Create Custom Graphs in SAS® Visual Analytics Using SAS® Visual Analytics Graph Builder

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ABSTRACT

SAS® Visual Analytics Designer enables you to create reports with different layouts. There are several basic graph objects that you can include in these reports. What if you wanted to create a report that wasn't possible with one of the out-of-the-box graph objects? No worries! The new SAS® Visual Analytics Graph Builder available from the SAS® Visual Analytics home page lets you create a custom graph object using built-in sample data. You can then include these graph objects in SAS Visual Analytics Designer and generate reports using them. Come see how you can create custom graph objects such as stock plots, butterfly charts, and more. These custom objects can be easily shared with others for use in SAS Visual Analytics Designer.

INTRODUCTION

The SAS® Visual Analytics Graph Builder (Graph Builder) is a new application that was added to the 6.3 version of the SAS® Visual Analytics suite of products. Included in this suite of products is the SAS® Visual Analytics Designer (Designer), an application that enables you to design reports of your data using out-of-the-box visual objects, including a pre-defined set of graph objects. The properties pane that is part of the Designer enables you to customize these objects to a certain degree. With the new Graph Builder application and its associated properties pane, you can build elaborate custom graph objects. You can then easily use the custom graph objects yourself or share them with others in the Designer by associating data with them and creating reports. You can create reports with the custom graph objects the same way you create reports using the built-in Designer objects. Using carefully constructed graph objects and then associating real data with them in the Designer, you can reveal associations in data, recognize patterns, and construct simple or complex reports as needed for the visual analysis.

Some of the key features of the Graph Builder are as follows:

- Drag and drop charts and plots onto a canvas.

- Combine and arrange the graphs as needed.

- Determine and configure which data roles become available for assignment in Designer.

- Specify the visual attributes of the graphs. You can specify properties for each graph type, for the graph cells, for the axes, and for the legend.

Audience: The audience for the Graph Builder consists of SAS® Visual Analytics users who are knowledgeable about graphs and who need to create graphs to explore the data or to present the results of their analyses. They might also be individuals who create graph objects for others who are looking to create reports that are not possible with out-of-the-box objects in the Designer.

GETTING STARTED

The Graph Builder web application can be launched by logging on to SAS® Visual Analytics and clicking the *Build Custom Graph* link under Common Actions on the right side of the home page. Alternatively, you can launch the application by using the application bar at the top of any Visual Analytics application and choosing *Build Custom Graph* from the home drop-down list. You will find the same option under the pull-down menu under *More Actions* on the top-level application bar of the home page.

THE GRAPH BUILDER USER INTERFACE

When you launch the application, you see the layout as shown in Figure 1. The three-pane layout is similar to the layout in the Designer application.
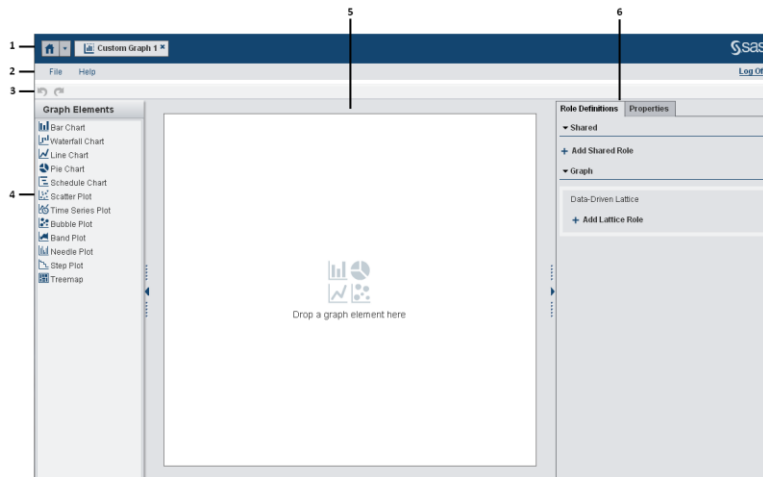
Figure 1. Layout of Visual Analytics Graph Builder Application

The different parts of the layout are as follows.

1. Application bar. Enables you to return to the Home page as well as launch other Visual Analytics applications from a pull-down menu. In addition, if other applications are already open, then a button is displayed for each application, enabling you to quickly switch between applications.

2. Menu bar. Enables you to create, open, and save your graph objects. The Help menu provides short how-to topics as well as a user's guide. At the far right on this bar, you can log off from SAS® Visual Analytics.

3. Toolbar. Contains icons that enable you to undo and redo changes to your graph objects.

4. Left pane. Contains graph elements that you can drag and drop onto the central pane, or canvas.

5. Center pane (canvas). Area where you build a graph object.

6. Right pane. Provides tabs that enable you to specify data roles and visual properties for your graph objects.

LEFT PANE

The left pane, also known as the Graph Elements pane, contains charts, plots, and graphs. These are the building blocks you use to create custom graph objects in the Graph Builder application. The list of graph elements available in the left pane are the following: Bar Chart, Waterfall Chart, Line Chart, Pie Chart, Schedule Chart, Scatter Plot, Time Series Plot, Bubble Plot, Band Plot, Needle Plot, Step Plot, and Treemap.

CENTER PANE

The center pane is the canvas area used to construct a graph object. You drag and drop the graph elements available in the left pane onto the canvas. In Figure 2, you can see different areas highlighted in green where you can drag and drop graph elements. You can combine and arrange the graph elements as needed. For example, you can layer multiple graph elements in a cell, create a lattice of cells in rows and columns, or combine these layouts.
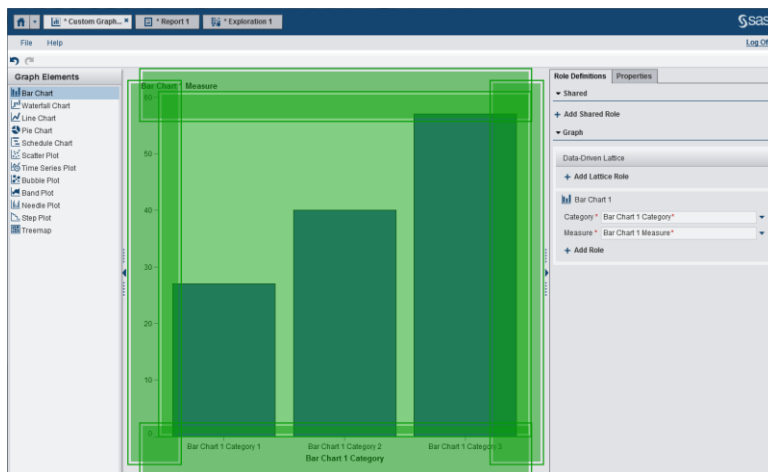
Figure 2. Center Pane (All possible drag and drop areas are highlighted in green.)

RIGHT PANE

The right pane provides two tabs that enable you to customize the data roles and properties of individual graph elements and their internal components.

Role Definitions Tab

The Role Definitions tab enables you to create new shared roles, modify names of existing roles, and add new roles.

Role Names

When you drag and drop a graph element onto the canvas, the required roles for that graph element are created with default names on the Role Definitions tab. You can specify different names for the roles by changing the default names.

When you specify the name for a role definition, choose a name that helps report designers understand which type of data to assign. Role names should be meaningful to report designers. Example names are Category, Response, Time, X variable, Y variable, Numeric X variable, Numeric Y variable, and so on. Normally, you do not specify names that reflect the particular data, such as sales items, unless you know that the graph object will be used only with that particular data.

Shared Data Roles

If your graph object contains multiple graph elements, you can specify that some data roles be shared across two or more graph elements. You share data roles when you want the graph elements to use the same data role for either of their axes or other graph roles. Then, when a report designer assigns roles to this graph object in a report, a single data column or row is assigned to all roles that use the shared role. If the graph element types are compatible, overlaid graph elements are automatically assigned a shared role on certain axes. Shared roles are very useful in a user-defined lattice. They enable you to manage data roles across columns and rows.

Properties Tab

To change the properties of a graph element such as a bar chart, you must first select one of the bars of the graph element. Similarly, to change the properties of an axis or a legend, you must first select the component by clicking on any part of the X or Y axis or on the legend.

When you select a component in a graph object, the selected component is highlighted. The component is also displayed in the drop-down list at the top of the Properties tab and can be selected by choosing from this drop-down list. The available properties vary depending on the selected component.

Figure 3 shows a highlighted bar chart. The Properties tab displays the properties for the bar chart, which is identified as Bar Chart 1**.**
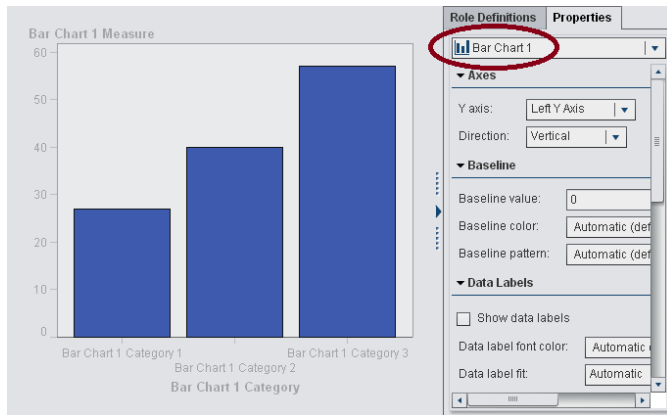
Figure 3. Bar Chart Selected and Displayed in the Properties Tab

When you have multiple graph elements on the canvas, you can click on the ▼ beside the drop-down list on the Properties tab, and then select the component that you want to modify. Selection of data element depends on the graph type. To select a graph element, you can select any part of the graph. For example, in a line chart or a time series plot, click a data point on a line; to select an axis, click directly on the axis; to select the entire graph object, click above the graph element or cell area. For a multi-cell graph object, click the background area just above the graph element. The cell is highlighted and a tab appears in the upper left corner of the cell. From the cell's tab, you can delete and reorder graph elements. You can also move graph elements to other cells.

Custom Graph Properties

Custom graph properties determine the overall appearance of the graph, including the background and border colors. Here are some changes that you can make on the Properties tab when custom graph is selected in a graph object:

- Show or hide missing data.

- Specify an overview axis for the graph. When you specify an overview axis, you can select which graph elements to include in that axis.

- Specify how graph attributes are rotated for graph data.

- Change certain appearance attributes of the graph, including border lines and the graph background.

Graph Element Properties

Graph element properties determine features that affect the appearance of the plots and charts in a graph. The types of properties that you see vary depending on the type of graph element that you are modifying. In general, you can specify colors, marker symbols, line attributes, and outline and fill colors.

To change the properties for a graph element, select the graph element, and then make your changes on the Properties tab.

Legend Properties

By default, a legend always appears when the graph object contains two or more graph elements. You can remove graph elements from the legend. Generally if you remove all graph elements, then the legend disappears from the graph object. There are instances when the legend appears with a single graph element (for example, with a Pie Chart or a Waterfall Chart.)

