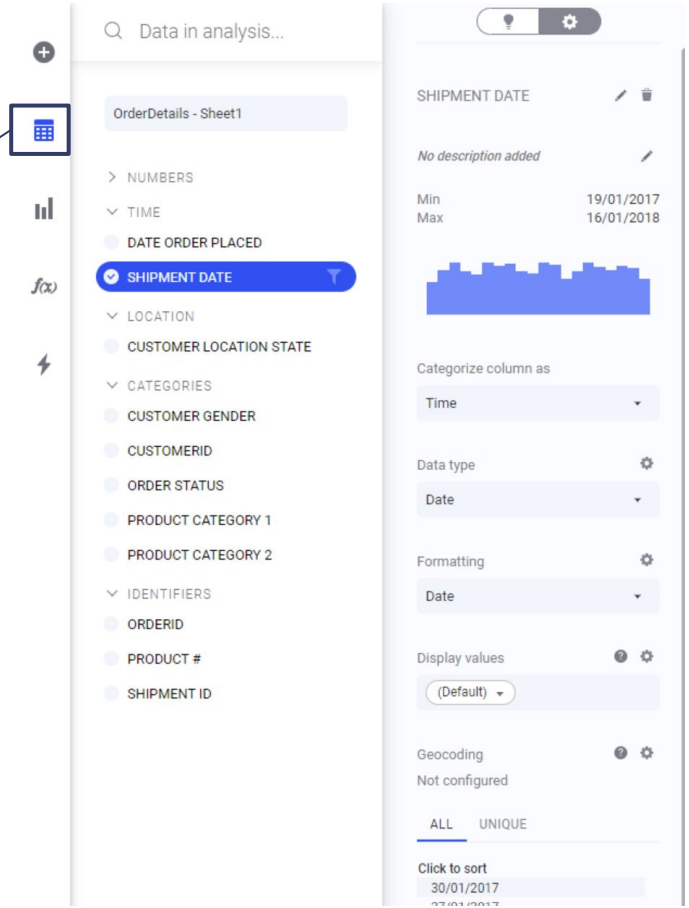
Authoring bar



Load data



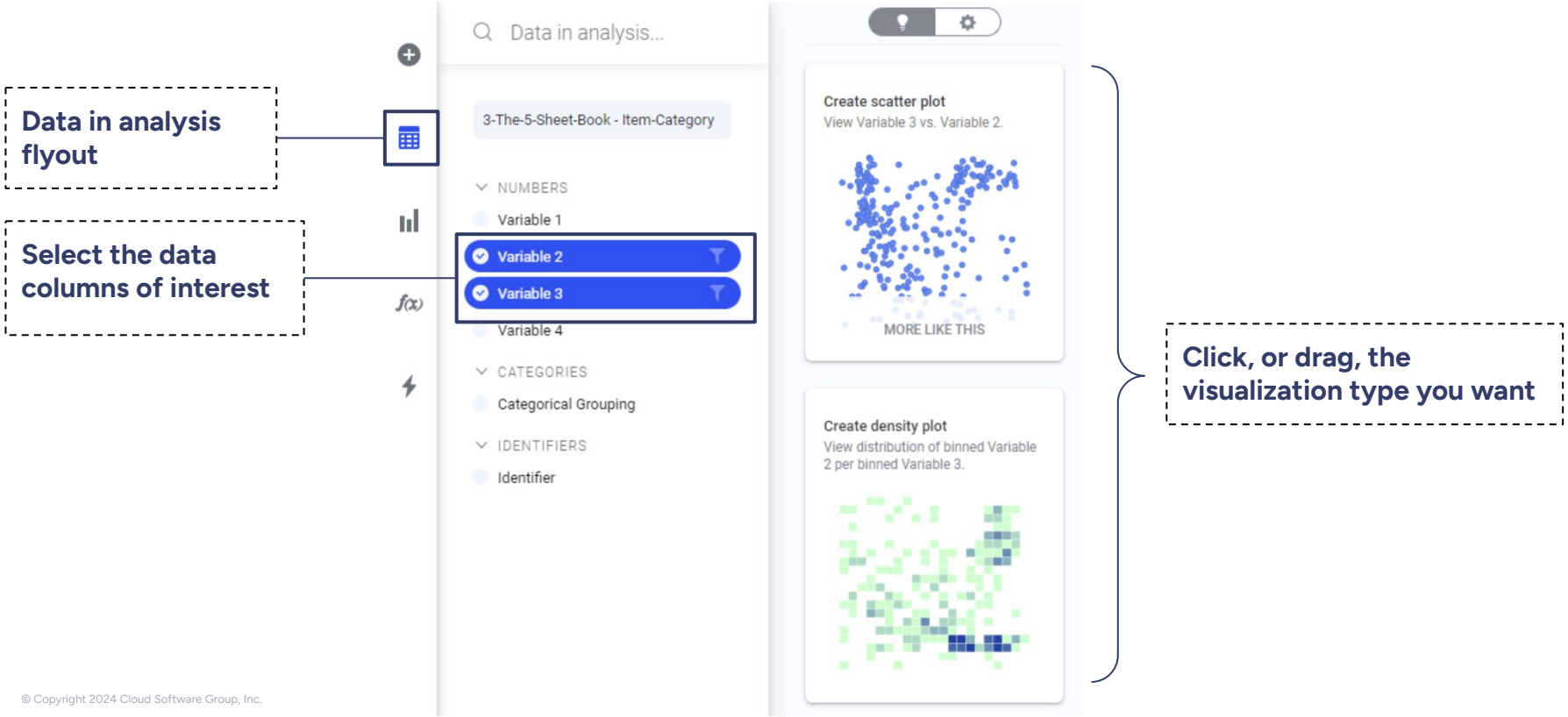
Analyze data



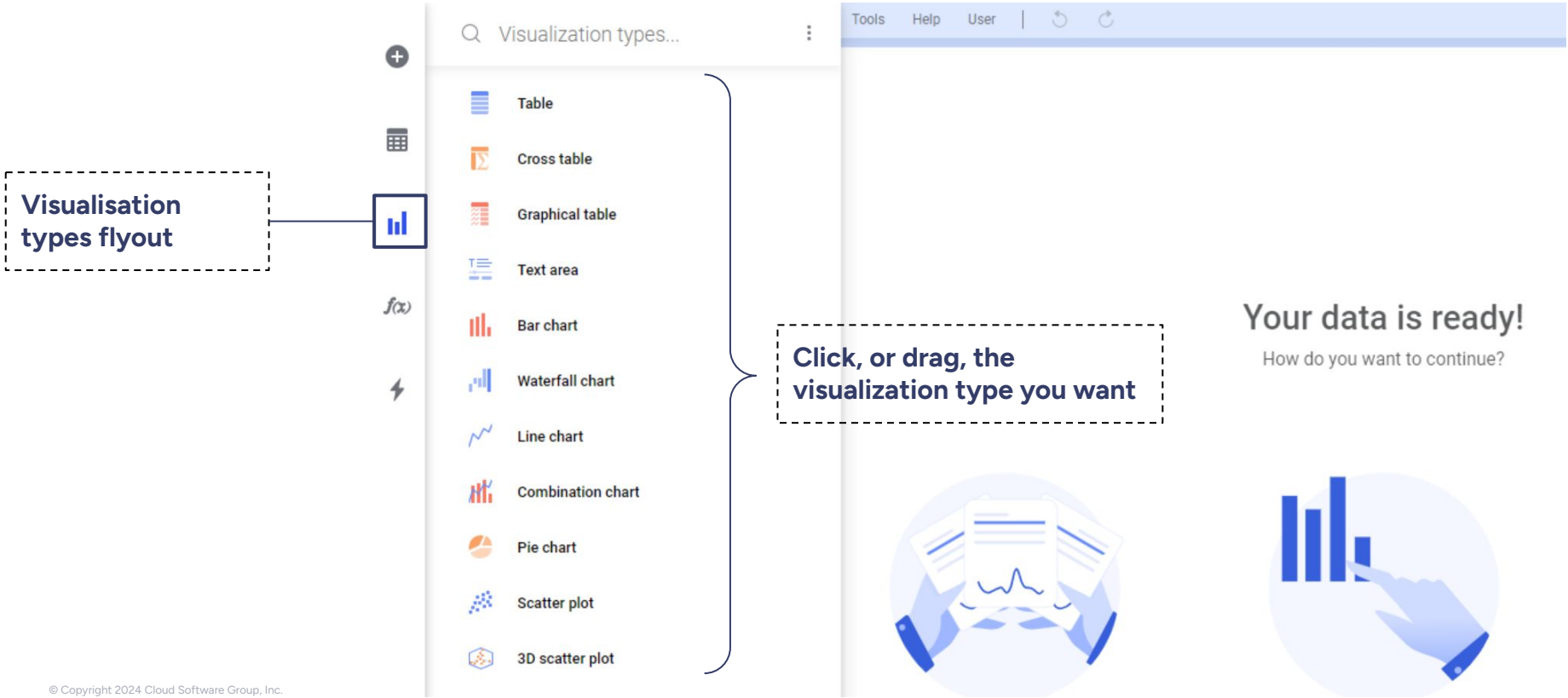
Data in analysis

Details on selected column

Visualize data

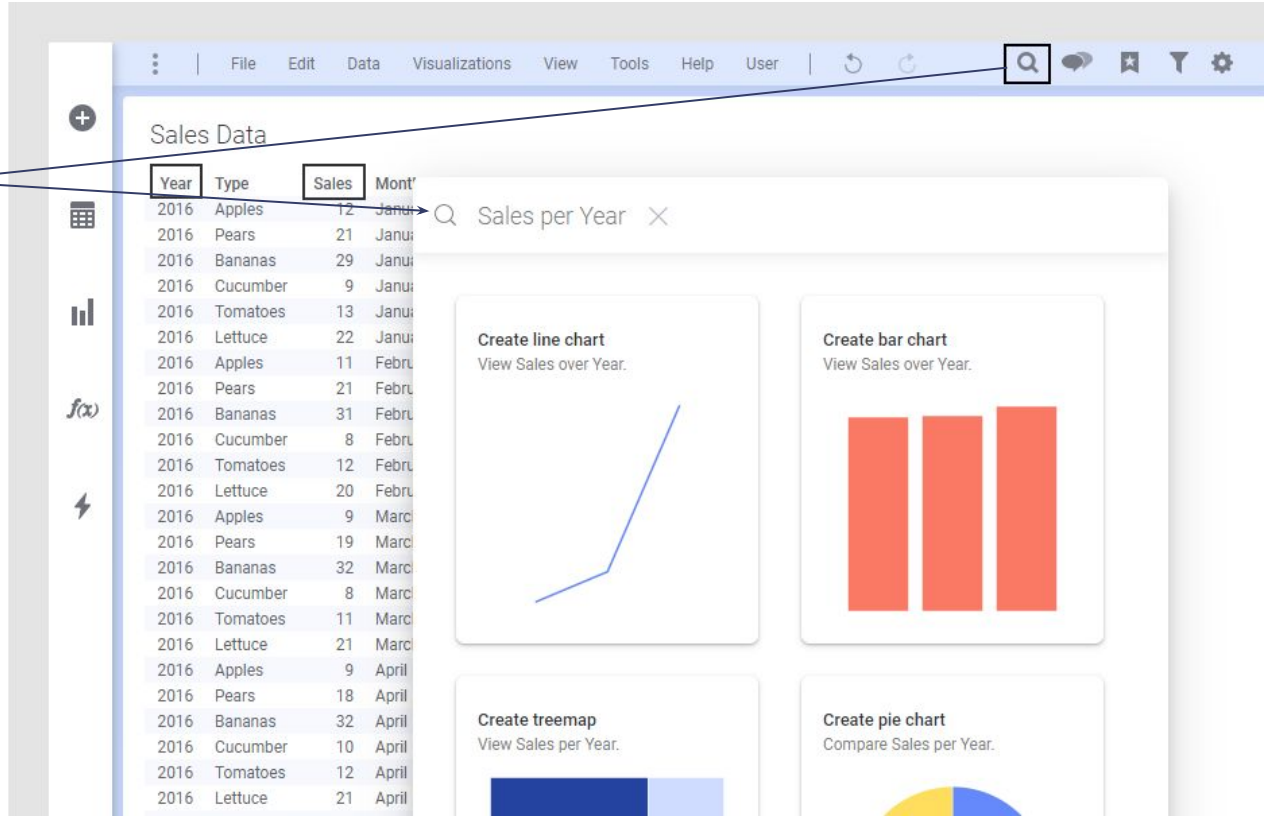


Visualize data

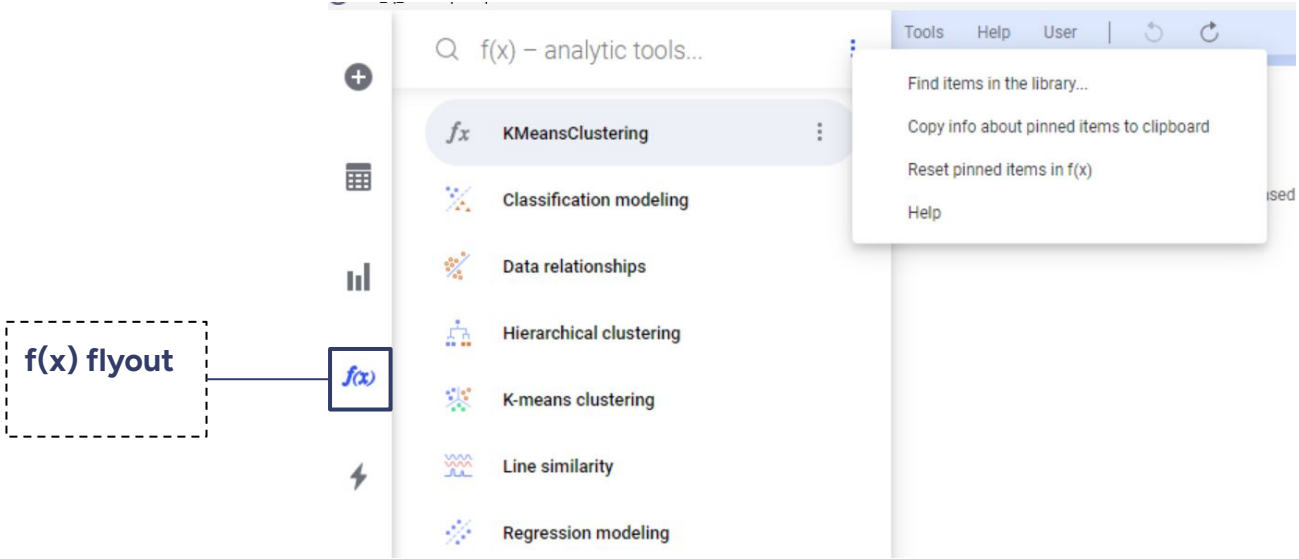


Visualize data

Click Find and type what you are looking for in your data

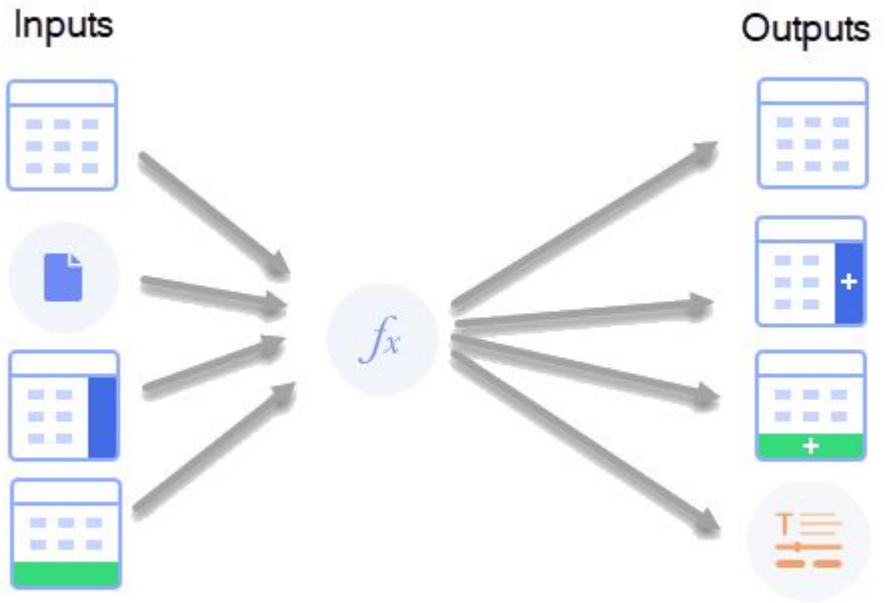


f(x) - analytics tools flyout

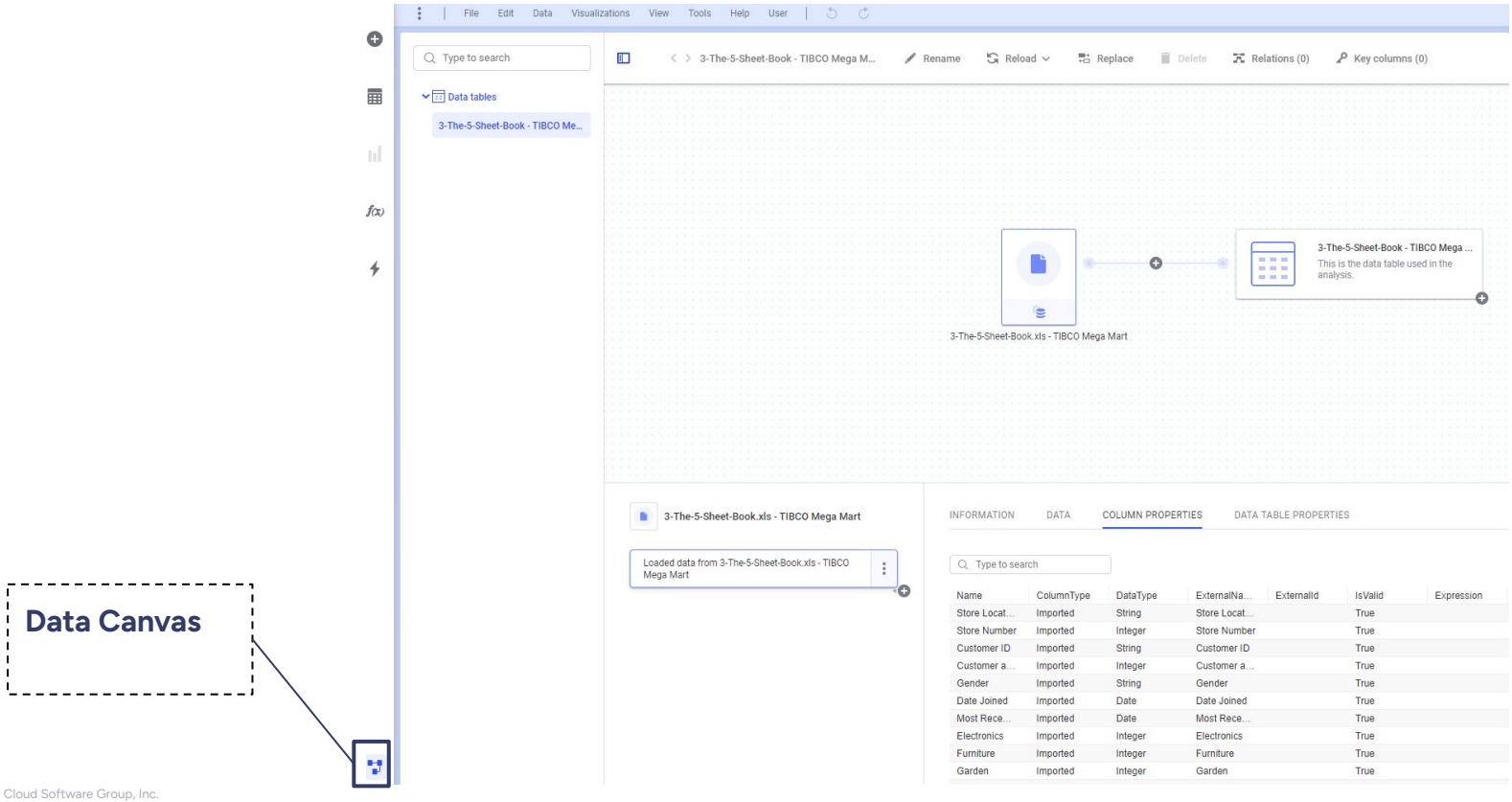


Data functions

- Complex calculations
- Versatile applications
- Inputs and outputs
- Library and Reusability



