

Altair Panopticon™ v2023.2
GUIDE TO ALTAIR VISUALIZATIONS

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[1] ALTAIR VISUALIZATIONS

Altair Panopticon supports a wide range of information visualizations, including our well-known Treemaps, Heat Maps, Scatter Plots, Horizon Graphs, and a wide range of other great visualizations designed for fast comprehension and easy interpretation of static, time series, real-time streaming, and historic data sets.

As no one visualization is ideal for every purpose, the appropriate visualization for the analytical task at hand must be used. Here are some general recommendations:

Analytical Task	Recommended Visualization
Read numeric values quickly	Table / Pivot Table
Performance against a KPI	Bullet Graph, Tile, Ticker Tile, Donut Gauge
Performance across a single variable for a small number of data elements, with different magnitudes	Bar Graph, Tile, Ticker Tile
Performance across a single variable for a small number of data elements, each with similar magnitudes	Dot Plot
Performance across a single variable for a large number of data items	Heat Map
Performance across a single variable for a large number of data items, which have different importance values	Treemap, Circle Pack
Performance across a hierarchical or grouped dataset	Treemap, Circle Pack
Correlation between two categories of data	Heat Matrix, Network Graph
Relationships between categories of data	Network Graph
Correlation between two or more numeric data columns	Scatter Plot
Geographic correlations of data	Map Plot Geographic Scatter Plot
Correlation over both a single numeric data column and various categories of data	Dot Plot
Trending performance across ordered categories	Dot Plot
Trending performance between two numeric variables	Numeric Line Graph
Trending performance between three numeric variables	Surface Plot (& 3D)
Trending performance across time	Line Graph
Time based Ranking	Line Graph with Ranking Axis
Time Based Contributions	Stack Graph
Time Based Correlations between time series	Horizon Graph

Time Based Transactions	Needle Graph
Financial Time Series Distributions	Candle Stick or OHLC Graph
Auction Price & Interest/Volume Distribution	Numeric Needle Graph
Geospatial Area Densities	Shapes
Spread between two time series	Spread Graph

[2] AXIS GRAPHS

With the 2023.0 release, Axis Graphs were introduced in Panopticon. These new Axis Graphs are the recommended visualization components to use for all use cases that they can meet. The Axis Graphs should be used with priority over the legacy graphs presented in this document, for example the different varieties of bar graphs, needle graphs, and line graphs.

Axis Graphs are different from the visualization parts available since before in Panopticon in the following ways:

- ❑ The same part can produce several different graph types, such as line, bar, etc.
- ❑ The same part can display multiple visualization layers superimposed
- ❑ The same part can display multiple visualizations juxta positioned, i.e., side by side
- ❑ The same part can use any kind of data type on the main axis: Numeric, Text, Continuous Time, Time Buckets, or Time Series Transformed continuous time.

There are two different Axis Graphs: **X-Axis Graph** and **Y-Axis Graph**. As the names imply, X-Axis Graphs use the X-axis as the main axis, while Y-Axis Graphs use the Y-axis as the main axis. For example, a line graph where the line goes from left to right would be created with the X-Axis Graph, while a bar graph where the bars are drawn horizontally would be created with the Y-Axis Graph.

In an Axis Graph, you have the freedom to change from one data column to another on the main axis while designing the graph, even if it means changing from one data type to another. This capability provides full freedom to build graphs in an iterative, exploratory manner. This can be contrasted against the inherent limitation of the legacy visualization parts, which require that the data type of the main axis is decided à priori.

	X-Axis Graph	Y-Axis Graph
Main axis (domain axis)	X-axis	Y-axis
Numeric columns	Yes	Yes
Text columns, nominal mode	Yes	Yes
Text columns, series mode	Yes	Yes
Time Bucket columns	Yes	Yes
Time columns	Yes	No
Time Series Transformed time columns	Yes	No

X-AXIS GRAPH

The following visualization types are available in the X-Axis Graph:

X-Axis Graph	Nominal (Text)	Series (Numeric)	Series (Text)	Time	Time (Time Series Transformed)
Area	--	Yes	Yes	Yes	Yes
Band	--	Yes	Yes	Yes	Yes
Bar (Needle)	Yes	Yes	Yes	Yes	Yes
Box	Yes	Yes	Yes	Yes	Yes

X-Axis Graph	Nominal (Text)	Series (Numeric)	Series (Text)	Time	Time (Time Series Transformed)
Box Whisker	Yes	Yes	Yes	Yes	Yes
Dot	Yes	Yes	Yes	Yes	Yes
Line	Yes	Yes	Yes	Yes	Yes
OHLC	--	Yes	Yes	Yes	Yes
Order Book	--	--	--	--	Yes
Waterfall	Yes	--	Yes	--	--
Constant Reference Line	Yes	Yes	Yes	Yes	Yes
Constant Reference Band	Yes	Yes	Yes	Yes	Yes

Y-AXIS GRAPH

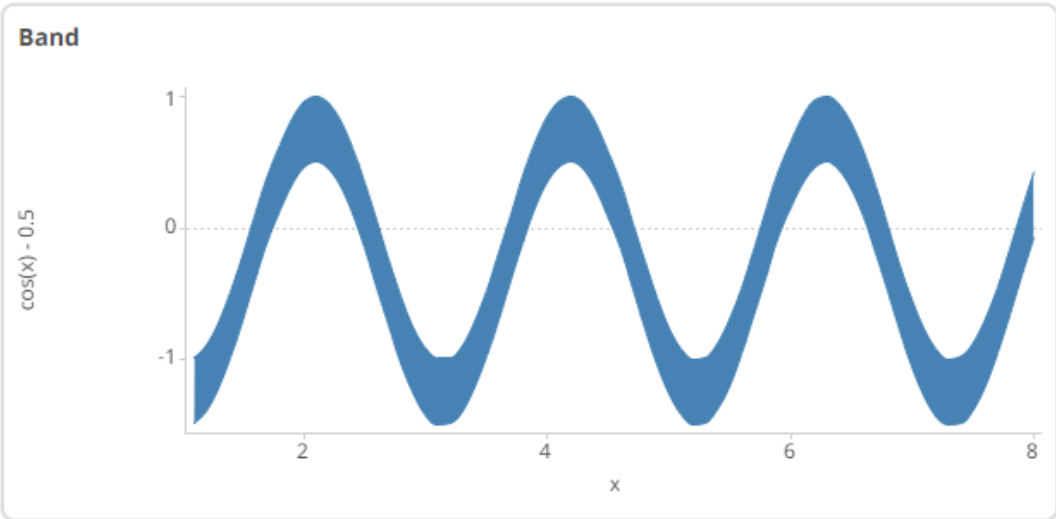
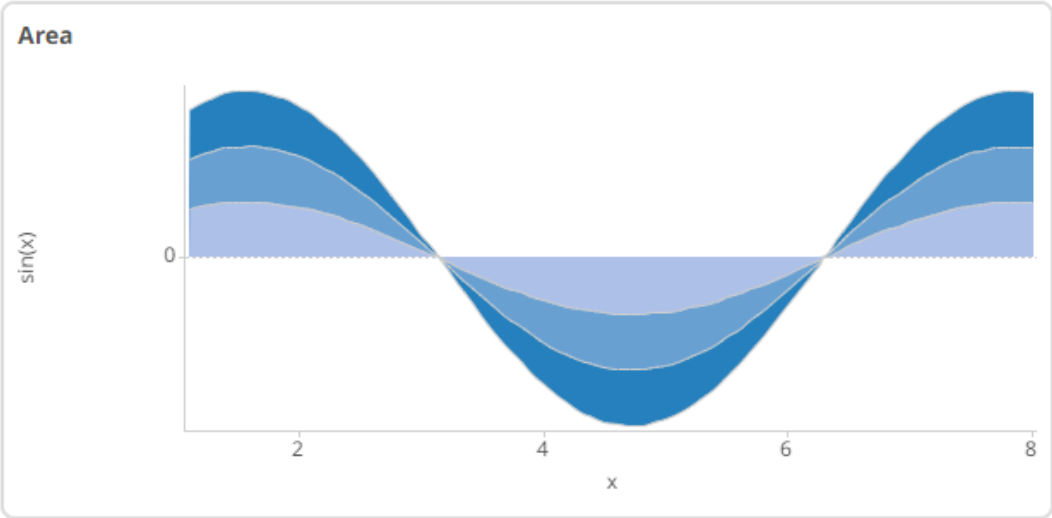
The following visualization types are available in the Y-Axis Graph:

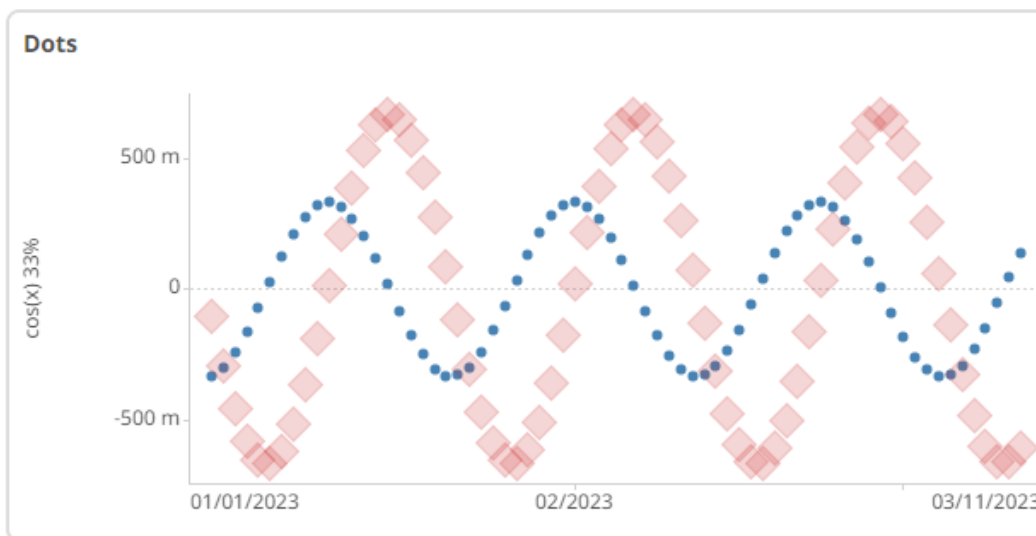
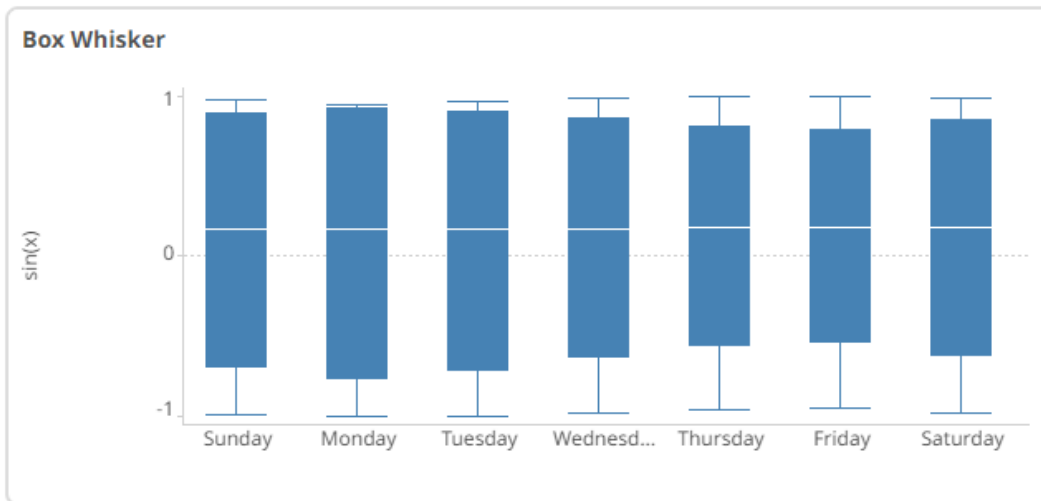
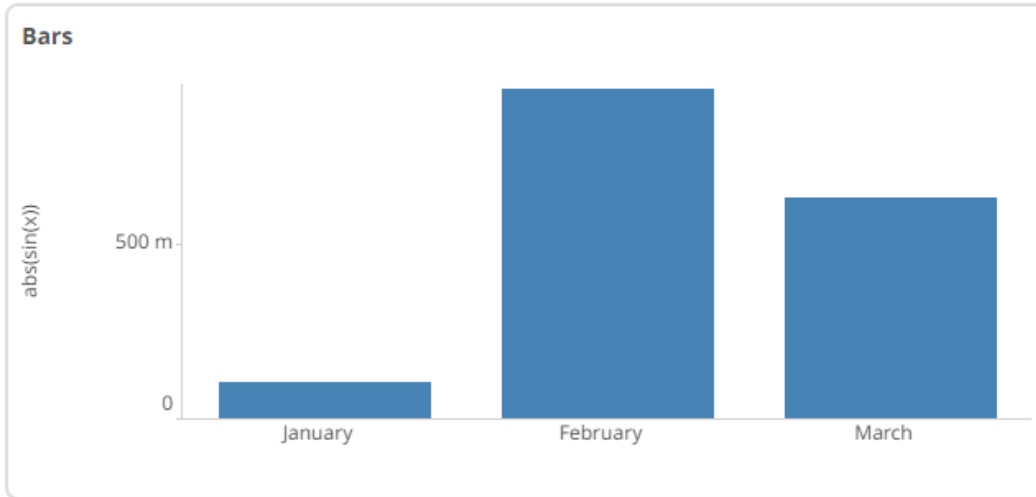
Y-Axis Graph	Nominal (Text)	Series (Numeric)	Series (Text)
Area	--	--	--
Band	Yes	Yes	Yes
Bar (Needle)	Yes	Yes	Yes
Box	Yes	Yes	Yes
Box Whisker	Yes	Yes	Yes
Dot	Yes	Yes	Yes
Line	Yes	Yes	Yes
OHLC	--	--	--
Order Book	--	--	--
Waterfall	--	--	--
Constant Reference Line	Yes	Yes	Yes
Constant Reference Band	Yes	Yes	Yes

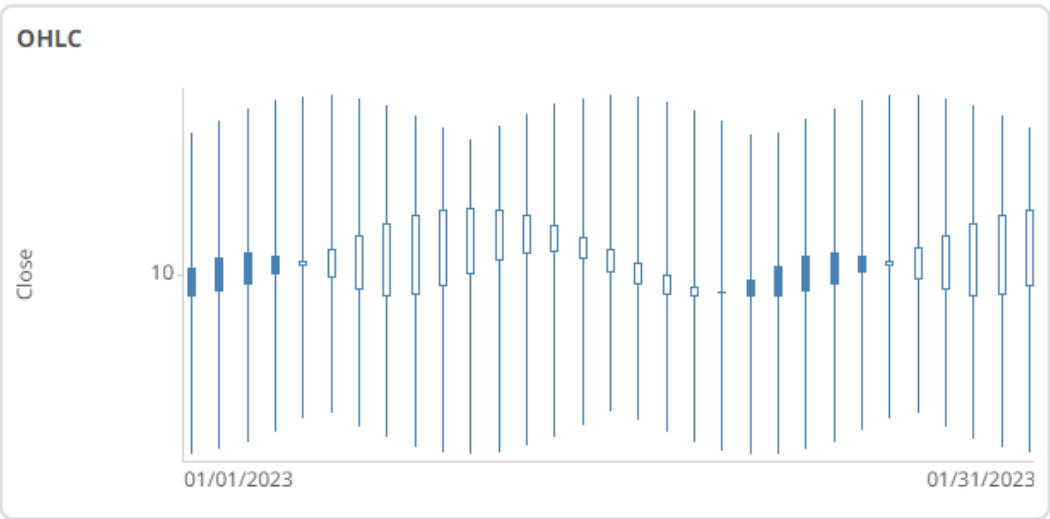
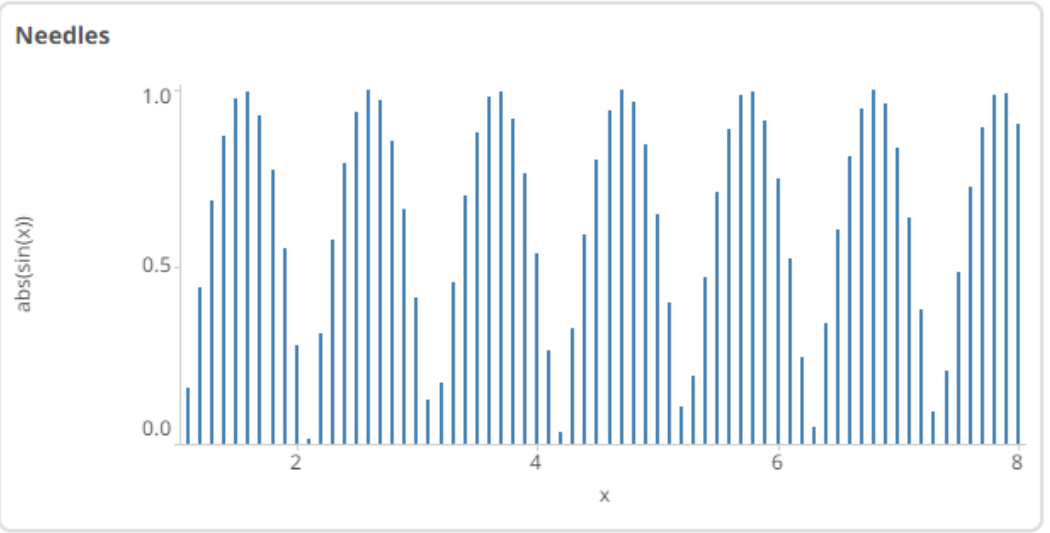
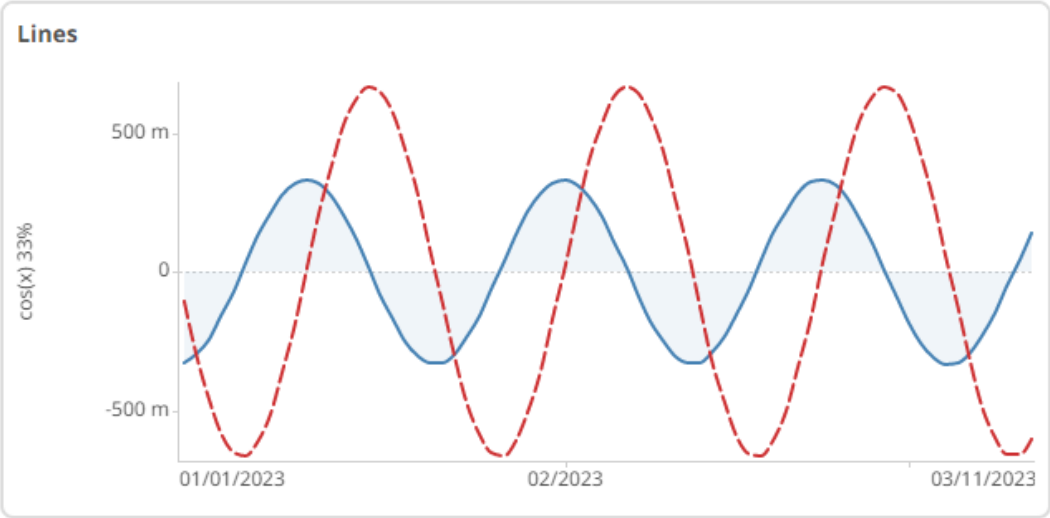
Samples of Axis Graphs

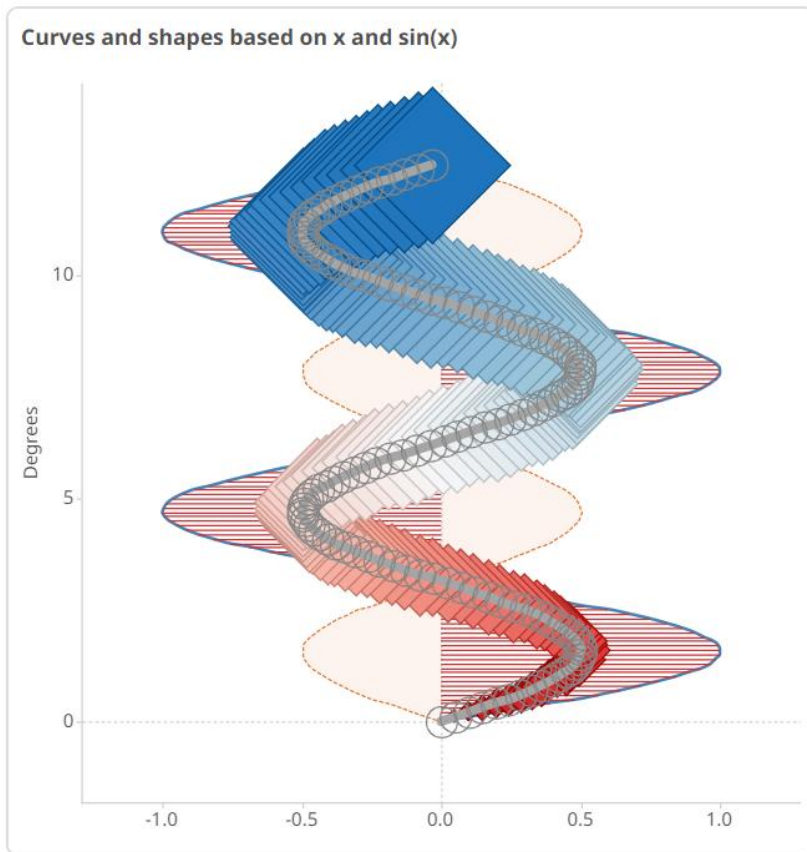
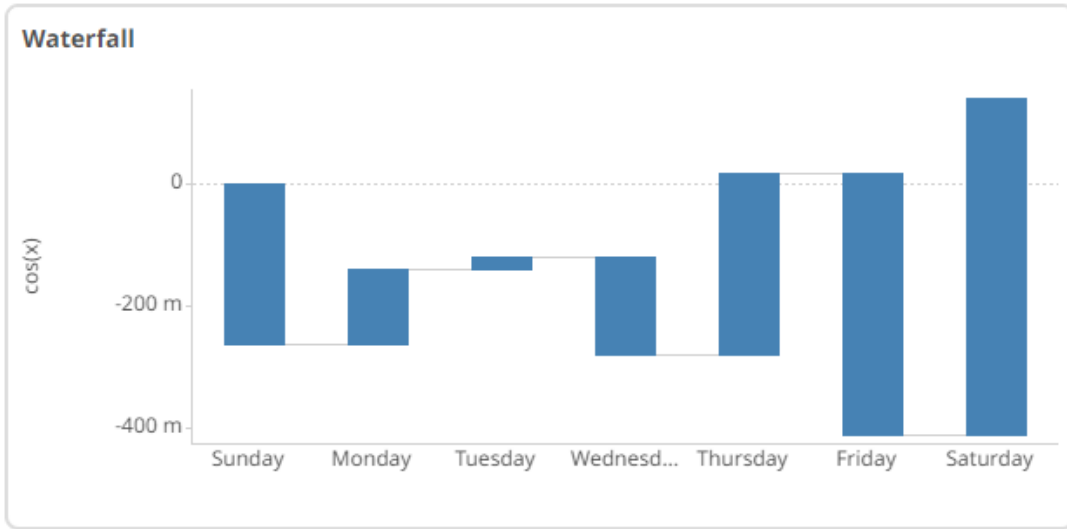
These graphs can be tried and examined in the following example workbooks:

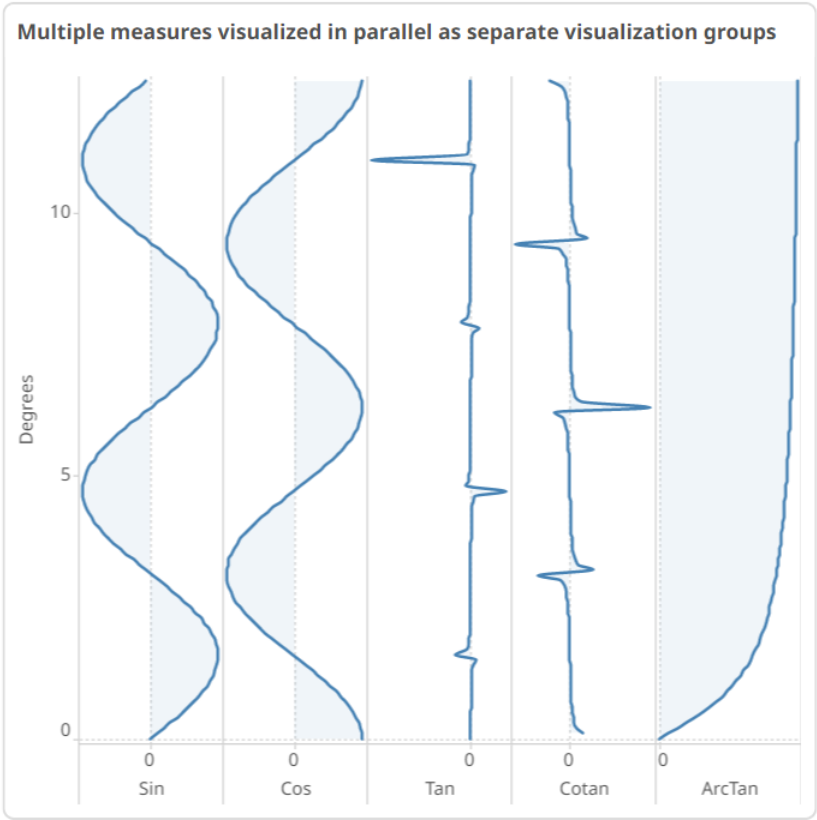
- **Axis Graphs**



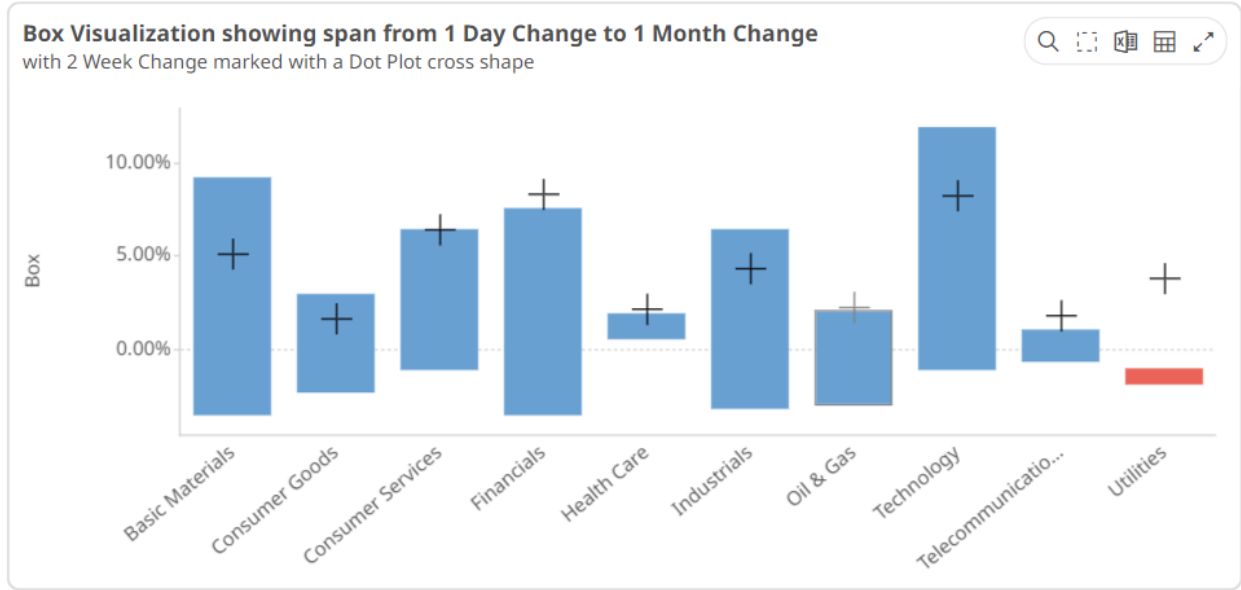




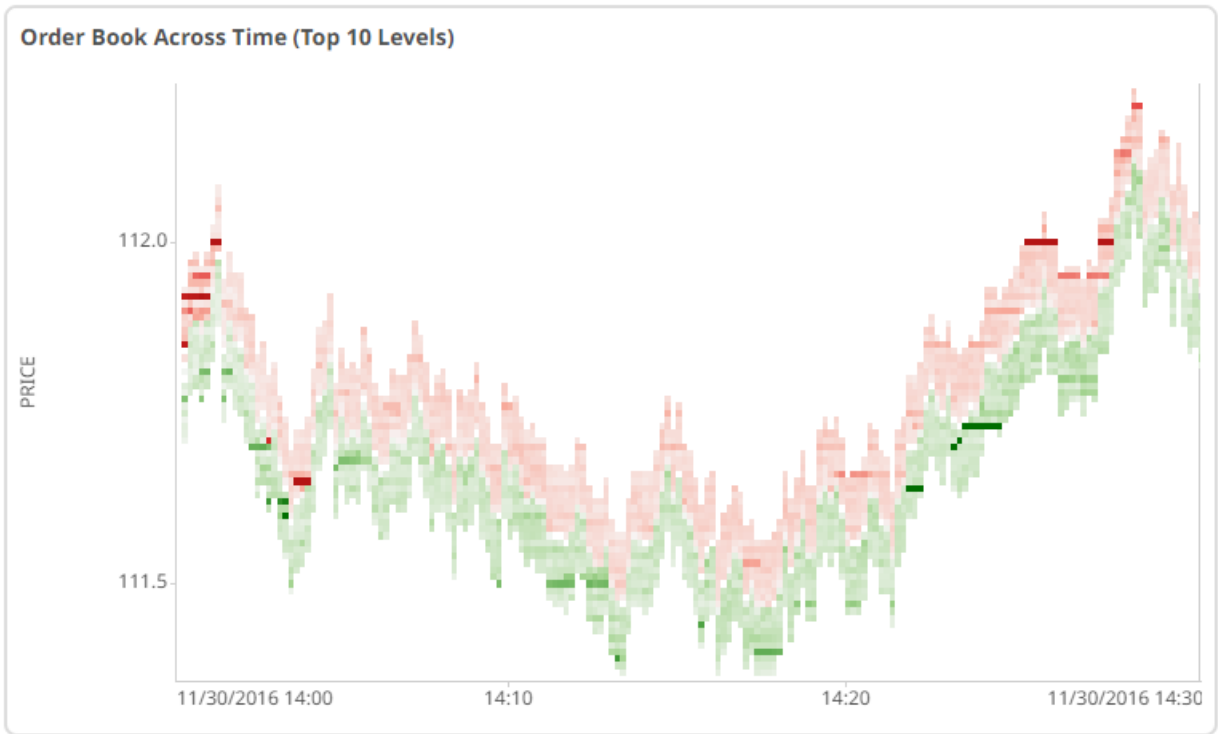




□ **VizGuide**



□ OrderBook Across Time and Playback



[3] TIME SERIES VISUALIZATIONS

The ability to handle very large quantities of multivariate time series data is an essential element in a complete visual analysis system. Panopticon offers a range of specialized data visualizations, including Horizon Graphs, Stack Graphs, and Line Graphs, designed specifically to make analyzing historical data easier and more efficient. The software's ability to connect to traditional row-oriented relational databases or column-oriented databases is key to supporting fast, responsive multi-dimensional analysis of large data sets. Our time series capabilities are especially important for users in global investment banks, hedge funds, proprietary trading firms, and exchanges.