To change the properties for a legend, select the legend in the graph object, and then make your changes on the Properties tab.

Here are some changes that you can make to the legend:

- Show or hide the border and specify its appearance.

- Specify the formatting and style for the title.

- Specify which graph elements are included in the legend. In the *Display in legend* section, select or clear visibility of graph elements in the legend.

Axis Properties

The types of axis properties that you see vary depending on the type of axis that you are modifying.

Here are possible types:

- Discrete: The axis contains independent data values rather than a range of numeric values. Each distinct value is represented by a tick mark. Discrete is the default axis type for character data. Some graph elements require a discrete axis. For example, bar charts use a discrete axis for the Category role.

- Linear: The axis contains a linear range of numeric values. Linear is the default axis type for numeric data. Some graph elements require a linear axis. For example, bar charts use a linear axis for the Measure role.

- Time: The axis contains a range of date, time, or date-time values.

To change the axis properties for an axis, select the axis in the graph object, and make your changes on the Properties tab.

Here are some changes that can you can make to the axis:

- Reverse the axis order.

- Show or hide the axis elements, such as the axis line, tick marks, and grid lines.

- Change the appearance of tick marks, tick values, axis labels, and grid lines.

- Merge two or more column axes or two or more row axes.

- Specify the lowest and highest axis range tick offsets.

- Specify an alternate axis for a graph element. For example, you can use the left or the right Y axis for the Measure role of a bar chart.

ANATOMY OF A GRAPH OBJECT

The different parts of a typical graph object are shown in Figure 4 and explained below.
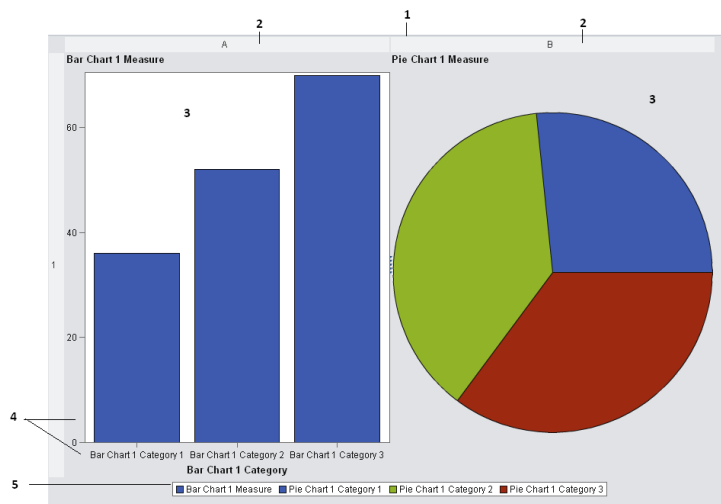

Figure 4. Parts of a Graph Object

1. Graph object. Consists of one or more cells that contain a composite of one or more graph elements overlaid on top of each other.

2. Cell. A distinct rectangular area of a graph object that can contain graph elements, axes, and legends. Multiple cells are arranged as columns and rows. The example graph object contains two cells that are arranged as columns.

3. Graph element. A visual representation of data, such as a scatter plot or a bar chart. The example shows a bar chart and a pie chart, each in its own cell. Multiple compatible graph elements can be overlaid in a cell.

4. Axis. Collectively refers to the axis line, the major tick marks and values, and the axis label. In multi-cell graph objects, the columns and rows of cells can share common axes if the cells have the same data type.

5. Legend. Collectively refers to the legend border, one or more legend entries (where each entry has a symbol and a corresponding label), and a legend title.

INTERACTIONS

The Graph Builder was designed to clarify the layout options available for custom graphs. As you add graph elements and build your template layout, the software reacts to show your layout options. In addition, changing the layout or overlay order of graph elements is easily done though drag-and-drop functionality.

DRAG AND DROP GRAPH ELEMENTS TO CREATE A LAYOUT

The primary way to add graph elements to a layout in the Graph Builder is to drag an element from the left pane and drop it onto the canvas. As you drag an element over the canvas, the places you can drop the element are highlighted and outlined in green, and a green plus symbol appears with the cursor. For example, when you drag the first graph element onto the center pane, the center of the canvas is outlined and highlighted in green, indicating that you can drop the element there as shown in Figure 5. If you hold the element over a highlighted area for a short time, a tooltip appears to provide more information about the area.
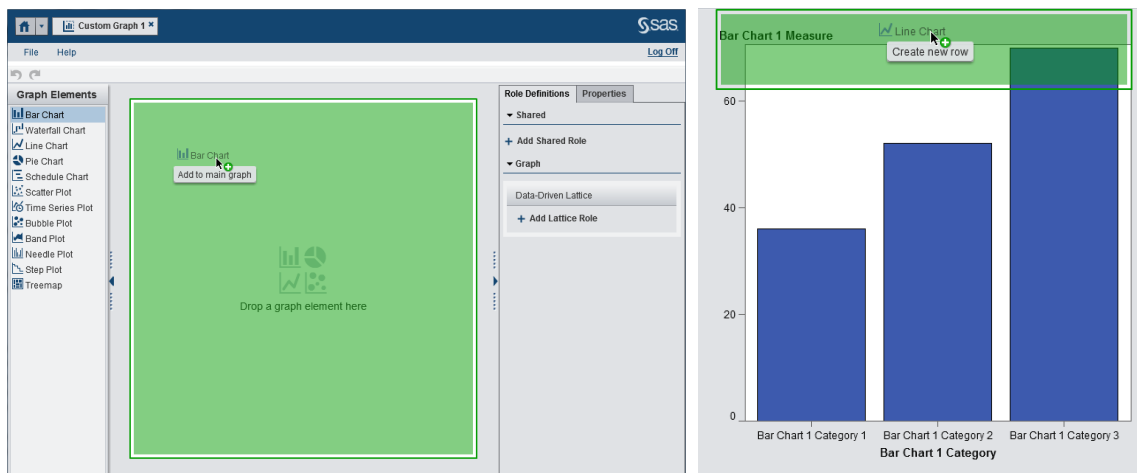

Figure 5. Dropping a Graph Element onto the Canvas (The canvas is highlighted and outlined in green to show how the new element will fill the canvas.)

Figure 6. Dropping a Second Graph Element (The highlighted area shows where the new element will be placed.)

As you build your layout, more places become available for dropping new elements. After you have one element, you can drop other compatible elements on top of it, or you can drop the new elements above or below, or to the left or right, to create a new row or column as shown in Figure 6.

All currently available layout options appear as highlighted green areas as you drag a new element over them.
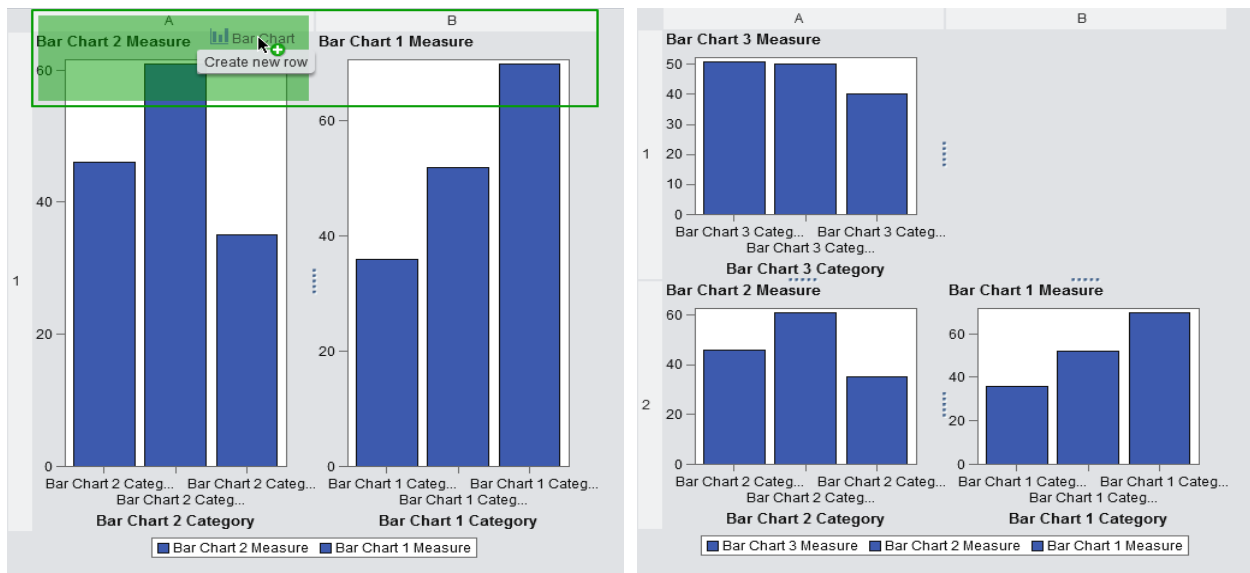
Figure 7. Highlighted Area for a New Row

Figure 8. Layout after a New Element is Dropped on the New Row

If you are working with a layout that has more than one cell and you drag an element to create a new row or column, the entire row or column is outlined in green, but only the portion of the row or column into which your element will be placed is highlighted with a green fill as shown in Figure 7 and Figure 8.

If the element you are dragging cannot be added to the area over which the mouse pointer is held, the area is not highlighted in green. Instead, a red X symbol appears with the cursor, and a tooltip explains why the element cannot be placed there as shown in Figure 9. Table 1, at the end of this paper, shows which graph elements can be overlaid in the same cell.
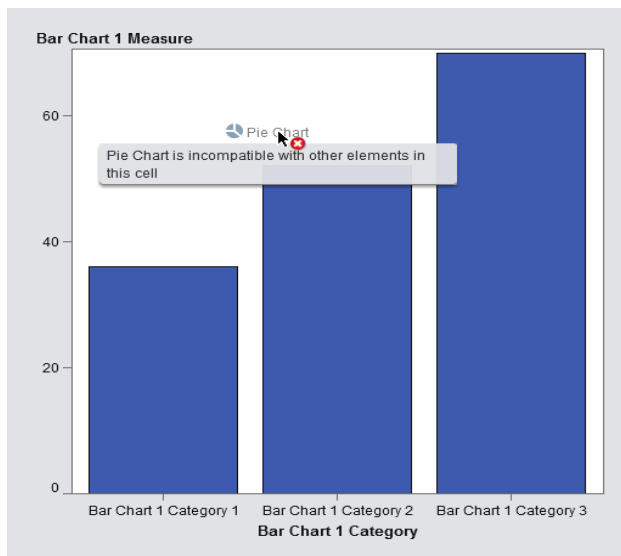
Figure 9. Incompatible Plot (No highlight areas appear when elements are incompatible. In addition, a tooltip with a warning is shown.)

USE CONTEXTUAL OPTIONS TO ADD GRAPH ELEMENTS

After a cell has graph elements in it, you can add additional elements into a cell using the pop-up menu.