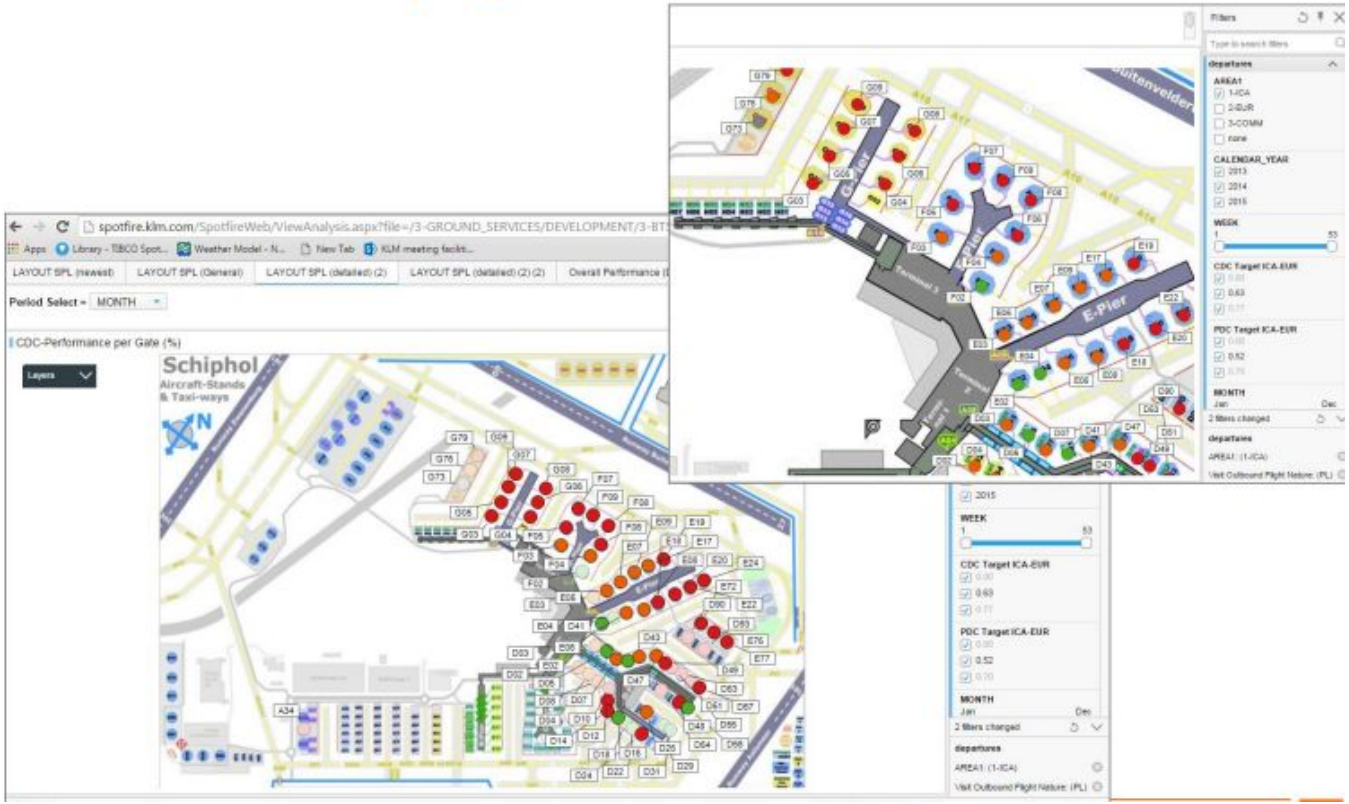
Data Canvas



Data Canvas

Spotfire Data Visualization inspiration

Gate Performance

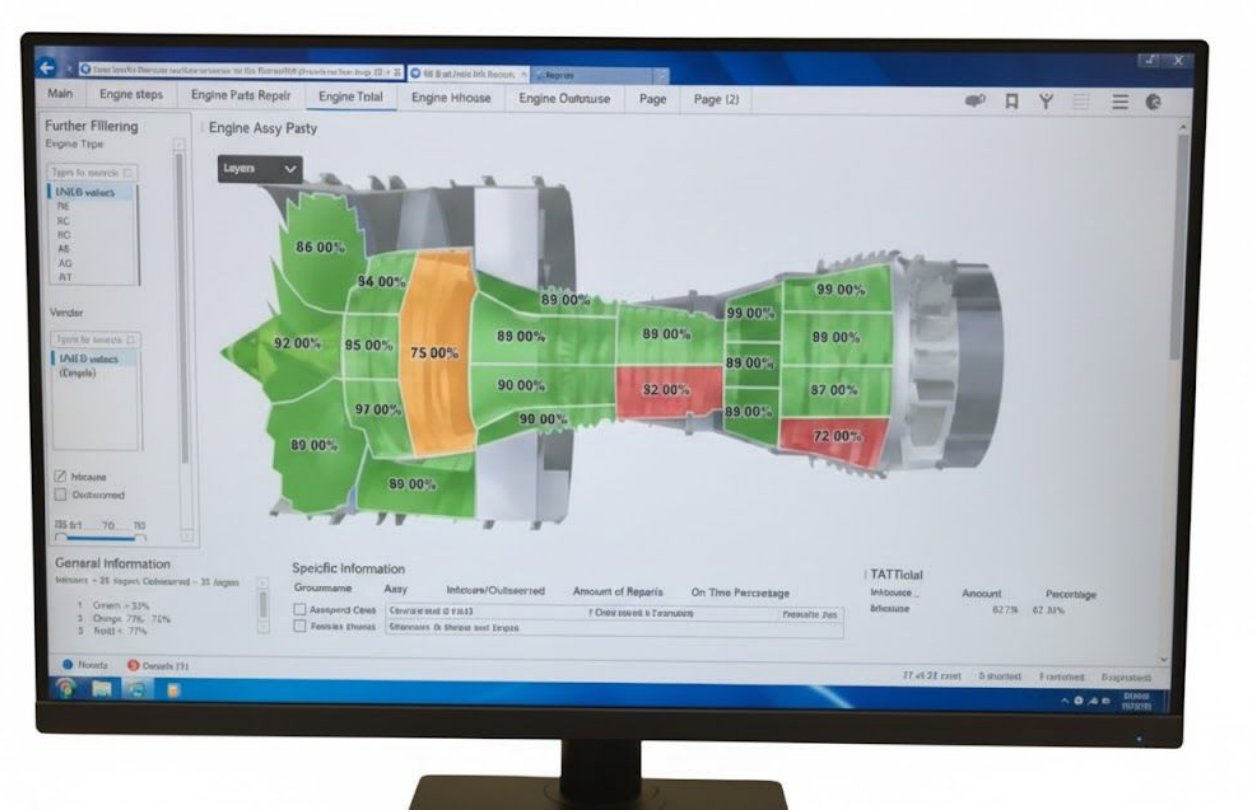


Turn around times - Gantt chart

Spotfire community demo - Airport visitor ratings

[Open demo]

Engineering & Maintenance example



Map charts demo

Wind Energy root cause failure demo

The demo shows data from Wind Turbines in the Netherlands.

The goal of this demo, is to find any anomalies in the data. And if there are any anomalies to be found, what can be done to:

- find the root cause of these anomalies;

- mitigate or prevent these anomalies.

Start the demo by clicking this link: Wind Turbine Overview

This demo requires a TERR package. See here for more information.

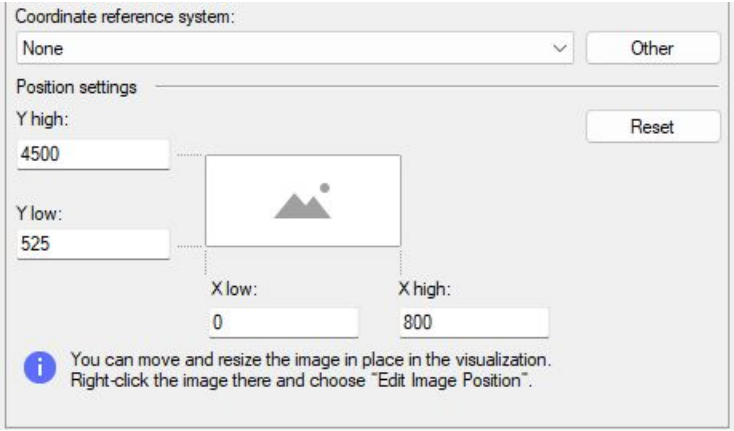
184 of 1,598 rows | 0 marked | 19 columns | WindTurbineDataFailures

[Open Demo]

Visualizations - Exercise

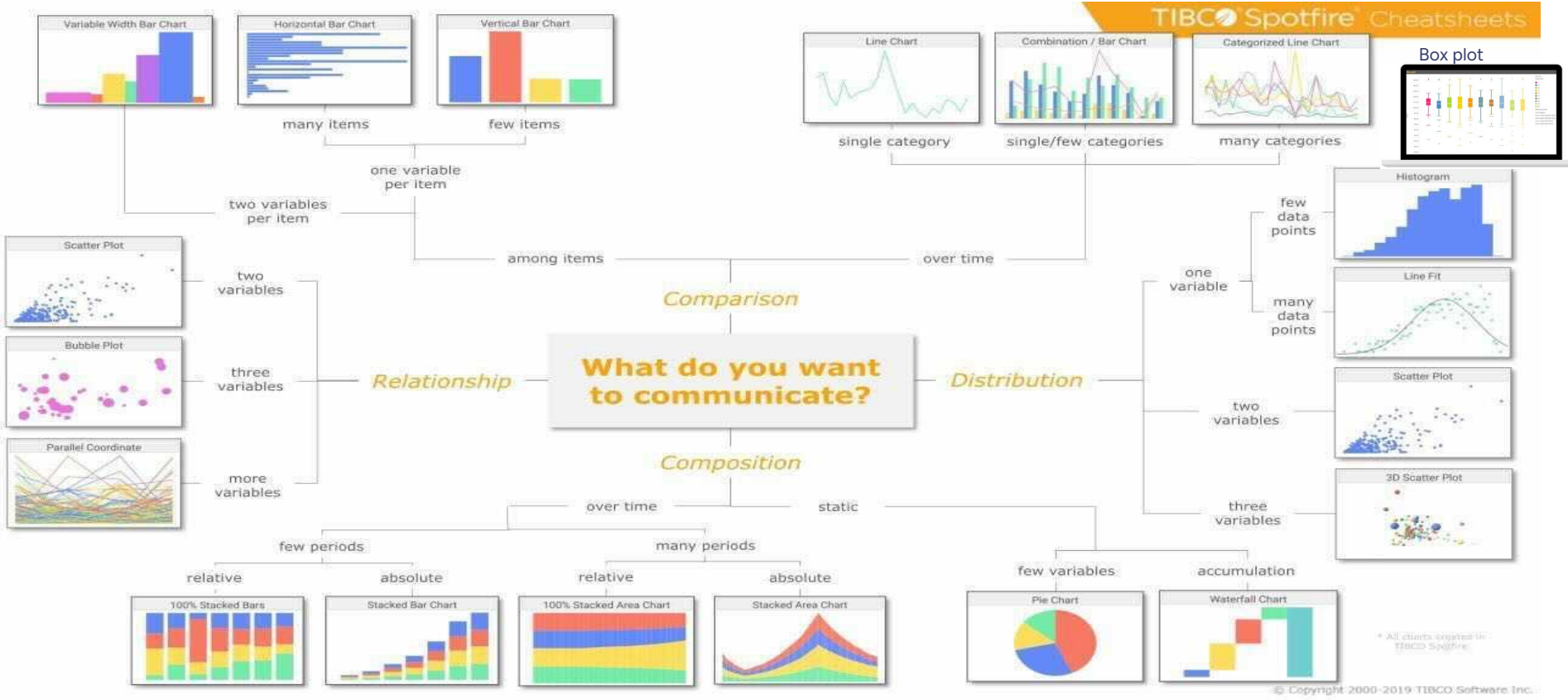
Demo of the vending machine analysis

1. What use case can be derived of this analysis?
2. Create a similar analysis with the provided seat plan image and dataset.
    a. Use these settings for the image position:



Spotfire Advanced Visualizations

Picking the right tool for each message



Visualizations: When to use which one?

Type	Purpose
Bar Chart	Aggregate Measures
	Histograms
Line Chart	Trends/Patters
	Categorical variables
	Color/Trellis
Graphical Table	Categorical items
Combination Chart	Compare patterns line/bars
Scatter Plots	Correlations/relations (curves/lines)
	Clustering
	Outliers
	Density plots
Pie Chart	Relative comparison
	Color by / Sector by / Size by
Tables	Tables/Summary/Crosstable
	Details on demand
	Summary Table: Aggregation by category
	CrossTable: category (pivot) and color/mark

Type	Purpose
Treemap	Hierarchically organized
	1-2 continuous variables
Box Plots	Data distributions
	Box edges 25% <-----> 75%
	Line ends: upper/lower quartiles
	Outliers
	Comparison circles (overlapping: groupings are not significantly different)
Map Chart	Coordinates
	Geocoding
	Layers
	Images
3D Scatter Plot	3 Dimensions of data
	Identifying outliers or clusters
Parallel Coordinate Plot	>3 Dimensions (multivariate)
	Normalized data (%)
	Compare measures
Heat Map	View data in color
	Large data sets: easier to understand than PCP
	Multivariate data

Advanced Visualizations: Can you guess them?