CANDLESTICK GRAPH

Candlestick graphs are a traditional financial visualization for display of time-based price distributions. Specifically, for each time slice, they display:

- Opening Price
- Highest Price
- Lowest Price
- Closing Price

The Candle is filled if the closing price is lower than the open and empty if the closing price is higher than the open.

The vertical line (or candle wick) displays the range of traded prices across the period.

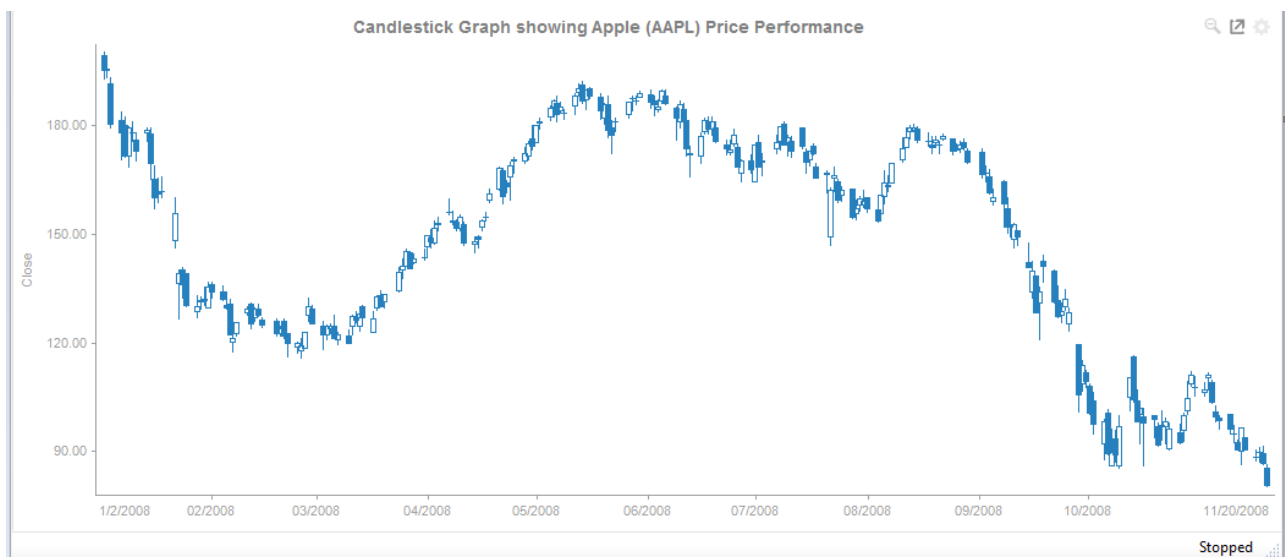


Figure 3-1. A candle stick graph.



Figure 3-2. Close up of data points in a candle stick graph.

HORIZON GRAPH

Horizon Graphs are a fantastic way to overview a large number of time series in a limited rectangular space. Since this visualization packs the information in a line graph in 1/6th the space through smart pre-attentive color encoding, it allows for an overview of a large number of time series. Users can scan huge amounts of data points across all relevant time series and immediately identify areas of concern that require closer scrutiny.

Our Horizon Graph visualization is particularly useful when you need to see a large number of time series on a single screen. This makes it easy to compare trends and spot patterns that would be very difficult or impossible to see in a standard report.

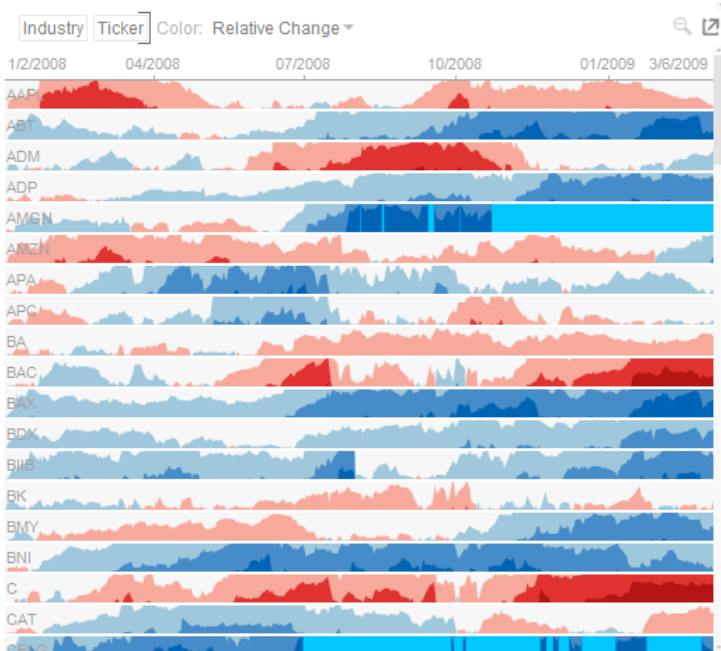


Figure 3-3. A horizon graph.

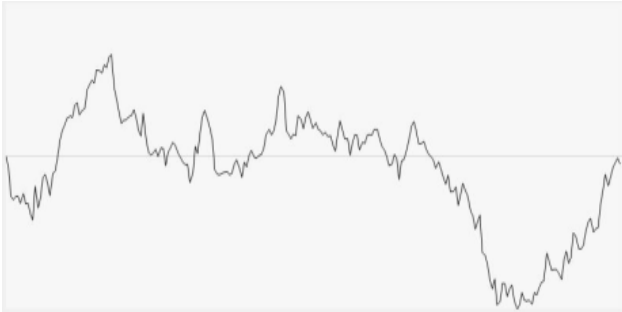


Figure 3-4. Starting with a line graph.

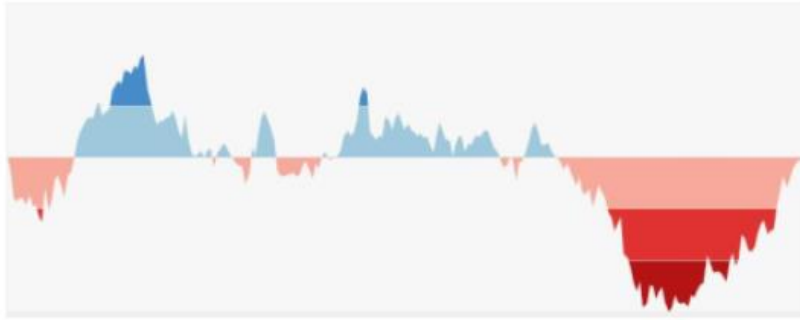


Figure 3-5. Creating color performance bands.



Figure 3-6. Inverting negative regions.



Figure 3-7. Collapsing the performance bands.

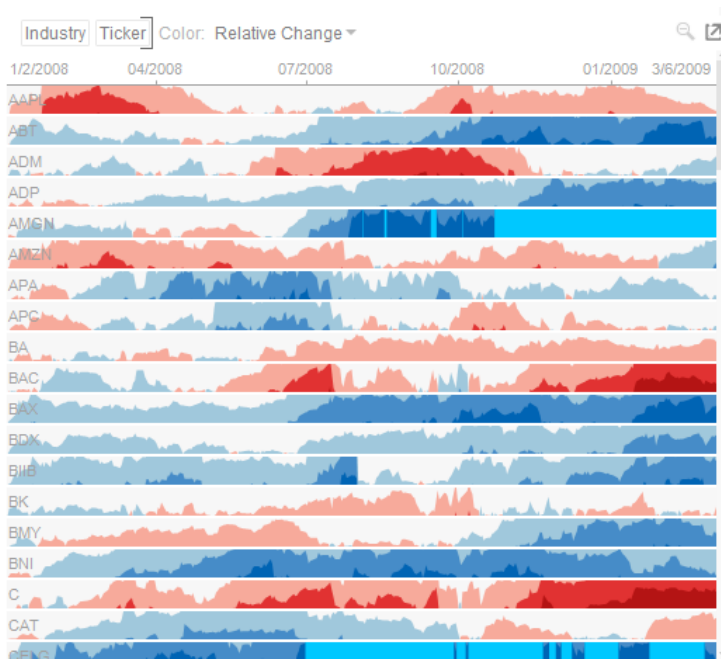


Figure 3-8. A horizon graph is finally created.

LINE GRAPH

Line Graphs are easy to understand and are a great way to communicate important time-based trends, clustering, and outliers.

They work especially well when comparing ten or fewer data sets (our [Horizon Graph](#) is a good solution for displaying time series data with ten or more data sets).

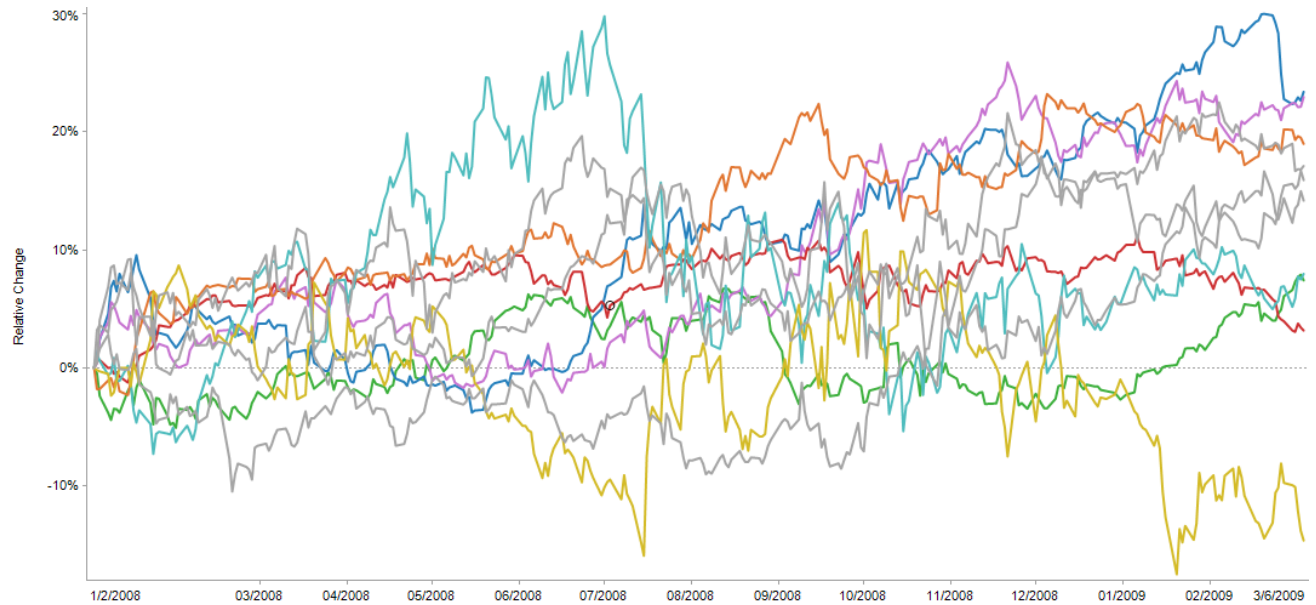


Figure 3-9. A line graph.

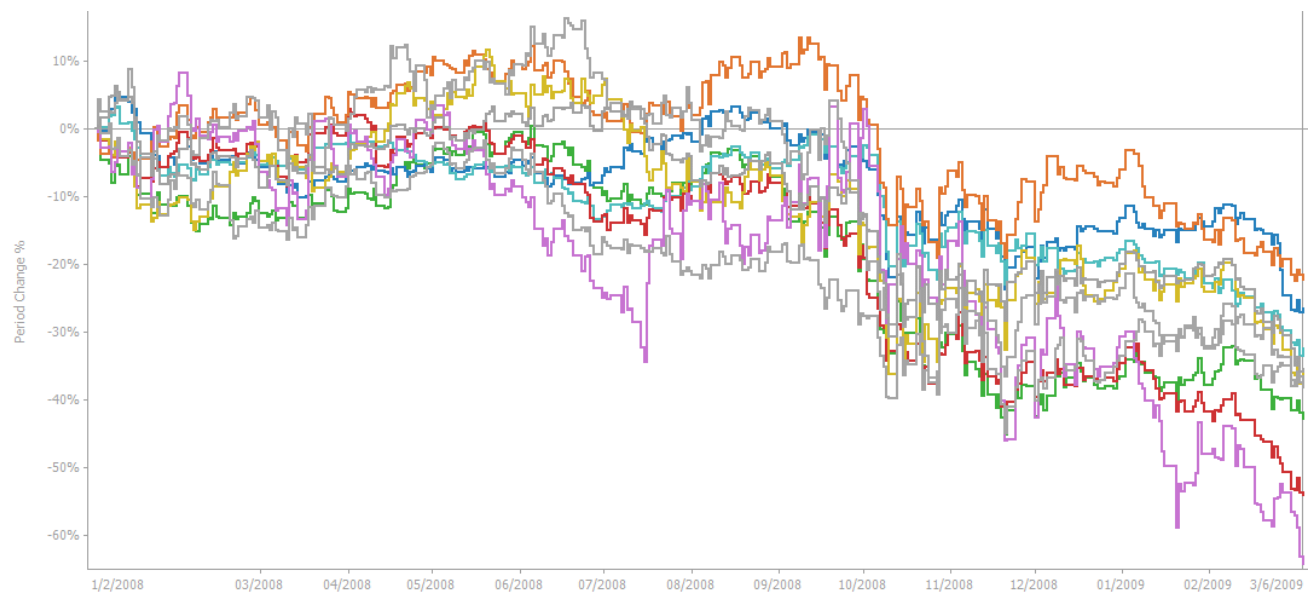


Figure 3-10. A line graph with stepped interpolation.

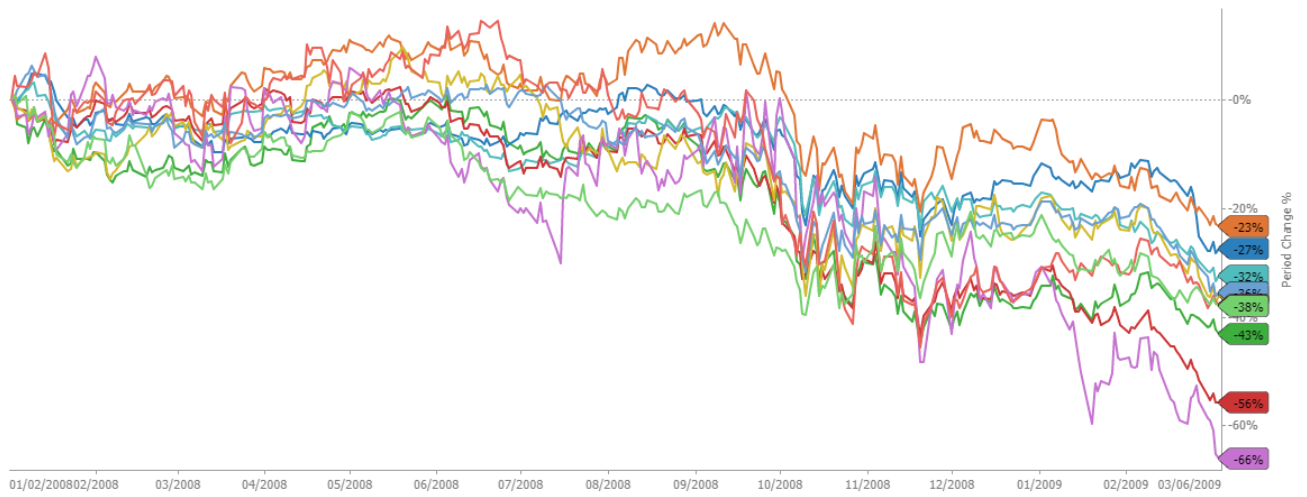


Figure 3-11. A line graph with last values shown on a right aligned Y-axis.



Figure 3-12. A line graph with last value and name shown on a right aligned Y-axis.

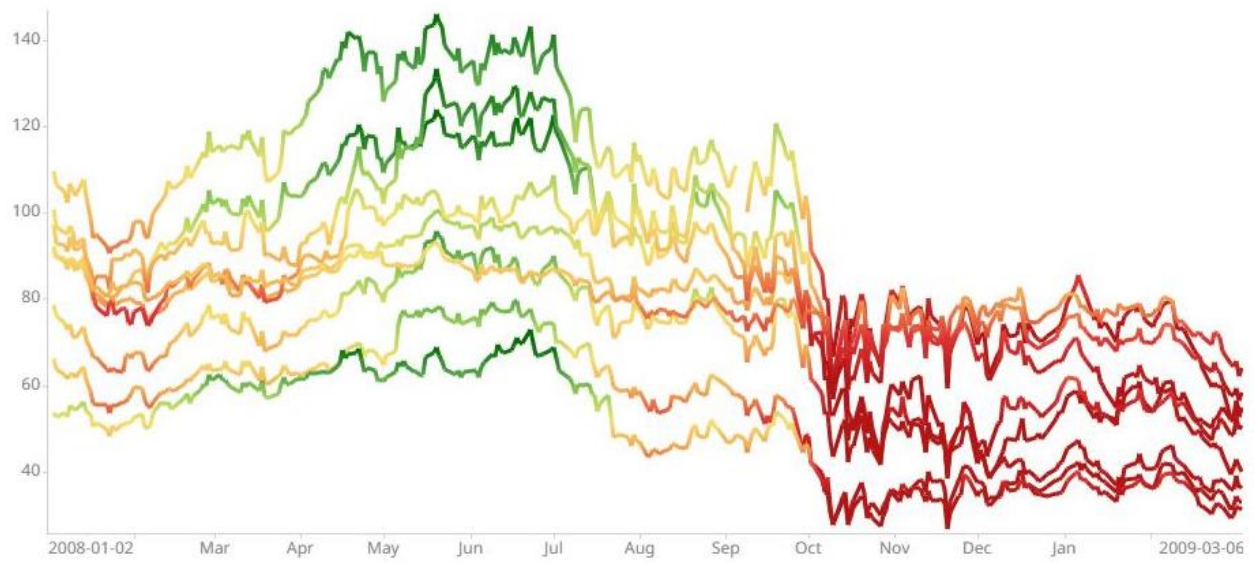


Figure 3-13. A line graph with lines colored by a numeric variable with different color per time slice.

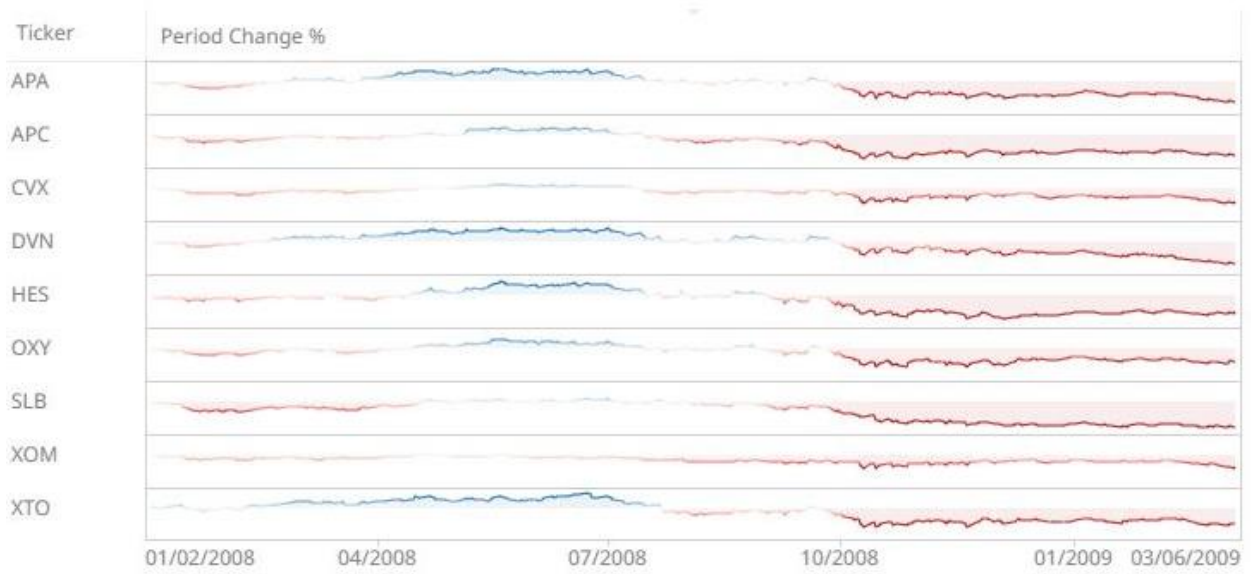


Figure 3-14. A line graph with lines colored by a numeric variable with different color per time slice in a visual table.

NEEDLE GRAPH

Needle Graphs display time-based transactions or occurrence frequencies, rather than time-based trends. They are simply time-based Bar Graphs where each bar is located at a particular time point on the axis.

They work especially well when combined with a [Line Graph](#).

The most common use of a Needle Graph is when showing the trading volume for a stock, typically underneath the price performance.

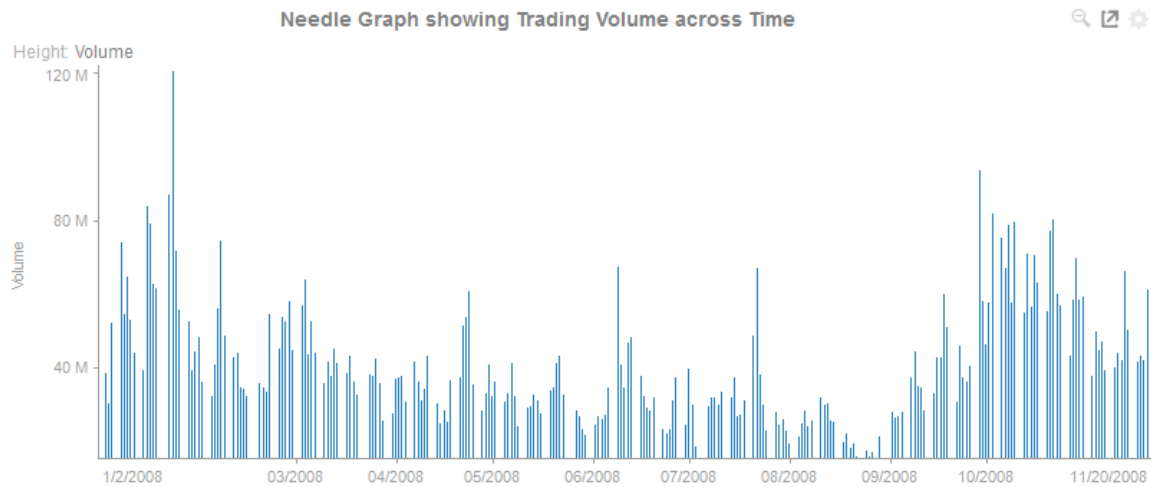


Figure 3-15. A needle graph.

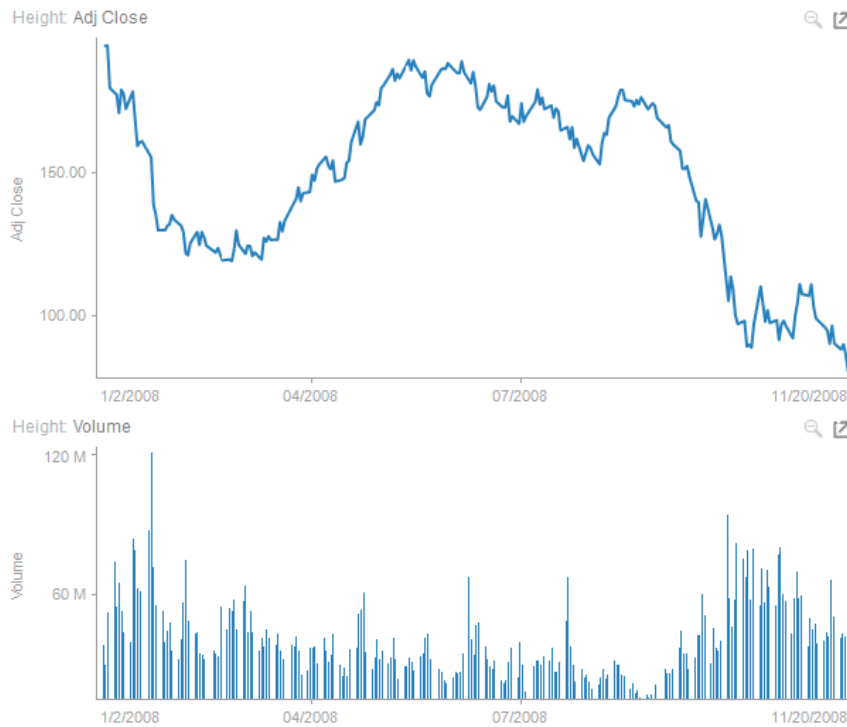


Figure 3-16. A needle graph in combination with a line graph.



Figure3-17. A needle graph with full width needles in combination with an Order Book graph.

OHLC GRAPH

OHLC Graphs also display time-based distributions of price data. For each time slice, they display:

- Opening Price
- Highest Price
- Lowest Price
- Closing Price

Similar to the [Candlestick Graph](#), a vertical line defines the range of traded prices across the period. However, in this case, the left notch determines the opening price and the right notch determines the closing price.