Right clicking an occupied cell opens the pop-up menu, which offers only the elements that are compatible with the elements that are already in the cell as shown in Figure 10. You can use the same menu to remove the existing element.
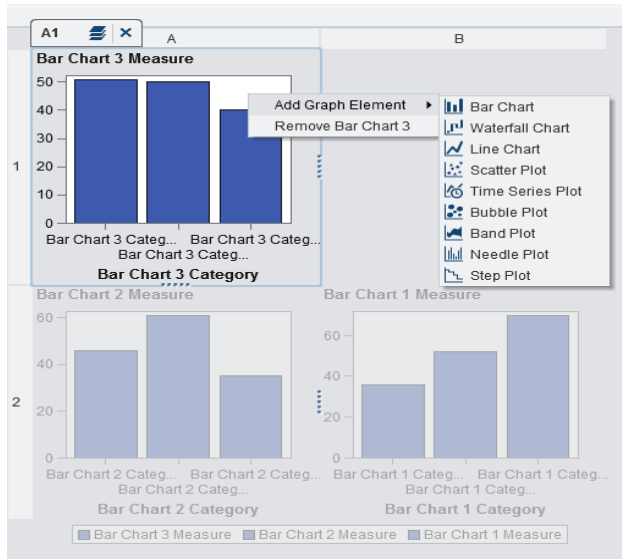
Figure 10. Popup Menu (Only compatible elements are offered through the pop-up menu.)

REORDERING, MOVING AND DELETING GRAPH ELEMENTS

After a graph element has been added to the layout, it can be moved up or down in the stacking order in its cell. It can be moved to another cell or to a new row or column. Or, it can be deleted from the layout.

Reordering the Stacking Order within a Cell

When multiple graph elements are overlaid in one cell, you can choose the order in which the graph elements appear. When a cell is selected, a tab displays containing the stack button (📚). Click the stack button to see a list of graph elements in the cell. Elements are listed in the order in which they appear, with the element listed at the top being the one that is on top of the stack visually. Drag a graph element up or down in the list to change its place in the order, as shown in Figure 11.
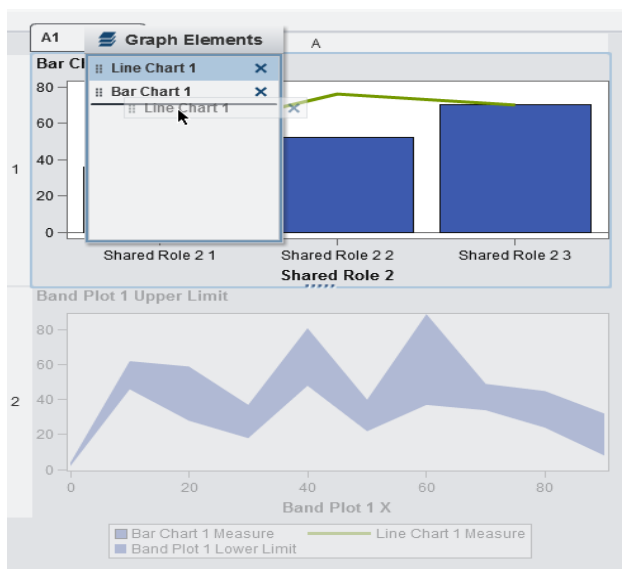
Figure 11. Reordering the Stacking Order of Graph Elements in a Cell

Moving Elements from Cell to Cell

The list of graphs revealed by the stack button can be used to move elements from one cell to another. Click on an element in the list and drag it into another cell. Dragging an element over a cell that already has elements displays

the list for that cell. Drop the element in the list wherever you would like it to appear in the stacking order, as shown in Figure 12. The list of elements per cell is also available in the properties tab for each cell.
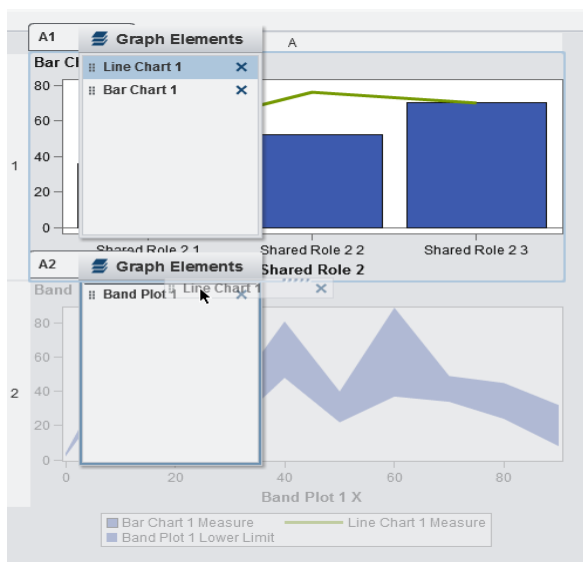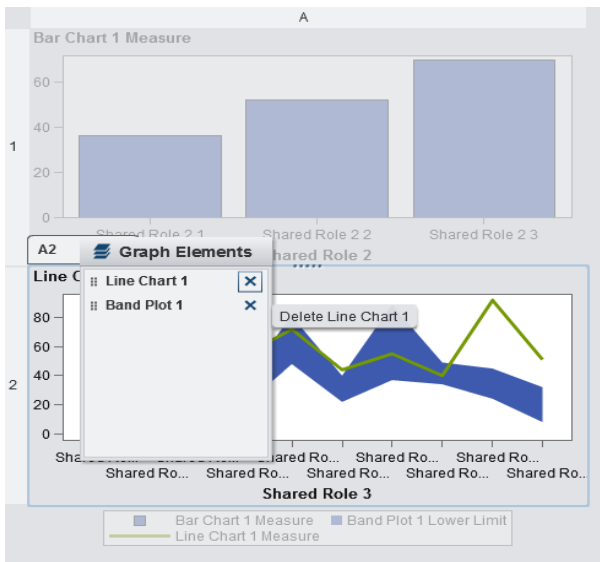

Figure 12. Moving Elements between Cells

Figure 13. Deleting Elements from a Cell

Deleting Graph Elements

The list of graphs revealed by the stack button can be used to delete elements. To delete a graph element from the layout, use the X icon next to the element you want to remove, as shown in Figure 13. Or, right-click in the cell and choose the delete menu option for the element you want to remove.

Changing Column and Row Sizes of Adjoining Cells

After you have added the graph elements required for your layout, you might need to change the size of some of the rows or columns to achieve the look you want. Drag the resize handle between any pair of rows or columns to change their height or width, as shown in Figure 14 and Figure 15.
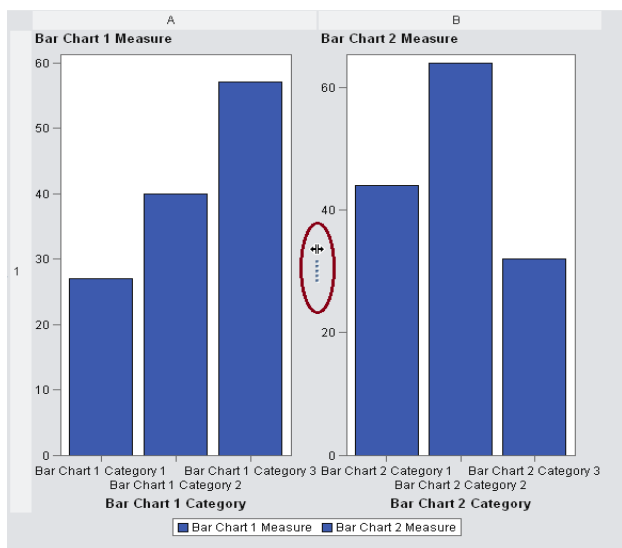
Figure 14. Resizing Column Width (On hover, the cursor changes to show which direction the cell boundary can be moved.)
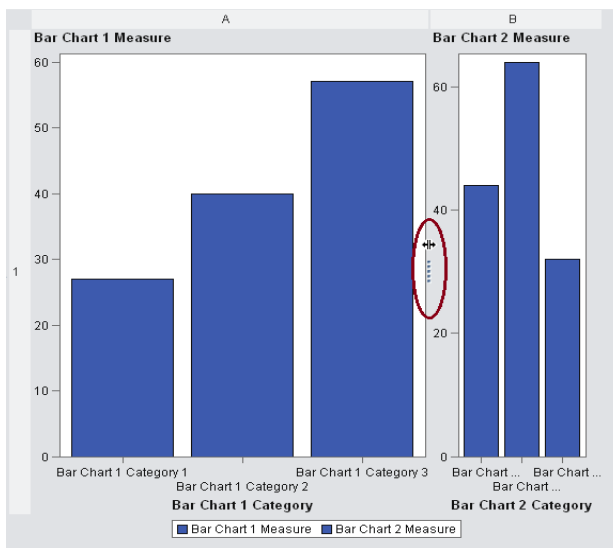
Figure 15. After Resizing (Clicking and dragging the cell boundary changes the relative size of cells.)

CONTEXTUAL AXIS OPTIONS

Right-clicking an axis reveals two shortcuts that can be used to create a graph object with axes that share the same data column and data range. The following examples describe how X axes are affected. These axis shortcuts are also available for the Y axis.

Merging All Horizontal Axes

Merging all horizontal axes makes the data range for all X axes in the object the same. It also creates a shared role for all the X axes to use.

Merging Horizontal Axes per Column

Merging horizontal axes per column makes the data range for the X axes in each column the same and, for each column, creates a shared role that all the X axes in that column will use.

Figure 16. Axis Popup Menu (Right-click an axis to see the pop-up menu containing axis merge shortcuts.)

CREATING CUSTOM GRAPH OBJECTS

Custom graph objects that can be created in the Graph Builder fall into two main categories: single-cell graphs and multi-cell graphs.

As the name suggests, single-cell graphs consist of only one cell. Examples of these would be Bar Chart, Scatter Plot, and so on. You can also overlay one or more compatible graph elements on top of each other in a single cell. Compatible graph elements are x-y graphs, meaning graphs that have an X and a Y axis that can share a data range. Examples of these would be Bar and Line Charts, Bubble and Time Series Plots, and so on. Single-cell graphs that don't have axes are Pie Charts and Treemaps. These cannot be overlaid on top of each other.

Multi-cell, or lattice graphs, are constructed by assembling more than one cell. Lattice graphs themselves are of two types:

- A data-driven lattice is a multi-cell graph in which the cell data is determined by the values of one or more class variables. The number of cells is determined by the unique values of the class variables. Each cell of the lattice has the same graph elements. However, these graph elements have different values of the class variables.

- A user-defined lattice is a multi-cell graph in which you create cells independently and place them in a regular MxN grid. Each cell can contain different types of graph elements, including overlaid graph elements.

Note: You can create a graph object that is either a user-defined lattice or a data-driven lattice, but not a combination of the two.

An example of each type and the steps to create them are provided in the following sections.