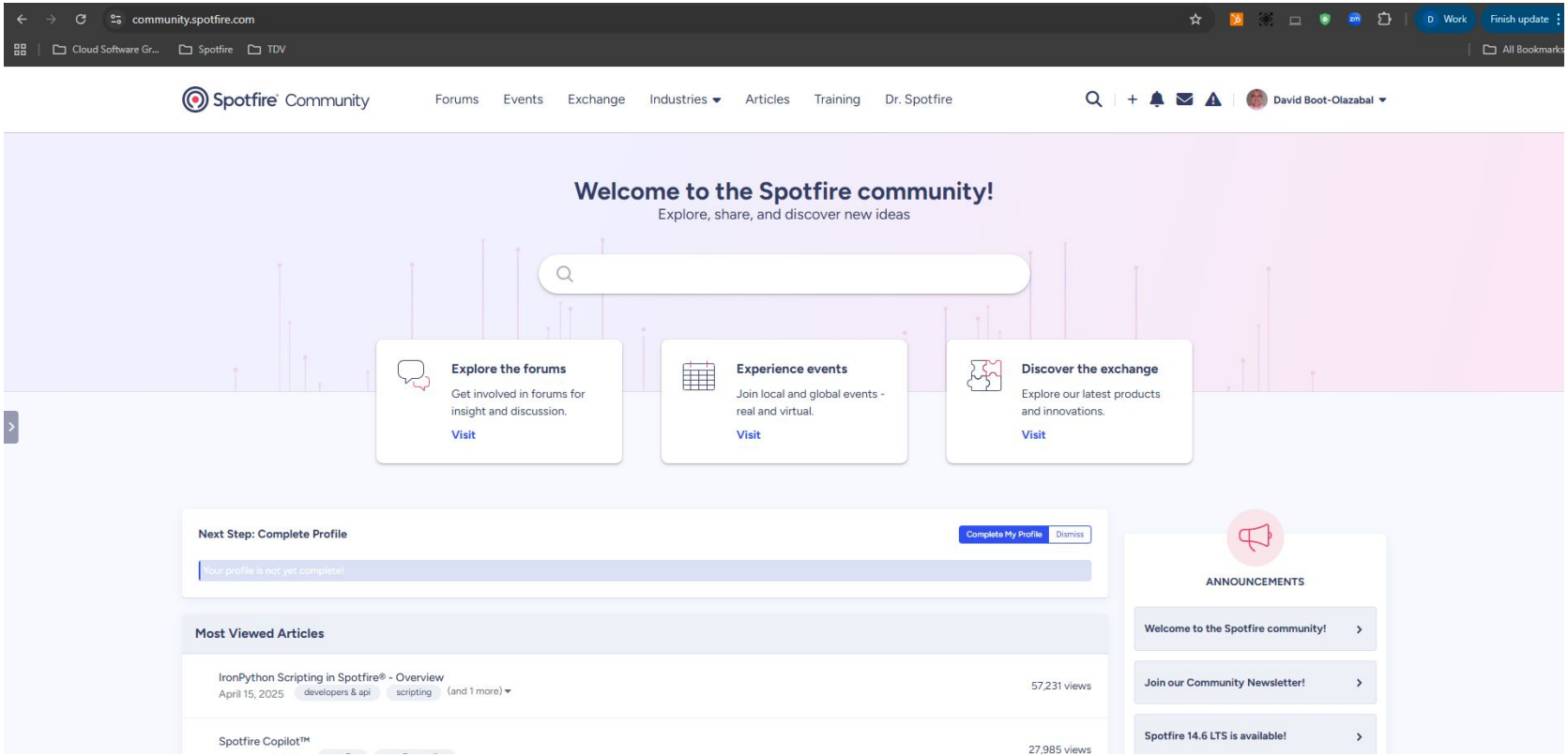
1. KPI Chart
2. Parallel Coordinate Plot (PCP)
3. Box Plot
4. Combination Chart
5. Pie Chart

Community & Spotfire Mods

Spotfire Community

https://community.spotfire.com

Spotfire community



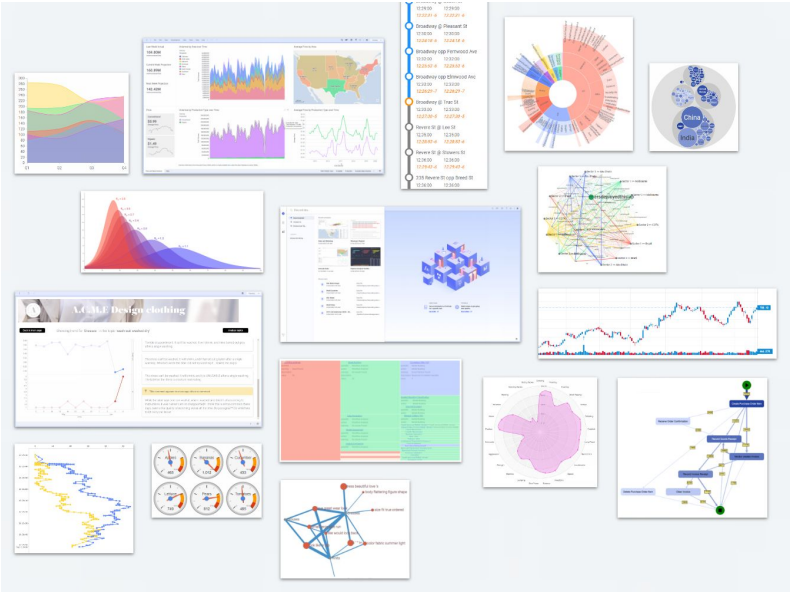
Spotfire Mods

Spotfire Mods

Spotfire mods is a lightweight, cloud-ready extension framework

First release of mods, build visualization mods

Useful for different roles like analyst, report developers and web developers

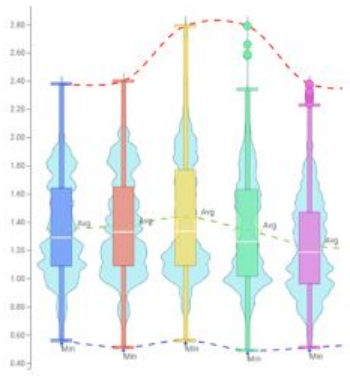


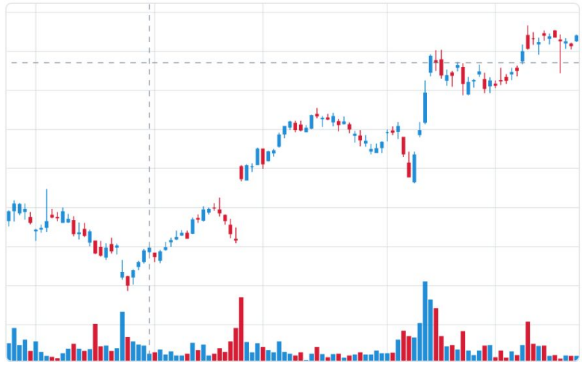
What are Visualization Mods

Seamless integration with native visualizations for a consistent user experience

Fully customizable design with Spotfire powerful data handling

Compatible with all Spotfire data sources, including streaming and on-demand



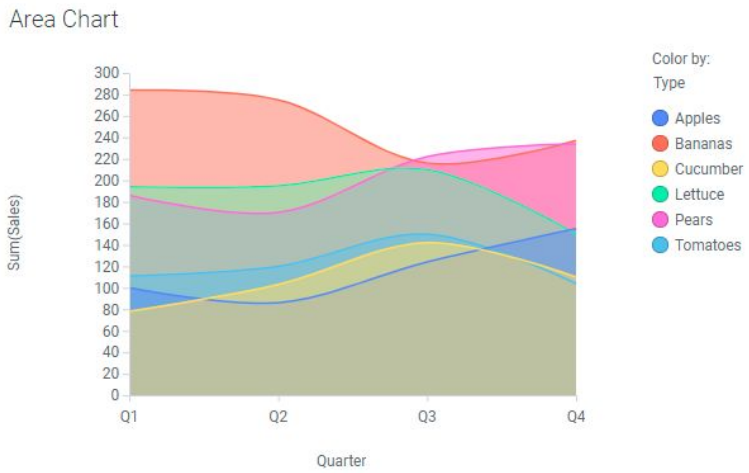


Visualization Mods

A lightweight, shareable and reusable visualization component to add new visualization types

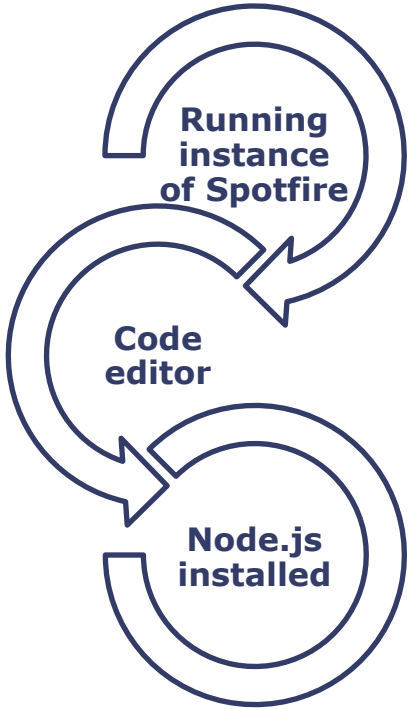
Built with web technologies such as JavaScript and HTML to integrate third-party JavaScript visualizations

It can be based on any Spotfire supported data sources i.e. in-memory, in-database etc.



Develop Visualization Mods

Prerequisites to build a mod



Getting started

Create an empty visualization mod in Spotfire

Start from a mod example

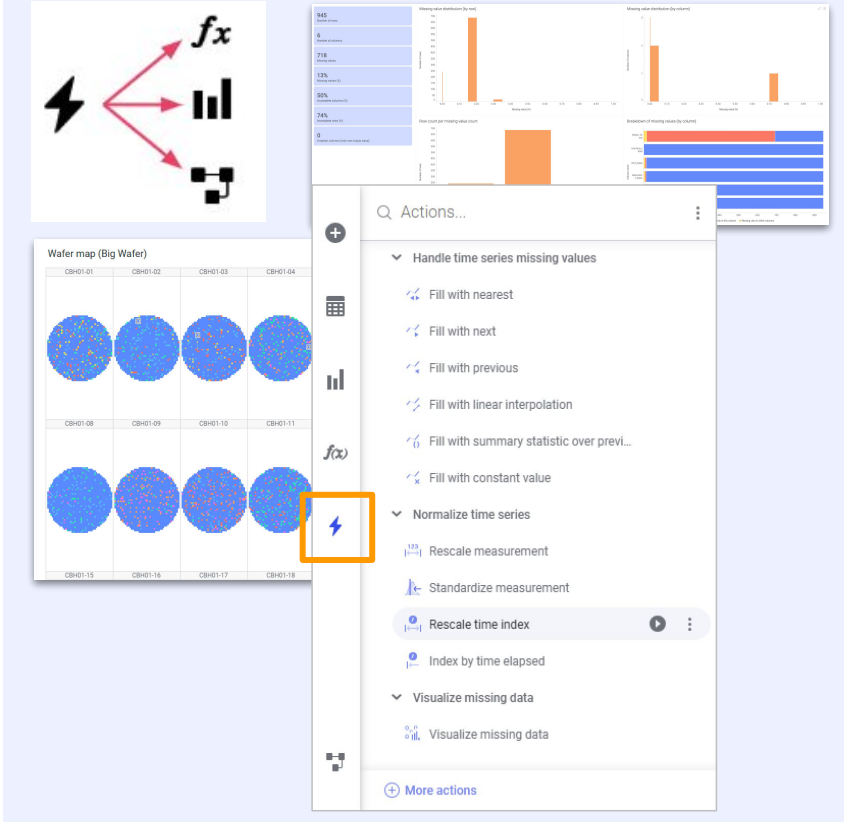
Start local development server

Connect Spotfire to the development server

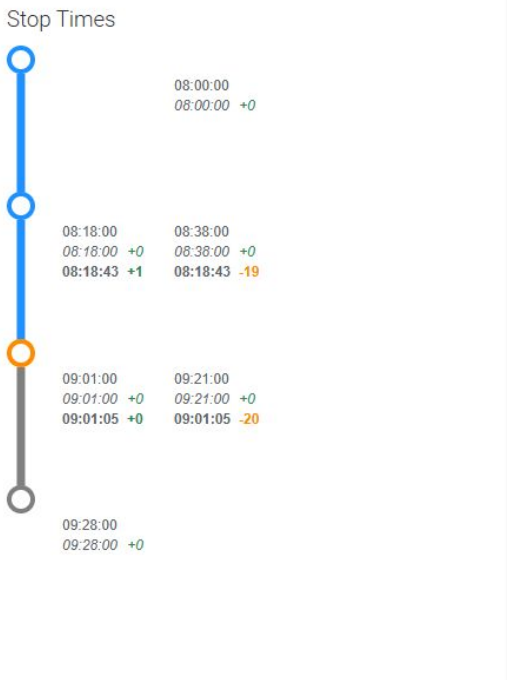
Start editing the example

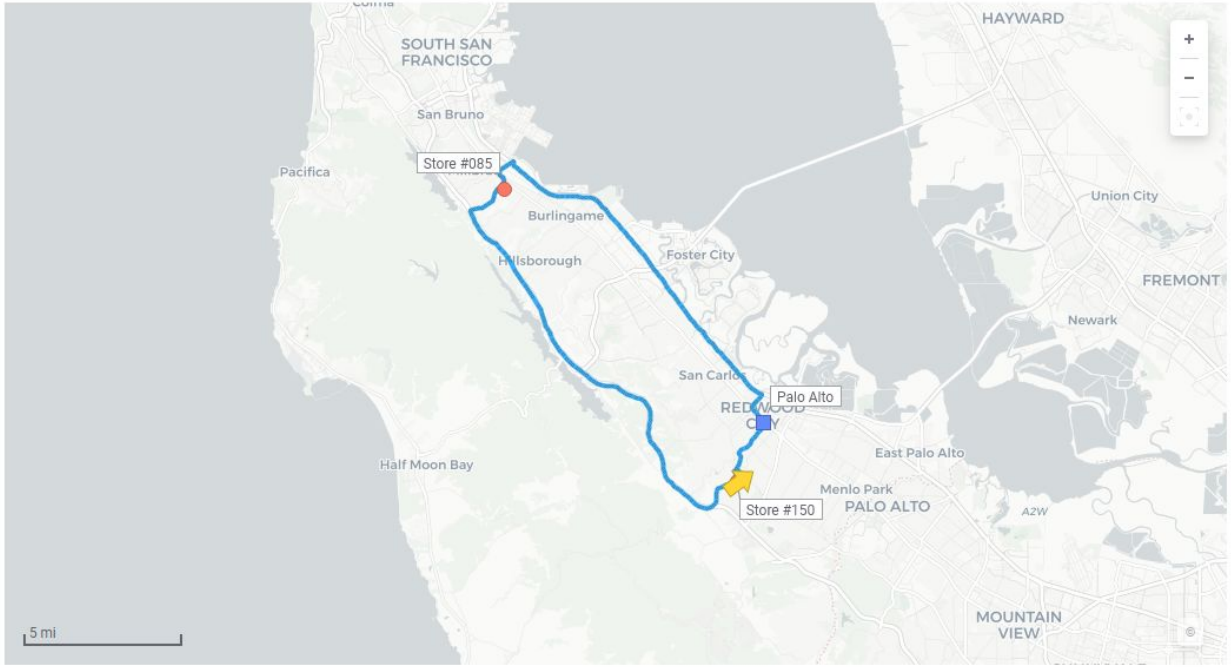
Visualization Mods

Action Mods



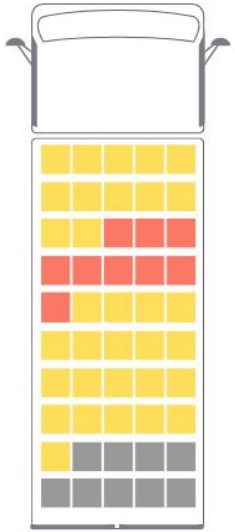
Visualization Mods for transportation



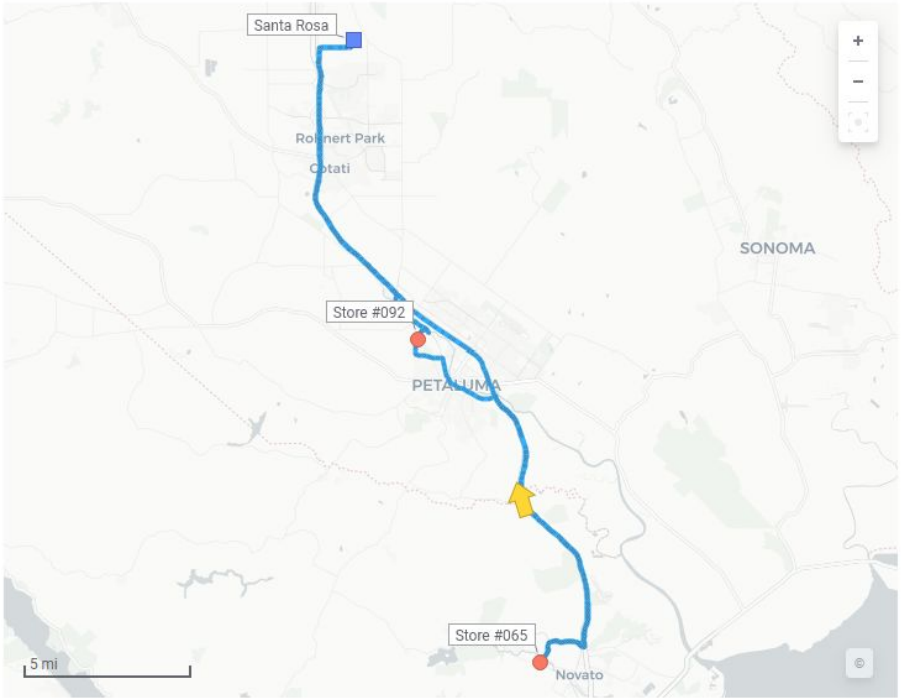


Visualization Mods for transportation

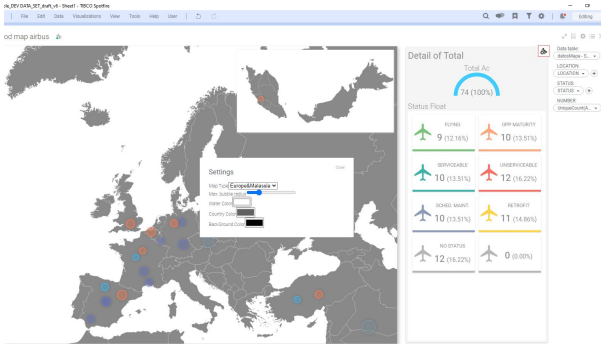
Vehicle Loading

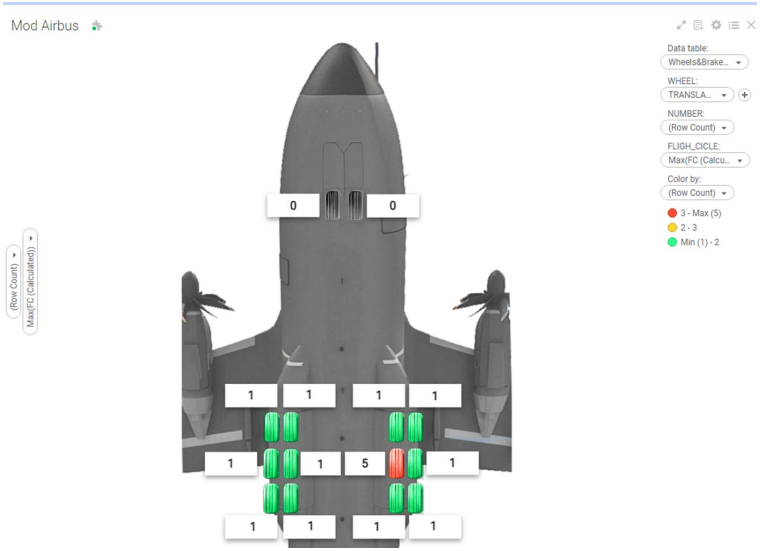


Data limiting:
Marking
Data table:
OrderStore
Consignment Units:
Sum(Shipped Units)
Vehicle Capacity:
500
Cab Open:
SKU
Cargo Open:
Center Name
Color by:
Status
Delivered
Shipped