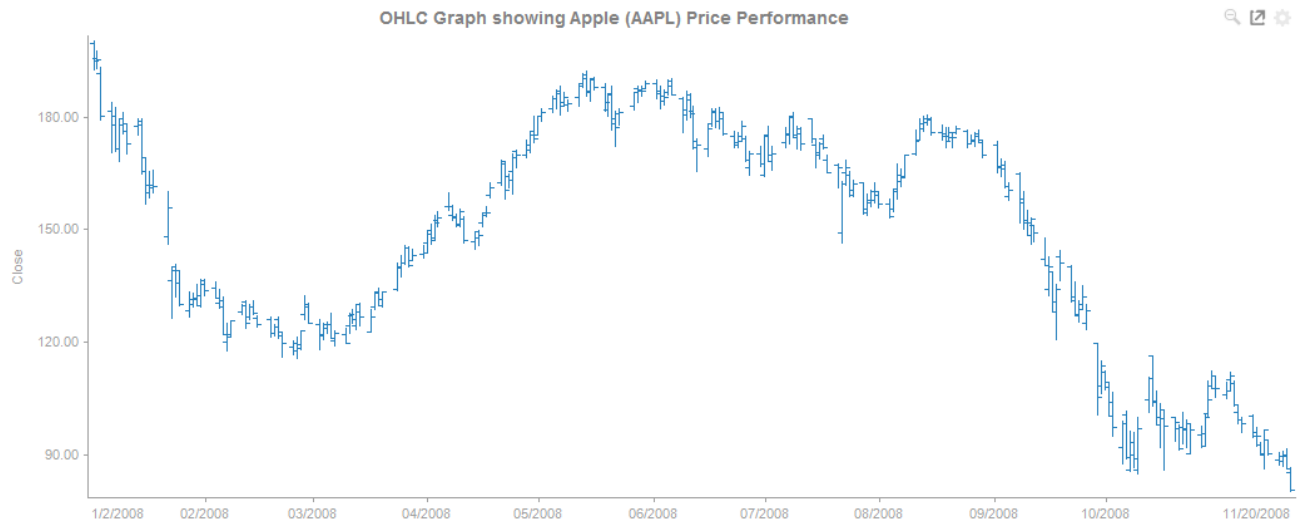


Figure 3-18. An OHLC graph.



Figure 3-19. Close up of data points in an OHLC graph.

ORDER BOOK GRAPH

The Order Book Graph displays an aggregated order book of prices and associated sizes across time. For each time slice, it displays:

- Price (as Height)
- Tick Size (as Size)
- Order Size (as Color)
- Duration of Aggregated Orders at a given price (time period)

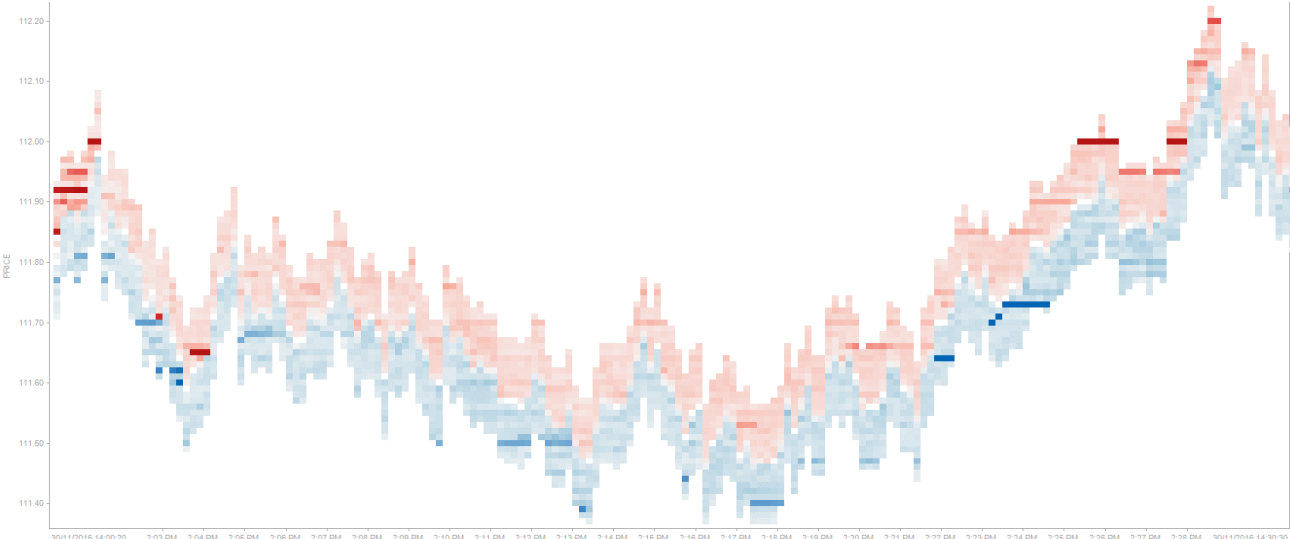


Figure 3-20. An order book graph displaying the top 10 levels of an orderbook across time

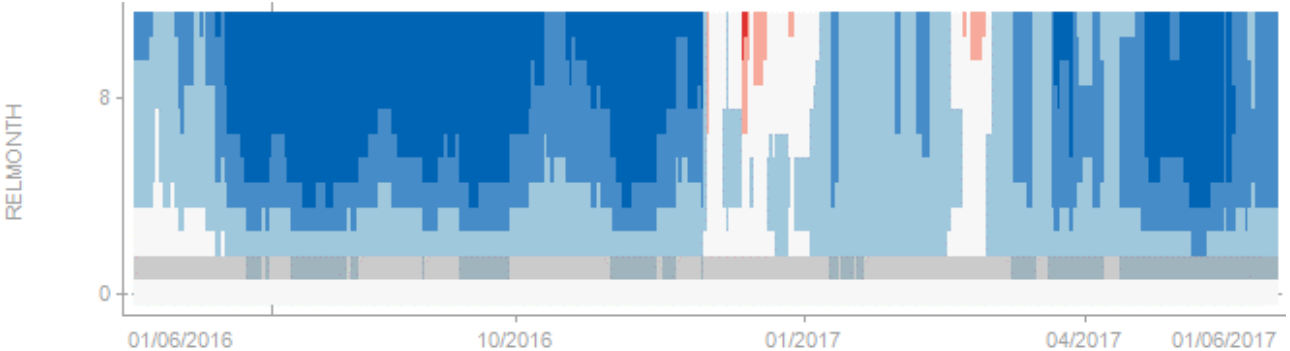


Figure 3-21. An order book graph displaying a forward curve across time.

PERCENTAGE AREA GRAPH

A Percentage Area Graph is like a [Treemap](#) spread out over time; you can see how each constituent part contributes to the total at any point in the time series. It is an excellent choice for visualizing time series data when you are interested in seeing the relative contributions for each data set in the series, regardless of the absolute total.

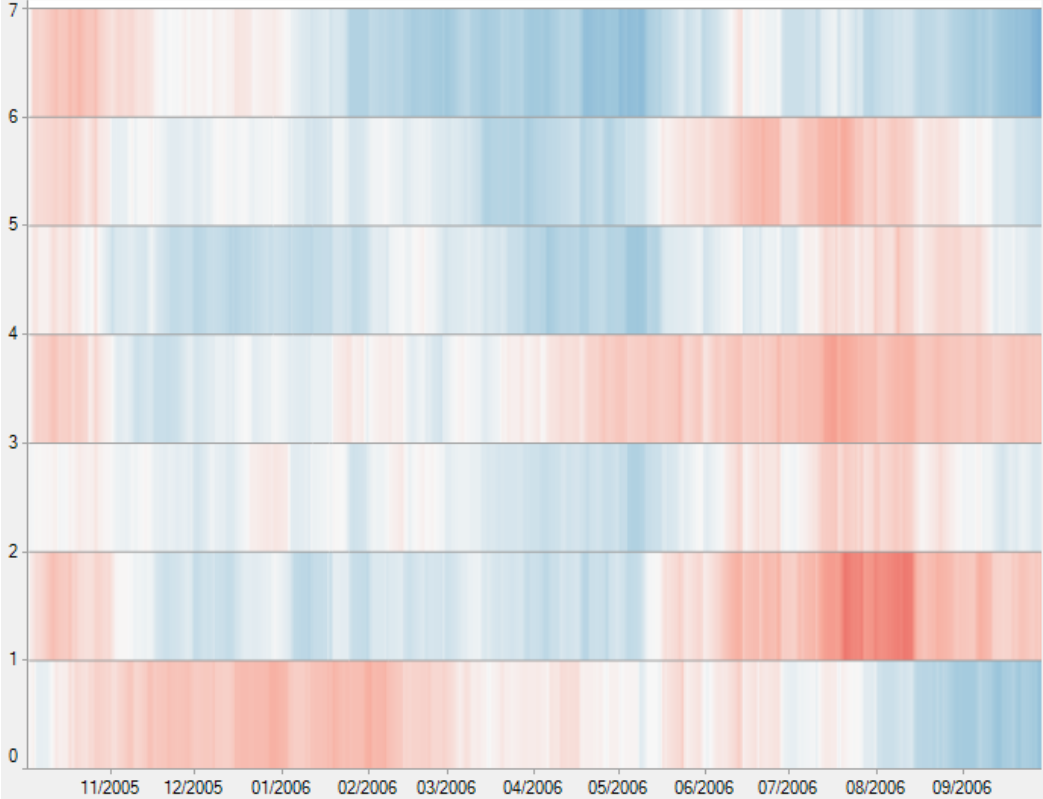


Figure 3-22. A percentage area graph.

PRICE BANDS GRAPH

The Pricing Band Graph displays the variance or spread between two time-based metrics.

Each grouping defined in the breakdown will be displayed as a separate layer of the overall graph, where typically color is used to display the category.

As it is expected that spread layers will occlude, the transparency is defaulted to 50% and can be modified as appropriate.

Typical use cases include comparing the pricing bid offer spreads from multiple liquidity providers.



Figure 3-23. A price bands graph with linear interpolation.

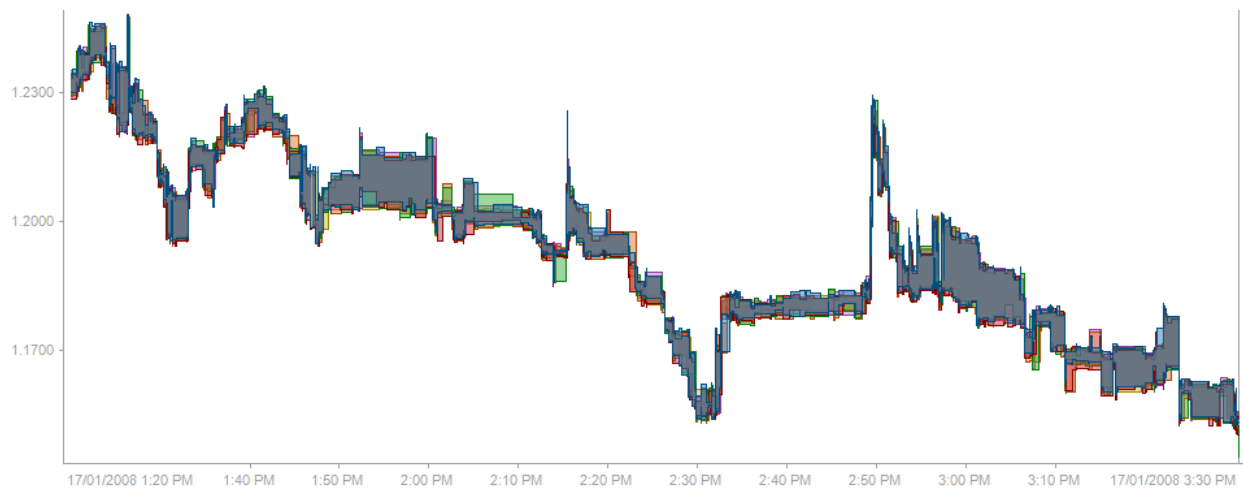


Figure 3-24. A price bands graph with stepped interpolation.

SPREAD GRAPH

The Spread Graph displays the variance or spread between two time-based data series.

Typical use cases include comparing a stock's price performance to an Index or a bond's yield to a benchmark rate.

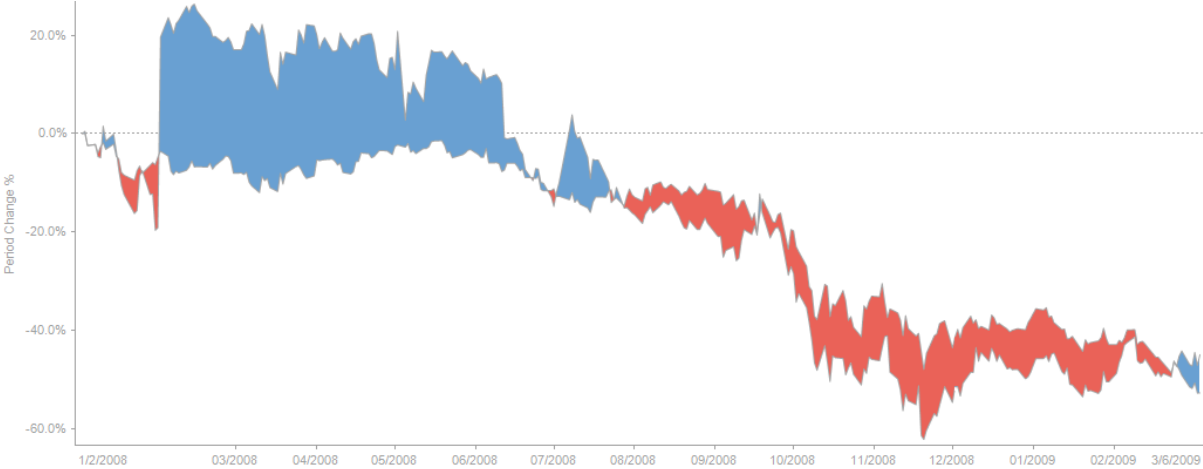


Figure 3-25. A spread graph with linear interpolation.

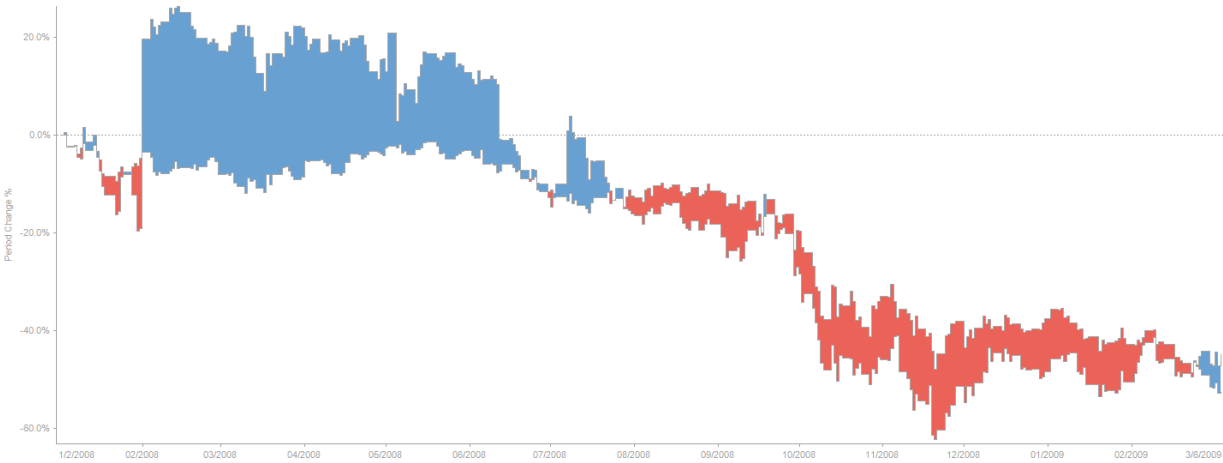


Figure 3-26. A spread graph with stepped interpolation.

STACK GRAPH

Stack Graphs let you visualize quantitative changes to several data sets over time, and you can see how each data point contributes to the total. As with the [Treemap](#) the Height of the stack relates Importance, while the color relates Urgency or variance.

Stack Graphs are a great way to look at revenue or gross profit figures over time across several product lines. Stack Graphs are also good to use when you have up to ten or eleven time series data sets to look at, especially for data sets that have a large number of data points.

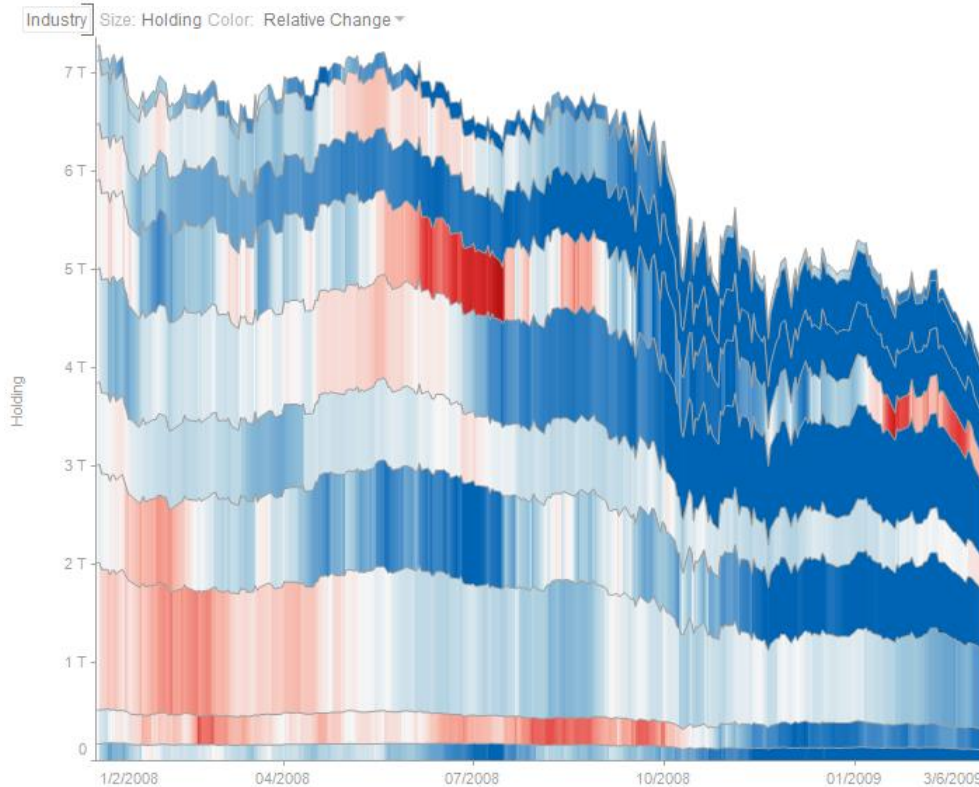


Figure 3-27. A portfolio stack graph.

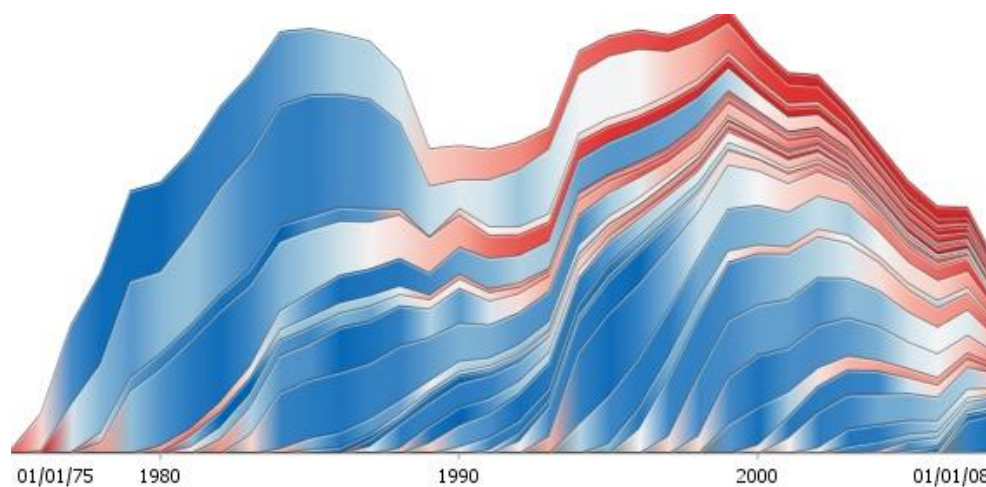


Figure 3-28. An oil production stack graph.

STACKED AND GROUPED NEEDLE GRAPH

Stacked and Grouped Needle Graphs display time-based transactions or occurrence frequencies, similar to the standard [Needle Graph](#).

It allows each transaction to be split into its components, allowing contributions to the total to be viewed across time.

Common uses include splitting of transaction volumes by venue or by direction (Buy/Sell).

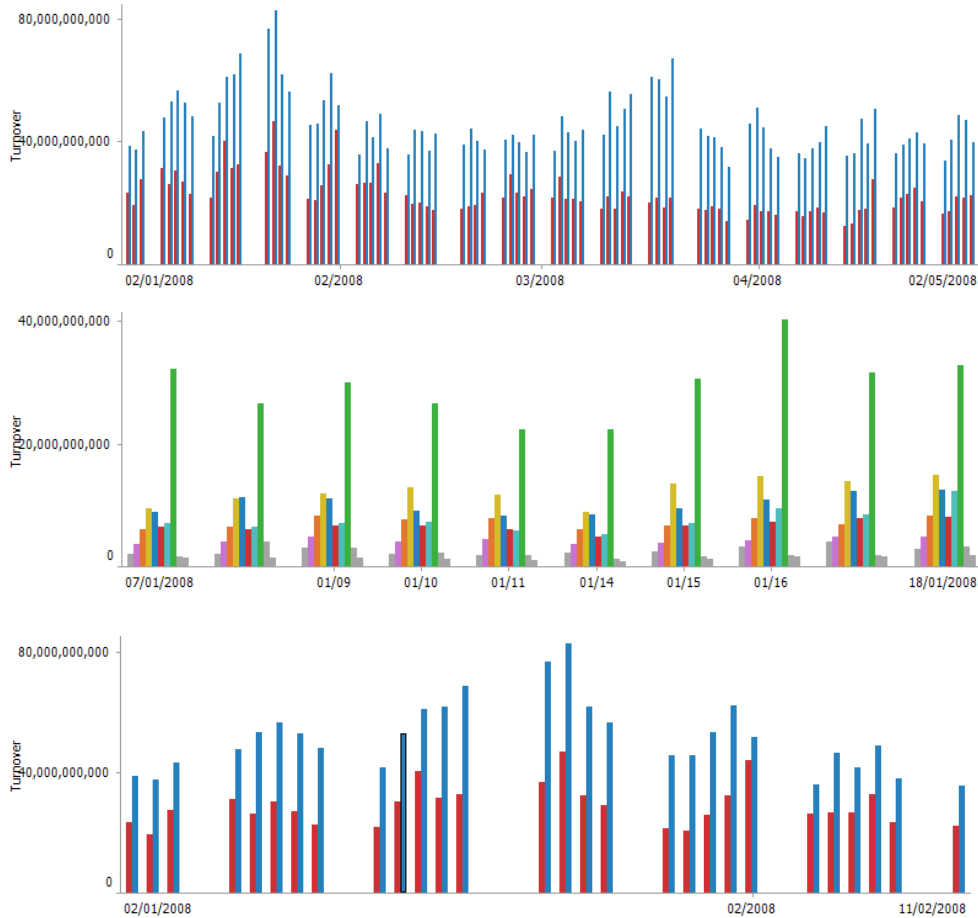


Figure 3-29. Samples of stacked and grouped needle graphs.

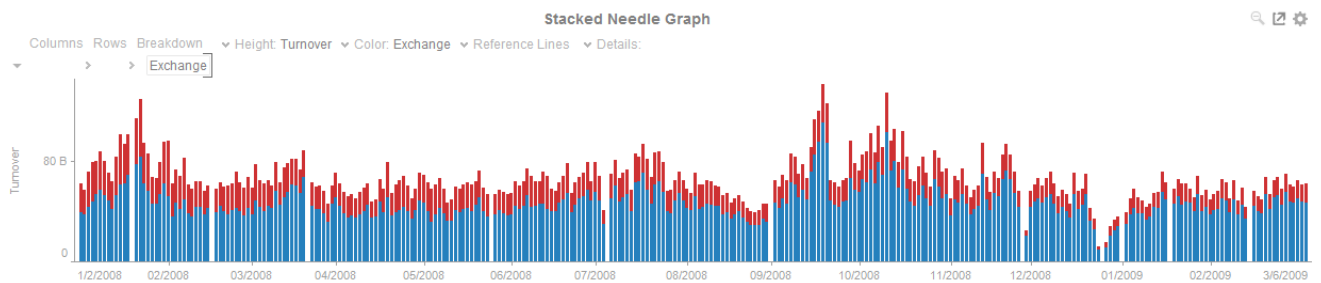


Figure 3-30. Stacked needle graph (Turnover by exchange).

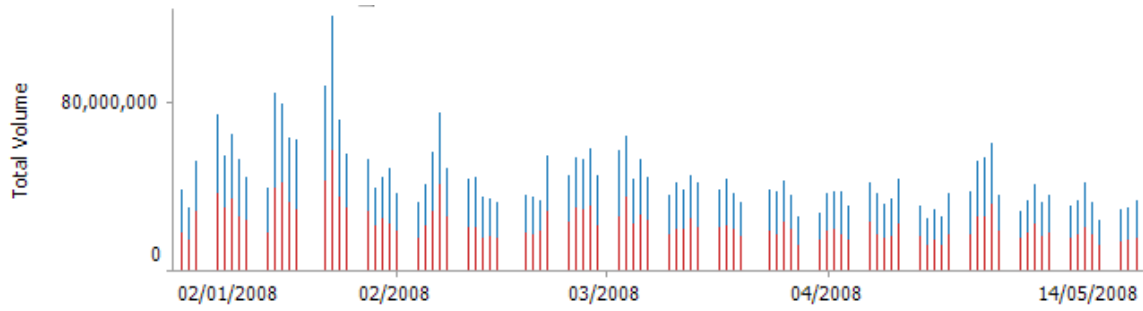


Figure 3-31. Stacked needle graph (Buy and sell volume).

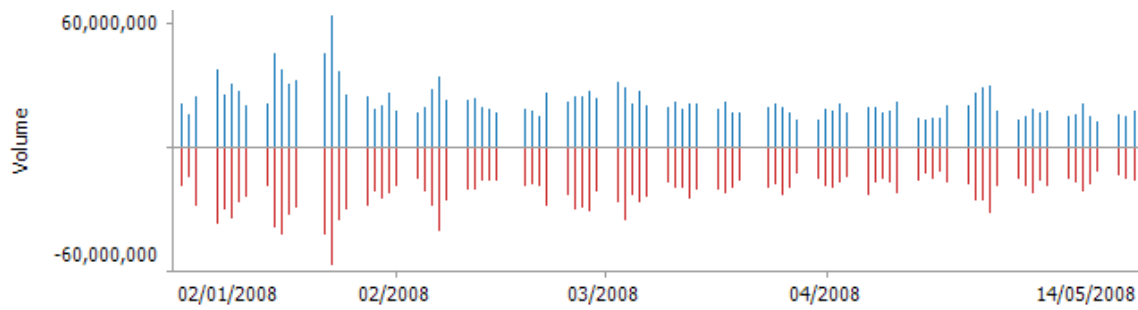


Figure 3-32. Stacked needle graph (Buy and sell volume - separated).