EXAMPLE 1: SINGLE-CELL OVERLAID GRAPH

This example steps through the process of creating what is known as a Stock Plot, which is an example of a single-cell graph object with multiple overlays in it, as shown in Figure 17.
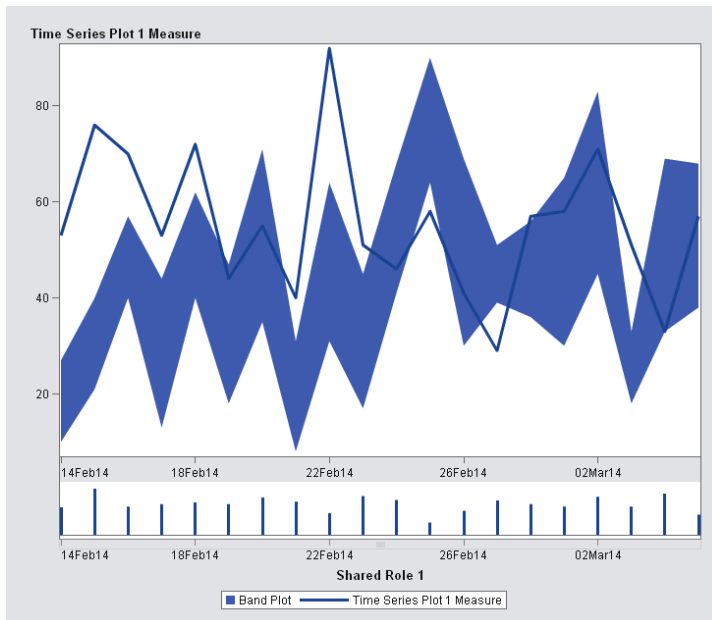

Figure 17. Stock Plot (a single-cell example)

1. Select the Band Plot from the list of graph elements in the left pane. Drag and drop this in the center pane.
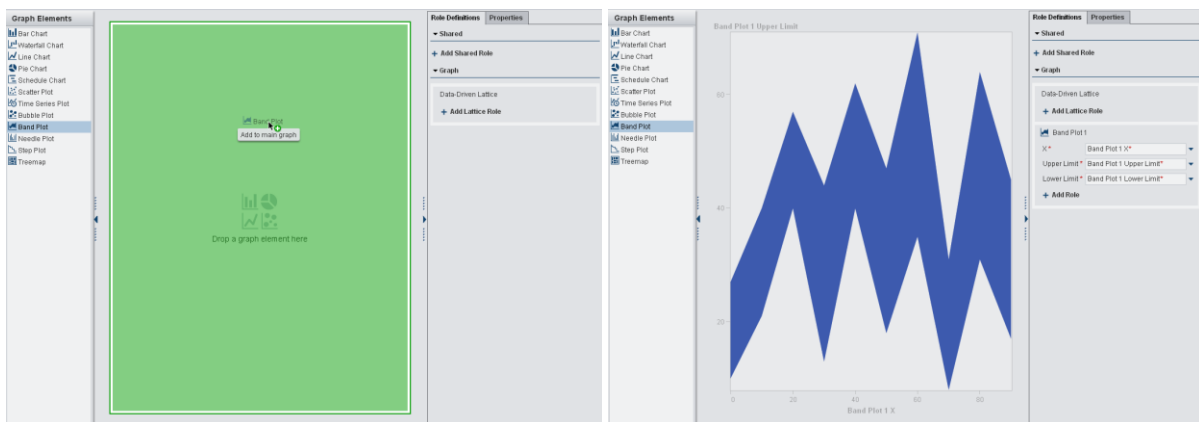

Figure 18. Band Plot Graph Element

2. Select the Time Series Plot graph element from the left pane, and drag and drop the element onto the center pane. Notice that the Time Series Plot is added on top of the existing Band Plot. In addition, the roles on the independent axis are shared and given the name Shared Role 1. Shared Role 1 takes on the properties of the dominant X axis between the two overlaid graphs. In this case, the dominant X axis is the time axis from the Time Series Plot.

11
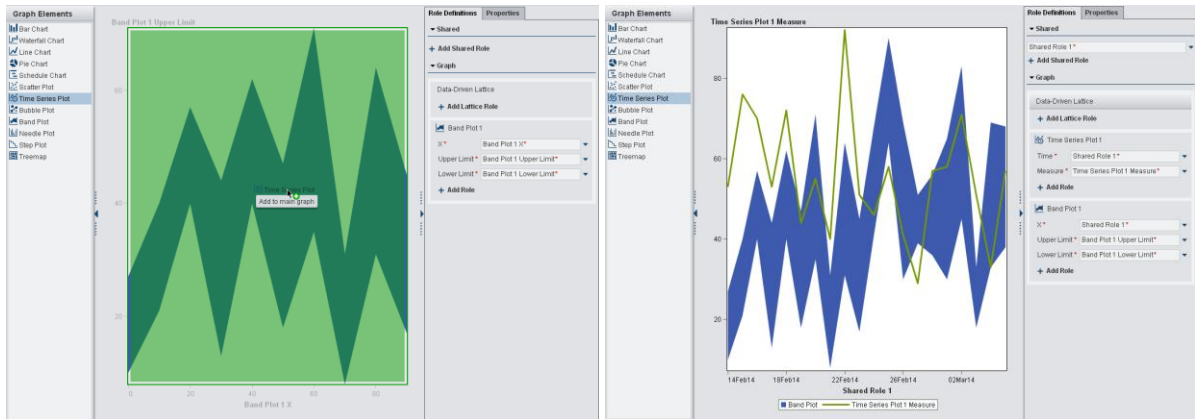
Figure 19. Time Series Plot on Top of the Existing Band Plot

Note: You can undo the shared role between the X-axes of the two overlaid graph elements. You can do this by clicking the down arrow next to the Share Role 1 (on the Roles Definitions tab) and selecting Delete Role. You could also opt to select *Edit Role*. This opens the Edit Shared Role dialog box. At the bottom of this dialog box you can unshare either or both of the graph element roles that use Shared Role 1. In the same dialog box, you can also give your own meaningful name to this role if you don't want to use the one that the application assigned.

3. Select the Properties tab in the right pane to view all the properties that are associated with the graph object being built.

4. Click on the drop-down menu at the top of this pane to reveal the hierarchy of the various components that make up the graph object. Select *Cell* from the hierarchy. Choose *All graphs start with the same color* from *Overlaid plot colors* option.This enables each overlaid graph to start with the same default color. The overlaid Time Series plot line changes from green to blue.

5. On the Role Definitions tab, click *Add Role* for Band Plot 1. This opens the Add Role dialog box as shown in Figure 20.

6. Keep the default settings of Role Type: Group and Classification: Category.

7. Click OK

8. Repeat steps 5 through 7 to create a Group role for Time Series Plot 1

9. Click the down arrow on Group role of Time Series Plot 1, select *Create Shared Role with Another Role,* and choose *Band Plot 1 Group* as shown in Figure 21*.*
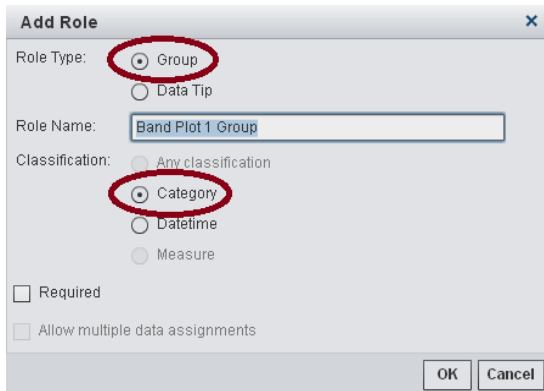

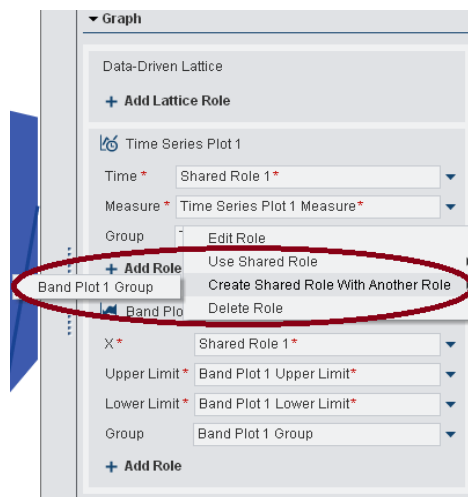**Figure 20. Add Role Dialog Box**

Figure 21. Creating Shared Role with Another Role

10. This opens the Add Shared Role dialog box.

11. Keep the default setting of Classification: Category.

12. Click OK. This creates Shared Role 2 that is also assigned to the Group roles of Time Series Plot 1 and Band Plot 1. At this point, you have completed your first custom graph object as shown in Figure 22.
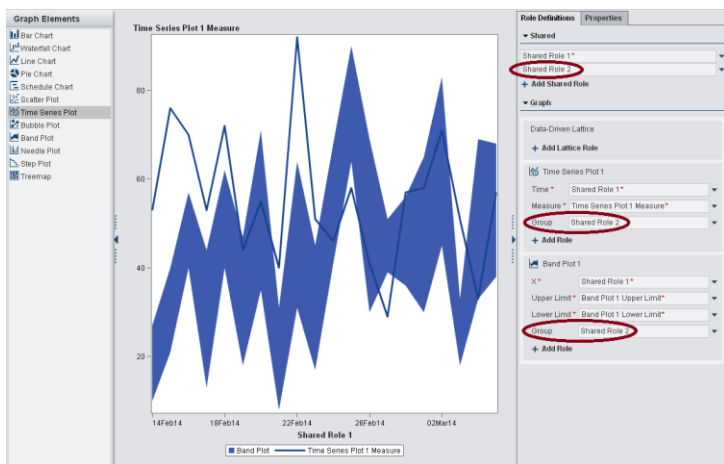

Figure 22. Basic Stock Plot Graph Object Showing Shared Role 2

You can enhance the basic stock plot shown in Figure 22 by converting the default X-axis to an overview axis. The steps to achieve this are given below.