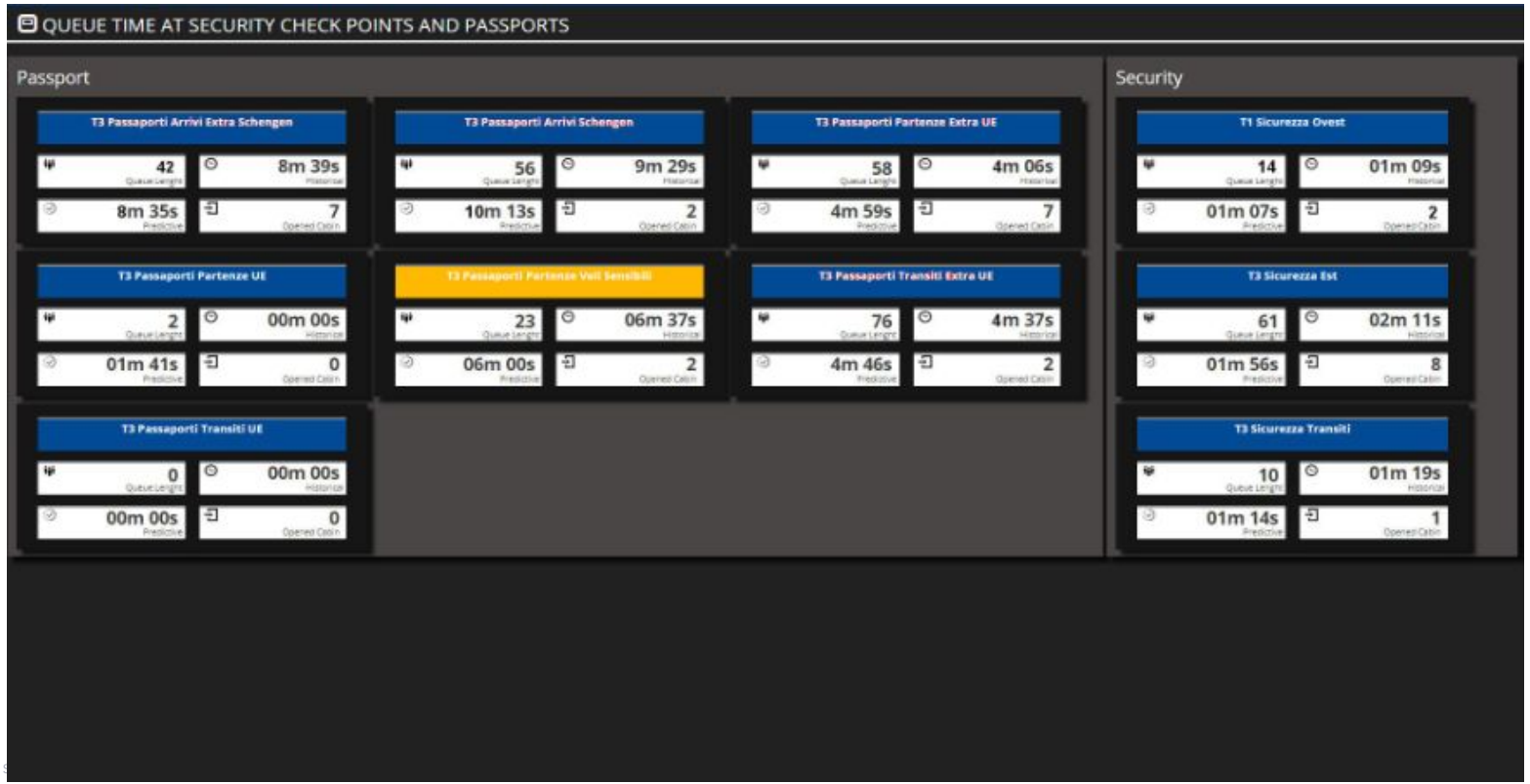


Visualization Mods for transportation

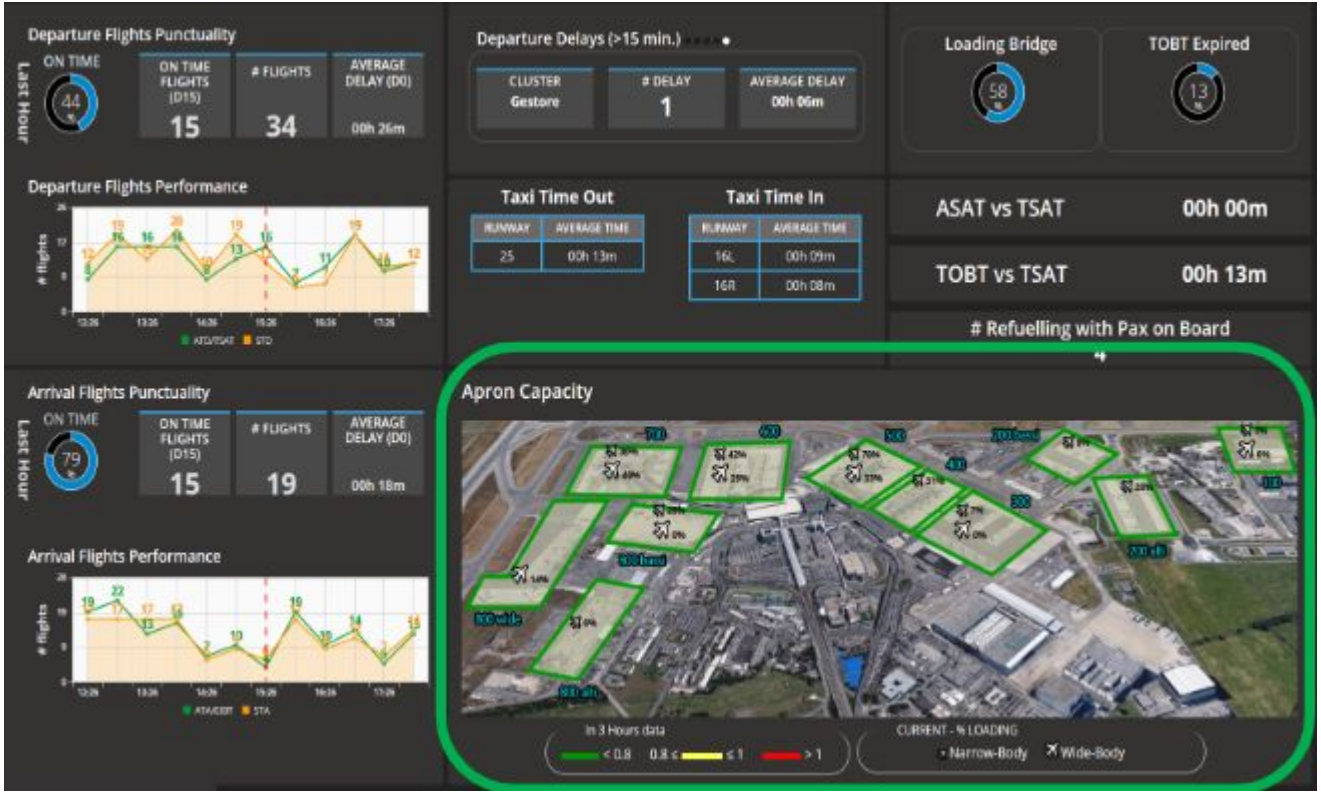




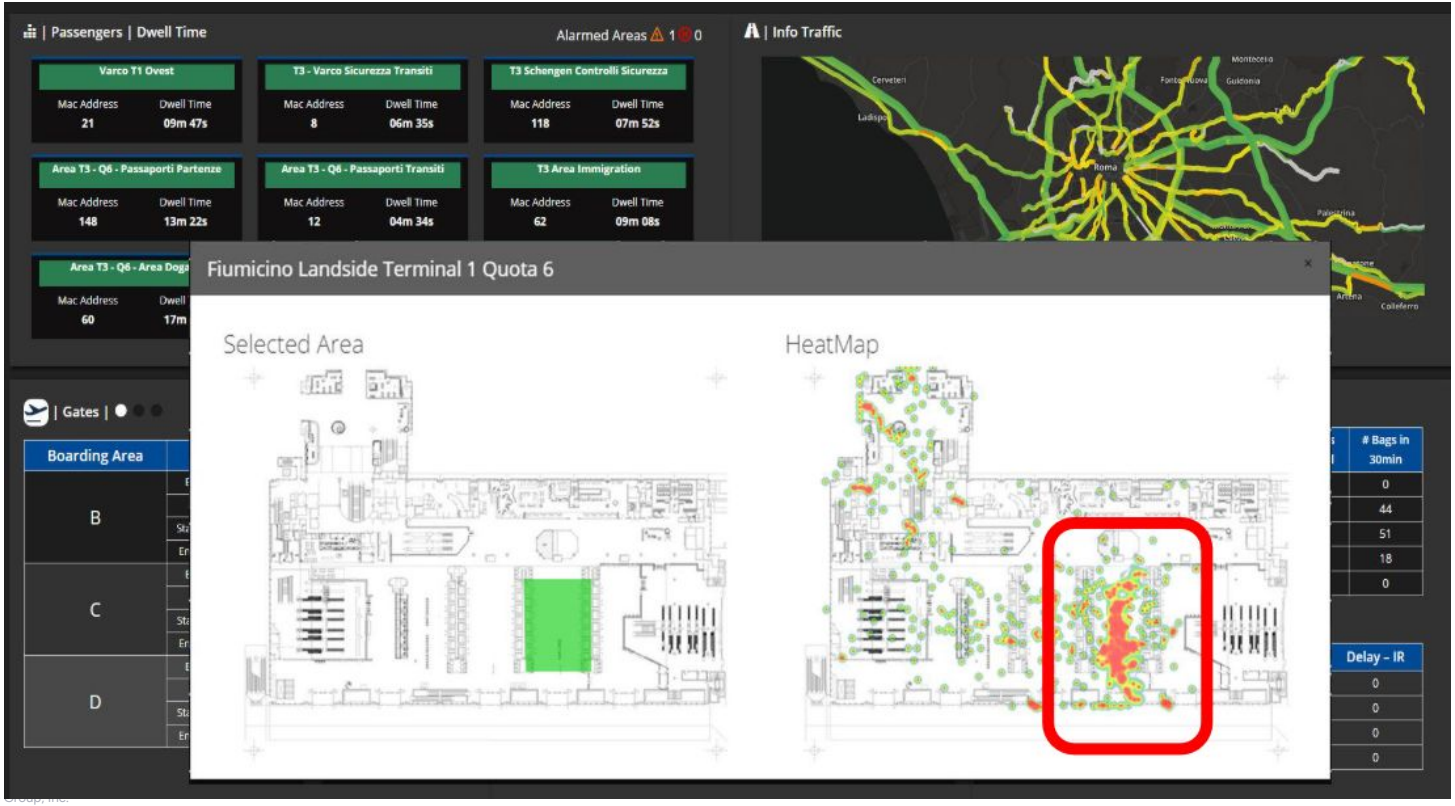
Visualization Mods for transportation



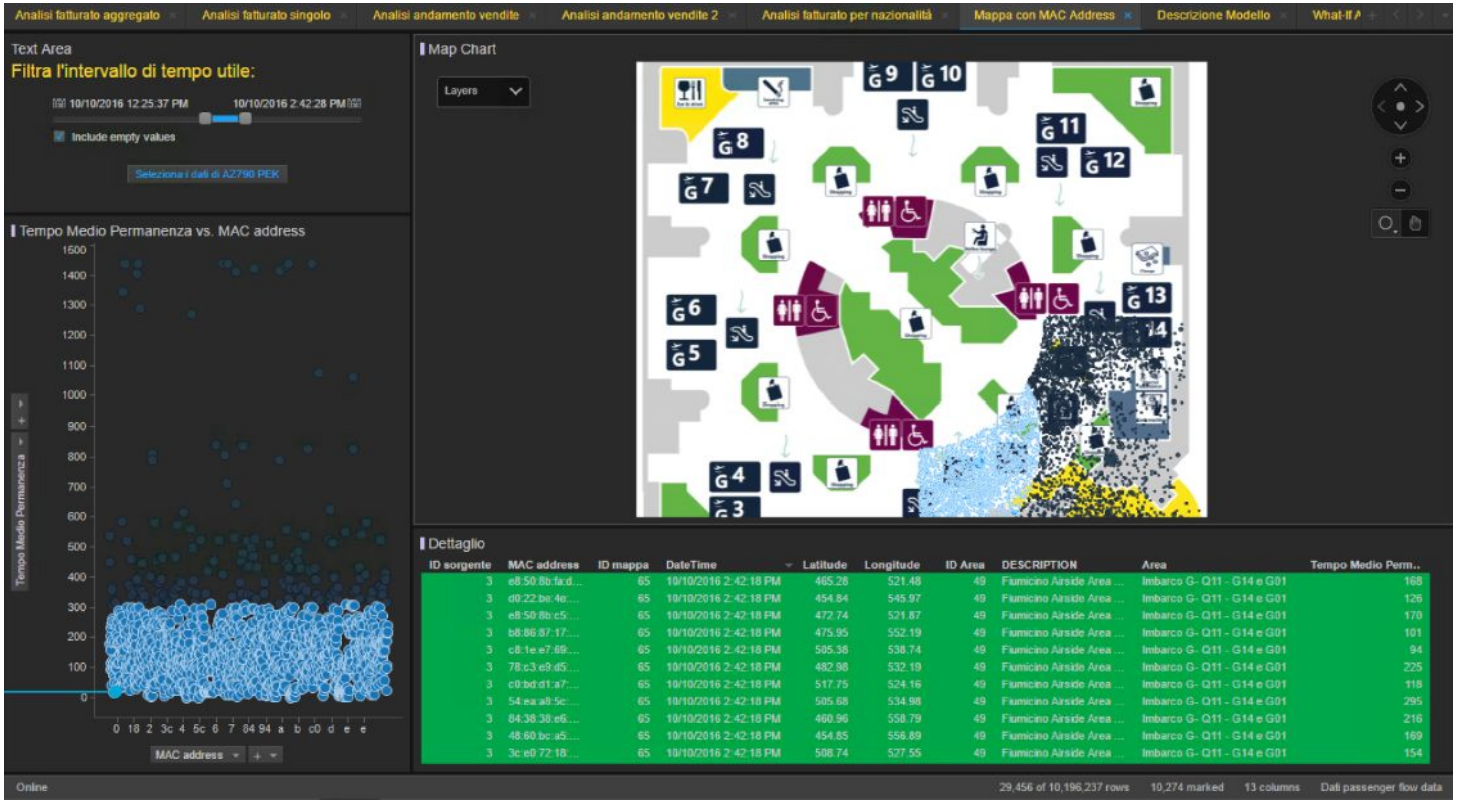
Visualization Mods for transportation



Visualization Mods for transportation

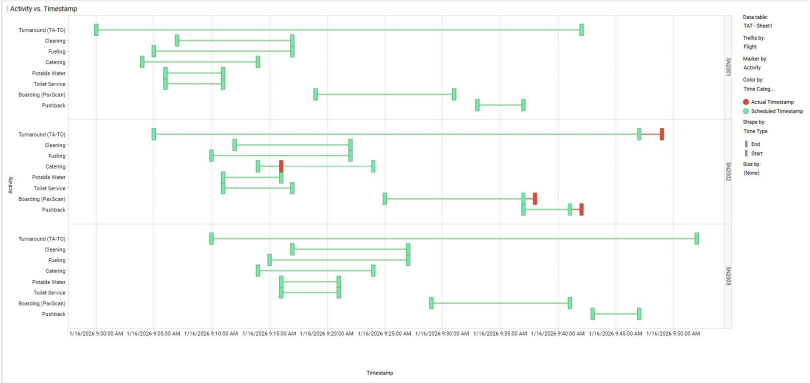


Visualization Mods for transportation

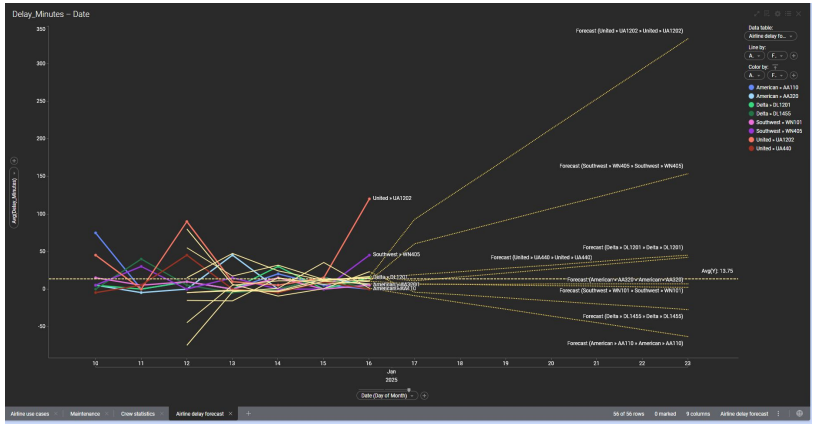


Visualizations - Exercise

1. Create a Turn around Time visualization
   a. Use the TAT.xlsx dataset.
   b. Create a scatter plot
   c. Set colors, size and shape
   d. Add a line connection, Trellis and Marker By

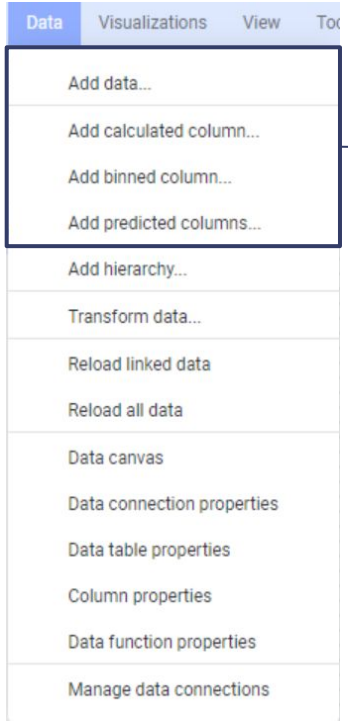


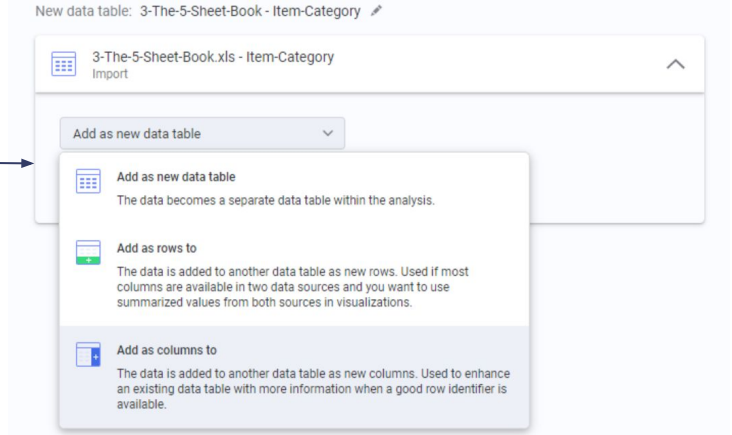
2. Create a line chart and use it to create a Forecast
   a. Use the Airline Delay forecast.txt data set.
   b. Create a line chart, with date on the Y-axis and date on the x-axis.
   c. Add a line by and color by using the same two columns.
   d. Add a Forecast line via a right click on the line chart.
   e. Verify what happened in the Lines and Curves section of the Line chart properties.