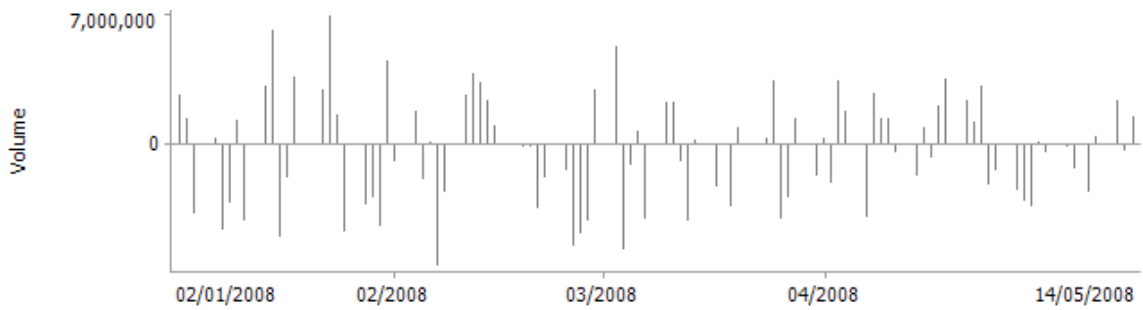


Figure 3-33. Stacked needle graph (Net volume through aggregation - Buy/sell).

TIME SERIES SCATTER PLOT

Time Series Scatter Plots display time-based transactions, similar to the Needle graphs. Like the scatter plot, it displays individual data points (or transactions), with a given numeric Y value and a given timestamp X value.

Common uses include displaying transaction volume across time relative to the price at which the volume was executed and displaying order book depth across time.

Typically, the graph is combined with line graphs to show the scatter points relative to defined boundaries.

Figure 2-30 shows trade volumes and prices relative to the best bid and offer across time.

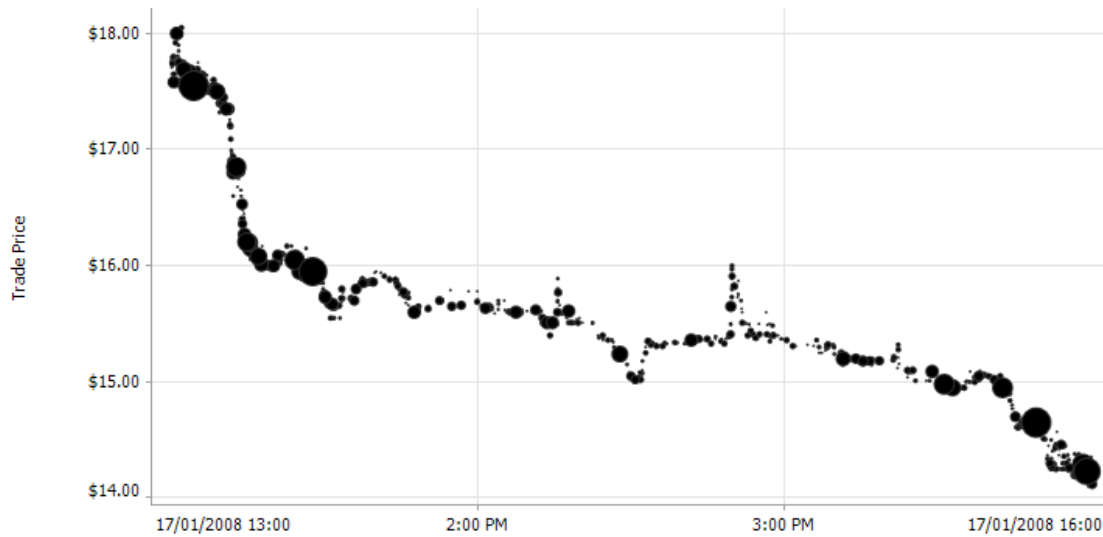


Figure 3-34. A time series scatter plot.



Figure 3-35. A time series scatter plot (Trade volume with best bid and offer).

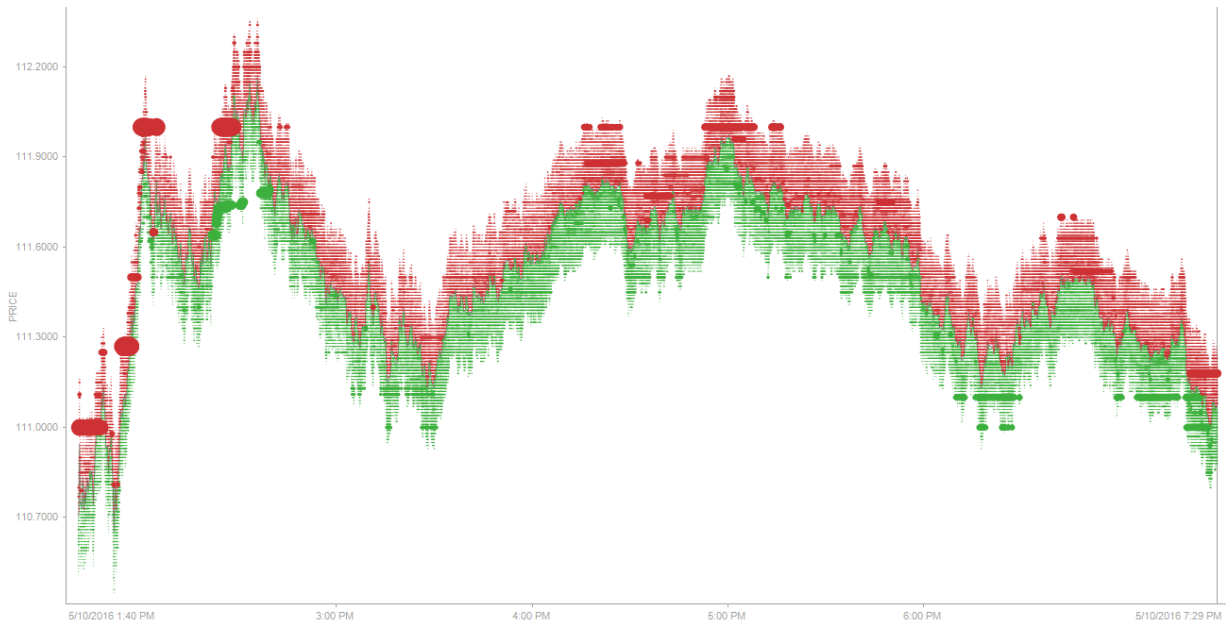


Figure 3-36. A time series scatter plot (Top 20 Levels of Order Book).

TIME SERIES SURFACE PLOT

Time Series Surface Plots are used to identify trends and outliers within Time Series surfaces, typically forward curves across time.

The Surface is made up of a series of points where each point has:

- ❑ Time Position
- ❑ Y Position
- ❑ Color (which represents the Z axis).

The color scale can be continuous or stepped to show a surface gradient.

The below figures show an Oil Futures forward curve, with prices relative to the front month.

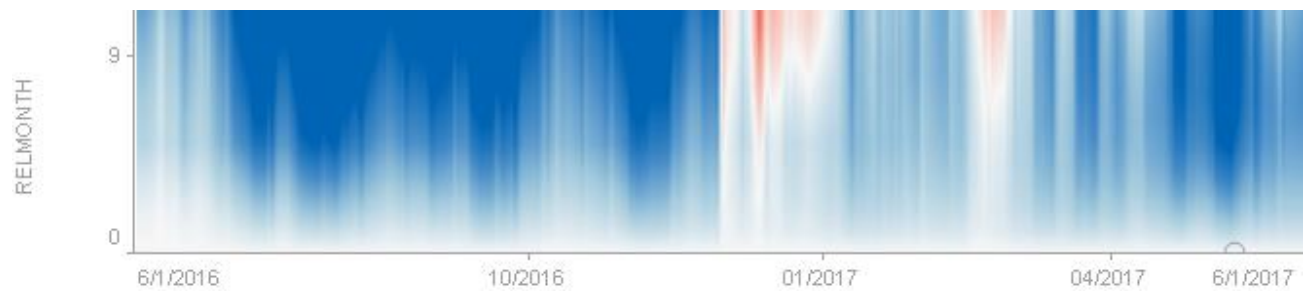


Figure 3-37. A time series surface plot with continuous colors.

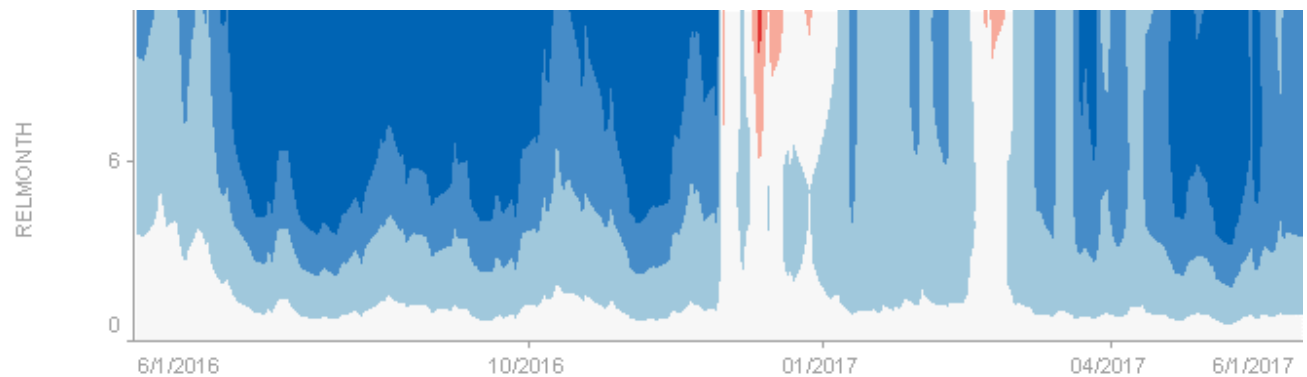


Figure 3-38. A time series surface plot with stepped colors

[4] SNAPSHOT VISUALIZATIONS

Some of the most common use cases for data visualization software require the system to display information about a data set as it exists at a particular point in time. These “snapshot” visualizations are extremely useful for understanding relative quantitative and qualitative measures and enable users to gain a comprehensive understanding of very complex data sets very quickly.

BAR GRAPH

Bar Graphs are probably the best-known visualization for quantitative data.

You can display Panopticon Bar Graphs either horizontally or vertically. These graphs are available in three variants:

- Standard
- Grouped
- Stacked

In each case, you can sort the layout of the bar graph according to your requirements, and, with hierarchical data, the graph represents the netted position at each aggregated depth level.

You can also use the Bar Graph visualization to display demographic data in so-called Tornado Charts or Population Pyramids.

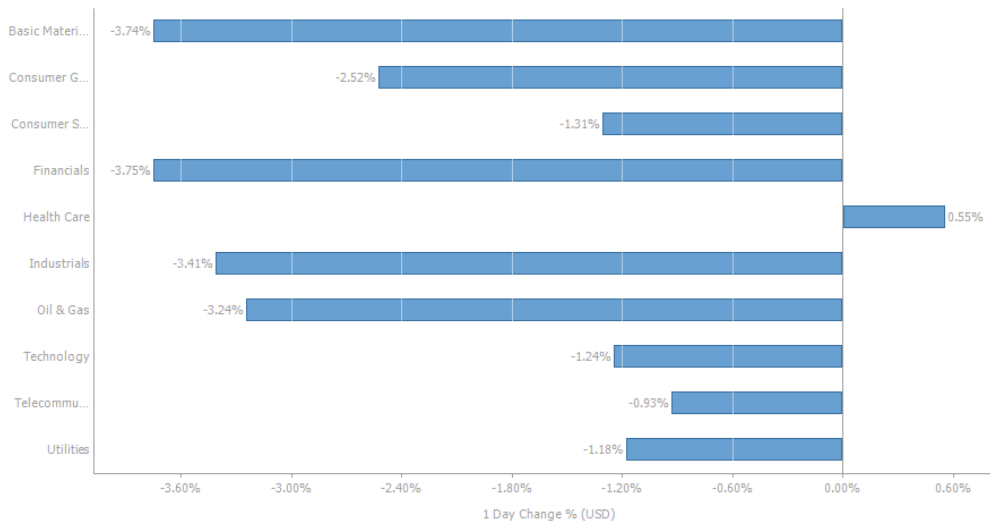


Figure 4-1. A horizontal bar graph.

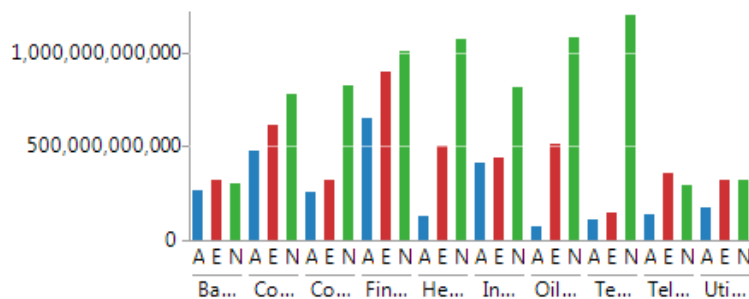


Figure 4-2. A standard bar graph.

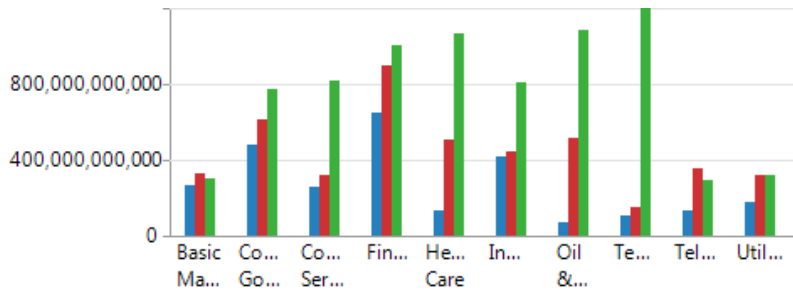


Figure 4-3. A grouped bar graph.

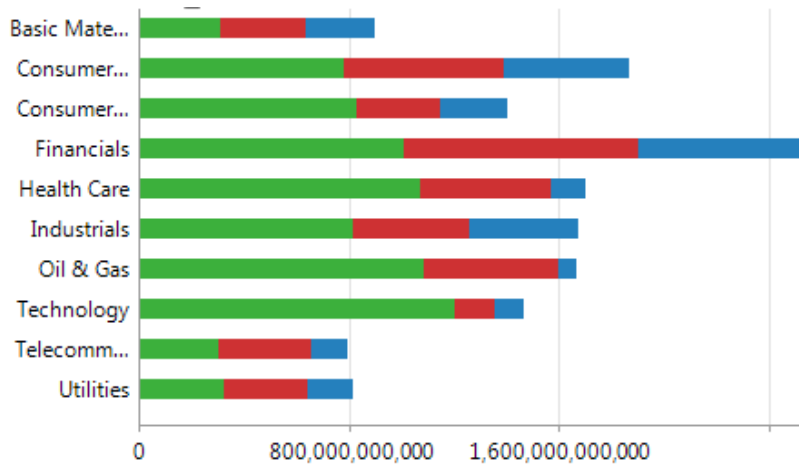


Figure 4-4. A stacked bar graph.

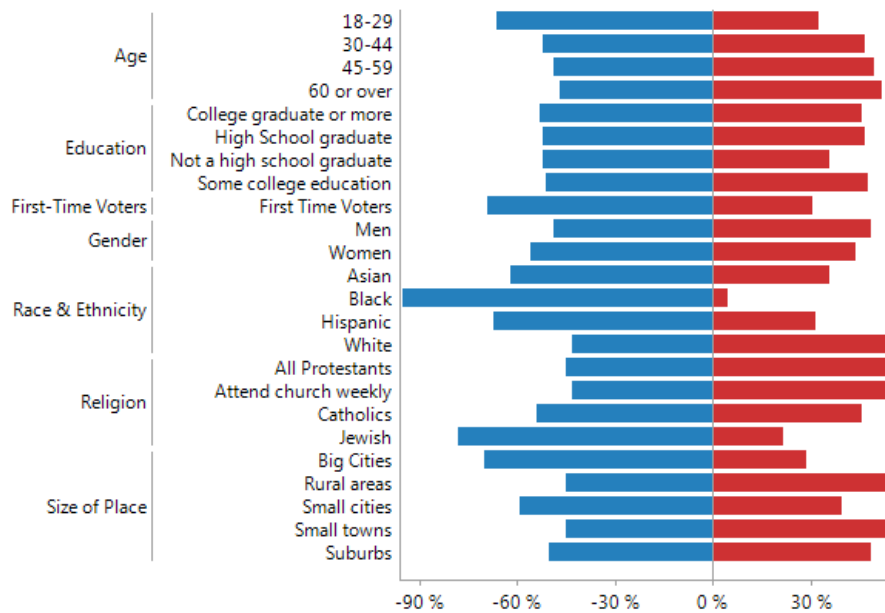


Figure 4-5. A stacked bar graph showing a tornado chart layout.

BOX PLOT

Box Plots are designed to display numeric distributions.

The plot draws the Minimum, 25th Percentile, Median, 75th Percentile, and Maximum of the specified measure by category.

This can be provided as a single measure, where Panopticon performs the aggregation.

Or as separate measures for each component of the box plot, where the data source performs the aggregation.

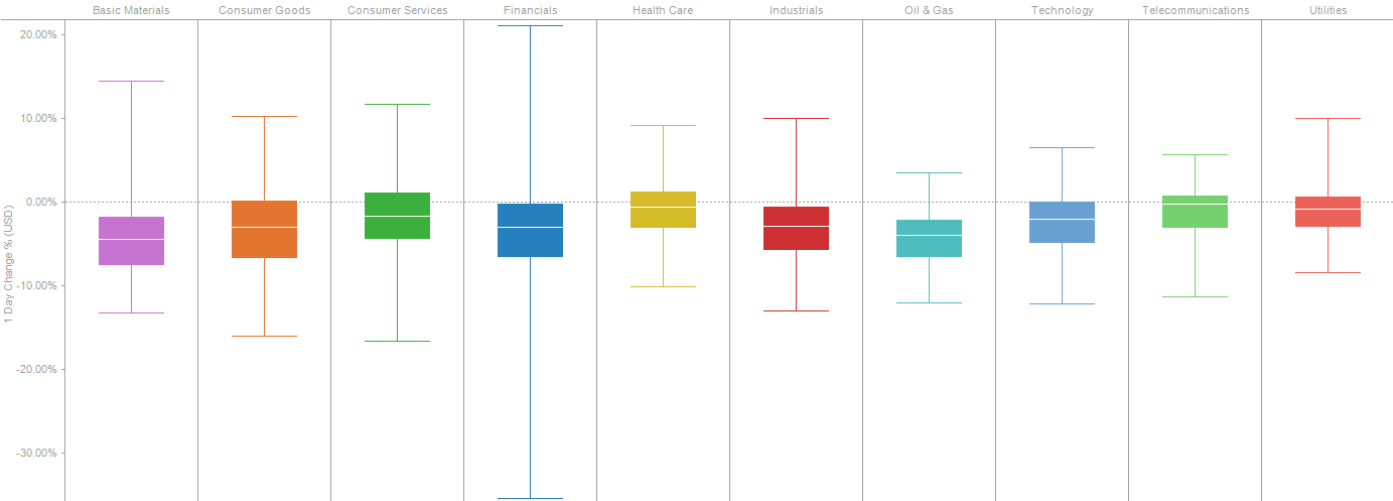


Figure 4-6. A Box Plot of Price Performance Distributions by Industry.

BULLET GRAPH

Bullet Graphs were designed by Stephen Few to remove unnecessary clutter and instead focus on visualizing metrics like Key Performance Indicators (KPI).

Research has shown that Bullet Graphs are easier to interpret in less time than the radial gauges or speedometers often seen in BI dashboards.

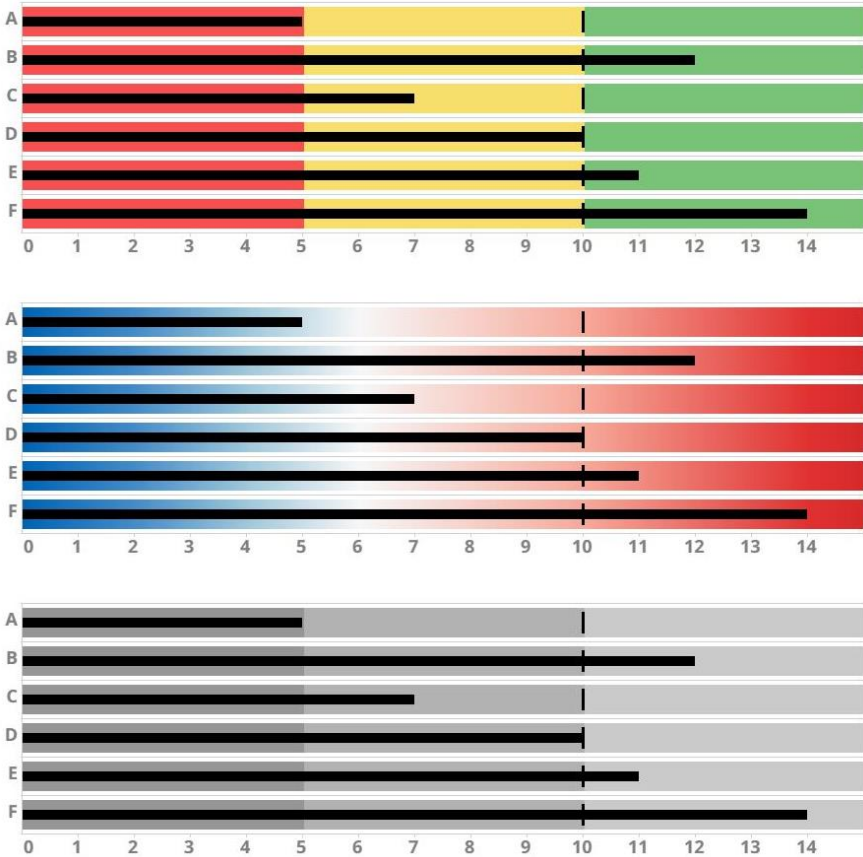


Figure 4-7. A horizontal bullet graph.

CATEGORICAL LINE GRAPH

Line Graphs are easy to understand and are a great way to communicate important time-based trends, clustering, relative performance and outliers.

However, on occasion the axis is not time, but instead categorical. In this case a categorical line graph is used.

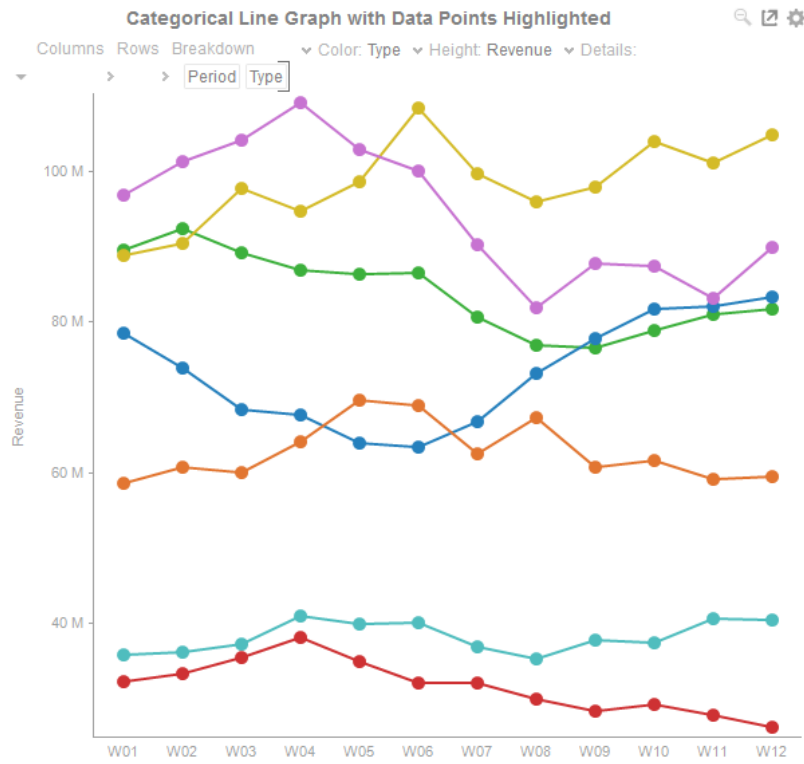


Figure 4-8. A business period categorical line graph

CIRCLE PACK

Circle Packs represent hierarchical data sets, showing both each level in the hierarchy and how they interact with each other. They are consequently used for identifying patterns of performance, and outliers within peer groups.

They are represented by a colorful mosaic of enclosed circles based on your data. The size of a circle reflects its importance. The color conveys urgency or variance.

Circle Packs can also be cross tabbed, and offer an alternative to the [Heat Matrix](#), with the added benefit of having both a size (typically relating to importance), and a color variable (typically related to performance variance).

Most people can learn to understand the information presented in a Circle Pack in under a minute – even if that Circle Pack is showing data representing an underlying data set of thousands of records.

A recommended alternative to the Circle Pack is the [Treemap](#), which can display a larger number of data points, and is easier to compare constituent data points.

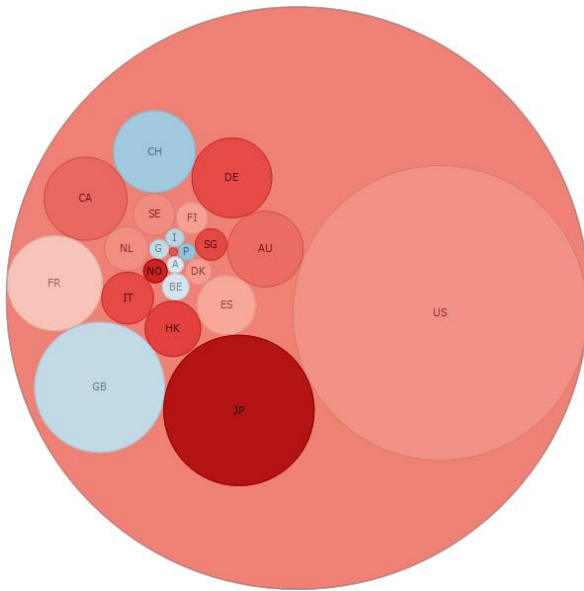


Figure 4-9. A flat Circle Pack –Showing Outer Circle with aggregate color.

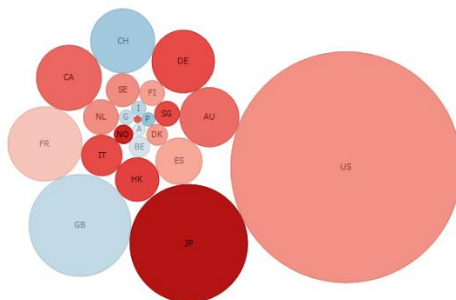


Figure 4-10. A flat Circle Pack –Hiding Outer Circle.

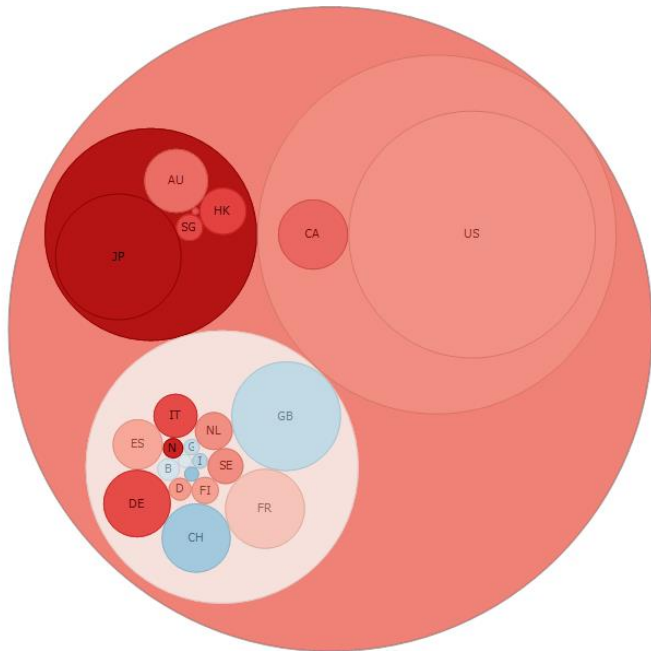


Figure 4-11. A Hierarchical Circle Pack –Showing Outer Circle.

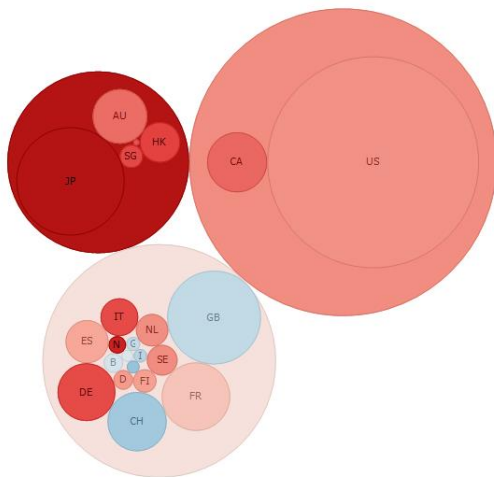


Figure 4-12. A Hierarchical Circle Pack – Hiding Outer Circle.