13. Select *Custom Graph* at the top of the hierarchy on the Properties tab.
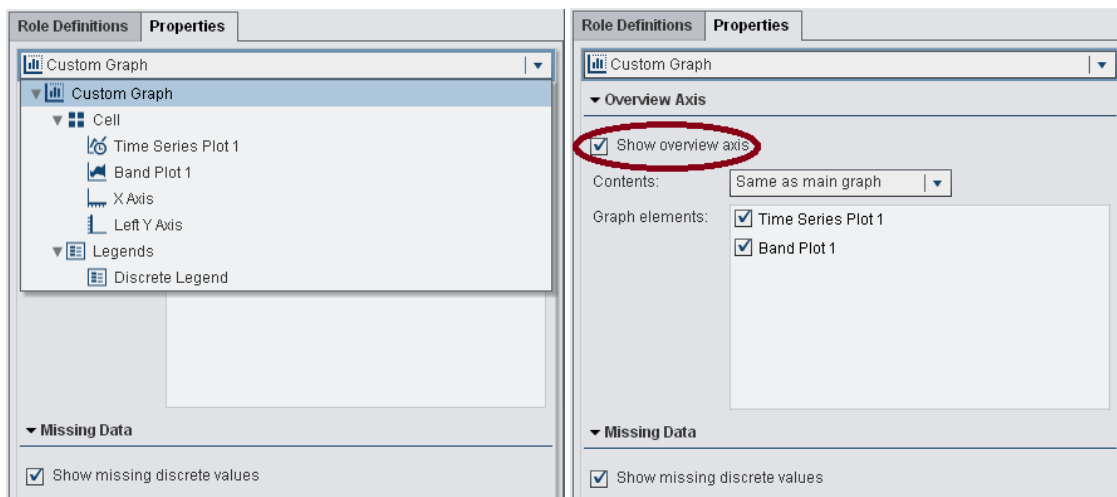
Figure 23. Selecting Custom Graph

Figure 24. Overview Axis Options Displayed after Selecting Custom Graph

14. Select the *Show overview axis* check box. This converts the default X-axis of the current graph object into an Overview Axis, as shown in Figure 25.
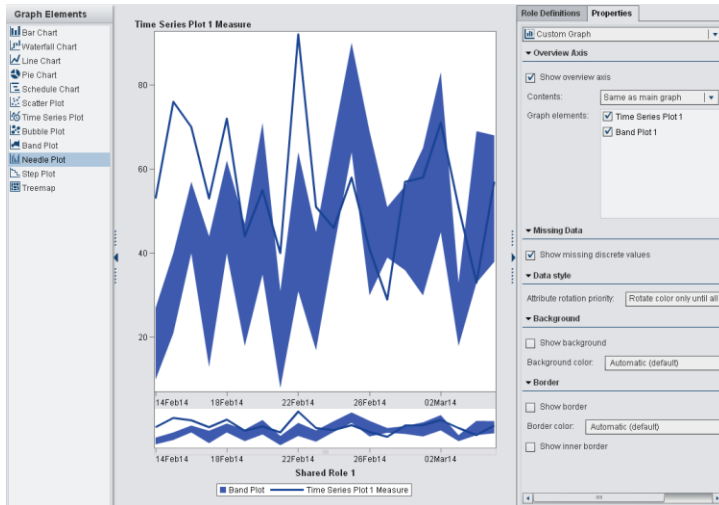
13

Figure 25. Basic Stock Plot Graph Object with Overview Axis

An overview axis is an axis that contains overlays that provide an overview or context of what is being zoomed into.

The overview axes that you create in the graph builder enable you to do the following:

- select specific graph elements from the main graph to show in the overview axis
- select completely different graph elements from the main graph to show in the overview axis

Note:Currently, the overview axis can be created only on the X-axis. Also, you can have an overview axis only in a single-cell graph object.

15. On the Properties tab, select *Specify graph elements* from *Contents*. This removes the existing Band Plot and Time Series Plot from the overview axis.

16. Drag and drop a Needle Plot from the Graph Elements pane onto the overview axis area of the center pane. This gives you a Stock Plot with an Overview Axis that has different graph elements in the overview and the main graph areas, and looks like Figure 27. Save the graph object as Stock Plot for use in the Designer.
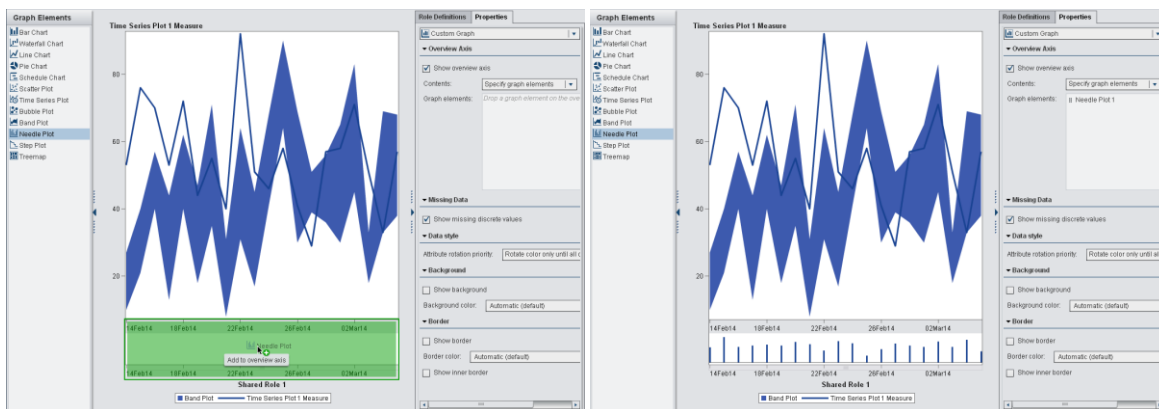

Figure 26. Needle Plot Added to the Overview Axis

Figure 27. Enhanced Stock Plot with Needle Plot in Overview Axis

Note: The graph elements that you add to the overview axis are displayed in the Graph elements section on the Properties tab. If you add more than one graph element to the overview axis area, then you can change the order of the graph elements by dragging and dropping a graph element to a different position in the list.

EXAMPLE 2: MULTI-CELL DATA-DRIVEN LATTICE GRAPH

In this example, you will create a data-driven lattice where each cell contains a prototype graph that is repeated in other cells but reflects the data associated with the classification crossings of the lattice. The prototype in the lattice can be an overlay of one or more graph elements. The graph object you will create is shown in Figure 28.
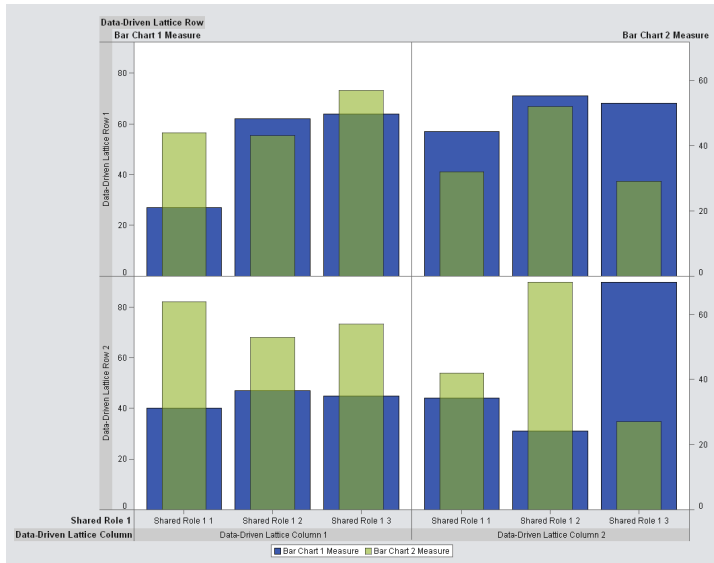

Figure 28. Dual-Axis Bar Chart – an Example of a Data-Driven Lattice

1. Drag and drop a Bar Chart from the Graph Element pane onto the empty canvas in the center pane.
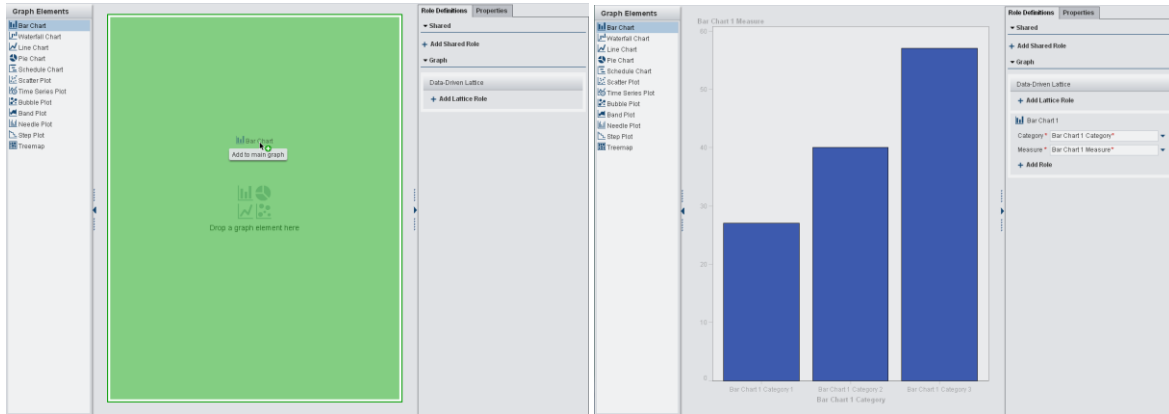

Figure 29. Adding a Bar Chart to the Canvas

Figure 30. Bar Chart on the Canvas

2. Drag and drop another Bar Chart from the Graph Element pane on top of the existing Bar Chart. Notice that the two charts now share a common classification axis called Shared Role 1. As well as displaying in the graph object, the common classification axis is listed on the right pane in the Role Definitions tab.
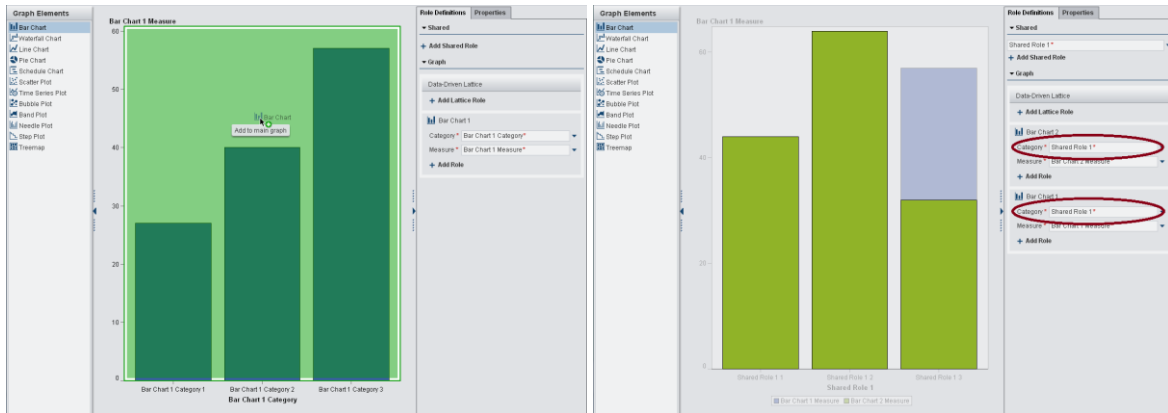
15