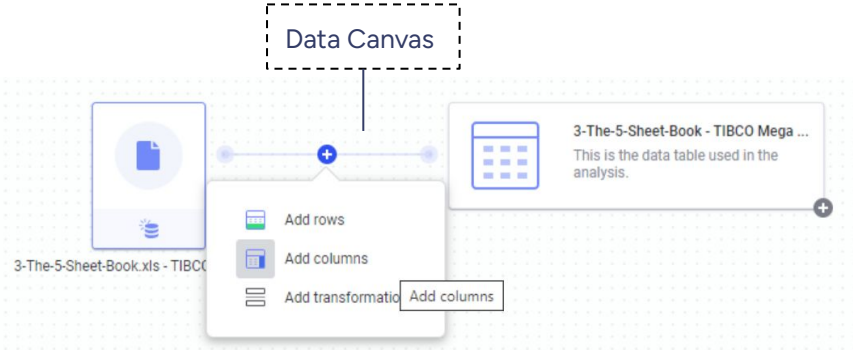


Spotfire data canvas and transformation

Import Multiple Data Tables



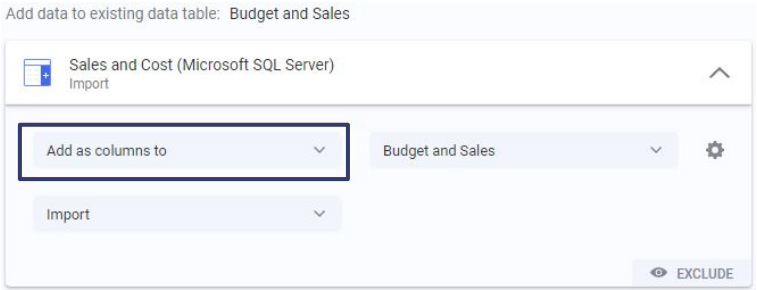




Add New Columns

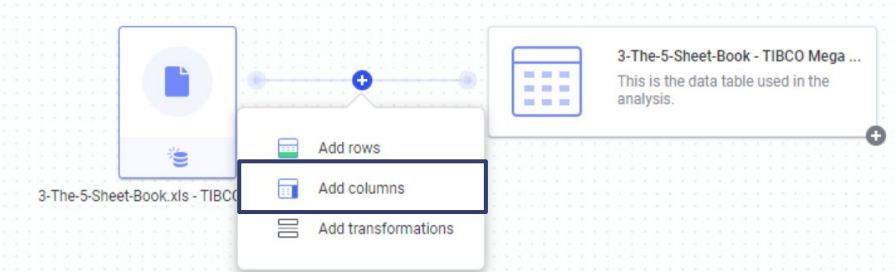
Data Inserted from:

- Local file
- Library file
- Information link
- Data connection
- Clipboard etc.



Add columns from:

- Files and Data Flyout
- Data Canvas Flyout

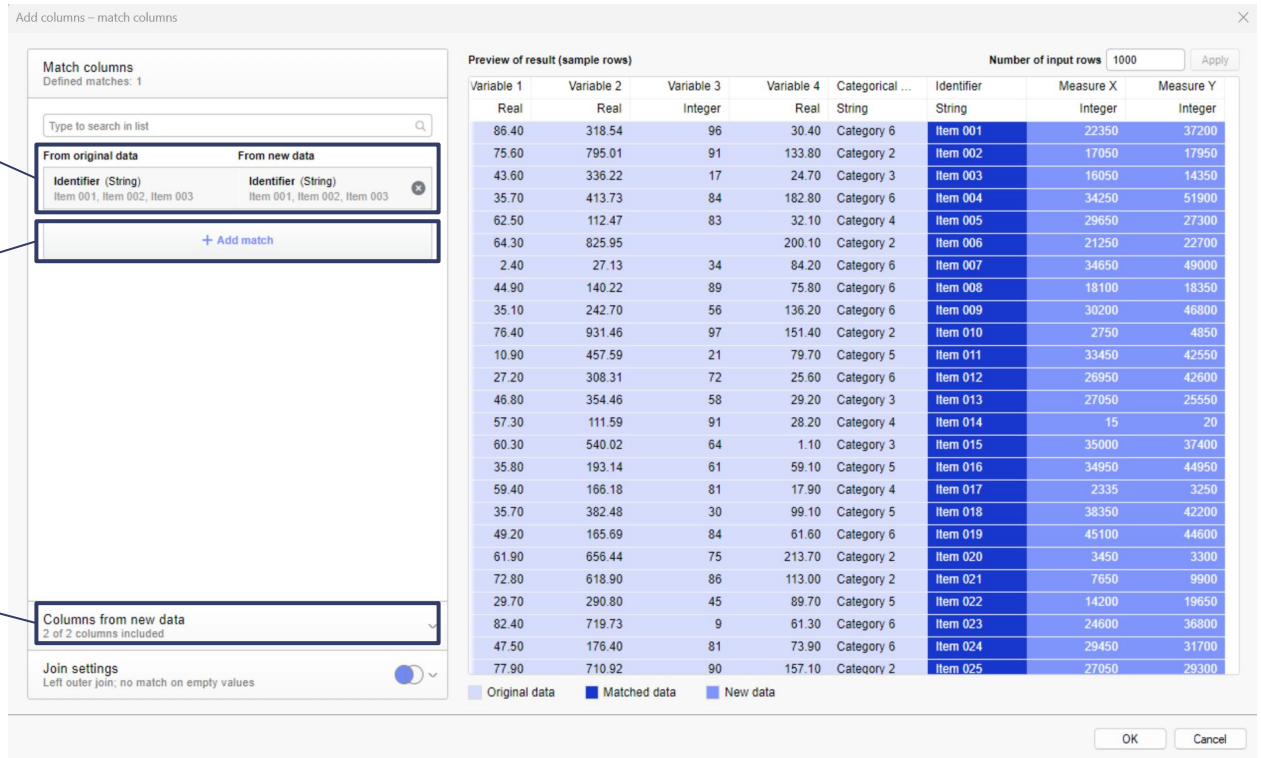


Match Column Dialog

Column match suggested by recommendation engine

You can ADD, REMOVE and EDIT matches

Column match suggested by recommendation engine

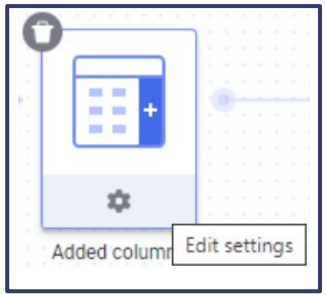


Variable 1	Variable 2	Variable 3	Variable 4	Categorical ...	Identifier	Measure X	Measure Y
Real	Real	Integer	Real	String	String	Integer	Integer
86.40	318.54	96	30.40	Category 6	Item 001	22350	37200
75.60	795.01	91	133.80	Category 2	Item 002	17050	17950
43.60	336.22	17	24.70	Category 3	Item 003	16050	14350
35.70	413.73	84	182.80	Category 6	Item 004	34250	51900
62.50	112.47	83	32.10	Category 4	Item 005	29650	27300
64.30	825.95		200.10	Category 2	Item 006	21250	22700
2.40	27.13	34	84.20	Category 6	Item 007	34650	49000
44.90	140.22	89	75.80	Category 6	Item 008	18100	18350
35.10	242.70	56	136.20	Category 6	Item 009	30200	46800
76.40	931.46	97	151.40	Category 2	Item 010	2750	4850
10.90	457.59	21	79.70	Category 5	Item 011	33450	42550
27.20	308.31	72	25.60	Category 6	Item 012	26950	42600
46.80	354.46	58	29.20	Category 3	Item 013	27050	25550
57.30	111.59	91	28.20	Category 4	Item 014	15	20
60.30	540.02	64	1.10	Category 3	Item 015	35000	37400
35.80	193.14	61	59.10	Category 5	Item 016	34950	44950
59.40	166.18	81	17.90	Category 4	Item 017	2335	3250
35.70	382.48	30	99.10	Category 5	Item 018	38350	42200
49.20	165.69	84	61.60	Category 6	Item 019	45100	44600
61.90	656.44	75	213.70	Category 2	Item 020	3450	3300
72.80	618.90	86	113.00	Category 2	Item 021	7650	9900
29.70	290.80	45	89.70	Category 5	Item 022	14200	19650
82.40	719.73	9	61.30	Category 6	Item 023	24600	36800
47.50	176.40	81	73.90	Category 6	Item 024	29450	31700
77.90	710.92	90	157.10	Category 2	Item 025	27050	29300

Join Settings

Select Join Method

Select match on empty values



Add columns – match columns

Match columns
Defined matches: 1

Columns from new data
2 of 2 columns included

Join settings
Left outer join; no match on empty values

- **Left outer join** — *Rows from original data only*
- **Left single match join** — *Rows from original data only, single match from new*
- **Full outer join** — *All rows, from both original and new data*
- **Inner join** — *Rows matching in both original and new data only*
- **Right outer join** — *Rows from new data only*
- **Right single match join** — *Rows from new data only, single match from original*

☐ Treat empty values as equal

Join example (Left outer join; no match on empty values)

A	B
a	1
b	2
c	3
c	4
	5

+

A	C
a	6
c	8
c	9
d	10
	11

→

A	B	C
a	1	6
b	2	
c	3	8
c	3	9
c	4	8
c	4	9
	5	

Hover with the mouse pointer over rows to see how the selected join type works.

Preview of result (sample rows) — Number of input rows 1000 — Apply

Variable 1	Variable 2	Variable 3	Variable 4	Categorical ...	Identifier	Measure X	Measure Y
Real	Real	Integer	Real	String	String	Integer	Integer
86.40	318.54	96	30.40	Category 6	Item 001	22350	37200
75.60	795.01	91	133.80	Category 2	Item 002	17050	17950
43.60	336.22	17	24.70	Category 3	Item 003	16050	14350
35.70	413.73	84	182.80	Category 6	Item 004	34250	51900
62.50	112.47	83	32.10	Category 4	Item 005	29650	27300
64.30	825.95		200.10	Category 2	Item 006	21250	22700
2.40	27.13	34	84.20	Category 6	Item 007	34650	49000
44.90	140.22	89	75.80	Category 6	Item 008	18100	18350
35.10	242.70	56	136.20	Category 6	Item 009	30200	46800
76.40	931.46	97	151.40	Category 2	Item 010	2750	4850
10.90	457.59	21	79.70	Category 5	Item 011	33450	42550
27.20	308.31	72	25.60	Category 6	Item 012	26950	42600
46.80	354.46	58	29.20	Category 3	Item 013	27050	25550
57.30	111.59	91	28.20	Category 4	Item 014	15	20
60.30	540.02	64	1.10	Category 3	Item 015	35000	37400
35.80	193.14	61	59.10	Category 5	Item 016	34950	44950
59.40	166.18	81	17.90	Category 4	Item 017	2335	3250
35.70	382.48	30	99.10	Category 5	Item 018	38350	42200
49.20	165.69	84	61.60	Category 6	Item 019	45100	44600
61.90	656.44	75	213.70	Category 2	Item 020	3450	3300
72.80	618.90	86	113.00	Category 2	Item 021	7650	9900
29.70	290.80	45	89.70	Category 5	Item 022	14200	19650
82.40	719.73	9	61.30	Category 6	Item 023	24600	36800
47.50	176.40	81	73.90	Category 6	Item 024	29450	31700
77.90	710.92	90	157.10	Category 2	Item 025	27050	29300

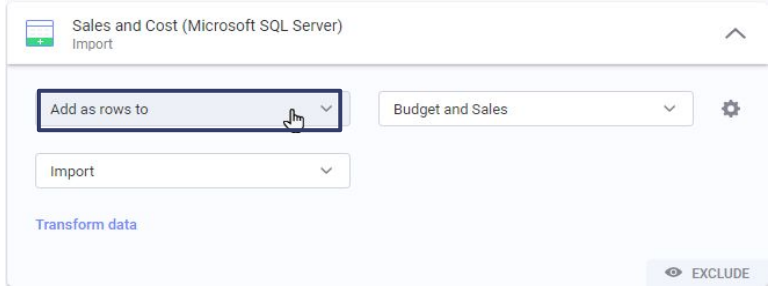
Original data Matched data New data

OK Cancel

Add New Rows

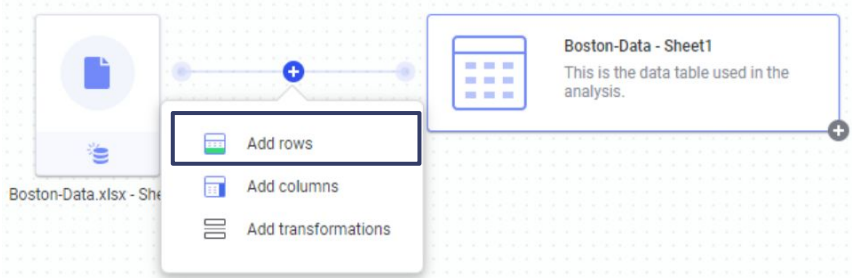
Data Inserted from:

- Local file
- Library file
- Information link
- Data connection
- Clipboard etc.



Add rows from:

- Files and Data Flyout
- Data Canvas Flyout

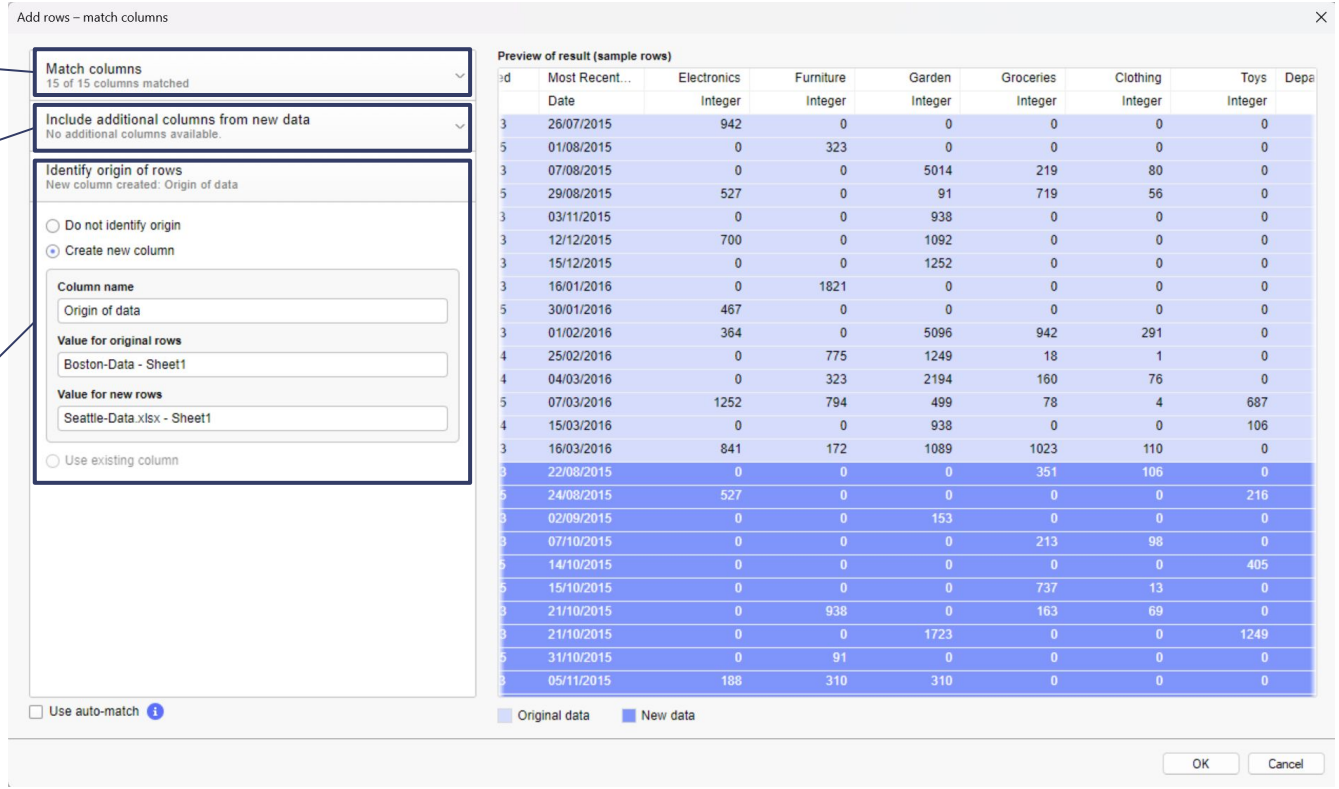


Add rows - Match Column Dialog

Column match suggested by recommendation engine

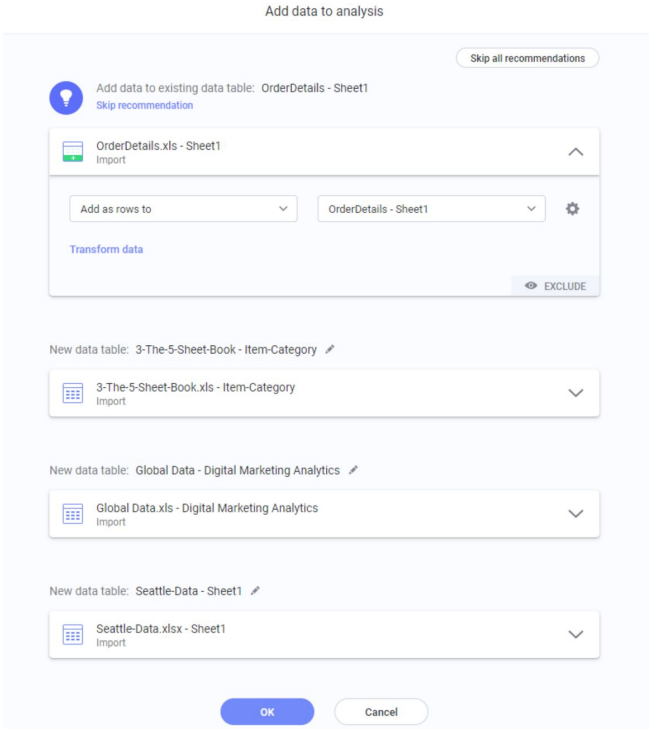
You can ADD, REMOVE and EDIT matches

To identify origin of rows, add a new column:
Provide column name
Define original and new values
Or use existing column



Import Multiple Data Tables

- Using Files and Data Flyout
- Import settings dialog is provided separately for each table
- Add data to analysis allows you to select how to add data for each table



Column matches and Table relations

In TIBCO Spotfire, both **Table Relations** and **Column Matches** are used to link separate data tables, but they serve two very different functional purposes.