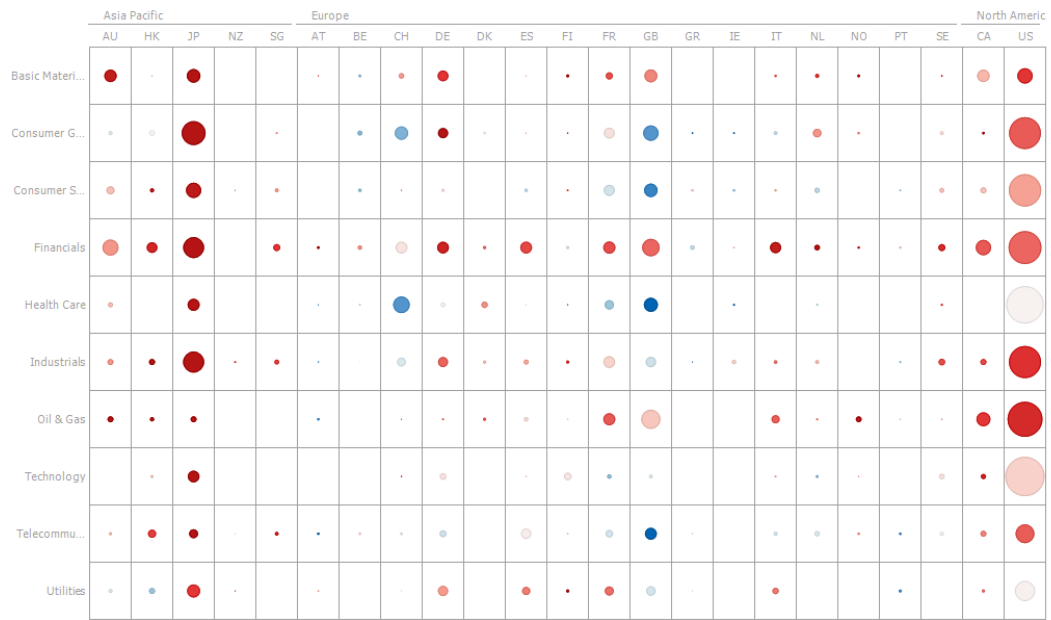


Figure 4-13. A Cross Tabbed Circle Pack – Showing Correlation of Industries to Countries

CROSS TAB PIVOT TABLE

Although selected visualizations can be cross tabbed into small multiples, each showing subsets of the original data set, the Cross Tab can itself be used to display a Pivot table.

Pivot Tables support a single numeric value being represented at the cross point of hierarchical rows and columns.

Each intersection cell can display the aggregated numeric value and its associated color range, which can be subdued or intense. Numeric labels can also be removed to produce a [Heat Matrix](#).

Pivot Table with Subdued Colors

Columns: Rows: Color: Revenue Variance Icons: Details:

▼ Super Region | Region > Area | Type

		North			South & East			West		
		Midlands	North East	North West	East	Greater London	South	South East	South West	Wales
Alcohol	Alcohol	-2.83%	-1.89%	-1.22%	-5.00%	-0.04%	-3.09%	-4.36%	-1.00%	-3.28%
Ambient	Chilled	-12.40%	-6.45%	-9.32%	-18.00%	-10.15%	-12.50%	-11.72%	-16.00%	-14.46%
	Confectionary	-18.42%	-13.08%	-12.04%	-3.00%	-18.97%	-22.39%	-23.57%	-19.00%	-20.54%
	Home Prod...	-2.25%	-1.00%	-0.80%	5.00%	-3.38%	-2.55%	-2.77%	-1.00%	-3.29%
	Savoury	-0.26%	2.00%	1.76%	5.00%	-0.18%	-0.13%	-0.96%	2.00%	-0.27%
	Soft Drinks	-8.33%	-6.00%	-6.01%	5.00%	-9.85%	-7.90%	-8.25%	-5.00%	-8.21%
	Store Cupb...	1.00%	1.00%	1.78%	4.00%	-0.16%	0.89%	-0.16%	1.00%	0.66%
	Tobacco	0.86%	1.89%	2.00%	5.00%	1.37%	1.36%	1.26%	2.00%	1.49%
Cold & Froz...	Chilled	4.44%	2.90%	3.54%	5.00%	3.79%	5.69%	3.42%	5.00%	2.38%

Figure 4-14. A pivot table with subdued colors.

Pivot Table with Intense Colors

Super Region | Region > Area | Type | Color: Revenue Variance

		North			South & East			West		
		Midlands	North East	North West	East	Greater London	South	South East	South West	Wales
Alcohol	Alcohol	-2.83%	-1.89%	-1.22%	-5.00%	-0.04%	-3.09%	-4.36%	-1.00%	-3.28%
Ambient	Chilled	-12.40%	-6.45%	-9.32%	-18.00%	-10.15%	-12.50%	-11.72%	-16.00%	-14.46%
	Confectionary	-18.42%	-13.08%	-12.04%	-3.00%	-18.97%	-22.39%	-23.57%	-19.00%	-20.54%
	Home Prod...	-2.25%	-1.00%	-0.80%	5.00%	-3.38%	-2.55%	-2.77%	-1.00%	-3.29%
	Savoury	-0.26%	2.00%	1.76%	5.00%	-0.18%	-0.13%	-0.96%	2.00%	-0.27%
	Soft Drinks	-8.33%	-6.00%	-6.01%	5.00%	-9.85%	-7.90%	-8.25%	-5.00%	-8.21%
	Store Cupb...	1.00%	1.00%	1.78%	4.00%	-0.16%	0.89%	-0.16%	1.00%	0.66%
	Tobacco	0.86%	1.89%	2.00%	5.00%	1.37%	1.36%	1.26%	2.00%	1.49%
Cold & Froz...	Chilled	4.44%	2.90%	3.54%	5.00%	3.79%	5.69%	3.42%	5.00%	2.38%
	Frozen	3.09%	4.11%	3.42%	5.00%	2.36%	3.89%	2.26%	4.00%	2.68%

Figure 4-15. A pivot table with intense colors.

DOT PLOT

Dot Plots have two primary use cases:

- ❑ A more effective alternative to a [Bar Graph](#)
- ❑ A distribution display similar to a [Scatter Plot](#)

Dot Plots are an effective alternative to Bar Graphs, particularly in cases where the data being analyzed contains many similar numeric values.

In comparison with the Bar Graph, Dot Plots do not use a zero baseline and are less cluttered. This makes it easier to add additional data variables to the visualization.

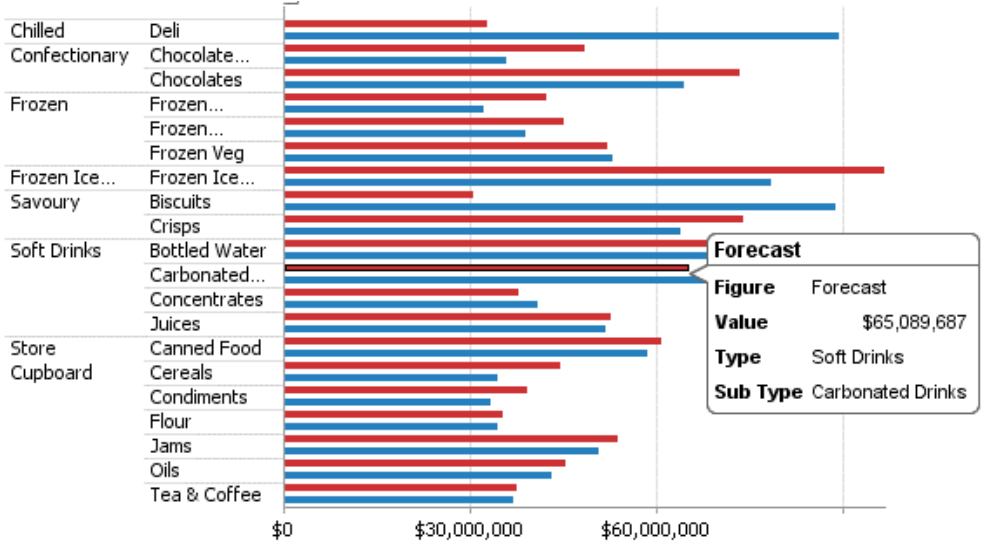


Figure 4-16. A sample horizontal bar graph showing revenues versus forecasts.

Dot Plots can also be used to represent data distributions in which one axis is numeric while the other axis is categorical. Scatter Plots using such data sets can be misinterpreted; Dot Plots of the same data are unambiguous and easy to understand.

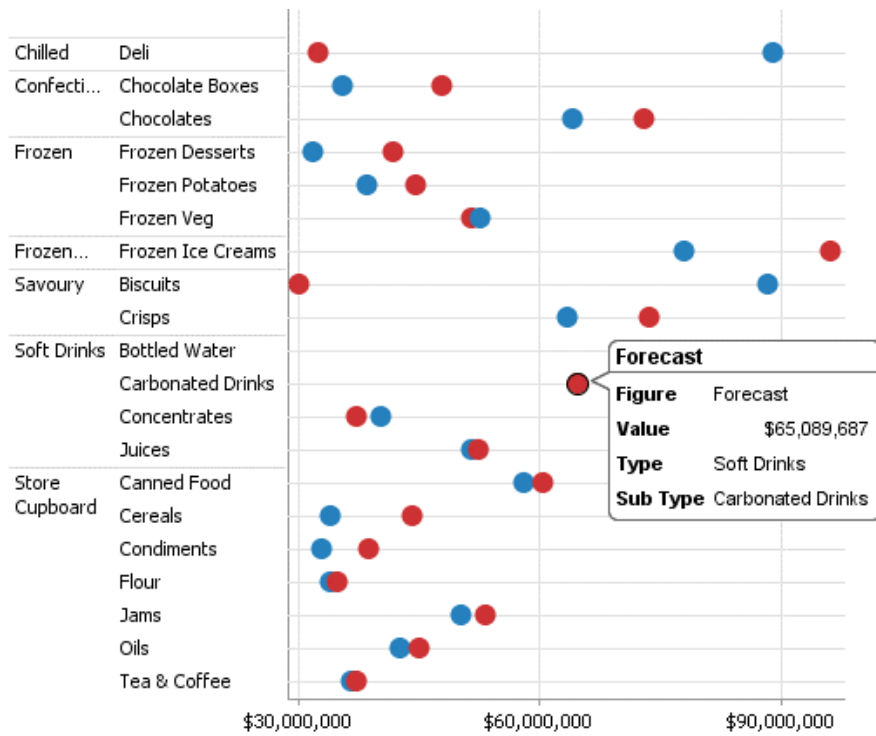


Figure 4-17. A dot plot of revenues versus forecasts

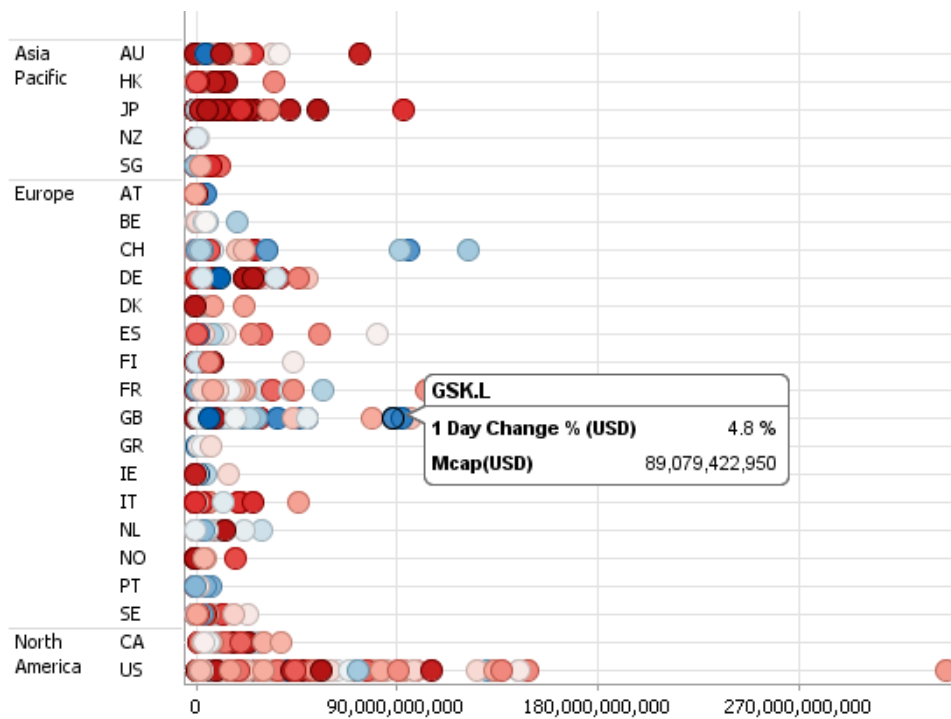


Figure 4-18. A distribution dot plot.

DONUT CHART

Donut Charts are a derivative of the pie chart and are used in the same manner for displaying contributions to a total.

Panopticon can produce standard Donut Charts in which the donut slice represents a numeric variable that is proportional to the total size of the donut. The color variable can represent either a category or another numeric variable.

Donut Charts can be flat, showing a single set of slices. They can also be hierarchical and display multiple levels of data in a variant called a Multilevel Donut Chart.

A recommended alternative to the Donut Chart is the [Treemap](#), which can display a larger number of data points, and is easier to compare constituent data points.

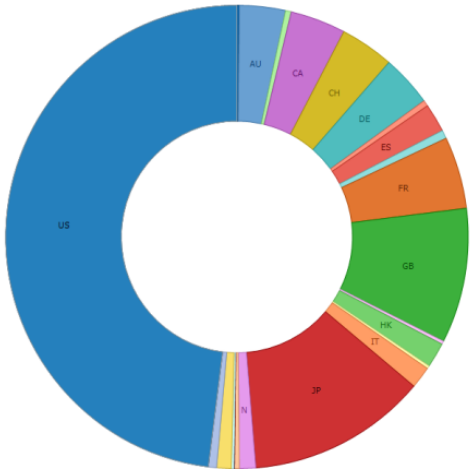


Figure 4-19. A typical Donut chart.

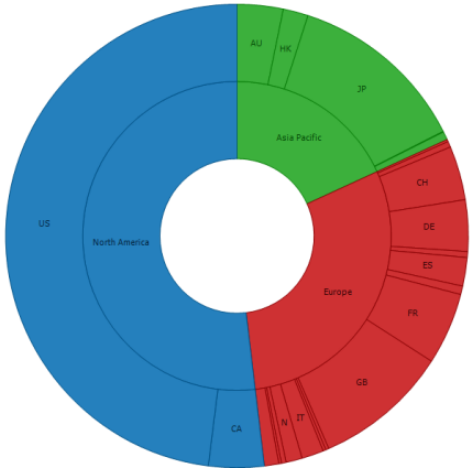


Figure 4-20. A multilevel Donut chart

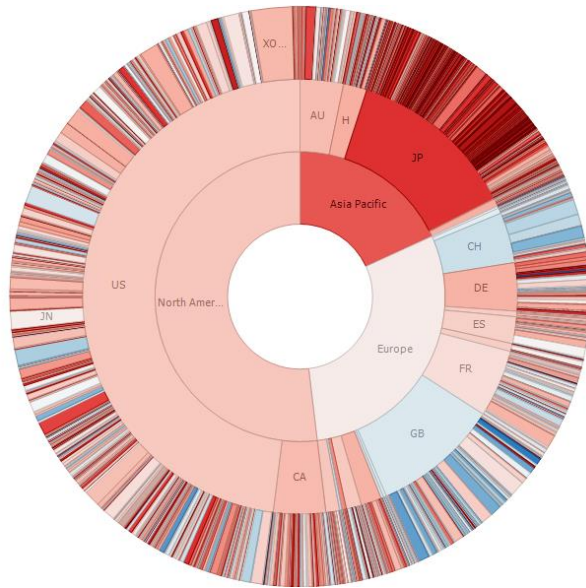


Figure 4-21. A multilevel Donut chart with deeper hierarchy, and numeric color variable

DONUT GAUGE CHART

Donut Gauge charts display percentage of total based metrics like Key Performance Indicators (KPI), and support values between 0 and 100%.

They remove unnecessary clutter and instead focus on best displaying the metric and provide an alternative to the Bullet graph.

Panopticon can produce standard Donut Gauge Charts in which the slice angle represents a percentage.

The color variable can represent either a category or another numeric variable.

Donut Gauge Charts can be individual, or displayed in cross tabs, highlighting differences between items.

An alternative visualization to the Donut Gauge to highlight differences between items and contribution to the total may be the [Treemap](#).

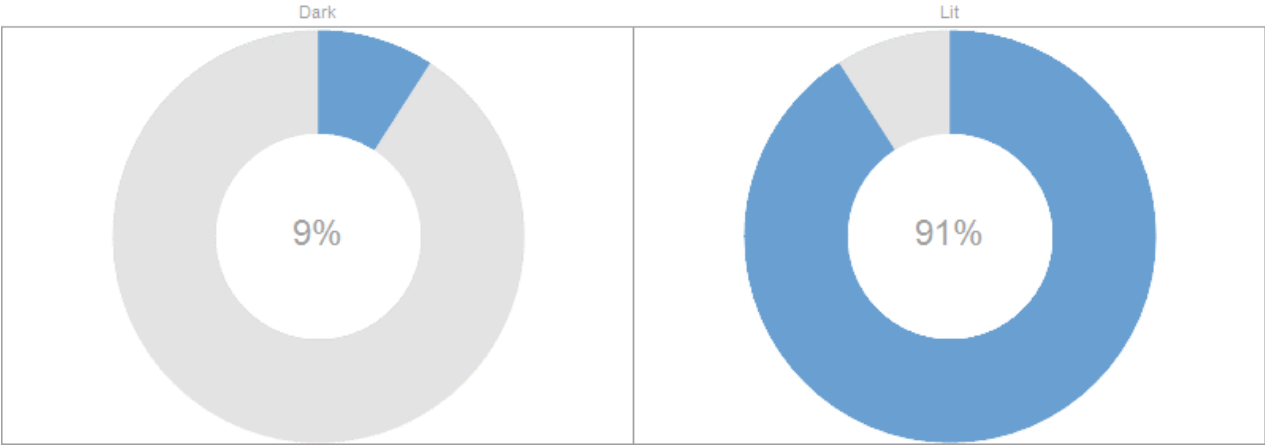


Figure 4-22. Cross Tabbed Donut Gauge (with No Color)

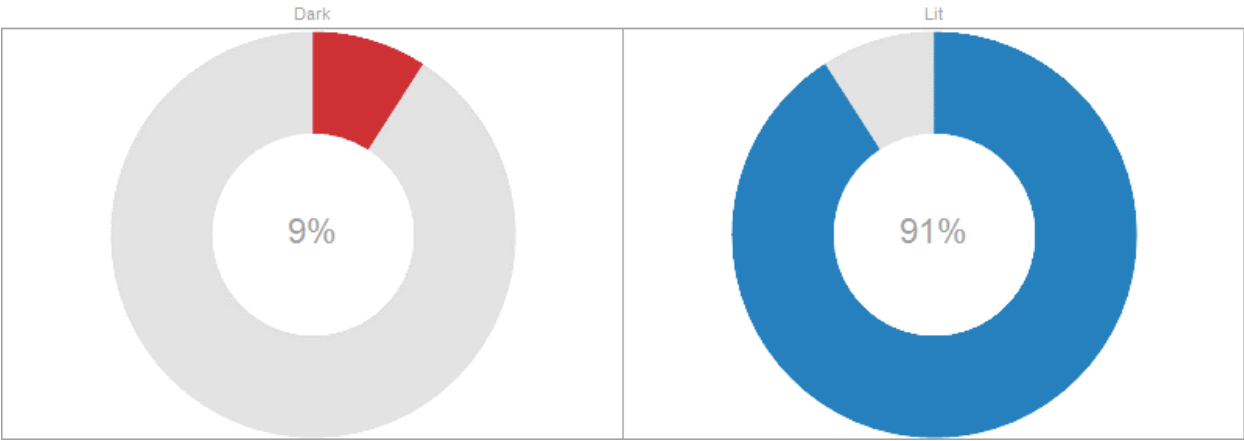


Figure 4-23. Cross Tabbed Donut Gauge (with Categorical Color)

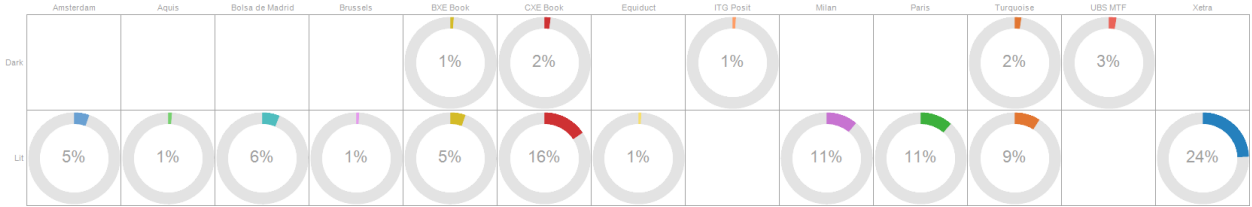


Figure 4-24. Donut Gauge Cross Tabbed into Rows & Columns

FUNNEL CHART

Funnel Charts are a type of Bar Graph, often used to represent stages in a sales process or order fulfillment process and can show the amount of potential revenue for each stage.

This type of chart can be useful in identifying potential problems in an organization's sales process.

Color can be used to represent either a Stage in the process, or the change in performance for that stage against a prior period.

Alternatives to the Funnel Chart would be a simple [Bar Graph](#), or a [Stacked Bar Graph](#).

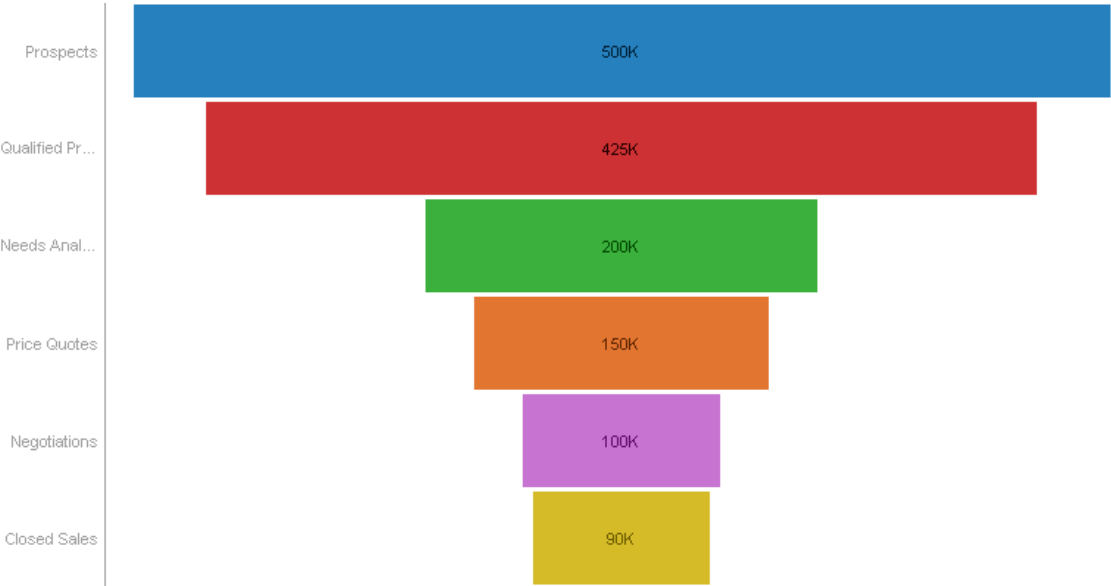


Figure 4-25. Funnel Chart with Color showing Stage in the Funnel

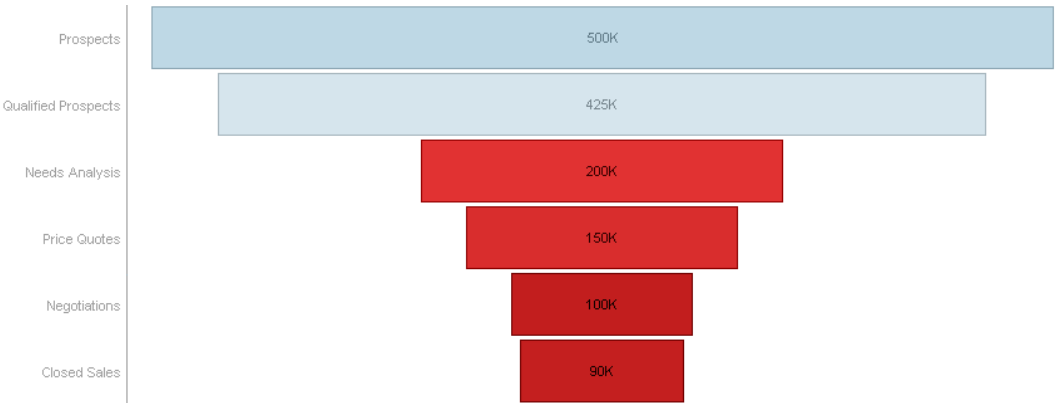


Figure 4-26. Funnel Chart with Color showing Change in Performance

HEAT MAP

A Heat Map is a special type of color-based data visualization that is well suited for analyzing large flat data volumes using an intuitive graphical display. Heat maps are good at representing large numbers of data points in ways that would be unwieldy and hard to interpret using traditional tables or charts.

A Heat Map represents each item in the data set as an equally-sized cell, unlike a [Treemap](#) that uses the size of the box to represent a qualitative value and location to represent hierarchical relationships. In a Heat map, the color of the square represents a quantitative value relative to the other boxes in the Heat map, while the location can represent the sorting of another quantitative or categorical value. This allows the analyst to see all of the data items simultaneously. The user can also hover over any item to bring up more detailed information on demand.

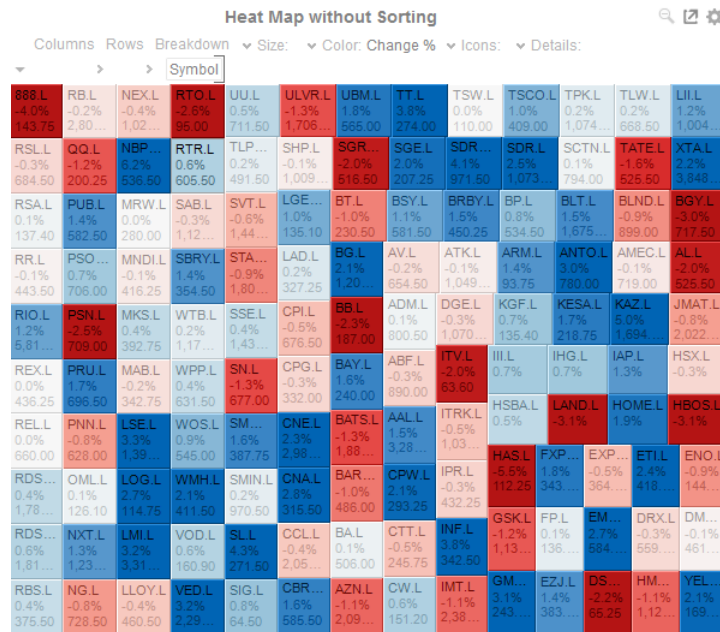


Figure 4-27. A heat map without sorting.