Figure 31. Adding Another Bar Chart on Top of Existing Bar Chart

Figure 32. Two Overlaid Bar Charts with a Shared Role

3. On the Role Definitions tab, click *Add Lattice Role*. This opens the Add Role dialog box.

4. Keep the default settings of Role Type: Row and Classification: Category. Also, check the *Required* check box on the dialog box.
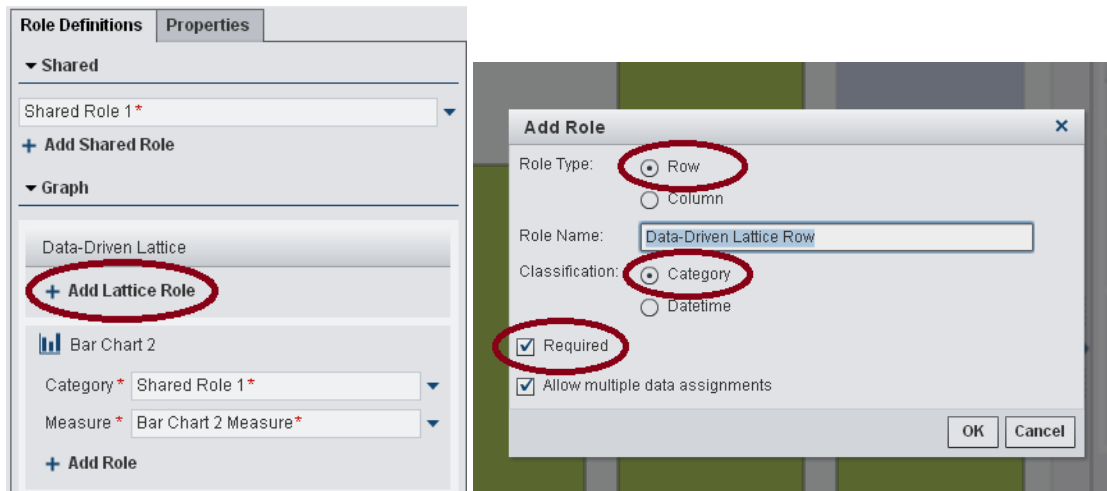

Figure 33. Add Lattice Role Option

Figure 34. Add Role Dialog Box

Note: Selecting *Required* forces report designers to assign data to the role. If this option is not selected, then report designers can choose whether to assign data to the role.

Also, when the *Allow multiple data assignments* check box is selected, the role can have more than one classifier/measure assigned. In the current example, you want it checked so that the report author has the ability to assign multiple classification variables to the Row role.

5. Click OK.

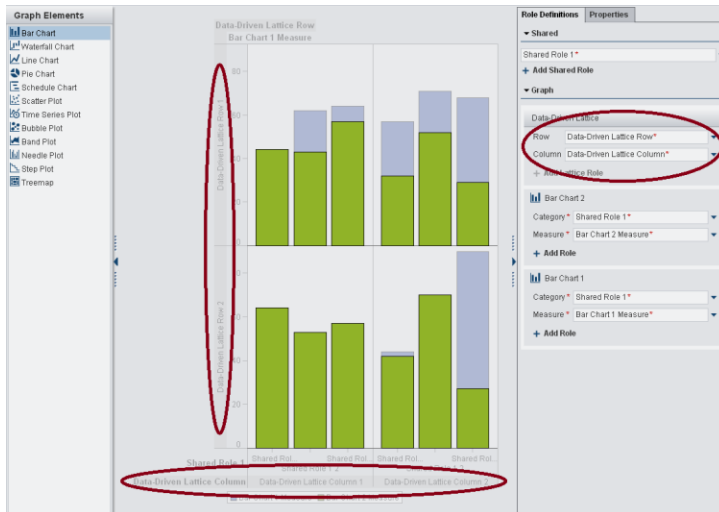6. Repeat steps 3 through 5, but this time create Column role.

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Figure 35. Graph Object with Row Role and Column Role

Note: When the Add Lattice Role dialog box is launched a second time after choosing Role Type of Row the first time, you can add only a new Role Type of Column.

7. Select the *Bar Chart 2* element from the graph hierarchy in the drop-down menu on the Properties tab. Alternatively, select one of the bars of the Bar Chart 2 element to activate the properties of Bar Chart 2.

8. By default, Bar Chart 2's Y axis is displayed on the left. Move it to the right by selecting *Right Y Axis* from the Y axis drop down menu. Switching the measure axis to the right side of the graph enables the left and right Y axis of the two overlaid graphs to display their ranges independently.
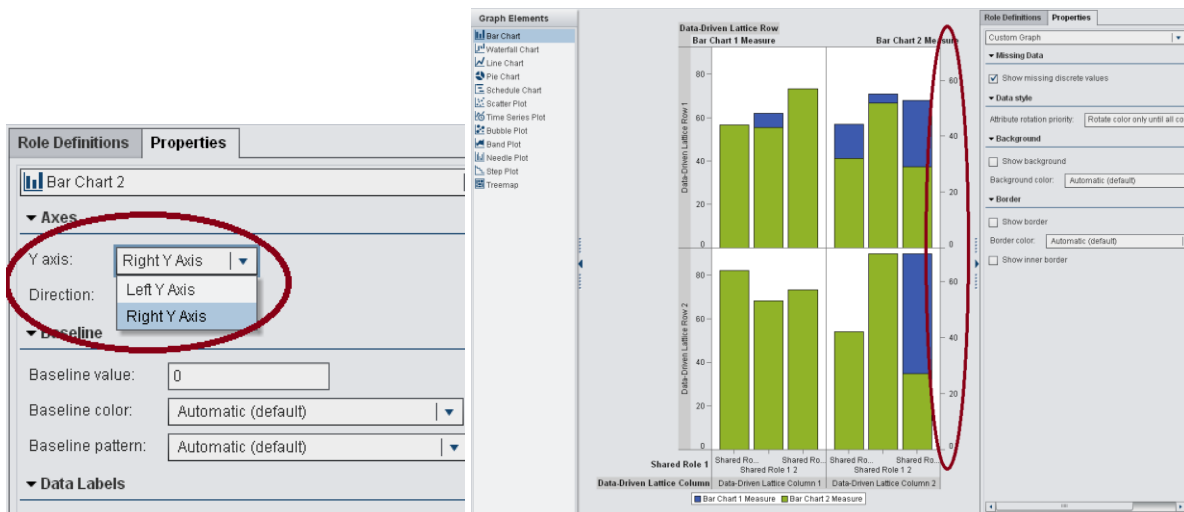

Figure 36. Right Y Axis Option for Bar Chart 2

Figure 37. Right Y Axis Enabled for the Graph Object

9. Next, change the bar width by moving the *Bar width* property slider from 85% down to 50%.

Note. If you reduce the width of the two bars and change the Discrete Offset property, then the resulting graph object will be similar to the out-of-the-box Dual Axis Bar Chart graph object in the Designer.

10. Change the *Transparency* property slider from 0% to 40% transparency.
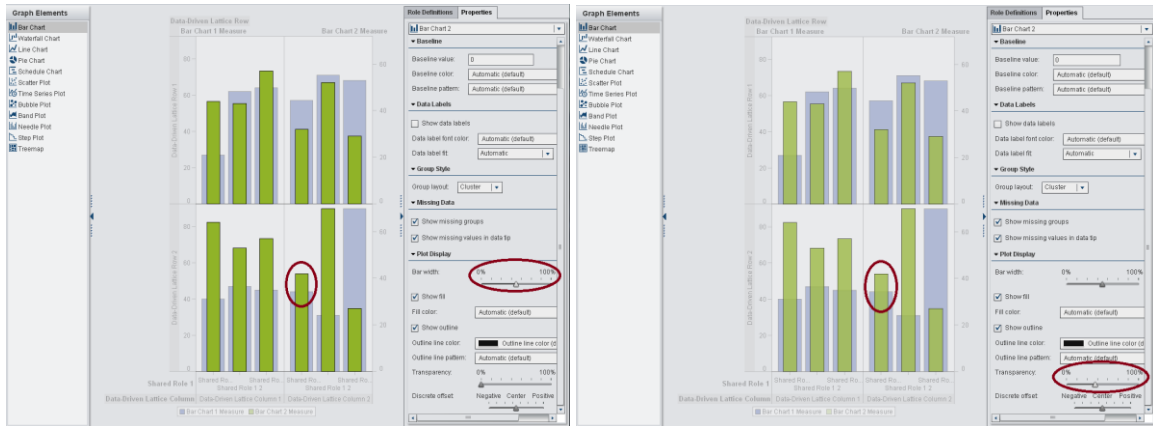
17

Figure 38. Changing the Bar Width of Bar Chart 2

Figure 39. Changing the Transparency of Bar Chart 2

This completes the setup of a data-driven lattice, as shown in Figure 28. Save the graph object as Data-Driven Bar Chart for use in the Designer.

EXAMPLE 3: MULTI-CELL USER-DEFINED LATTICE GRAPH

In this final example, you will create a graph object for a Butterfly Chart, which is a type of multi-cell user-defined lattice graph. Each cell can be an overlay of either one or multiple graphs. In the previous example you created one prototype graph for a cell that is then replicated according to the data values of the classification variable that is assigned to the row and column. In this example, you will manually create each cell of the multi-cell graph. When you are done creating the graph object, it will look as shown in Figure 40.
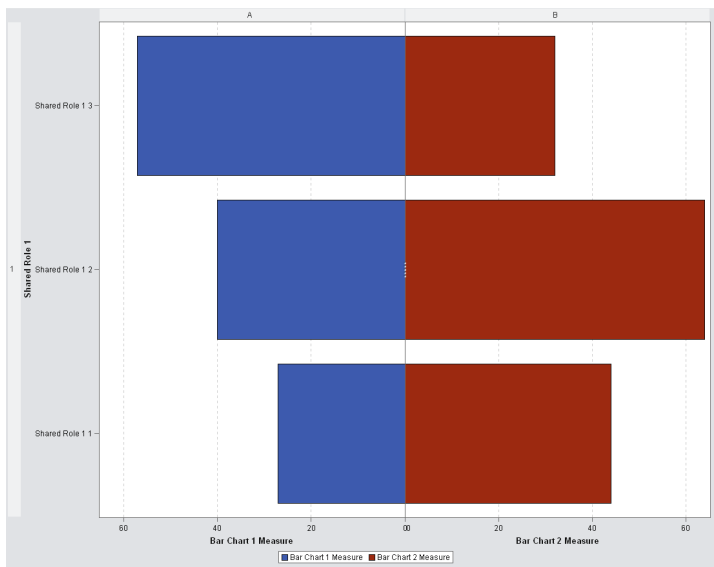

Figure 40. Butterfly Chart: a User-Driven Lattice

1. From the Graph Element pane, drag and drop a Bar Chart onto the empty canvas in the center pane, as shown in Figures 29 and 30.

