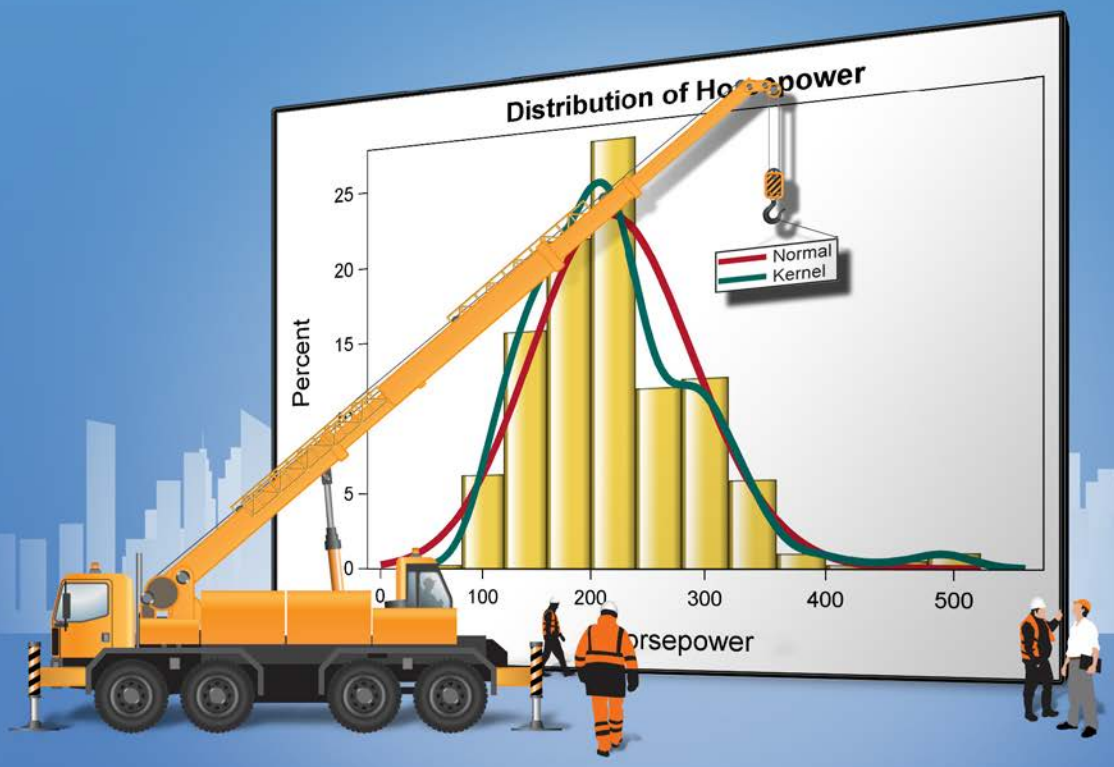
SAS® ODS Graphics Designer by Example

A Visual Guide to Creating Graphs Interactively



Sanjay Matange · Jeanette Bottitta

The correct bibliographic citation for this manual is as follows: Matange, Sanjay and Jeanette Bottitta. 2016. *SAS® ODS Graphics Designer by Example: A Visual Guide to Creating Graphs Interactively*. Cary, NC: SAS Institute Inc.

SAS® ODS Graphics Designer by Example: A Visual Guide to Creating Graphs Interactively

ISBN 978-1-61290-191-6 (Hard copy)
ISBN 978-1-62960-547-0 (EPUB)
ISBN 978-1-62960-548-7 (MOBI)
ISBN 978-1-62960-549-4 (PDF)