The simplest way to distinguish them is: **Relations** link user actions (filtering/marking) between visualizations, while **Matches** link the data itself within a single visualization.

At a Glance: Key Differences

Feature	Table Relations	Column Matches
Primary Purpose	**Interactivity:** Propagate marking and filtering across different visualizations.	**Visualization:** Combine data from multiple tables in a single chart.
Creation	Must be created **manually** by the user.	Often created **automatically** by Spotfire (if names/types match).
Use Case	Clicking a bar in Table A highlights corresponding rows in Table B.	A Bar Chart showing Sales from Table A and Budget from Table B on the same axis.
Calculations	Cannot be used to calculate across tables directly.	Allows **Custom Expressions** that reference columns from multiple tables.

Column Matching

Automatic column matching

- Match with same name and data type

Manual column matching

- Data->Data Table Properties

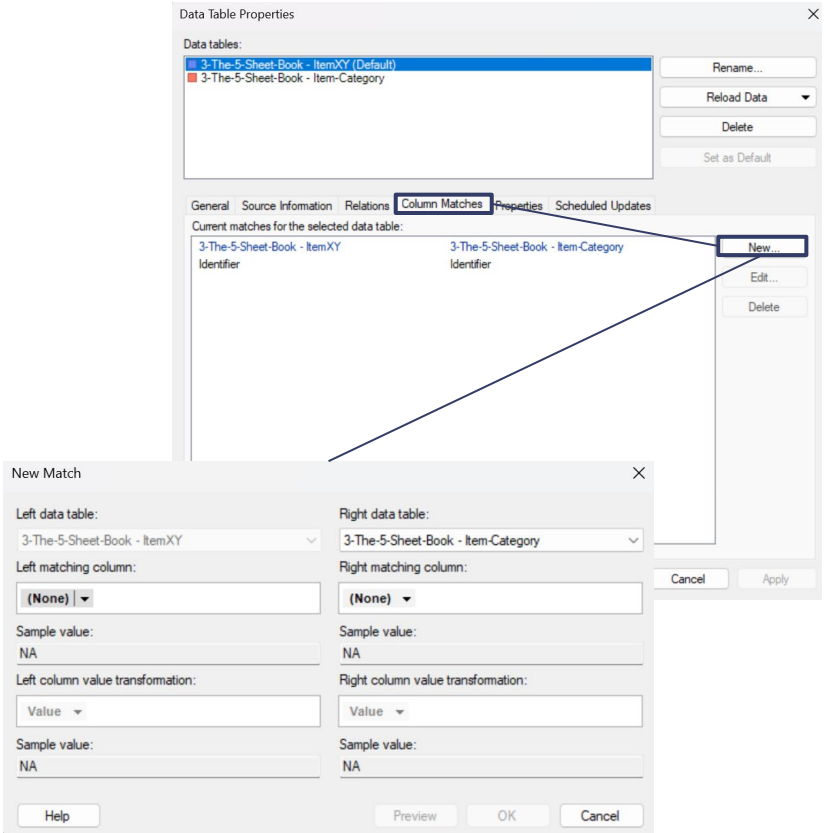


Table Relations

- Data->Data Table Properties

- Select Left/Right
- Data table
- Columns
- Methods

- Related tables share the same colour
- Colour is displayed in visualisation title and filters panel

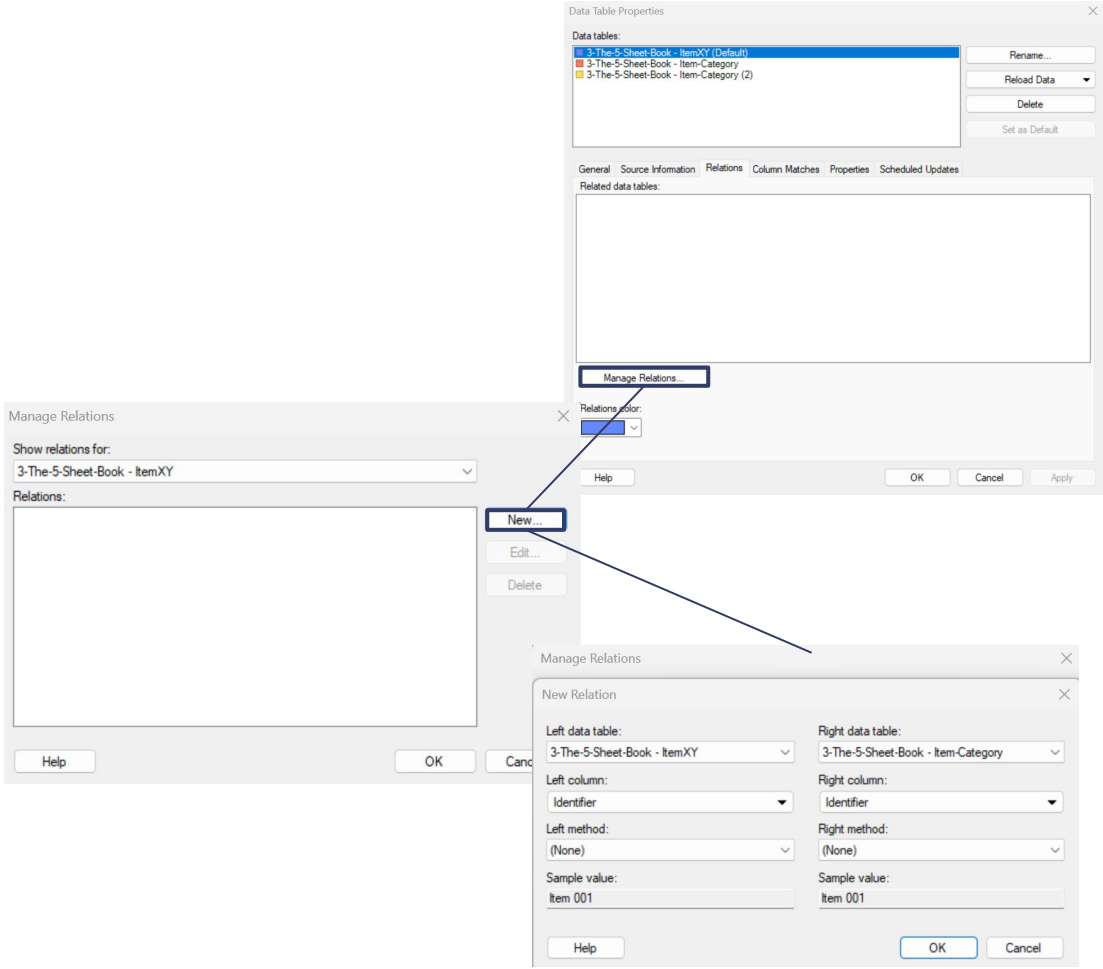
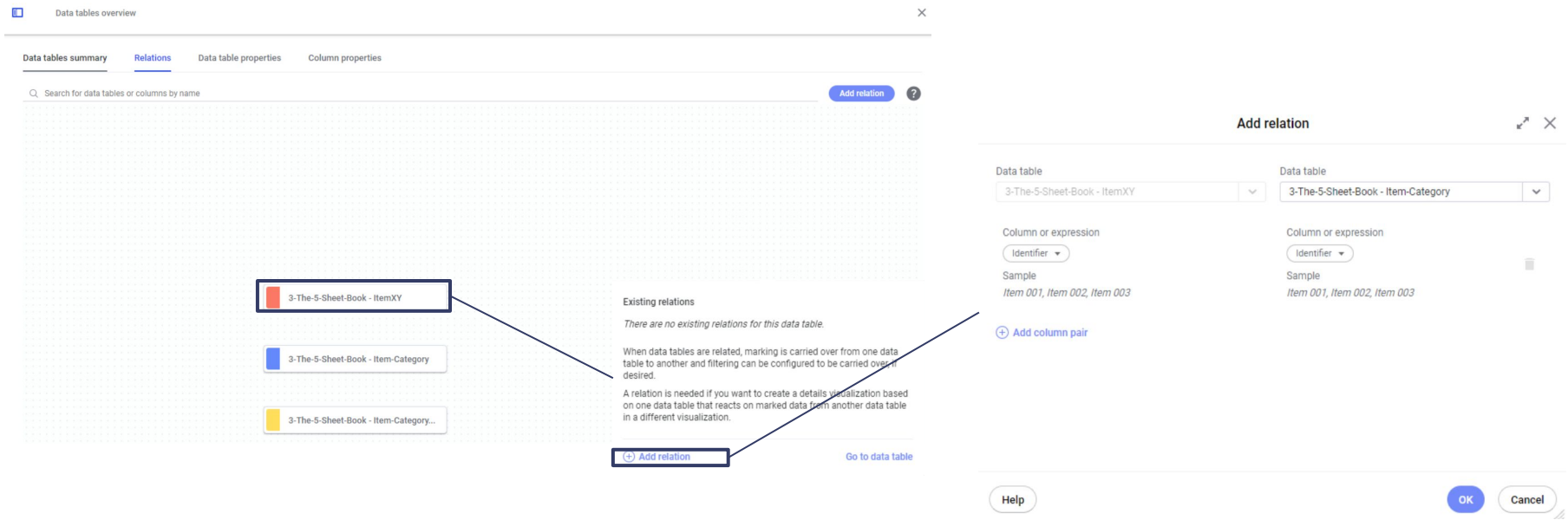
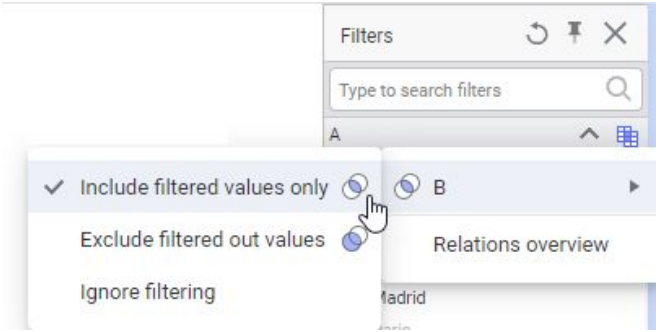
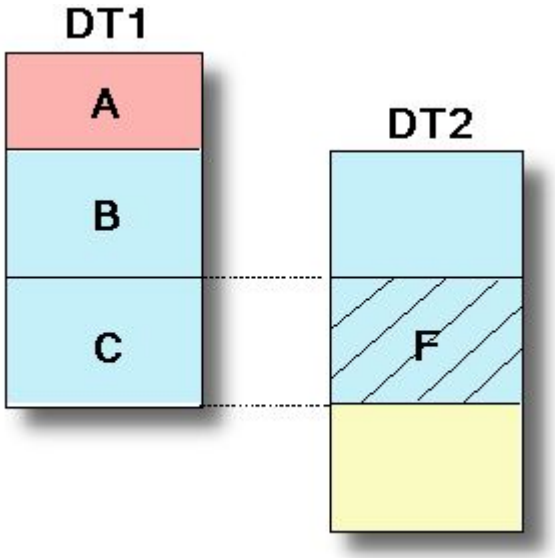


Table Relations



Effect on Marking and Filtering





Add data - Exercise

1. Load the different data sets into an analysis.
2. Combine the different data sets. If possible:
    a. Add columns
    b. Add rows
    c. Match and Relate data tables
3. Create visualizations on top of the combined data set.
4. Ensure that marking and filtering is working dynamically on the visualizations.

Custom expressions, Calculated columns, transformations

1. Custom Expressions (Dynamic & Visual)

Custom expressions are written directly on the axes of a visualization (e.g., the Y-axis of a bar chart).

- **When they calculate:** Every time you change a filter, mark a data point, or change the zoom. They are **highly dynamic**.
- **Scope:** They only calculate based on the **filtered** data currently visible in the chart.
- **Key Advantage:** You can use "Axis Navigation" (like `Parent`, `All`, or `Previous`) to compare data points (e.g., Year-over-Year growth).
- **Best For:** Aggregations like `Sum([Sales])` or complex metrics that must change as the user explores the data.

2. Calculated Columns (Static & Row-Level)

These create a new, permanent column in your data table.

- **When they calculate:** Only when the data is first loaded or manually refreshed. They are **static**.
- **Scope:** They calculate across the **entire** data table. They **do not** react to filters.
- **Key Advantage:** The result is available as a filter. If you create a column `[Sales] > 1000` as "High Value", you can then use a checkbox filter to hide/show those rows.
- **Best For:** Grouping data, creating flags, or performing row-by-row math (e.g., `[Price] * [Quantity]`).

3. Transformations (Structural & Sequential)

Transformations are "upstream" calculations. They happen while the data is being pulled into Spotfire's memory.

- **When they calculate:** During the data loading process in the **Data Canvas**.
- **Scope:** They become part of the table's "source" structure.
- **Key Advantage:** Unlike standard calculated columns, a column created via transformation **can be used for Column Matching** or joining to other tables. They also follow a strict order; Transformation #2 can see the result of Transformation #1.
- **Best For:** Data cleaning, fixing data types before joining, or preparing columns that will link multiple tables together.

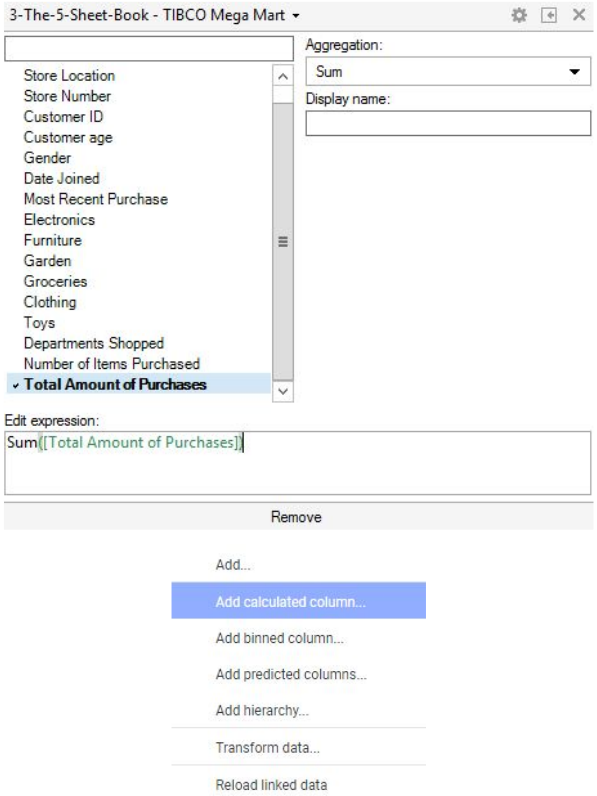
Custom Expressions Overview

Powerful feature of Spotfire

Allows to create custom aggregation methods for visualizations

Insert custom expressions

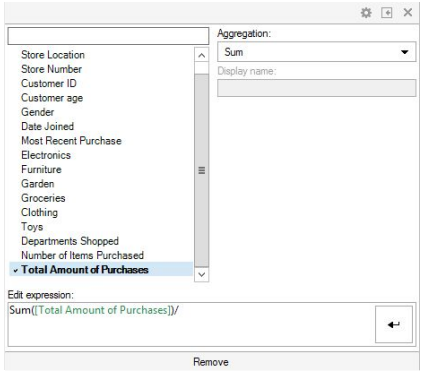
- Custom expression
  - Modify existing column
- Calculated column
  - Create new column