2. Drag and drop another Bar Chart to the right of the existing Bar Chart on the canvas, as shown in Figures 41 and 42.
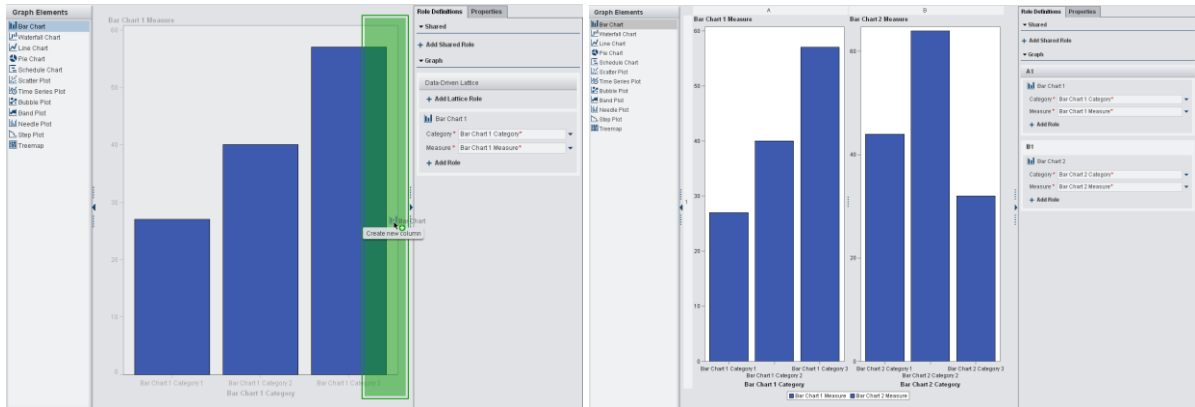
18

Figure 41. Adding a Second Bar Chart to the Right of the First Bar Chart

Figure 42. Two Bar Charts in Separate Cells

Note: During the drag operation, you have the option of dropping the new graph element either on top of the existing graph on the canvas or adjacent to it: to its left or right, above it, or below it. Dropping on top creates overlaid graphs. As in this example, dropping to the right creates cells A1 and A2. The cells are arranged in a grid form with the columns labeled as letters and rows as numbers. The action of manually creating multiple cells takes you down the path of creating a user-defined lattice. If you head down this path, you can no longer create a data-defined lattice. The option to add a Lattice Role under the Roles tab is no longer available.

3. Click the Properties tab to make changes to the properties of the Bar Chart elements.

4. Select the *Bar Chart 1* element from the graph hierarchy in the drop-down menu. Alternatively, select one of the bars of Bar Chart 1 element to activate the properties of Bar Chart 1.

5. Under the Axes options, change the *Direction* property from Vertical to Horizontal.
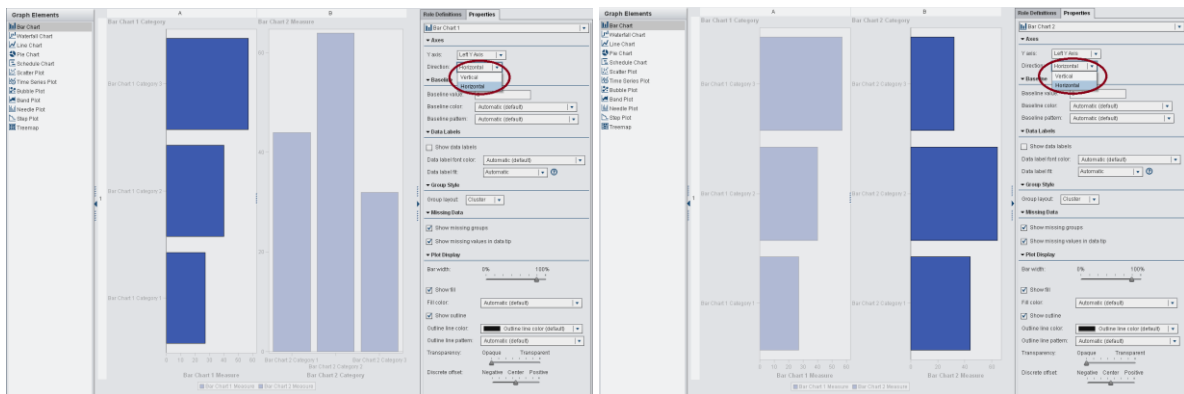
6. Repeat steps 4 and 5 for Bar Chart 2.

Figure 43. Changing the Direction of Bar Chart 1 to Horizontal

Figure 44. Changing the Direction of Bar Chart 2 to Horizontal

7. Move the cursor to the Y axis for Bar Chart 2. Right-click and choose *Merge vertical axes per row* from the pop-up menu. This automates the following steps, which you could opt to do yourself.

    a. It creates Shared Role 1, which is shared by the categorical axis of the two bar charts.

    b. It changes the *Row axis range (left axis only)* property from *Determined by data* to *Uniform across row*. This is available under the Axes option of Custom Graph. *Determined by data* displays each individual graph element's axis separately, inside its cell. *Uniform across row* combines the separate axes into a single axis, which is displayed outside the cells. The data range of the combined axis is a union of the data ranges of the separate axes that were combined.
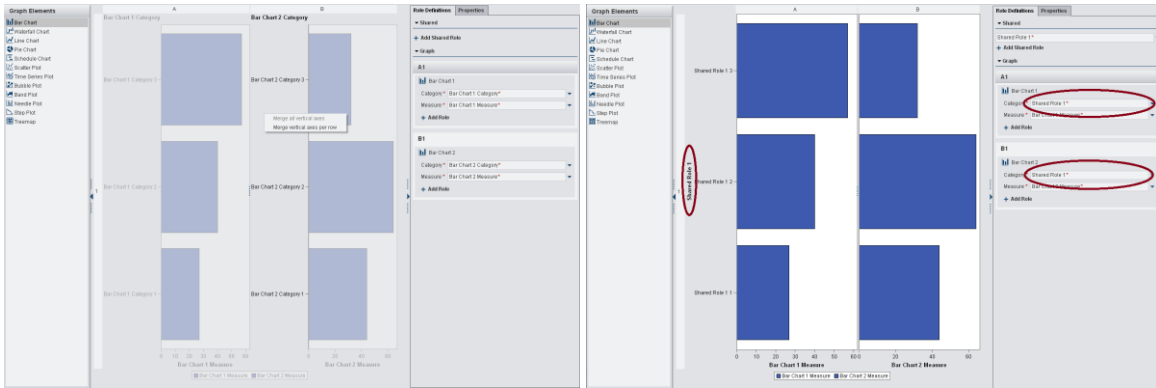
19

Figure 45. Merging the Vertical Axes by per row pop-up

Figure 46. Effect of merging axes – combined external axis on left and Shared Roles

8. Typically, in a butterfly chart, the measure axes of the two bars is a union of the individual axis data ranges. Change *Column axis range* property under the Axes option of Custom Graph from *Determined by data* to *Uniform across all columns*.
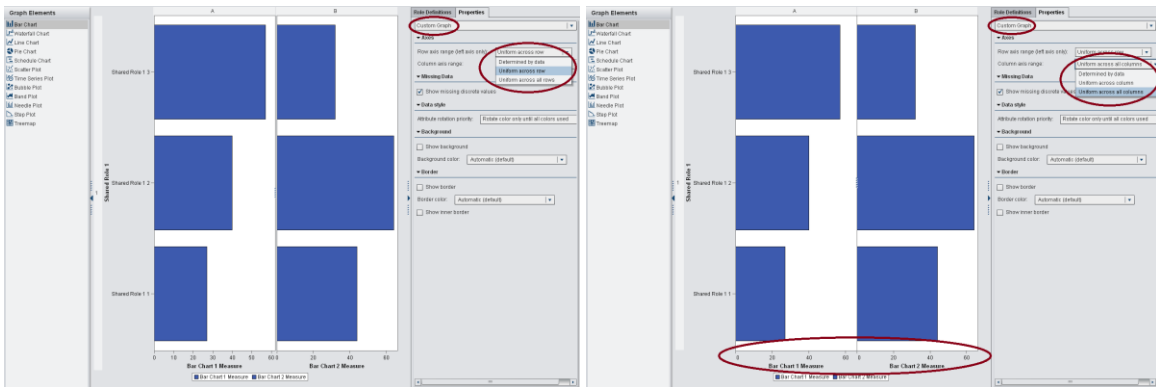

Figure 47. Selecting Uniform across all Columns

Figure 48. Uniform Columns

Note: If you select *Uniform across column* instead in step 8, then it will union the data range for the axis across all other graphs that are stacked above that axis and independently for each of however many such stacks you might have. By choosing *Uniform across all columns,* you have chosen to union the data range between the vertical stacks of axis.

9. Select the measure axis of Bar Chart 1 and check *Reverse order* under the Axis Settings options of X Axis on the Properties tab.
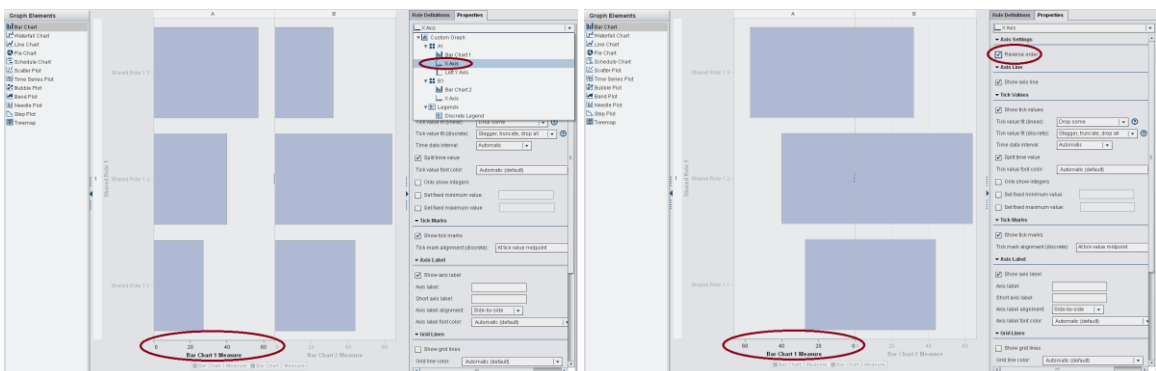

Figure 49. Reversing the X Axis of Bar Chart 1

Figure 50. Reversed Axis

10. Next turn on vertical grid lines for the measure axes of each bar chart. Check *Show grid lines* under the Grid Lines options of X Axis on the Properties tab for each Bar Chart x axis.

11. Select a bar of Bar Chart 2 to change the default color assignment. You do this by changing *Fill color* under the Plot Display option from *Automatic (default)* to say *Data Color 3*.
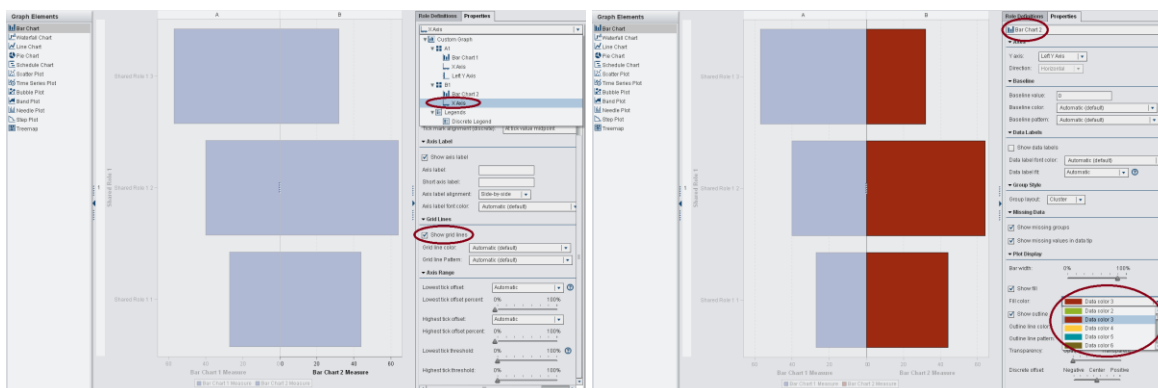

Figure 51. Selecting Show Grid Lines for X Axis of each Bar Chart

Figure 52. Changing the Fill Color of Bar Chart 2

This completes the setup of a Butterfly Chart, as shown in Figure 40. Save the graph object as Butterfly Chart for use in the Designer.