Produced in the United States of America

SAS Institute Inc., SAS Campus Drive, Cary, NC 27513-2414

December 2016

Contents

Preface vii
About this Book ix
About these Authors xiii
Acknowledgments xv

Chapter 1: Introduction to Creating Graphs 1
The Value of a Graph 1
Automatic Graphs 2
Creating Graphs Using the Graph Template Language 4
Creating Graphs Using the Statistical Graphics Procedures 6
Creating Graphs Using the SAS ODS Graphics Designer 6
Effective Graphics and the Use of Decorative Skins 8
Chapter 2: Using the Designer 9
Start the Designer 9
Designer Graphical User Interface 10
Menus and Toolbar 11
Graph Gallery 11
Elements Pane: Plots and Insets 12
Right-Click Pop-Up Menus 13
Create a Graph 13
Graph Terminology 14
Basic Concepts and Task Workflow 15
Graph Types and Layouts 16
Parameters Available for the SGDESIGN Macro 17
Chapter 3: Create Your First Graph 19
About This Example 19
Create Your Graph 20
Create a Histogram from the Graph Gallery 20
Assign Data to the Histogram 23

Change the Title and Remove the Footnote 24
Add Plots to the Graph 25
Set Plot Properties 28
Add and Modify a Legend 30
Add a Row to the Graph 32
Add a Horizontal Box Plot to the Empty Cell 33
Use a Common X Axis 35
View the GTL Code 36
Copy and Paste the Graph to Another Application 36
Save the Graph to a File 37
Save the Graph in the Graph Gallery 37
Run the Graph in Batch Mode 39

Chapter 4: Understanding Plot Types, Data Roles, and the Visual Properties of a Graph 41

Review of the Process for Creating Graphs 41
Plots and Insets Groups 42
Basic Plots 42
Fit Plots 43
Distribution Plots 43
Categorization Plots 44
Other Plots 44
Insets 44
Summary of Combining Plots and Insets 45
Data Assignment When Adding a Plot 45
Data Assignment from the Pop-Up Menu 48
Custom Features of Other Assign Data Dialog Boxes 49
Fit an Existing Plot 50
Model Band Options 51
Statistics Data in the Assign Data Dialog Box 51
Visual Properties of a Graph 52
Styles and Style Elements 52
Overview of Styles and Style Elements 52
Commonly Used Style Elements 53
Properties That Affect the Entire Graph 54
Plot Properties 57

Chapter 5: Classification Panels and Multi-Cell Graphs 61
About Classification Panels 61
Create a Classification Panel 63
About This Example 63
Create the Graph, Add a Highlow Plot, and Specify the Panel Variable 64
Add Titles to the Graph 67
Modify the Axis Properties 68
Apply a Different Style to the Graph 70
About Multi-Cell Graphs 71
Create a Multi-Cell Graph 71
About This Example 71
Create the Graph 72
Apply a Different Style to the Graph 74
Change the Marker Symbol for the Scatter Plots 75
Add a Discrete Legend to the Cell 77
Add a Global Legend to the Graph 78
Add an Axis Table in a Separate Cell 80
Customize the Titles and Remove the Footnote 83
Chapter 6: Auto Charts: Bulk Generation of Charts 85
About Auto Charts and Bulk Generation of Charts 85
The Auto Charts Window 86
About the Auto Charts Example 87
Generate Bulk Graphs 88
Customize Your Graph 89
Create Your Graph 89
Add an Axis Table to the Graph 91
Customize the Titles 94
Chapter 7: Advanced Features 97
About the Advanced Features 97
Overview of Graph Reuse 98
Create a Shared-Variable Graph with a Dynamic Title 99
Create the Shared-Variable Graph 99
Add Cells and Plots to the Graph 101
Assign a Different Variable to the Graph 104
Add a Dynamic Title and Save the Graph 105
Generate the Graph Using the SGDESIGN Procedure 106

Customize the Axes 109
About This Example 110
Create the Graph 110
Customize the Axis Properties 112
Add an Axis Table to the Graph 114
Customize the Appearance of Grouped Data 116
About This Example 116
Create the Graph 117
Change the Bar Fill and Outline Color Group Attributes 119
Where to Go from Here 122
Appendix: Code for Select Examples 123
Code for the First Example in Chapter 1 123
Code for the Classification Panel Example in Chapter 5 124
Code for the Survival Plot Example in Chapter 5 125
Code for the Axis Customization in Chapter 7 126
Index 127

Preface

SAS has always provided powerful syntax-based procedures to create graphs. In SAS 9.2, SAS analytical procedures generated modern statistical graphs automatically with tables. New statistical graphics (SG) procedures and the Graph Template Language (GTL) were released, greatly enhancing the user's ability to create modern statistical and analytical graphs.