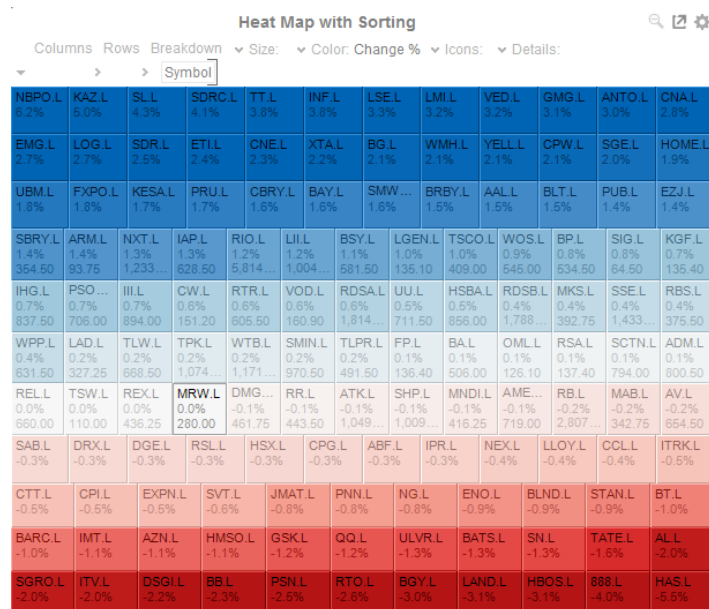


Figure 4-28. A heat map with sorting.

HEAT MATRIX

A Heat Matrix is similar to both the [Heat Map](#) and [Treemap](#) in that it displays many different data items and represents the value for each item using colors. However, unlike its cousins, the Heat Matrix has a defined structure where two data attributes define each axis, thus producing a correlation matrix. Within the Heat Matrix, each column and row represent a unique attribute, and the point where two items intersect represents a unique combination of the two attributes.

The matrix can display labels within each intersecting tile or simply display color.

Our Heat Matrix data visualization helps our clients identify correlations within their data sets using an intuitive graphical display.

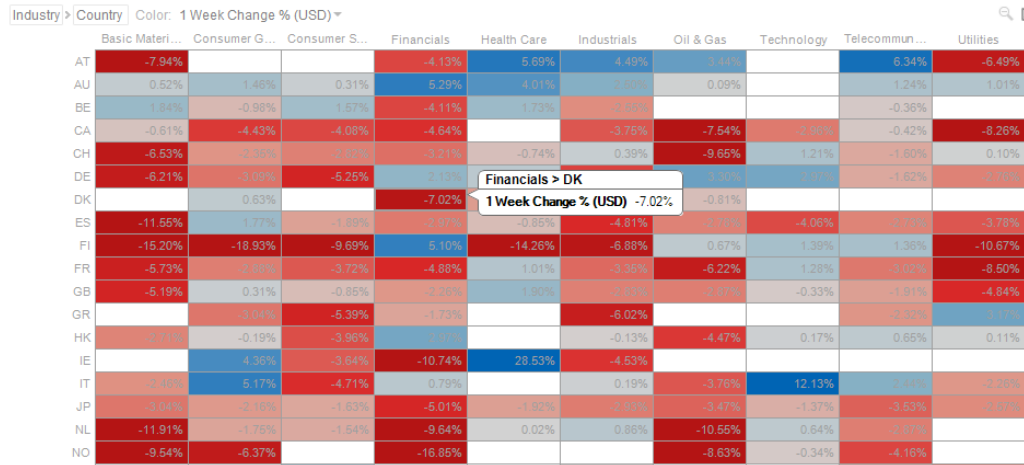


Figure 4-29. A heat matrix.

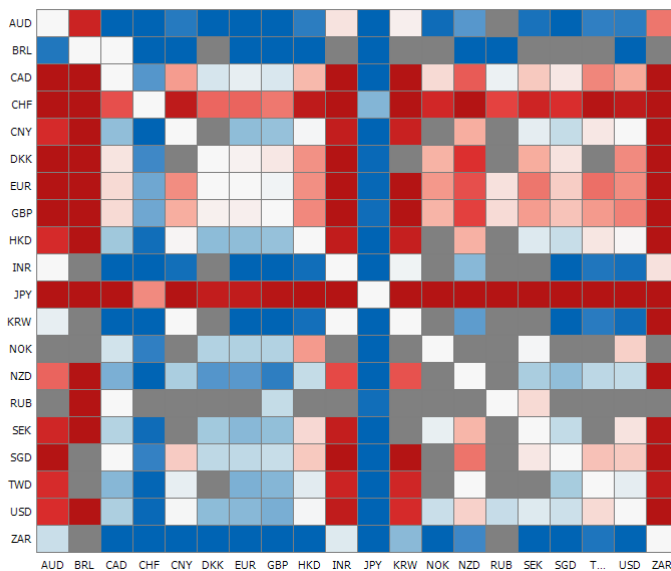


Figure 4-30. An FX cross rates heat matrix.

MAP PLOT

Use Map Plots to display geographic data, where you have longitudes and latitudes associated with individual data points. These plots clearly show data correlations and clustering that is geographic in nature.

In a Map Plot, the visualization expects latitude and longitude measures to be associated. It will then retrieve from the selected map tile provider the appropriate background map to display under the data points. This background map is constructed by retrieving individual map tiles at set zoom levels.

As the background map is provided automatically, it relies on:

- ❑ A range of supplied longitudes & latitudes to provide a bounding area
- ❑ An active Internet connection to retrieve the map tile images

Panopticon ships with a number of cross reference datasets to determine the appropriate latitude/longitude for datasets. These have been provided through subsets of the data available at GeoNames.org. (<http://www.geonames.org>)

More detailed geo-coding data is available from this website, and many others.

Zooming into the map will cause, new map tiles to be retrieved, and a new background map image behind the data points to be displayed.

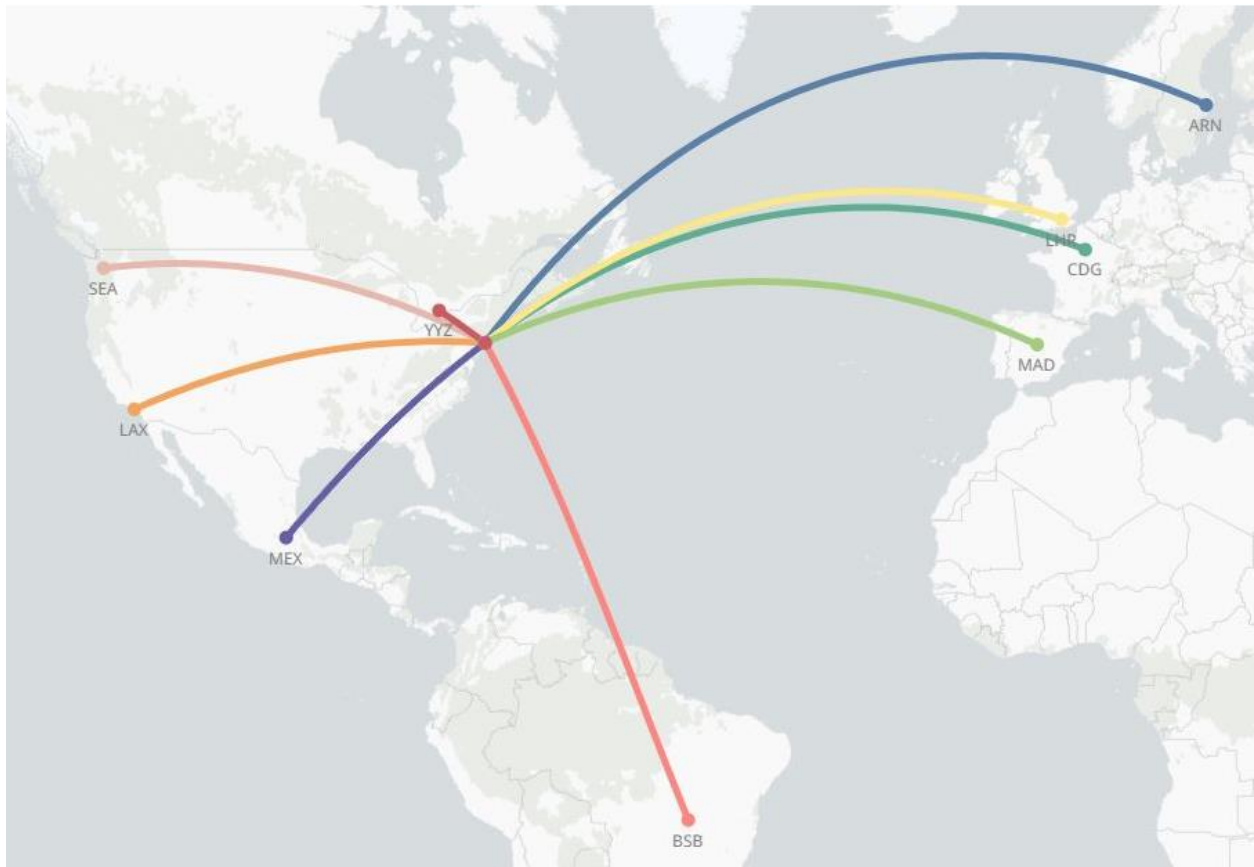


Figure 4-31. Map Plot of the flights of an airline.

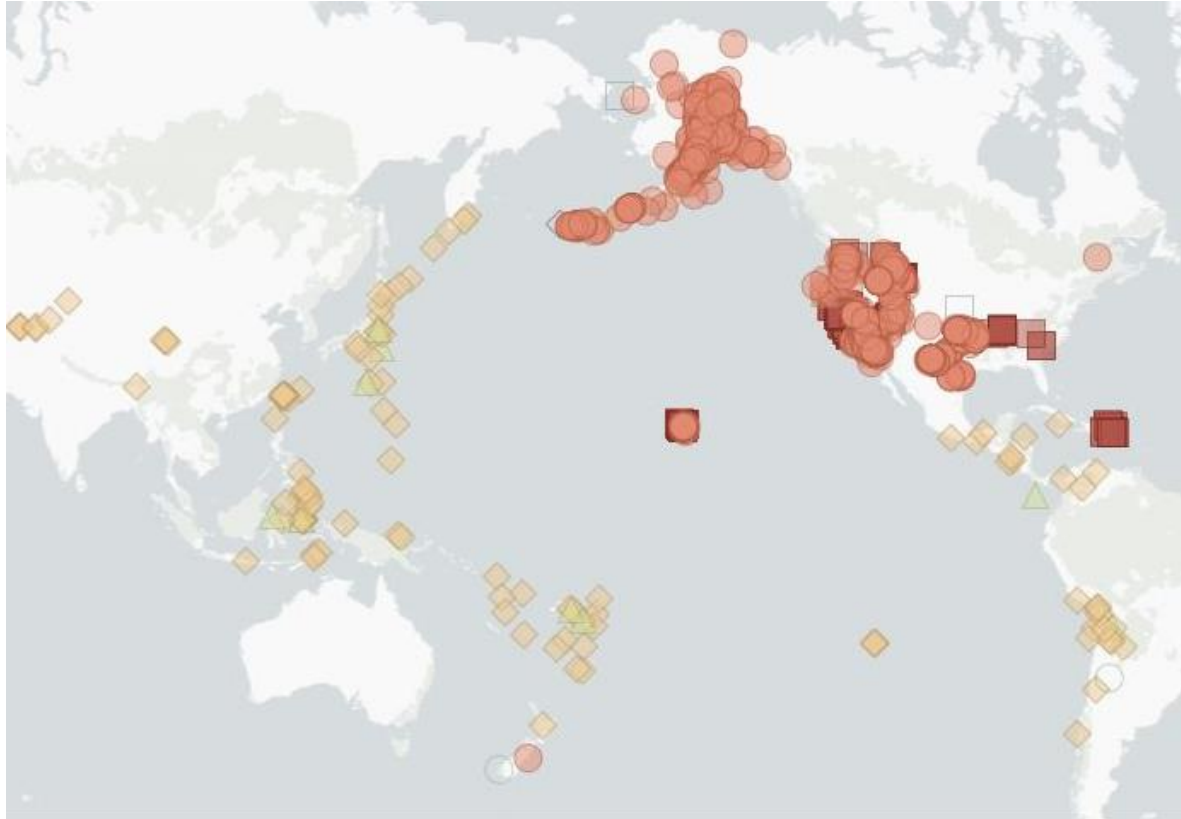


Figure 4-32. Map Plot with different shapes.



Figure 4-33. Map Plot with Alpha blending when there are many overlapping shapes.

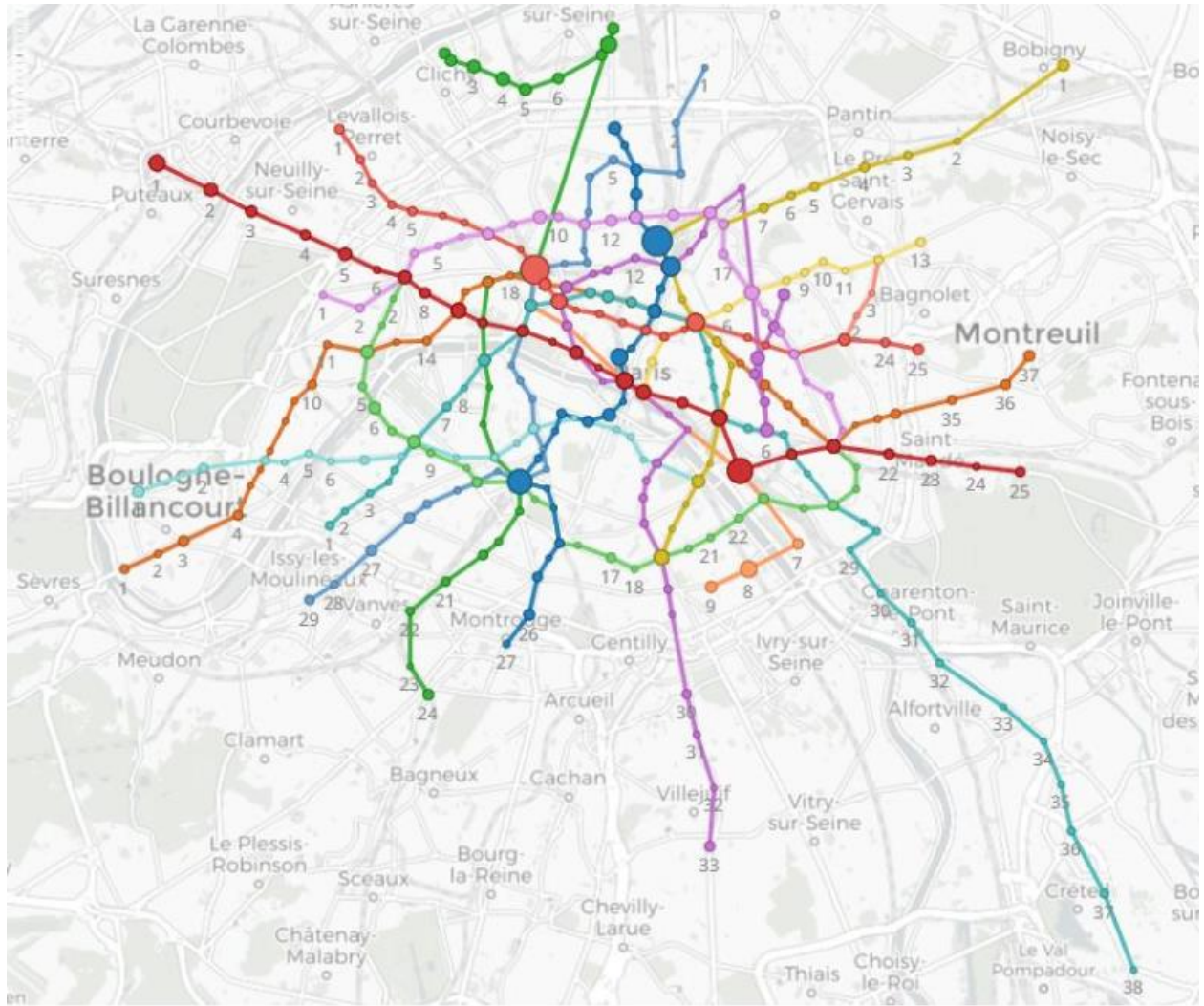


Figure 4-34. Map Plot with path lines between shapes.

NETWORK GRAPH

A Network Graph displays relationships between entities and can be used to identify correlations or flows between items.

The Network graph supports a two-level breakdown defining the “From”, and “To”, where each node (vertex / point), is either in the “From”, or “To” levels of the breakdown, and each edge (or line), represents the data specific to this “From → To” relationship.

The size of the node is specific to the number of interactions / relationships it has with other nodes. There can be up to two lines connecting two nodes, which can display arrows to show direction; and represent the “From → To” combinations. E.g. A → B, and B → A. Each line can also be colored to map to a numeric variable.

Customers use network graphs for investigating correlations, transactional flows, latency, and throughput bottlenecks.

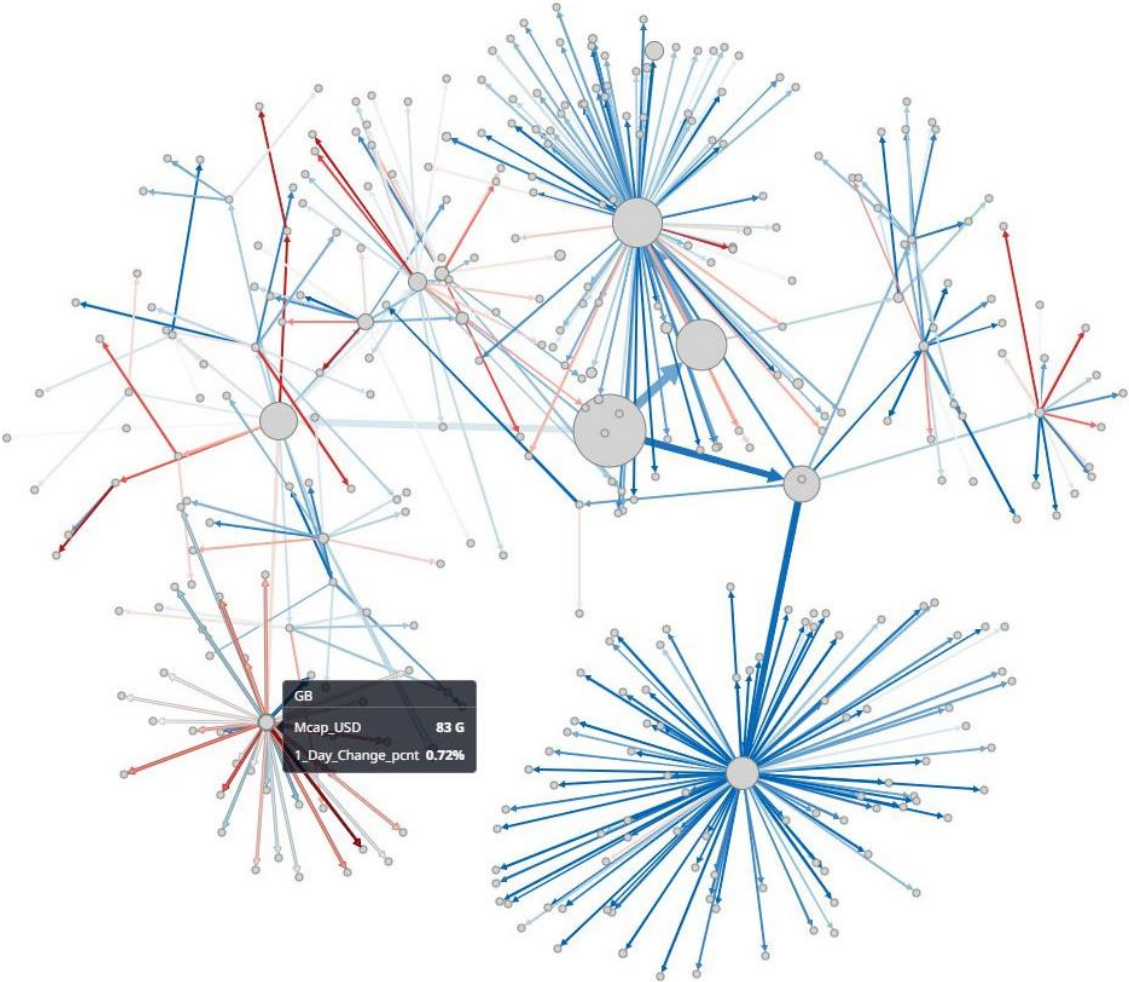


Figure 4-35. A Network Graph displaying clusters/groups and utilizing color and size.

NUMERIC LINE GRAPH

Numeric Line Graphs differ from the standard line graph in that they have a numeric X axis, rather than one based upon time.

They are commonly used in both scientific and financial scenarios to show trends in functions that are based on two numeric inputs (X and Y).

Common uses include the display of Yield Curves.

Numeric Line Graphs can also be used to display selected cuts through a [Surface Plot](#).

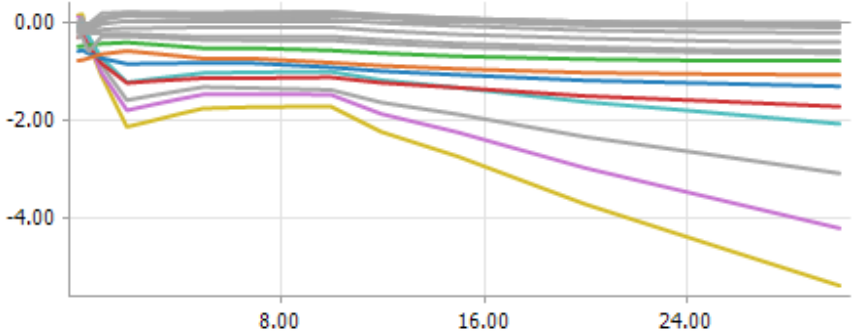


Figure 4-36. A numeric line graph.

Numeric Line Graphs can also be displayed on their side through a Vertical Numeric line Graph. These graphs are typically used in the Oil Industry for displaying drill sensor data.

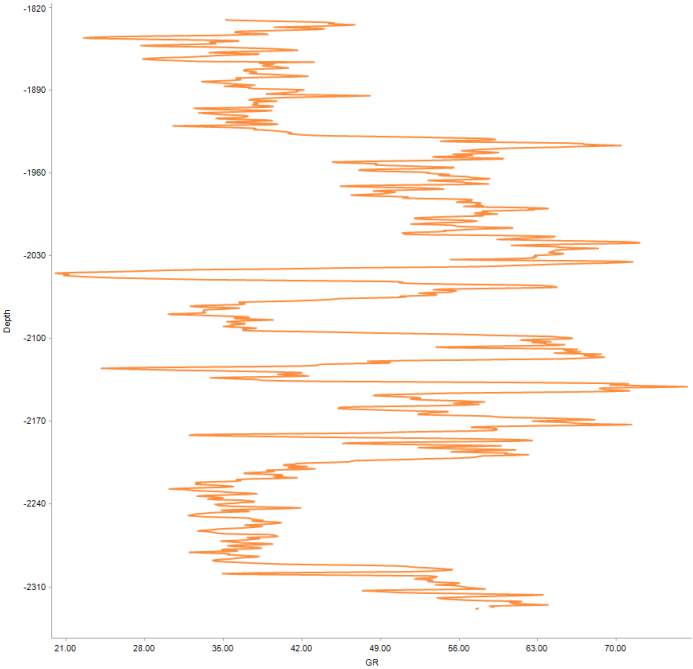


Figure 4-37. A Vertical numeric line graph.

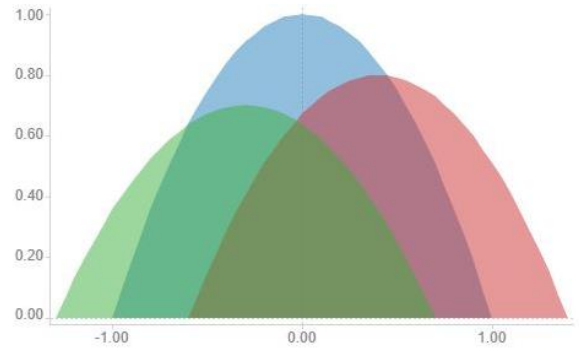
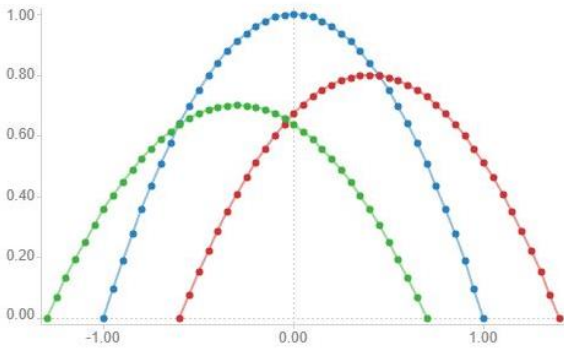
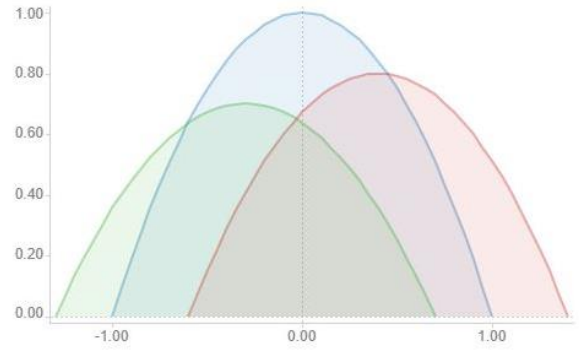
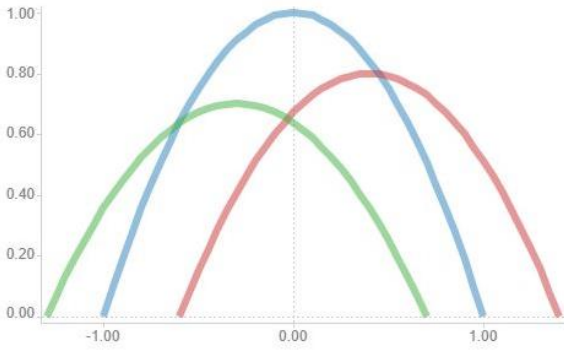


Figure 4-38. Several numeric line graphs.

NUMERIC NEEDLE GRAPH

Numeric Needle Graphs display price distributions.

Unlike a traditional Bar Graph, the X Axis is numeric rather than categorical. Bars are positioned along the X axis according to their X value, and their height is determined by their Y values. For the Horizontal variant, the X Axis represents the height, and the Y axis the price.

This allows gaps, and clustering in price to be more accurately identified, and are typically used for displaying price distributions and order book displays.

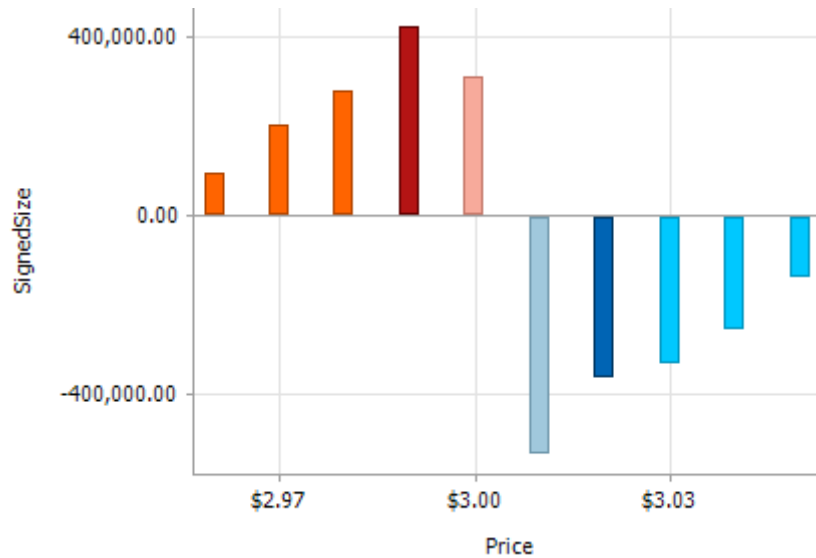


Figure 4-39. A numeric needle graph.