USING CUSTOM GRAPH OBJECTS IN VISUAL ANALYTICS DESIGNER

The custom graph objects created in the Graph Builder in the previous sections can now be used in the Designer. You can use these custom graph objects just like the standard objects in the Designer to associate your data and create reports. There are two main ways to incorporate custom graph objects for use in the Designer.

Using Custom Graph Objects in My Folder

In the Graph Builder, save your custom graph objects in your My Folder location with a descriptive name. In the Designer, your new graph objects automatically appear in the left pane, in the Objects tab under the heading Custom. You can now use your custom graph object as you would any of the other report objects. You can customize which report objects you want to see on the Objects table. To specify graph properties for your custom graph, click the Properties tab in the right pane. To specify role assignments, use the Roles tab in the right pane as well. In Figure 53, the custom graph object named MultiResponseLineChart that was saved in My Folder now appears by default in my designer session under Custom.
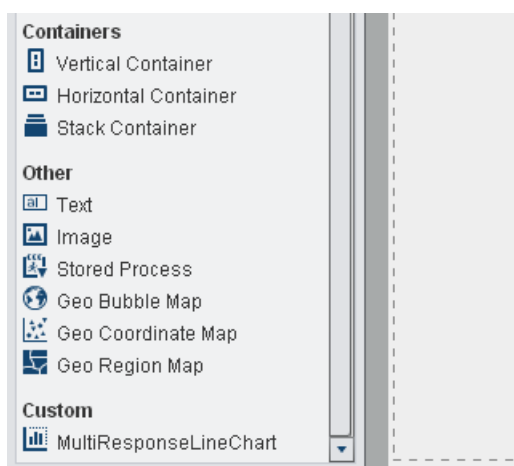

Figure 53. Custom Graph Objects in the Designer (Graph objects saved in My Folder in Graph Builder show up under Custom in the Objects pane.)

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Using Custom Graph Objects from Public Folders

Graph objects that you save in public folders are not automatically displayed on the Objects tab in the Designer. To add a graph object to the Designer's Objects tab, select the icon on the right of the object pane to display the Show or Hide Objects window, as shown in Figure 54. Click *Select custom* to open the Choose an Item window. Navigate to the graph object that you want to add, like stock plot, as shown in Figure 55. You can also search for the graph object, or you can search for all graph objects as shown in Figure 56. Specify Graph template for type to search for all graph objects. The selected graph object, stock plot, is now displayed with a check mark in the Show or Hide Objects window and is available under the Custom heading in the Objects pane, as shown in Figure 57.
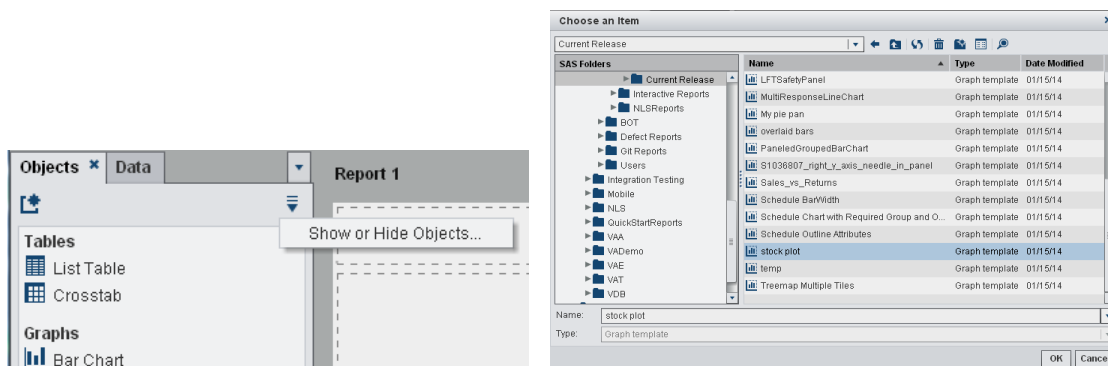

Figure 54. Show or Hide Objects Drop-Down in the Designer Objects Pane

Figure 55. Content Navigator Showing a List of Graph Objects Saved in the Current Release Folder
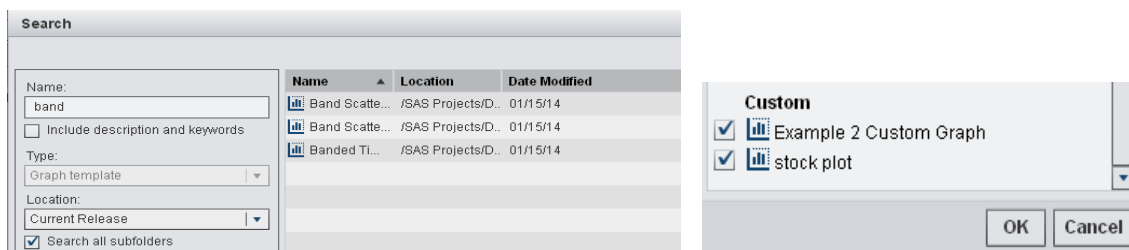

Figure 56. Searching for Graph Objects by Setting the Search Type to Graph Template

Figure 57. The Stock Plot Custom Graph Displayed under the Custom section

Creating a Report Using a Custom Graph Object

Let us now use the custom graph object stock plot that you added to your Custom Objects pane. Drag and drop the stock plot custom object onto the report pane. Figure 58 shows your custom graph in the Designer report pane before data is associated with the report. It looks similar to when the graph object was created in the Graph Builder, except the object now appears gray in color. When data items are assigned to all the required roles in the roles pane in the Designer, the colors will appear.
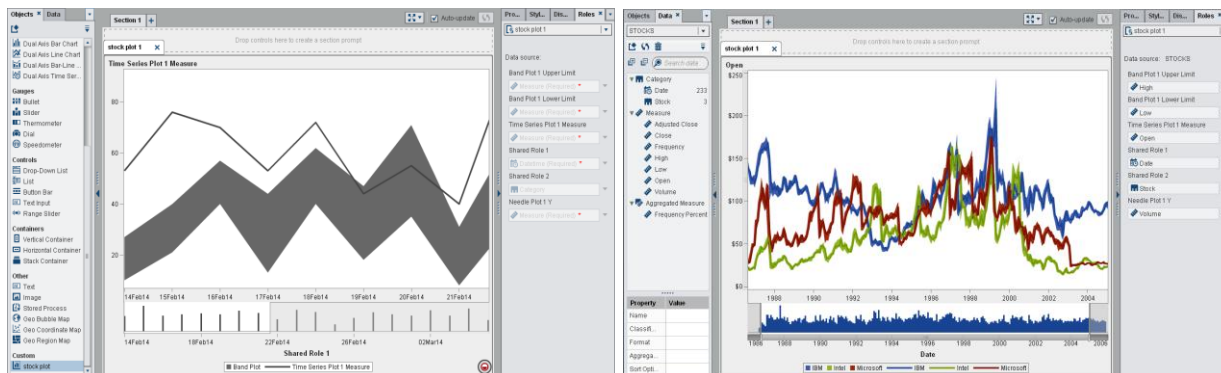

Figure 58. Stock Plot Graph Object in the Designer

Figure 59. Stock Plot Graph Object after Data Assignments

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Now, select your data as you would any object in the Designer to associate the data with the report. After you associate your data, the report appears as in Figure 59. You can further modify the report using the Properties tab in the Designer. Save the report to view it later or share with others.

Viewing reports on mobile devices and Other Viewers

You can now view your saved report with the SAS® Visual Analytics Viewer, the SAS® BI Mobile App on an iPad or Android tablet, or as a PDF file for printing within the Designer. You can also view the same reports inside SAS® Add-In 6.1 for Microsoft Office products like Microsoft Excel and Microsoft Outlook.

CONCLUSION

The Graph Builder application enables you to build complex graph objects by assembling simple graph elements. You can then use these objects in the Designer to create unique and interesting reports that are beyond those that you can create with the built-in graph objects. Using the drag and drop feature, you can easily build the graph objects by overlaying different graph types on top of each other and then placing them in user-defined or data-driven lattices. In addition, customizing the properties of different parts of the graph along with pre-defining the roles that a report creator can use makes it easy for you to custom build an object. This is a very powerful concept as it opens up limitless possibilities to you as a report author to design reports that are unique to your department, company, or business needs.

ACKNOWLEDGMENTS

RECOMMENDED READING

- SAS® Visual Analytics 6.3 User's Guide. Available at
  http://support.sas.com/documentation/cdl/en/vaug/66720/PDF/default/vaug.pdf

- Chitale, Anand, and Redpath, Christopher. 2013. "Whirlwind Tour Around SAS® Visual Analytics." *Proceedings of the 2013 SAS Global Forum*. Cary, NC: SAS Institute Inc. Available at
  support.sas.com/resources/papers/proceedings13/057-2013.pdf

- Styll, Rick. 2013. "Fast Dashboards Anywhere with SAS® Visual Analytics." *Proceedings of the SAS Global Forum 2013* Conference. Cary, NC: SAS Institute Inc. Available at
  support.sas.com/resources/papers/proceedings13/059-2013.pdf

- Matange, Sanjay. 2009. "ODS Graphics Designer: An Interactive Tool for Creating Batchable Graphs." *Proceedings of the 2009 SAS Global Forum*. Cary, NC: SAS Institute Inc. Available at
  support.sas.com/resources/papers/proceedings09/331-2009.pdf.

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	Horizontal Bar Chart	Vertical Bar Chart	Line Chart	Waterfall Chart	Scatter Plot	Time Series Plot	Bubble Plot	Band Plot	Needle Plot	Step Plot	Schedule Chart
Horizontal Bar Chart	Yes										
Vertical Bar Chart	No	Yes									
Line Chart	No	Yes	Yes								
Waterfall Chart	No	Yes	Yes	No							
Scatter Plot	Yes	Yes	Yes	Yes	Yes						
Time Series Plot	No	Yes	Yes	Yes	Yes	Yes					
Bubble Plot	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
Band Plot	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Needle Plot	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Step Plot	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Schedule Chart	No	No	No	No	Yes	No	Yes	No	No	No	Yes

Table 1. Graph Element Overlay Compatibility