Create Custom Expressions

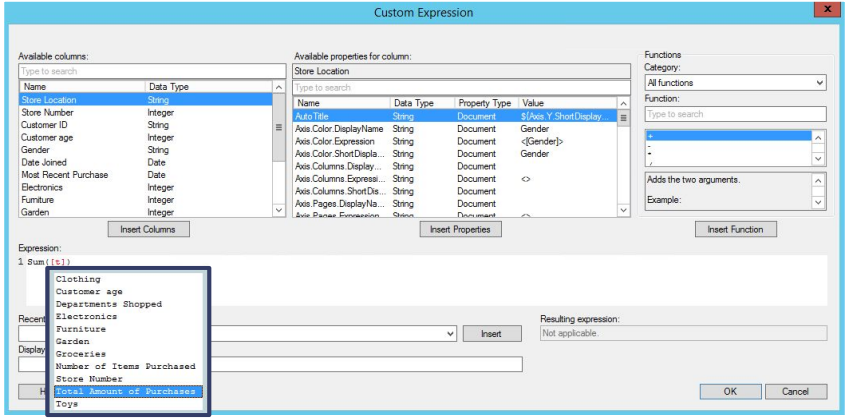
Column selector - Expanded mode

- Type in directly
- No autofill
- For experienced users

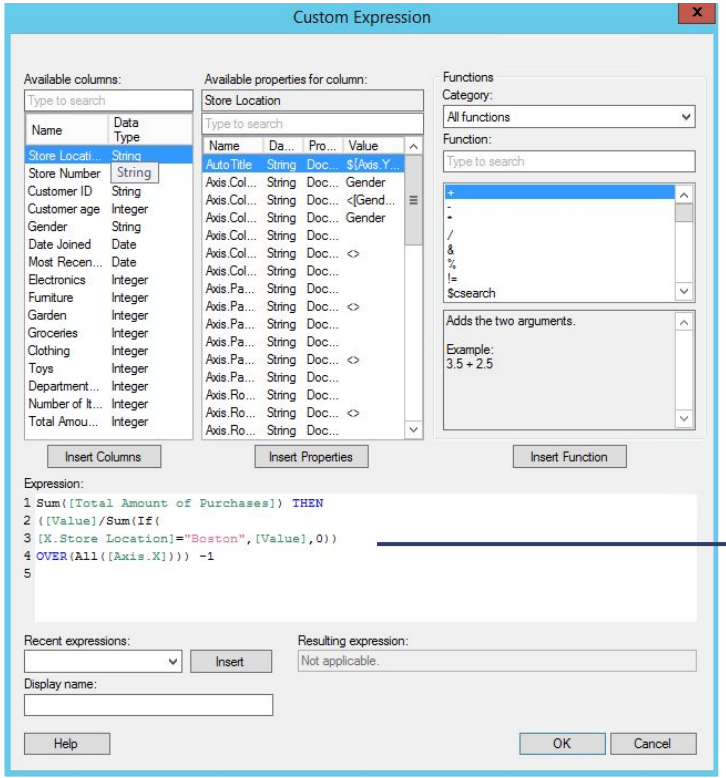


Custom expression

- Right click on column selector
- Autofill provided



Expression Builder Details




```
[Total Amount of Purchases]

${Axis.Color.DisplayName}

 THEN

"Boston",

[Value]
```

AutoBinNumeric([Electronics],37)

```
Expression:
1 Sum([Total Amount of Purchases]) THEN
2 ([Value]/Sum(If(
3 [X.Store Location]="Boston",[Value],0))
4 OVER(All([Axis.X]))) -1
5
```

Errors

${property}

Keywords

Text

[Column Name]

Syntax Check

Match parentheses shading

Line Numbering

Calculated Columns

Creates a new column in the data table

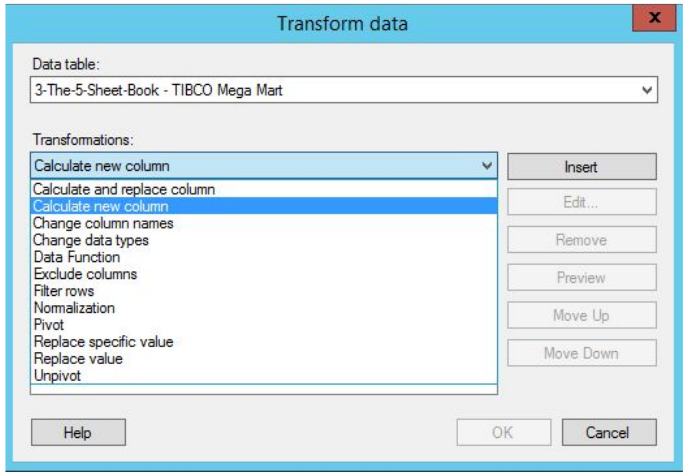
Computed from existing columns

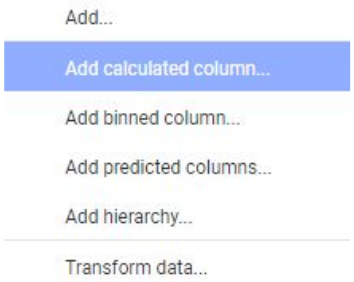
- Using mathematical or logical expressions

Data -> Add calculated column

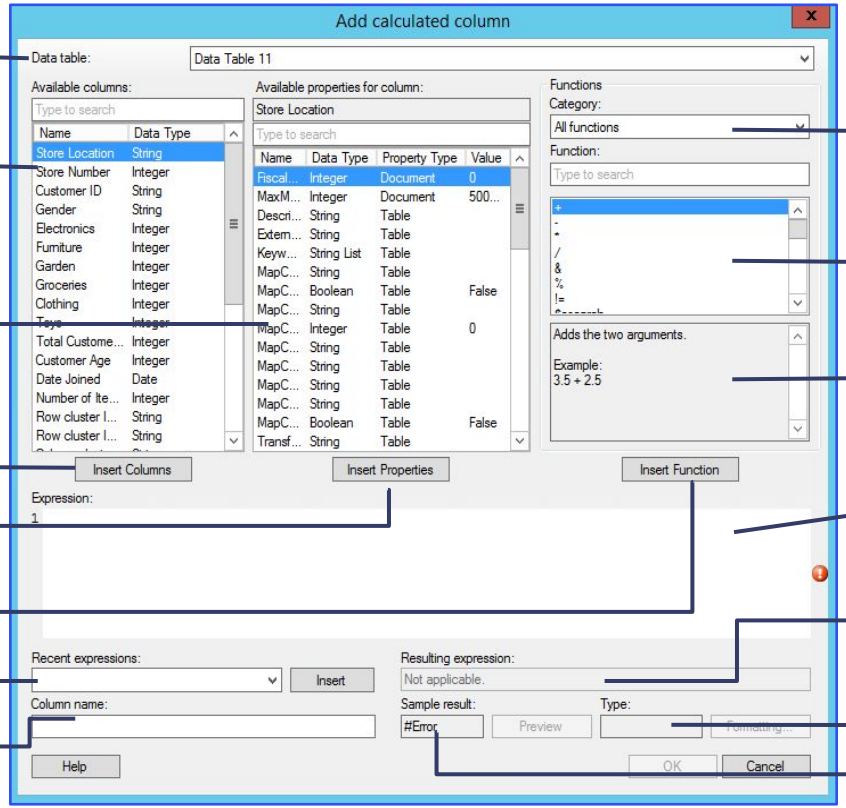
Features

- It can be treated like any other column
  - Use in filters/axes
  - Apply aggregations
- Static content





Add Calculated Column Details



Specify the data table to insert the data column

Lists all columns from existing data table to be used in calculation

Lists all Properties (Document & Column) to be used in calculation

Inserts selected column

Inserts selected Property as Text

Insert selected Function

Displays 10 most recently created expressions

Name of the new column

Select a Category of functions to limit the choice in Function list

Select a Function from the list

Brief description of the selected Function

Text field to build your Expression

Displays the expression after replacing all property values

Type of new calculated column

Displays the result of first row after applying the current expression

Use of Properties in Expressions

Property

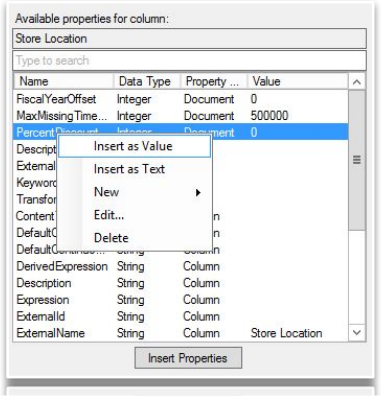
- Changeable settings in visualizations, data tables or documents or customized

Types

- Document properties
- Data table properties
- Column properties

Inserted in expressions as

- Actual values
  - Insert as value; PropertyType(“PropertyName”)
- Text values
  - Insert as text; ${PropertyName}



Expression:

```
1 [Total Amount of Purchases]*(1-DocumentProperty("PercentDiscount")/100)
```

Expression:

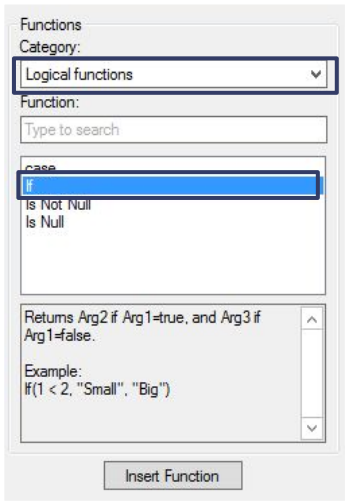
```
1 Sum(If([Store Location]="${LocationDiscount}",([Total Amount of Purchases]*
2 (1-DocumentProperty("PercentDiscount")/100)),[Total Amount of Purchases]))
```

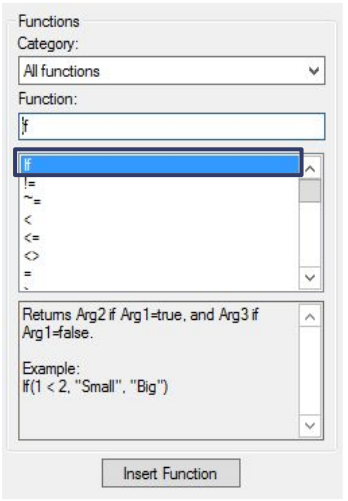
Use of Functions in Expressions

Grouped by category

Insert function in expression field

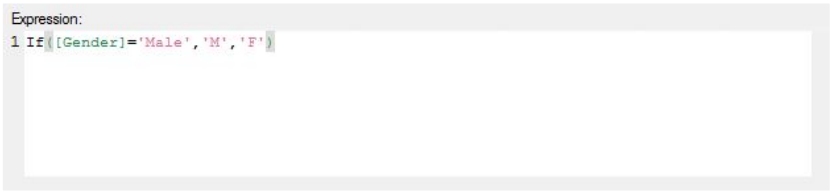
- Select function from the list or type a search string
- Click Insert Function or double click on function name





Arguments passed

- Columns
- Properties
- Numbers
- Text values



Create expressions - Exercise

1. Use your analysis file created in the previous exercise.
2. Create a Cross table
3. On the Cross table, create an expression on the Cell values axis
4. Create a calculated column.
5. Add a transformation and create a new column via the Data Canvas.
6. Observe the differences between these 3 types of expressions in terms of:
    a. Reusability
    b. Ease of use (edit your expression/calculated column).

Explore Details Visualization and Filtering Scheme

Explain Analyze Marked Data

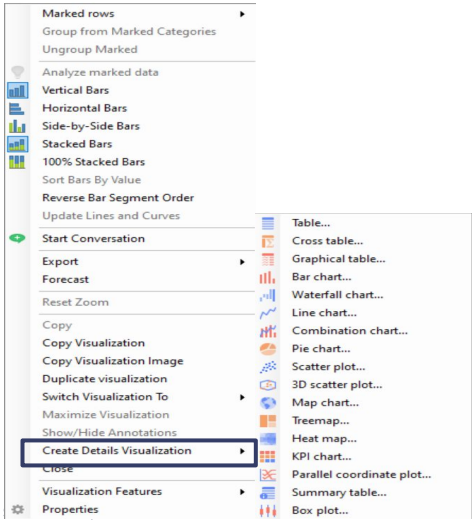
- Marking captures particularly interesting data in visualisation
- Explore marked data in different perspective like:
  - View details using details on demand
  - Drill down using details visualisation
  - Analyze marked data

Explore Details Visualisation

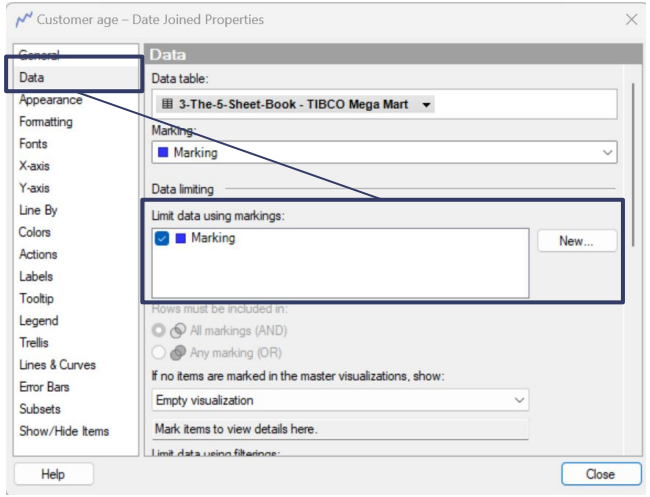
- Depends on marking of master visualisation
- Drill data in multiple steps
- Any visualization can be a detailed visualisation

Create Details Visualisation

- Right click on master visualization
- Create Details Visualization
- Configure Visualization as desired



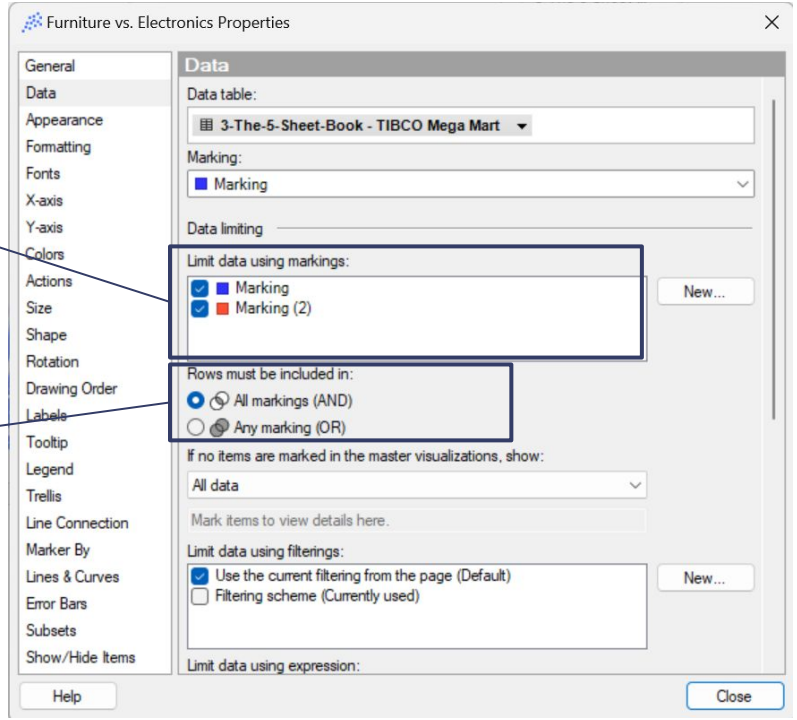
- Open Visualization Properties
- Data->Data Limiting
- Limit data using markings



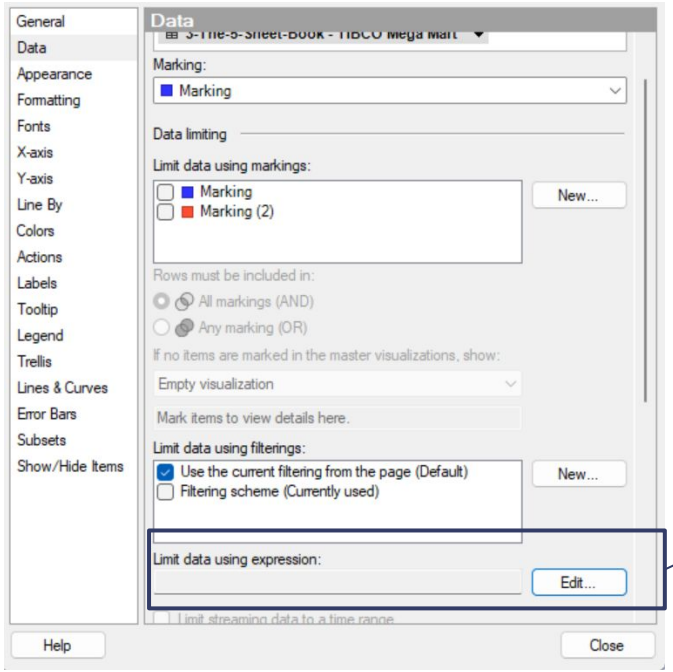
Explain Limit Data Using Multiple Markings