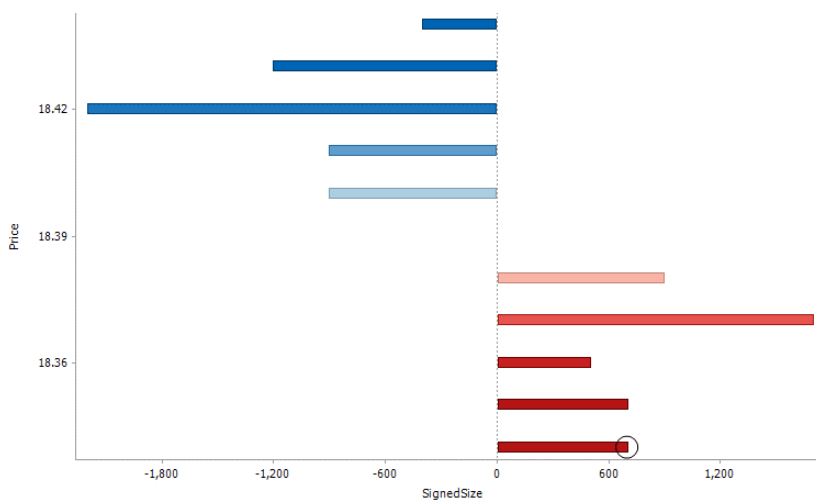


Figure 4-40. A horizontal numeric needle graph.

NUMERIC STACKED NEEDLE GRAPH

Numeric Stacked Needles again display price distributions.

Unlike the standard Numeric Needle Graph, multiple items can be identified at a single price.

A common usage is displaying client activity within an order book.

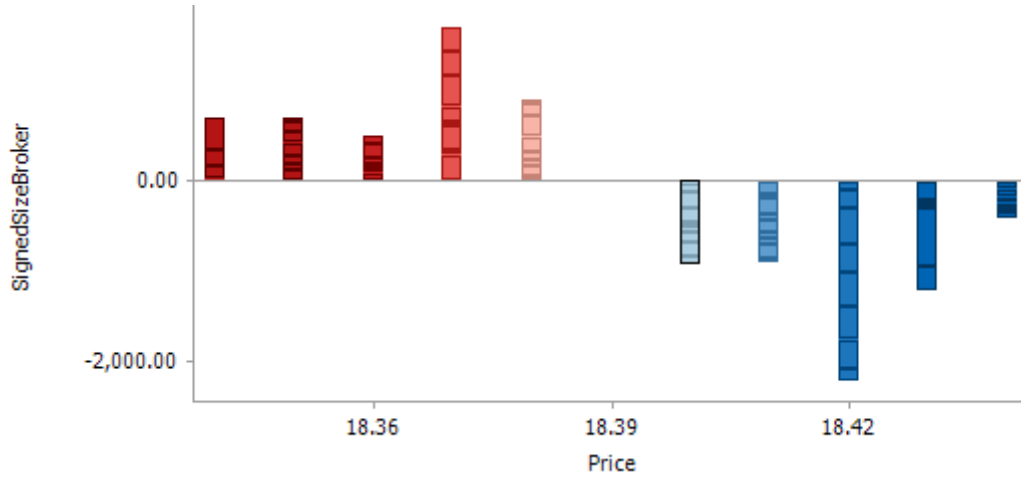


Figure 4-41. A separated numeric stacked needle graph.

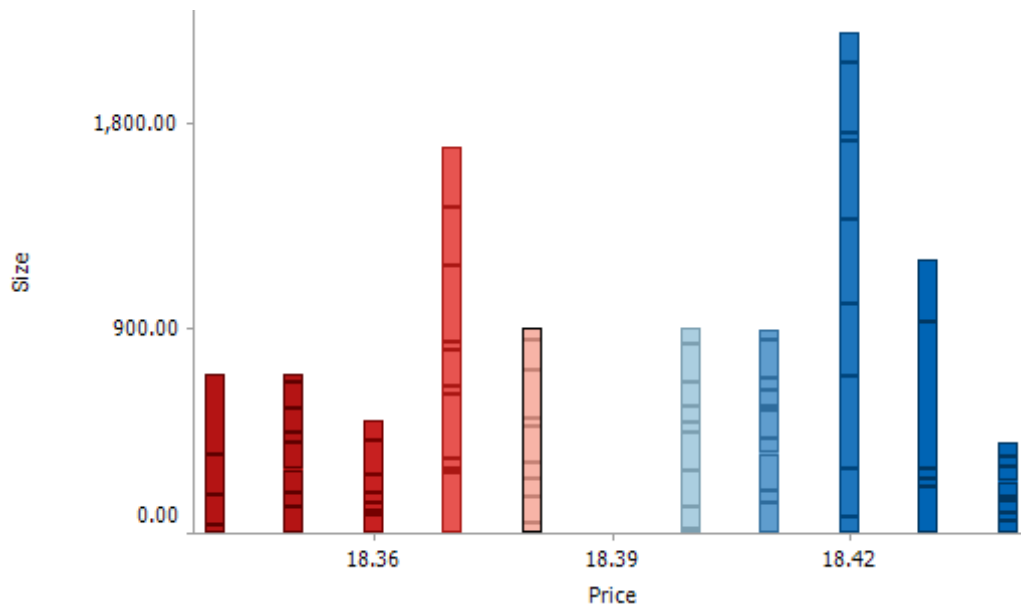


Figure 4-42. A numeric stacked needle graph.

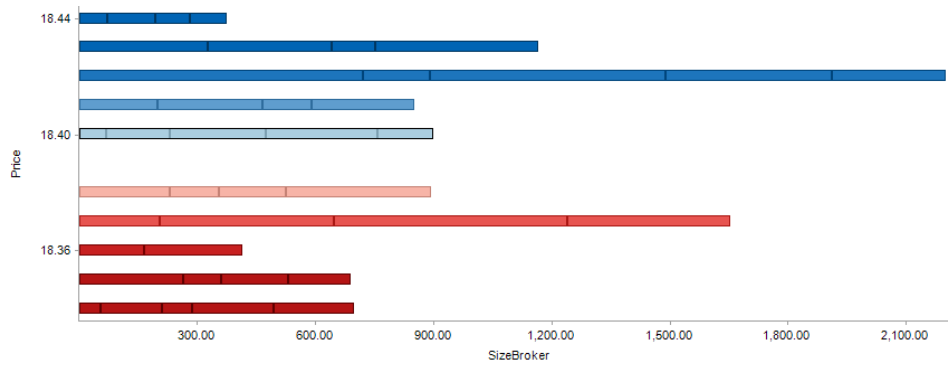


Figure 4-43. A horizontal numeric stacked needle graph.

PARETO CHART

The Pareto Chart is a combination of the [Bar Graph](#) and [Categorical Line Graph](#), and can be used for comparing actuals to forecasts, and if the dataset is available, comparing individual to cumulative returns.

The traditional usage of a Pareto chart displays individual values in a descending order as bars, with the cumulative total represented by the line.

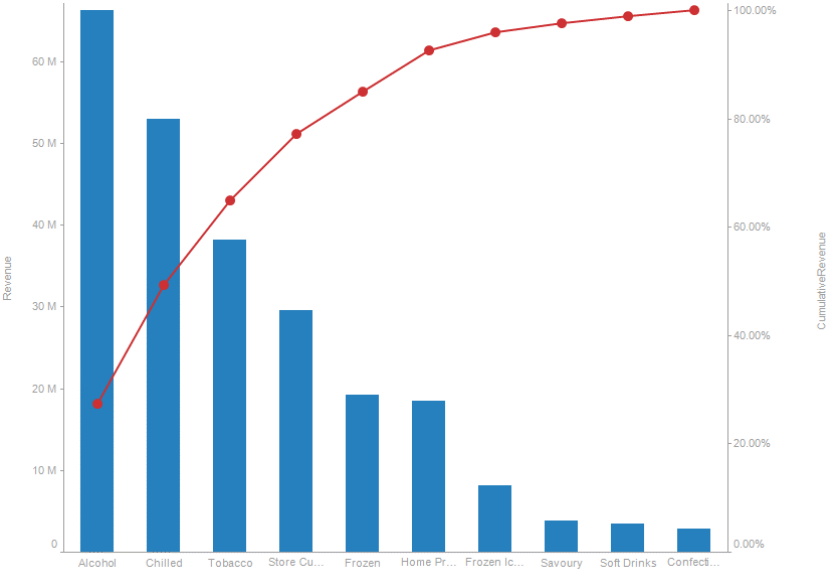


Figure 4-44. A classical Pareto graph.

A common usage of the Pareto chart is to compare actual values to forecast/target values, with the actuals being displayed as the bar, and the forecast as the line. In this scenario, typically both measures are bound to the left Y axis, so that they have comparable scales.

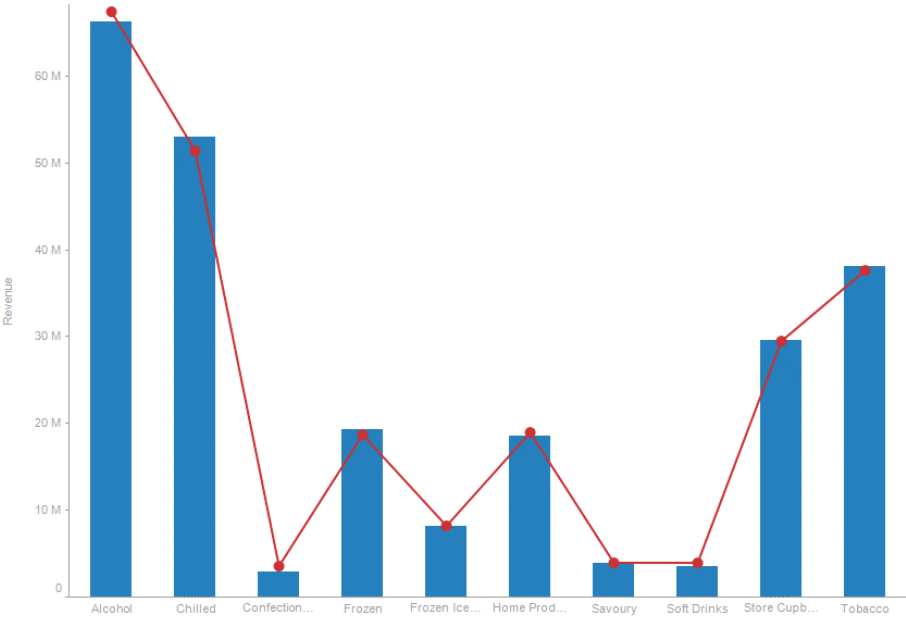


Figure 4-45. Displaying actuals vs. forecast values

PIE CHART

Pie Charts are one of the oldest and best-known visualizations for displaying contributions to a total.

Panopticon can produce standard Pie Charts in which the pie slice represents a numeric variable that is proportional to the total size of the pie. The color variable can represent either a category or another numeric variable.

Pie Charts can be flat, showing a single set of slices. They can also be hierarchical and display multiple levels of data in a variant called a Multilevel Pie Chart. This is also known as a Sun Burst or a Radial Treemap.

The user can modify the visible depth level and drill into particular slices to investigate further detail.

A recommended alternative to the Pie Chart is the [Treemap](#), which can display a larger number of data points, and is easier to compare constituent data points.

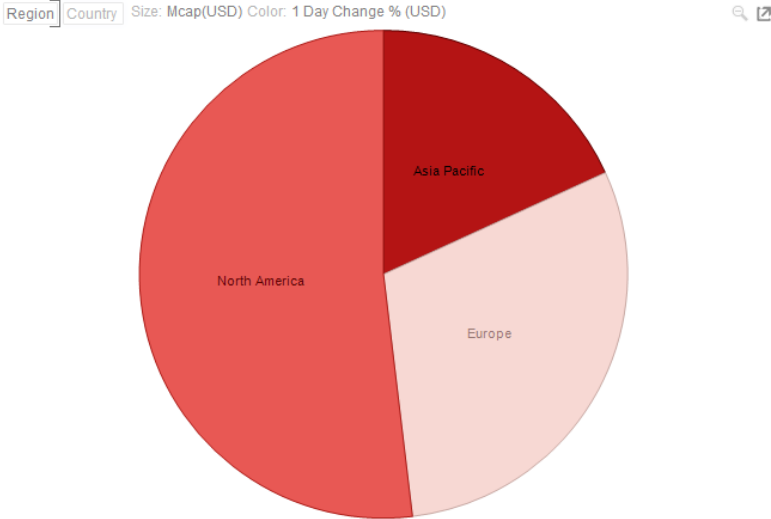


Figure 4-46. A typical pie chart.

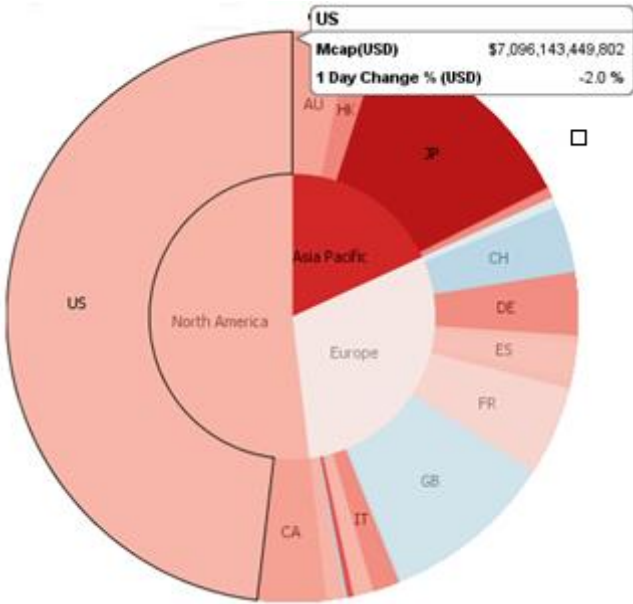


Figure 4-47. A multilevel pie chart (Sun burst).

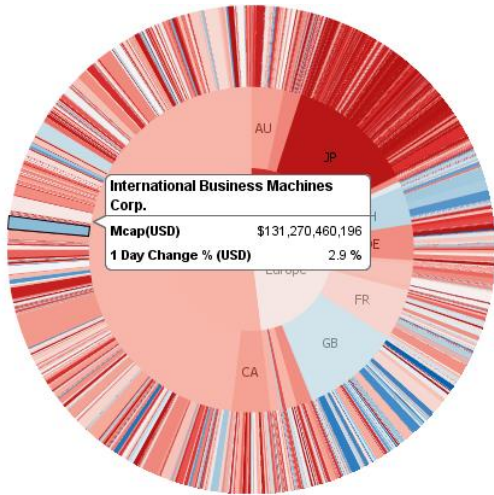


Figure 4-48. A multilevel pie chart with deeper hierarchy.

SCATTER PLOT

Scatter Plots are used to identify trends, clustering and outliers across a number of numeric variables, especially when investigating large data volumes.

Each scatter point is represented by:

- X Position
- Y Position
- Size
- Color (numeric or categorical)

A line of best fit can also be added to highlight outliers.

Panopticon's Scatter Plot data visualizations are easy to set up and highly customizable. You can configure your display in ways that will make the most sense to you and your users, and users have all the tools they need to filter and manipulate the Scatter Plot to concentrate on the most relevant subsets in the data.

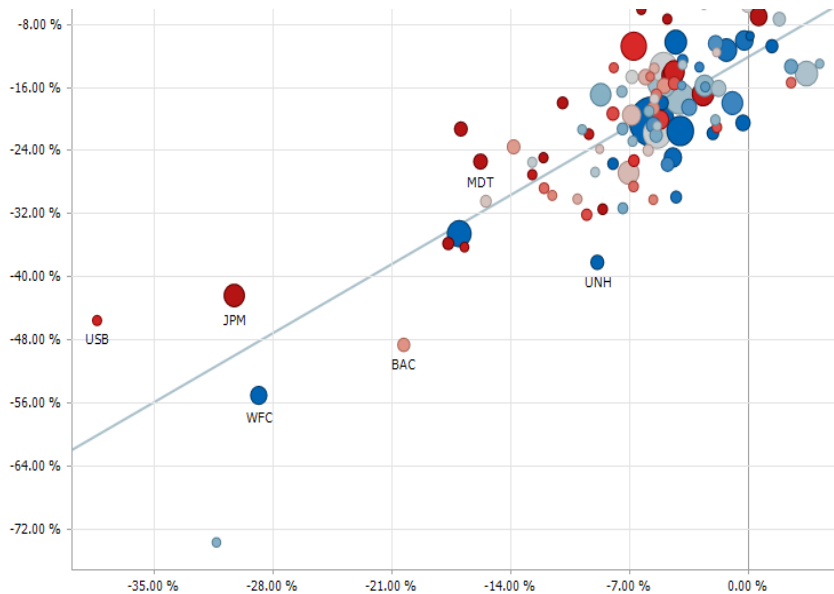


Figure 4-49. A scatter plot with line of best fit.

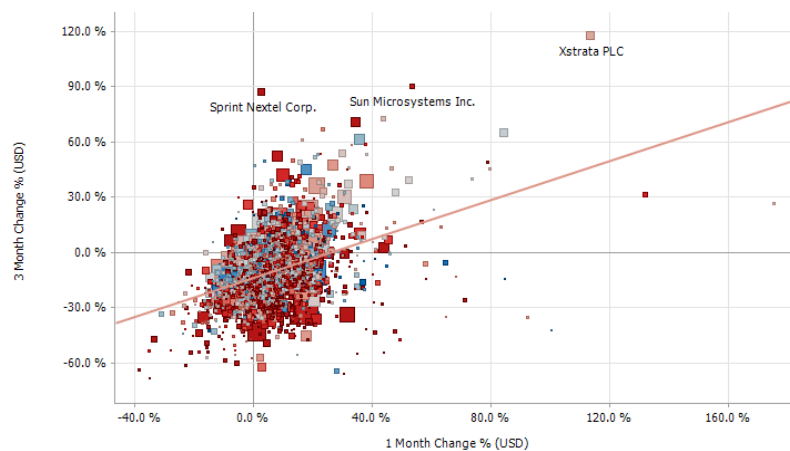


Figure 4-50. A scatter plot with square scatter points.

3D SCATTER PLOT

3D Scatter Plots are a 3D perspective version of the 2D Scatter Plot. They provide a clearer understanding of physical shapes in a 3D space. The Scatter Plot 3D is made up of a series of points where each point has X Position, Y Position and Z Position.

In addition, items can be sized by numeric data values, and colored by numeric or text data values. Items can also be shown as different shapes – either standard shapes available in Panopticon or custom shapes that you add to a custom shape palette.

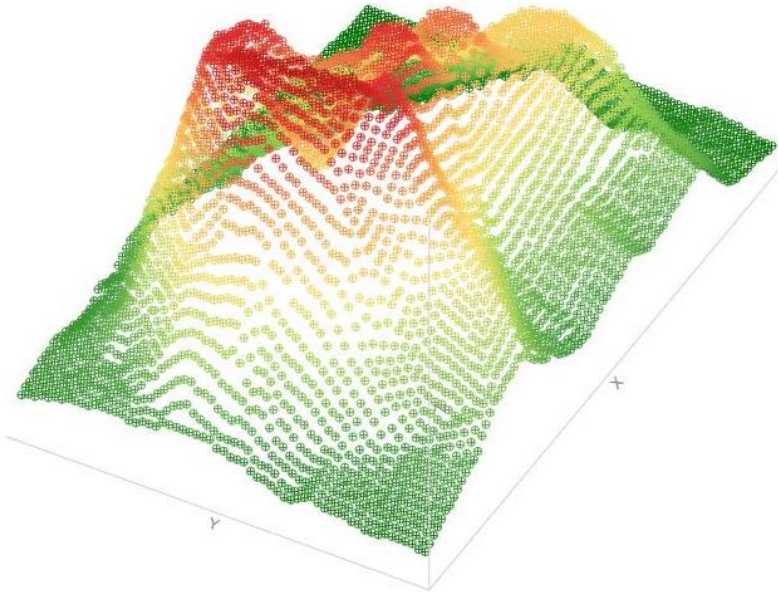


Figure 4-51. A volcano 3D Scatter Plot.

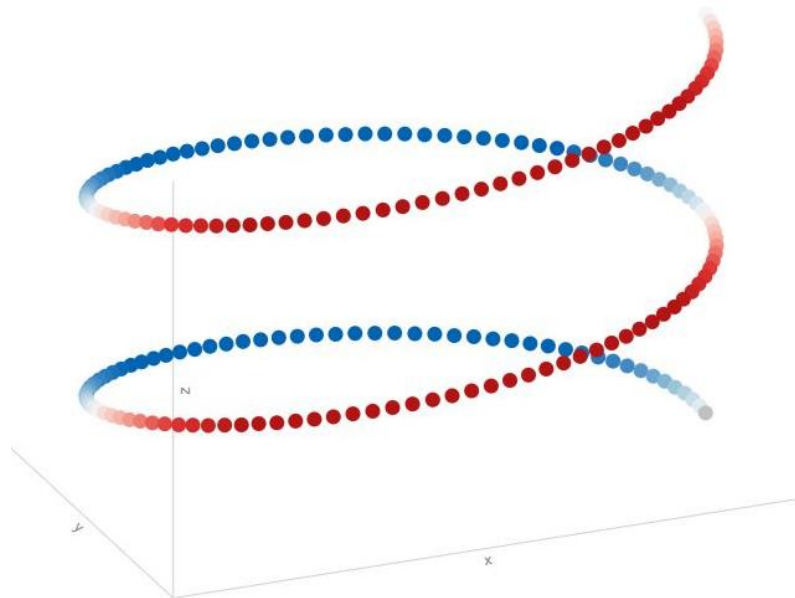


Figure 4-52. A spiral 3D Scatter Plot.

GEOGRAPHIC SCATTER PLOT

Use Geographic Scatter Plots to display data where physical location is important, and the background map image can be manually provided. These plots clearly show data correlations and clustering that is geographic in nature, and typically used for non-standard mapping.

If a standard map is required, then it is likely that the [Map Plot](#) should be used instead.

In Geographic Scatter Plots, the X and Y coordinates can correspond to longitude and latitude. The color and size of each scatter point represent other data variables.

As with standard statistical Scatter Plots, you can zoom and pan within the visualization to focus on specific areas of interest, but the underlying map image will not change.

As the background map image is manually provided, the visualization can be used for non-traditional maps, such as internal floor plans.



Figure 4-53. A geographic scatter plot.

SHAPES/CHOROPLETH

The Shapes visualization allows the display of Choropleth Graphs and other displays built from SVG Paths.

The Shapes visualization can be used to display data where both physical location and size are important.

They clearly show data correlations and clustering that is geospatial in nature.

Unlike the Geographic Scatter Plot, the size of each shape is fixed, imparting the importance of the item. As a consequence, data should be relative to each shape size, such as area densities.

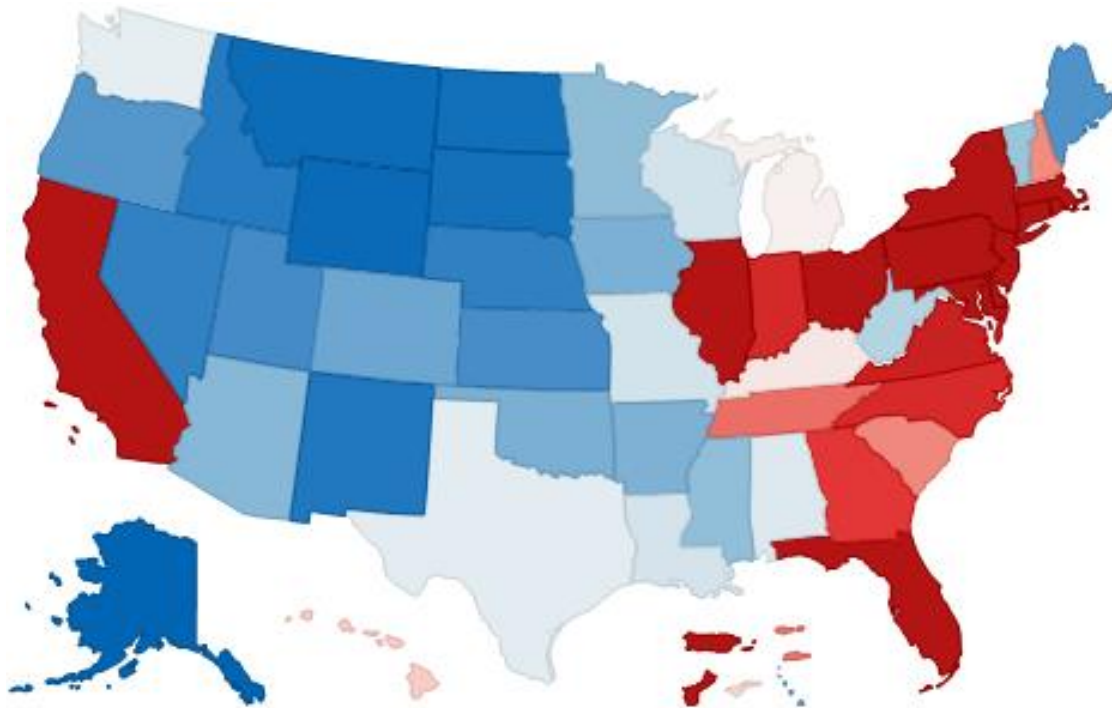


Figure 4-54. A shape visualization.

SURFACE PLOT

Surface Plots are used to identify trends and outliers within numeric surfaces.

The Surface is made up of a series of points where each point has:

- X Position
- Y Position
- Color (which represents the Z axis).

The Surface Plot can support data sets where the X and Y positions can both be regular and irregular in their distribution.

Additionally, the color scale can be continuous or stepped to show a surface gradient.

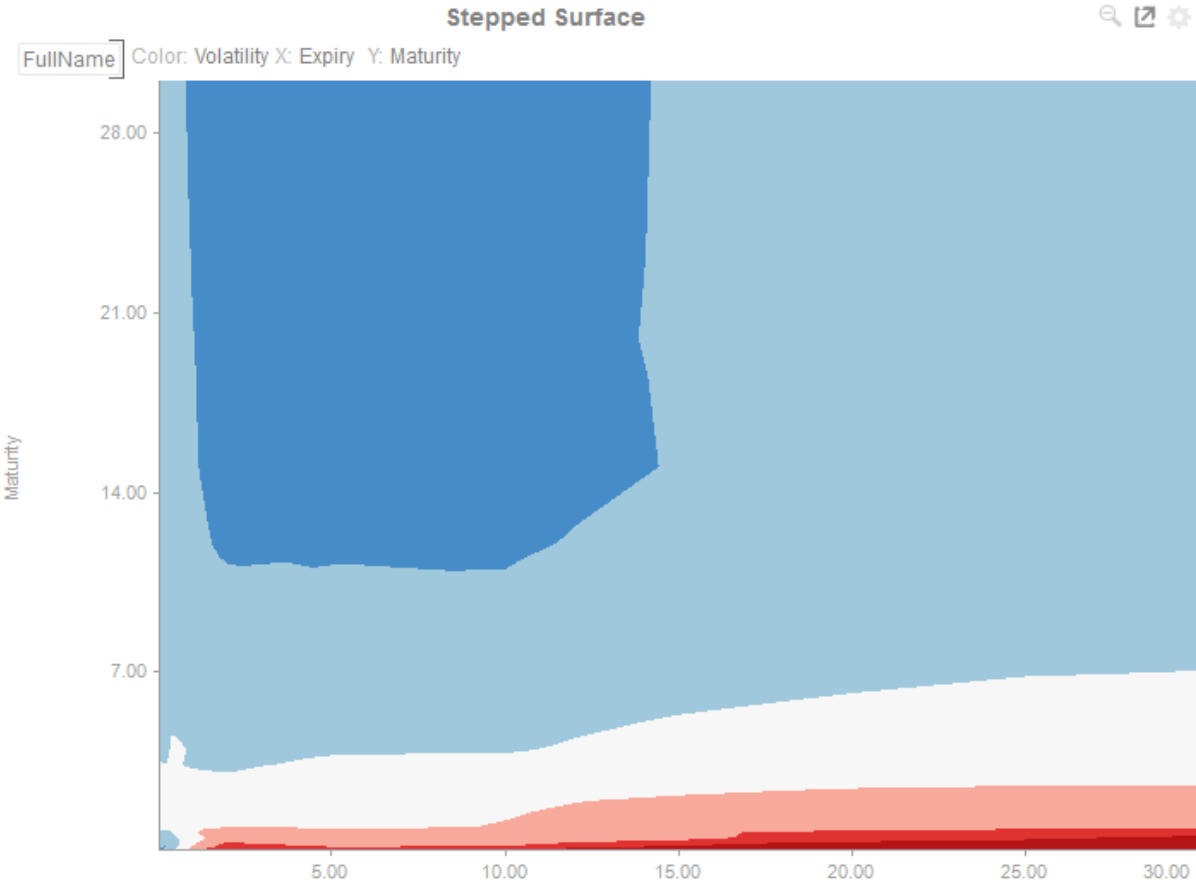


Figure 4-55. A surface plot with stepped colors.

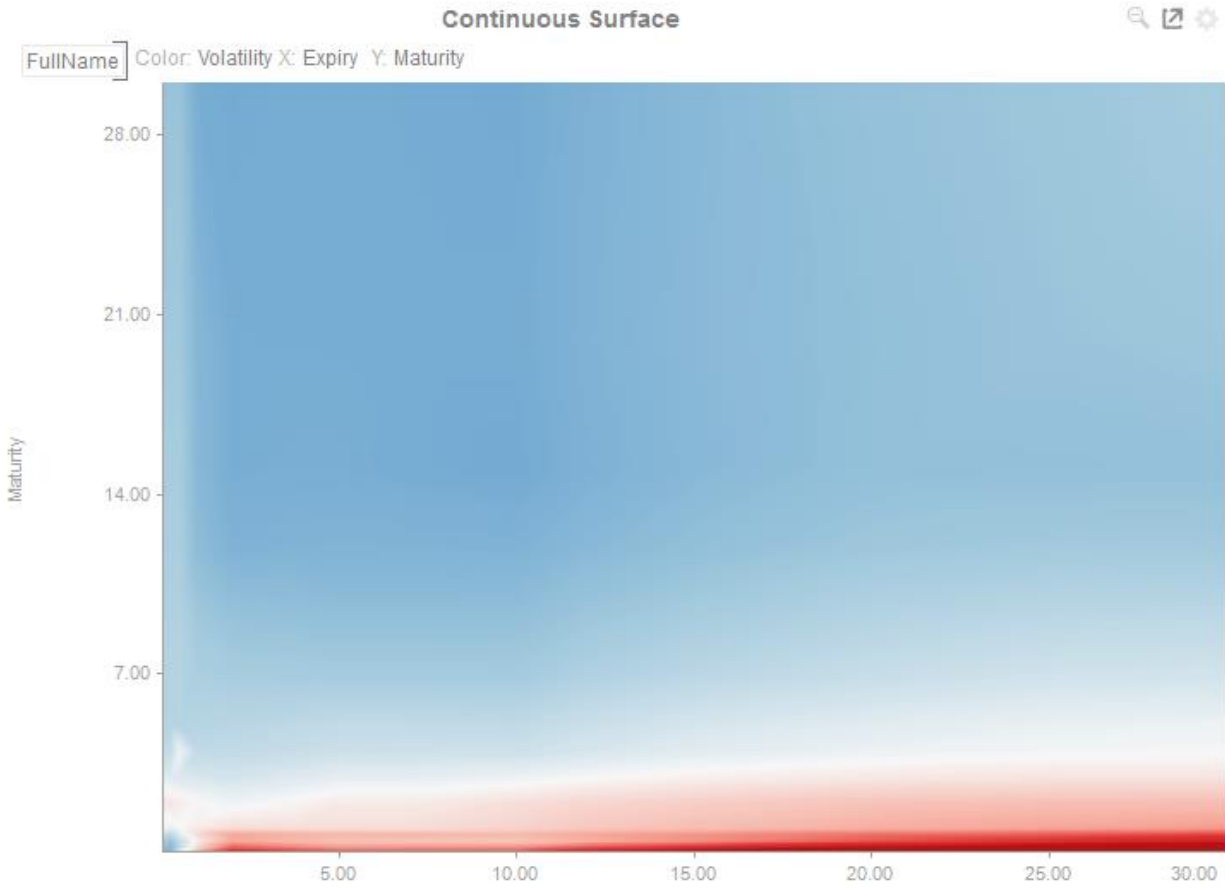


Figure 4-56. A surface plot with continuous colors.

3D SURFACE PLOT

3D Surface Plots are a 3D perspective version of the 2D Surface Plot.

They provide a clearer understanding of the overall “shape” of the surface but they also introduce occlusion problems; not all data points can be seen due to the display perspective.

The Surface Plot 3D is made up of a series of points where each point has:

- ❑ X Position
- ❑ Y Position
- ❑ Z Position (encoded by color)

The Surface Plot 3D can support data sets where the X and Y positions can both be regular and irregular in their distribution.

The color scale can be continuous or stepped to show a surface gradient.

Grid lines, a ground plane, and markers for data points can be shown if required.

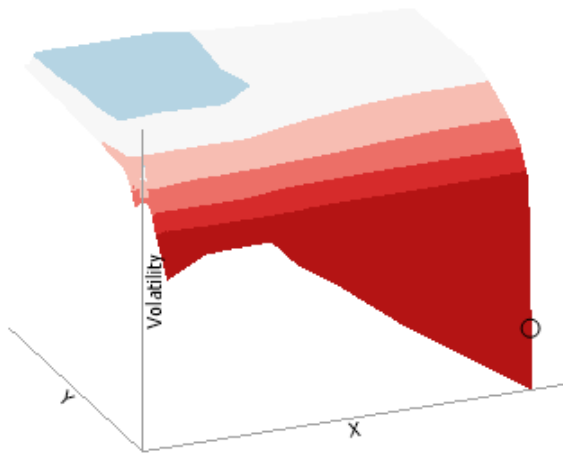


Figure 4-57. A 3D surface plot with stepped colors.

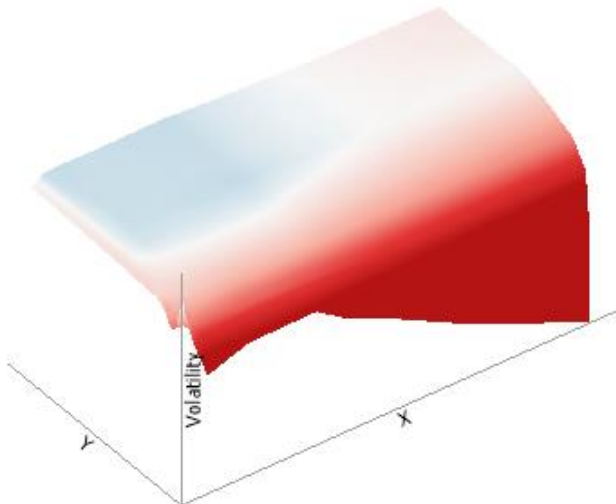


Figure 4-58. A 3D surface plot with continuous colors.

RECORD

A record visual is effectively a transposed table and can be used to display the metrics for one, or a few individual records (or aggregated records).

Like the table, metrics are added to “Visual Members”, but correspond to rows in the record (rather than columns in a table).

Row cells display their text value which may wrap into multiple lines.

Text can be colored either with a background or foreground.

Name	Apple Inc.
Exchange	NASDAQ
Forex	USD
Close(local)	105.12
Mcap(local)	93,444,860,130
Mcap(USD)	\$93,444,860,130
1 Day Change % (USD)	-1.62%
1 Week Change % (USD)	-2.36%
1 Month Change % (USD)	17.86%
Industry	Technology
Supersector	Technology

Figure 4-59. A Record showing a single set of aggregated metrics.

Name	Auckland International Airport Ltd.	Contact Energy Ltd.	Fletcher Building Ltd.	Sky City Entertainment Group Ltd.	Telecom Corp. of New Zealand Ltd.
Exchange	NZS	NZS	NZS	NZS	NZS
Forex	NZD	NZD	NZD	NZD	NZD
Close(local)	1.71	5.72	6.00	2.81	2.28
Mcap(local)	1,893,049,977	1,629,383,110	3,036,292,974	1,339,885,230	4,155,174,174
Mcap(USD)	\$1,080,458,274	\$929,970,410	\$1,732,964,215	\$764,739,495	\$2,371,565,660
1 Day Change % (USD)	0.54%	-7.03%	-6.29%	-3.15%	-0.04%
1 Week Change % (USD)	0.87%	-2.78%	-1.36%	1.73%	-1.45%
1 Month Change % (USD)	7.83%	12.01%	27.56%	18.36%	5.60%
Industry	Industrials	Utilities	Industrials	Consumer Services	Telecommunications
Supersector	Industrial Goods &	Utilities	Construction & Materials	Travel & Leisure	Telecommunications

Figure 4-60. A Record visual showing multiple sets of aggregated metrics.

TABLE

A table can be used to display a small dataset where all the values are visible or the aggregate values of a larger data set.

The table can be configured to show hierarchies, allowing sub totals and grand totals to be displayed. Additionally, branches of the hierarchy can be expanded and collapsed.

The table can be sorted by clicking on a column heading, and sorting is applied across the defined hierarchy.

Columns widths can be adjusted manually or automatically, and columns can be hidden when required.

Columns cells can be represented in their value form or, alternatively, graphically as a series of micro-charts including:

- Bullet Graph
- Bar Graph
- Dot Plot

Industry	Mcap(USD)	1 Day Chang...	1 Week Change ...	1 Month Chang...
Basic Mater...	889,465,969,106.00	-6.12	-5.16	17.26
Consumer ...	1,860,384,194,222.00	-6.42	-3.35	15.19
Consumer ...	1,399,419,319,489.00	-4.24	-2.92	13.47
Financials	2,546,812,258,311.00	-13.67	-12.54	44.40
Health Care	1,698,382,149,841.00	-0.93	-0.01	1.41
Industrials	1,665,548,943,290.00	-10.22	-6.62	27.80
Oil & Gas	1,661,193,841,291.00	-4.56	-7.57	8.01
Technology	1,456,797,585,162.00	-2.64	-1.16	12.45
Telecommu...	787,667,544,952.00	-0.51	-0.54	0.92
Utilities	811,127,128,583.00	-1.07	-2.83	-0.07

Figure 4-61. A simple table.

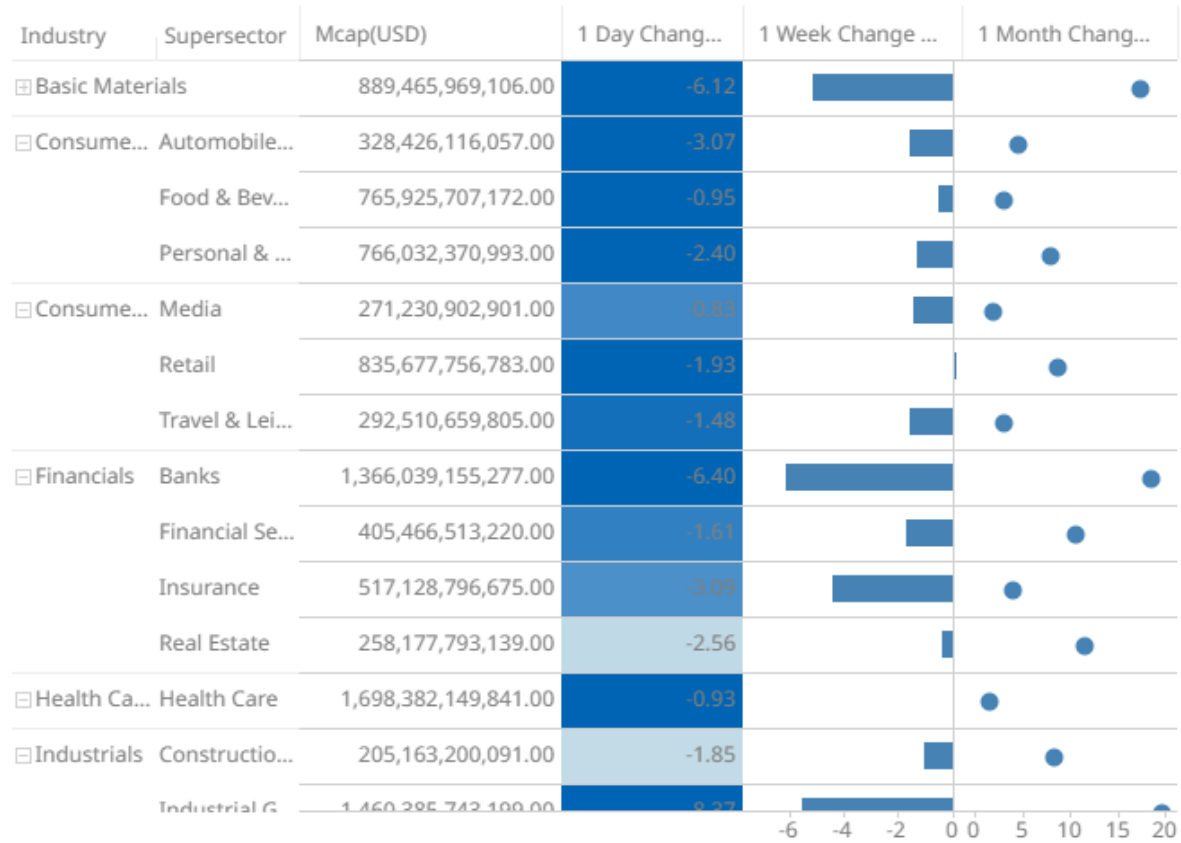


Figure 4-62. A table with hierarchy, totals, and micro-charts.

TICKER TILE

The Ticker Tile is used to display three metrics, typically:

- ❑ Price
- ❑ Change in Price
- ❑ % Change in Price

Where the price is displayed in a double height label, the change in price to the bottom left of the tile, and the color shown as the background of the tile, and the numeric value displayed in the bottom right of the tile.

Icons can also be added to the tile to indicate the change in other metrics.

As with all visualizations, as data changes the tile will automatically update.

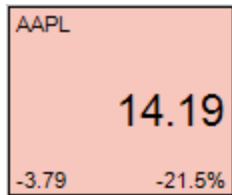


Figure 4-63. A Ticker Tile for a single stock.

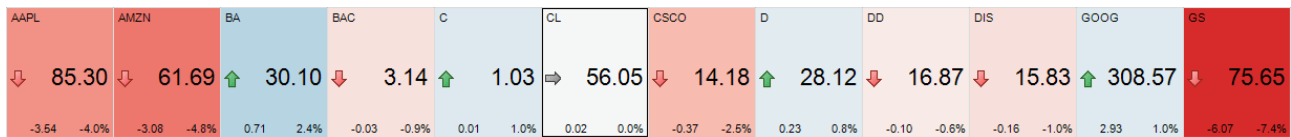


Figure 4-64. A Cross Tab of Ticker Tiles for a Selection of Stocks

TREEMAP

Treemaps represent hierarchical data sets, showing both each level in the hierarchy and how they interact with each other.

They are represented by a colorful mosaic of rectangular cells based on your data. The size of a cell reflects its importance. The color conveys urgency or variance:

- White – Target/Benchmark Performance
- Red – Under Performance
- Blue – Over Performance

The intensity of the red or blue shades indicates the level of under- or over-performance.

Most people can learn to understand the information presented in a Treemap in under a minute – even if that Treemap is showing data representing an underlying data set of thousands of records.

Our Treemaps are not static pictures. The real value of the visualization is quickly apparent when you interact with the data. Users can zoom, filter, and view details on demand, as well as link to and highlight other sources of information. For example, fund managers can link to a trading system directly from within the Treemap.

EX supports two different styles of Treemaps:

- Classic Treemaps
- Cluster Treemaps

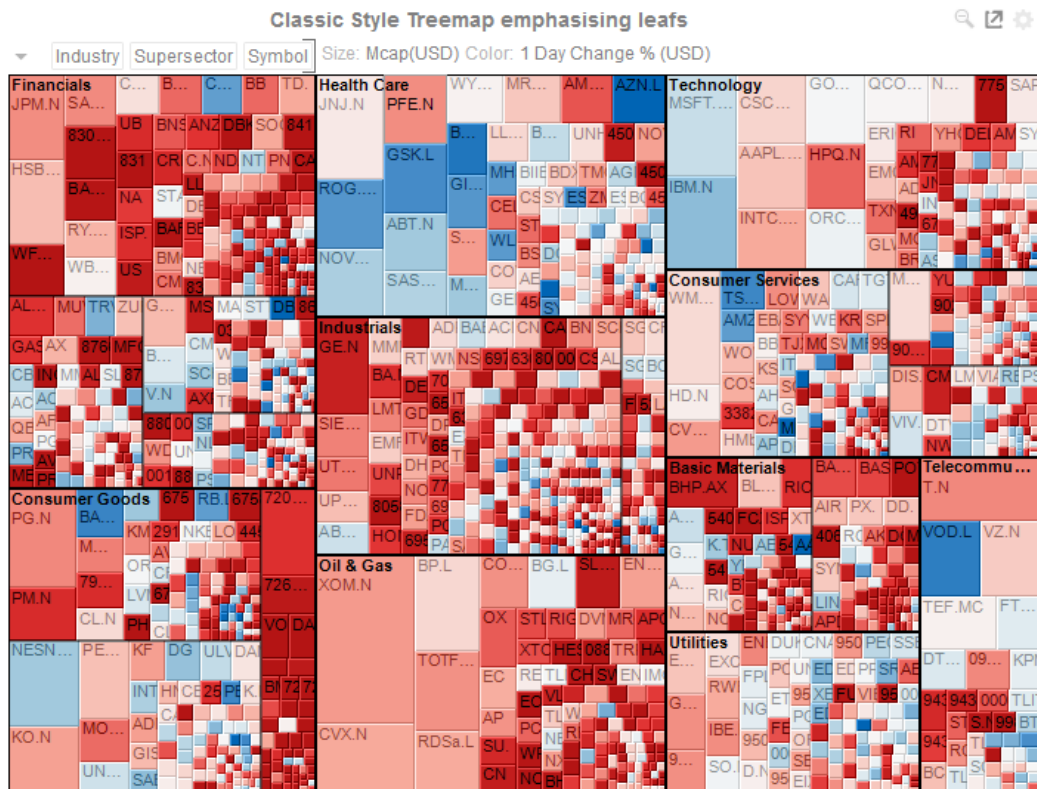


Figure 4-65. Classic Style Treemap

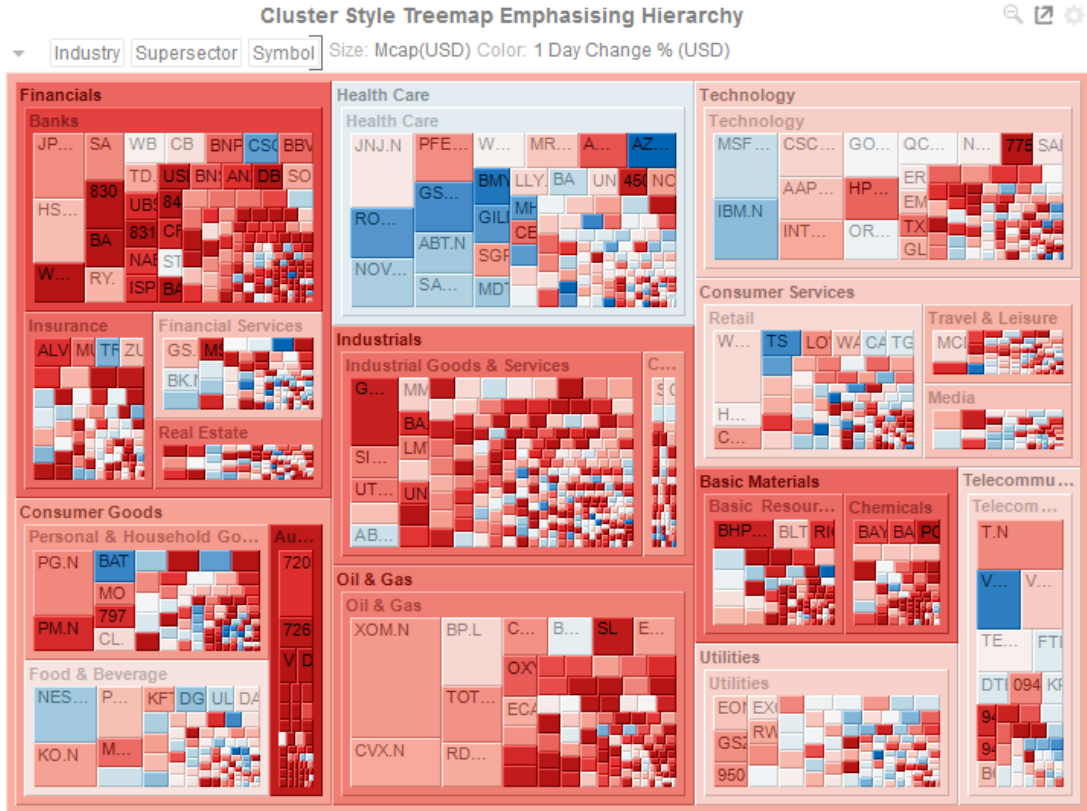


Figure 4-66. Cluster Style Treemap

WATERFALL CHART

Waterfall Charts are a form of cumulative Bar Chart, showing the cumulative effect across a series of changes. They can aid in the understanding of how performance changes contribute to a final position. Color can be used to represent either a Stage in the process, or the change in performance for that stage.

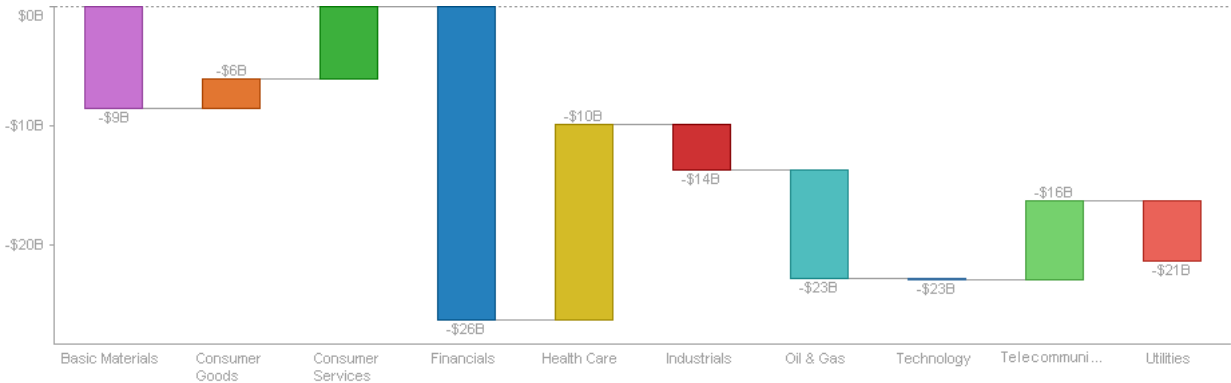


Figure 4-67. A Waterfall Chart with categorical color and cumulative performance value labels

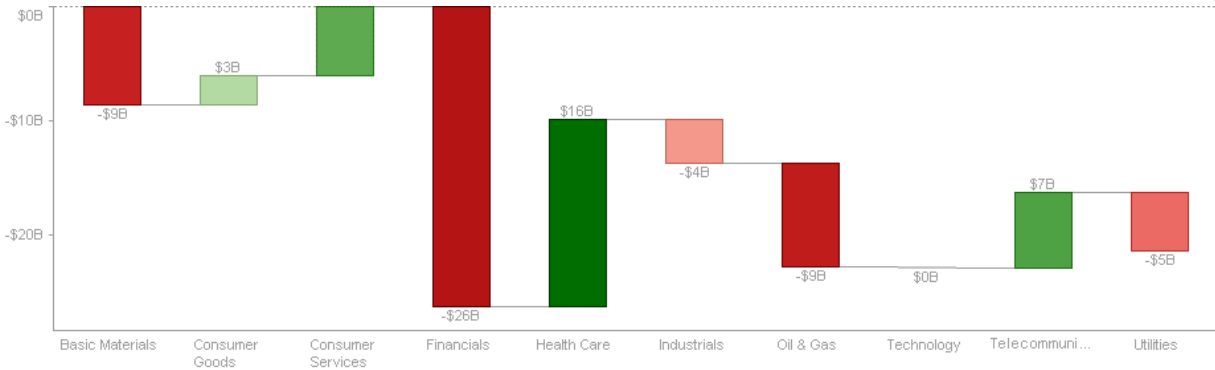


Figure 4-68. A Waterfall Chart with color and value labels showing performance change

[5] COMBINATION VISUALIZATIONS

Combination Graphs allow combining multiple variables as layers in a series graph sharing a common x-axis.

Unlike other visualizations, the Text-, Numeric- and Time Combination Graphs allow combination of many variables, based on different columns of a data table, each rendered independently, using a selected visualization.

The Time Combination Graph allows rendering using the following visualizations:

- Line
- Candle Stick
- Bar
- Grouped Bar
- Stacked Bar
- OHLC (Open-High-Low-Close)
- Order Book
- Price Band
- Scatter
- Spread
- Stack

The Text- and Numeric Combination Graphs support the following visualizations:

- Line
- Price Band
- Bar
- Grouped Bar
- Stacked Bar
- Scatter
- Spread
- Stack

All of the combination graphs also support reference lines, left and right y-axis as well as cross-tabbing, to create multiple small visualizations across dimensions.

TIME COMBINATION GRAPH

The Time Combination Graph combines a series of time series visualizations as individual layers of the total display. As a consequence, more complex time series visualizations can be built from the “base” visuals.

Each visual can be assigned to either the left or right Y axes, allowing multiple scales to be represented.

For example, the following visualization includes:

- Candle Stick Graph – Showing the distribution of prices (OHLC)
- Line Graphs – Showing moving averages of the closing price
- Bar Graph – Showing traded volume across the period

□ Spread Graph – Showing a price band across the period.

Each of the visuals has a defined “Z” order, which in this case places from back to front:

Spread, Bar, Candle Stick, Line

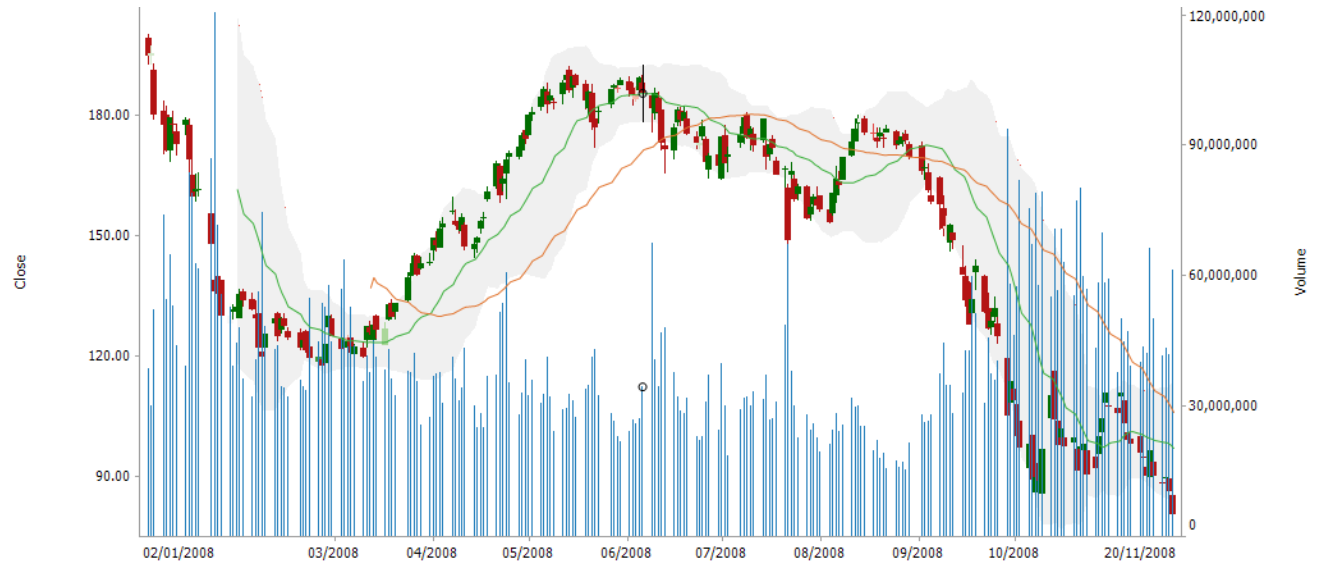


Figure 5-1. A time combination graph.

12.2023

ABOUT PANOPTICON

For more information on Panopticon and other resources, go to <https://www.altair.com/panopticon>.