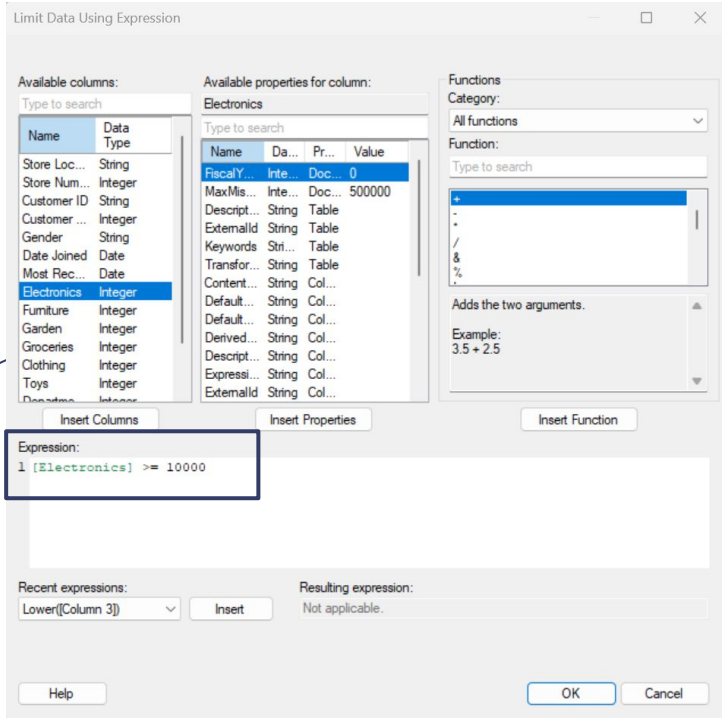
Multiple Markings selected

Use join methods AND or OR to display results in the details visualisation



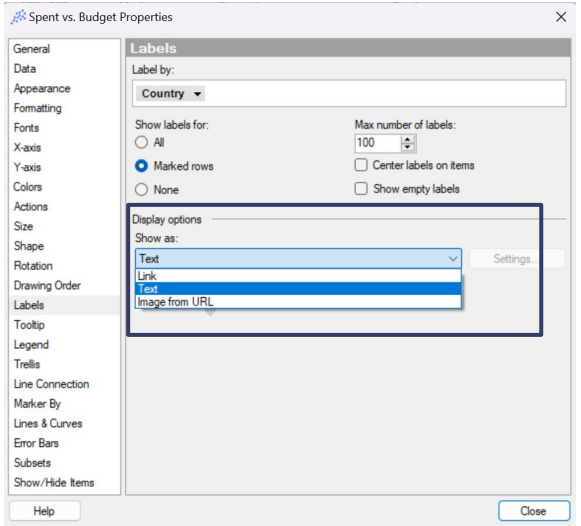
Explain Limit Data Using Expressions



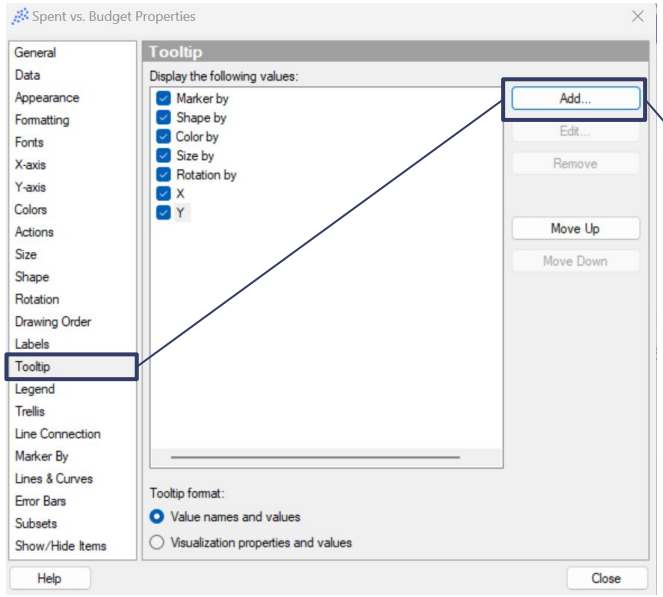


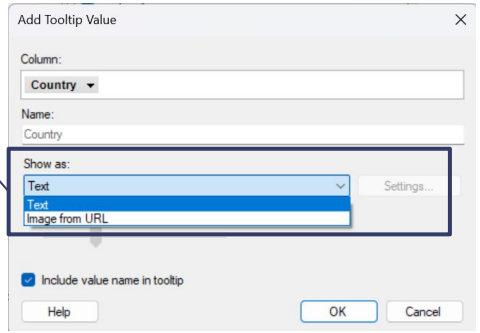
Labels

- Display information for all or marked values
- Set label by variable
- Display label as link, text or image as URL

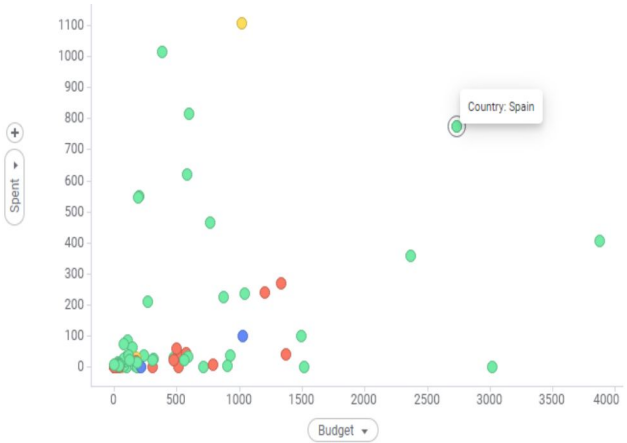


Tooltip





- Hover over information for data points
- Add values to display as text or image



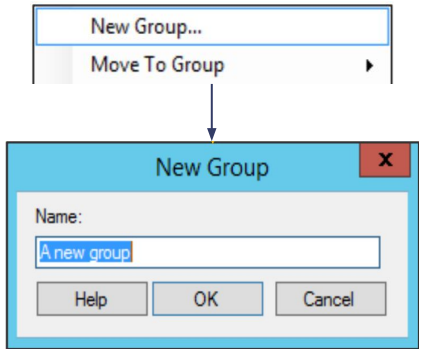
Sort and Group Filters

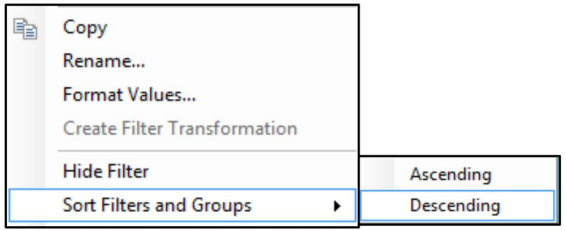
Move/Sort Filters

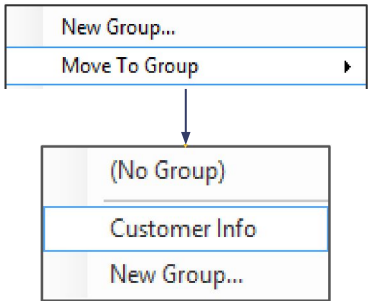
- Drag and Drop to the desired position in the panel
- Use sorting: ascending/descending

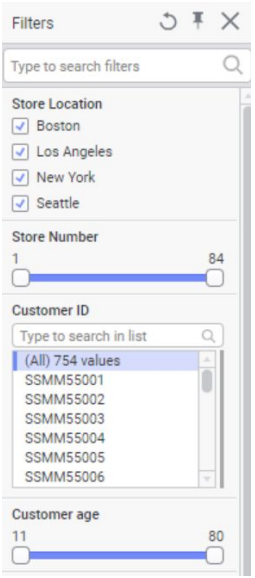
Filter Groups

- Gives an overview of the filter
- Group similar filters
- Expand/Collapse
- Show/hide or sort filters in the group

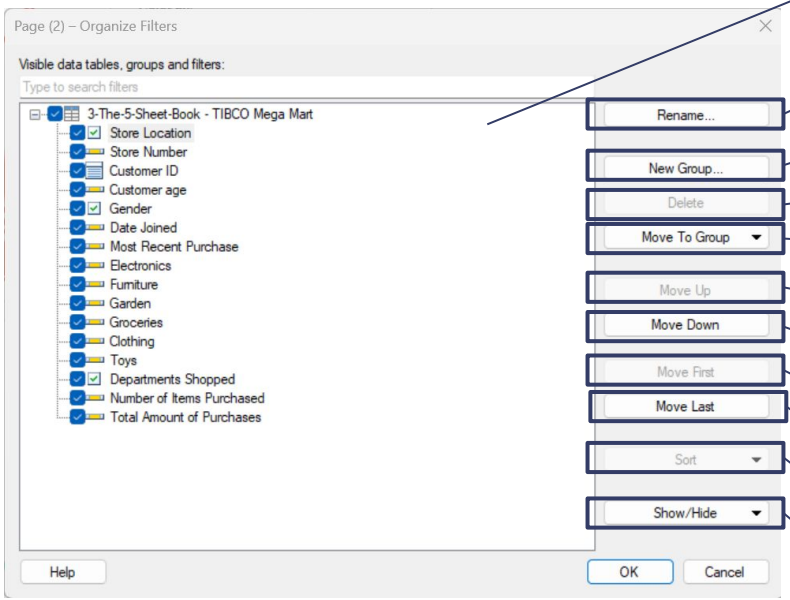








Organize filters



List all filters, groups and data tables in the document

Rename a filter, column or group

Create a new group

Delete a group

Move a filter to a specific group

Move a filter, group or a data table up in the list

Move a filter, group or a data table down in the list

Move a filter, group or a data table first in the list

Move a filter, group or a data table to the bottom of the list

Sort all items in the list

Show/hide filters/ groups or data table in the filters panel

Explain Filtering Schemes

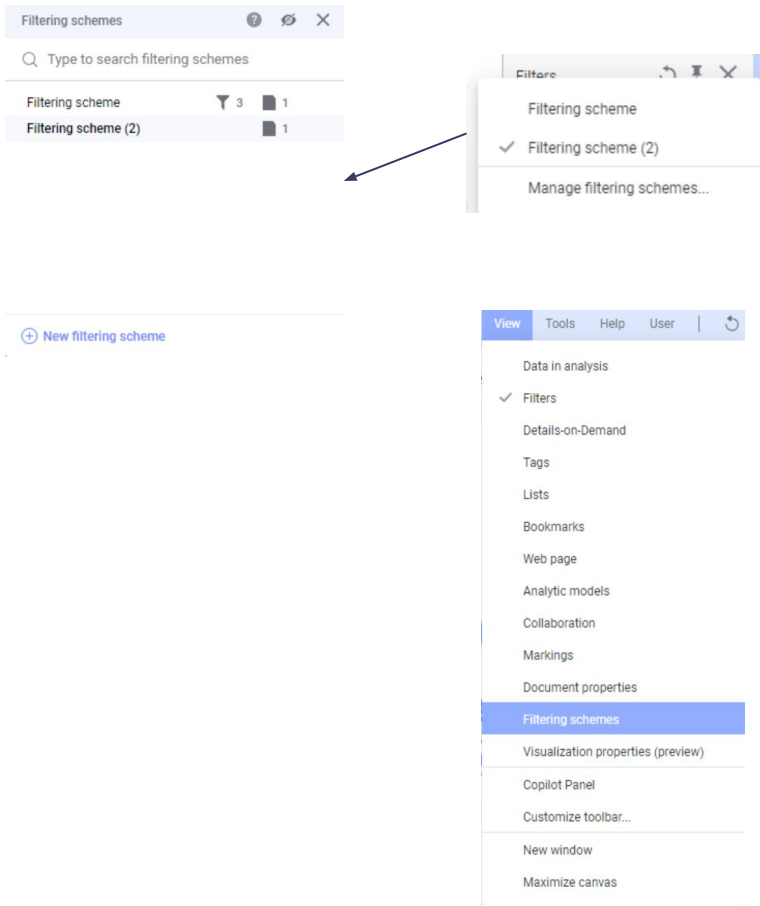
Applied per page or per visualisation

Comprises of

- Filters applied
- Filter types
- Sorting, grouping, show/hide filters

Create and manage filtering schemes

- File->Document Properties
- View->Filterings Schemes



Apply Filtering Schemes to Drill Down

Limit Data using filtering

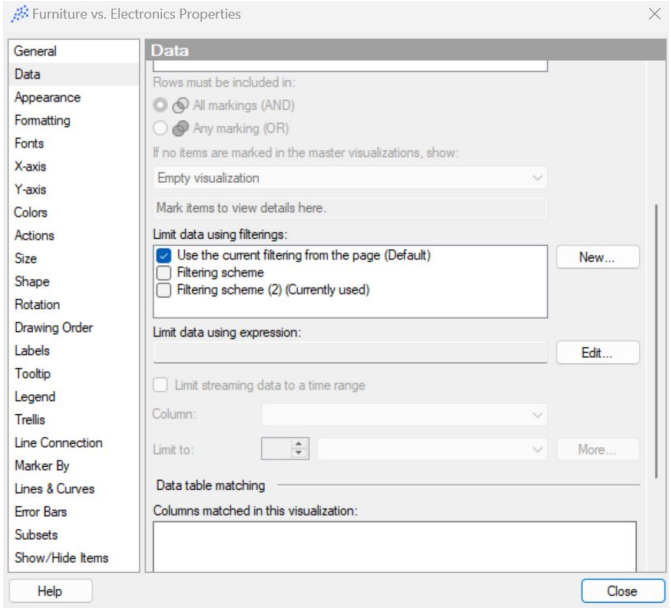
- Defines how filtering should affect visualisation

Options

- Use current filtering from the page
  - Filtering scheme changes with the change in page
- Specific filtering scheme
  - Remains the same irrespective of the visualisation location

When selecting more than one

- Intersection of the filtering is used



Filtering scheme - Exercise

1. Open your analysis file
2. Add a second Filtering scheme
3. Apply the second Filtering scheme to a visualization
4. Observe what happens when you filter on Filtering scheme 1 (and vice versa)
5. ‘Join’ Filters from multiple tables so they influence each other

Bookmarks

Bookmarks

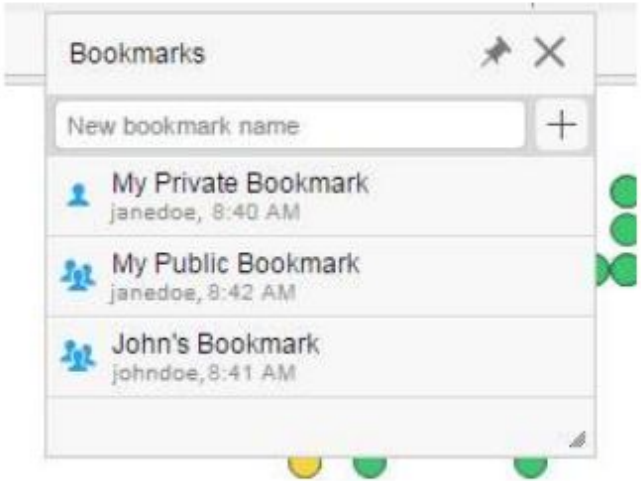
Bookmarks are snapshots of the state of an analysis.

A bookmark to your analysis allows you to return to a state where you found something interesting when you marked or filtered out certain items.

A bookmark can be applied at any time

Share insights with others by making your bookmarks available to other users, or by sending links to the bookmarks.

One of the most important uses of bookmarks is that they can be included as links in a text area. (create guided analyses).

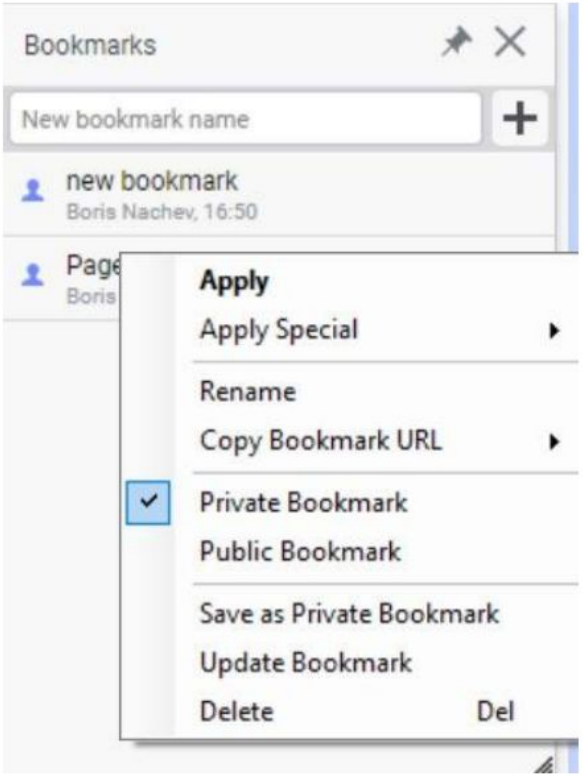


Bookmarks

You can view and manage bookmarks in a popover or in a docked panel.

To open Bookmarks, select View > Bookmarks on the menu bar.

The Bookmarks panel or popover will open in the mode it was opened the last time you had it open.



Bookmarks - Private and Public

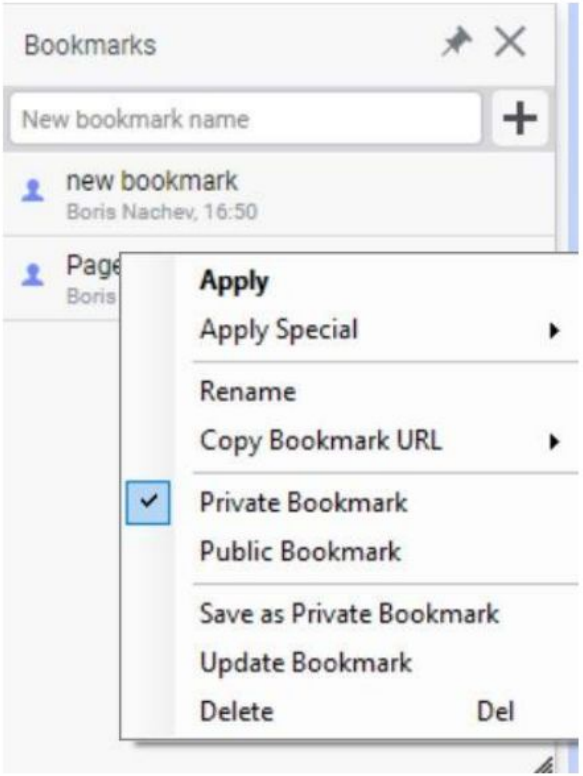
Bookmarks can be either private or public.

Private: Only you can see your private bookmarks
Public: visible to all users of the analysis.

When adding a new bookmark, it is private by default. Right-click on the bookmark and select Public Bookmark from the menu.

Private bookmarks are listed before public bookmarks. The bookmarks are also sorted in chronological order with the bookmark that was last
updated at the top of the list.

You can copy URLs pointing to analysis views that are captured in bookmarks and then share them
with others, if the analysis is saved in the library.



Bookmarks - Exercise

1. Open your analysis file
2. Set specific markings
3. Set specific filters
4. Create a public bookmark
5. Save the analysis
6. Re-open the analysis
7. Once the data is loaded, observe the presentation of the visualizations
8. Now activate the bookmark and notice the differences

Scripting

Scripting - IronPython

With IronPython scripts it is possible to configure and automate a lot of different aspects of a Spotfire® analysis and add behaviors to it without creating and deploying extensions.

IronPython scripts can access the capabilities available in the Spotfire Analyst API.

IronPython scripts can be added to several places in a Spotfire analysis. Scripts can be executed from action controls in the Text Area, from the Graphical Table or the KPI Chart or be triggered by Document Property changes.

To create an analyses containing IronPython scripts, the analyst needs the Author Scripts license function. Scripts in analysis files that are shared via the library by licensed script authors are considered as trusted. For security reasons you should always examine and approve a script that is not listed as trusted before executing it

Community snippets

Scripting - Exercise

1. Open your analysis file
2. Use any of the scripts from the Spotfire community article.
3. Add the script to your analysis file and execute the script