However, there is a segment of the SAS user community who prefers to create graphs using an interactive application. Often, these users do their data analysis in SAS, and then they export their data to third-party applications to create the graphs. These users have long desired an interactive application in SAS for creating graphs.

With SAS 9.2 Phase 2, the SAS ODS Graphics Designer (the designer) was released. The designer is an interactive application that makes creating graphs easy. This enables the SAS user to focus on the analytical task—not spending time learning procedure syntax or exporting data to other applications to create graphs.

The designer leverages the features of GTL under the covers. The GUI is an easy-to-use wrapper on GTL technology. The interactive actions performed by the user are converted into appropriate GTL syntax to create the graph, which has the following benefits:

- Making graphs with the designer is easy. No programming is required.
- The designer uses GTL to create the graphs. That means that graphs have the same look and feel as other graphs created by SAS procedures.
- You can see the syntax being created for you. So, the designer can be an excellent learning tool for users who want to learn GTL.
- The designer is an excellent prototyping tool for graph programmers. These users can quickly create different graphs using the designer, and then customize final versions using GTL syntax.
- You can run the designer graphs in batch with the same data or different data.

The target audience for the designer is the user who wants to create an analytical graph using an interactive application. You can launch the designer directly from a SAS session, build your graph from scratch, or start with a graph from the Graph Gallery. You can copy your graph directly into another application such as Microsoft Word or PowerPoint or into an email. You can save your graph for future use or run your saved graph in a SAS batch process using the same data or different data.

The designer is particularly useful to the SAS user who wants to quickly visualize raw data or create a graph from the results of a custom analysis. Often, you already have a mental image of the graph that you want to build—you just need to know how to build it. This book shows you the step-by-step process of building graphs commonly used in various domains. With the designer, you can literally build a graph in under a minute.

This book describes the extensive features of the designer. It includes examples of graphs commonly used for the analysis of data. You can browse the graph examples and find the type of graph you want to create. Each example shows the detailed steps needed to create the graph.

As with GTL, the designer uses a building-block approach to creating graphs. You start with a basic plot, and then simply add the features that you need, one at a time. The designer supports a large number of plot types and options, so the possible combinations grow rapidly. Simple plot types can be combined to create complex plots.

Visual aesthetics are built in by default. From the examples, it becomes evident that you have to do very little to get aesthetically pleasing graphs. The designer is designed with the principles of effective graphics in mind to convey information with maximum clarity and minimum clutter.

The examples and techniques discussed in this book are relevant and useful for all SAS users. This book is focused on how to create the required graph given the data. Techniques for modeling and analysis of the data itself are beyond the scope of this book.

About This Book

What Does This Book Cover?

This step-by-step guide is intended to facilitate the creation of graphs using the SAS ODS Graphics Designer (the designer). The book describes the graphical interface and features of the designer in detail, showing you how to use an interactive application to create the graph that you need. Topics are organized by feature, making this an excellent training manual or self-tutorial. With this book, you will quickly learn how to create simple or complex graphical views of data for analysis.

This book covers main graphics features, such as single-cell graphs, multi-cell graphs, classification panels, data roles, plot types, legends, titles and footnotes, styles, and the visual properties of a graph. The book provides details about some advanced features, including automatically generated charts, shared-variable graphs, and axis customization.

This book does not cover all the features of the designer. You are encouraged to refer to the *SAS ODS Graphics Designer: User's Guide* for complete concepts.

Is This Book for You?

This book is useful if you want to create graphs using a simple, interactive application. You do not have to be familiar with procedure syntax for creating graphs.

The first two chapters provide introductory information about ODS graphing software in general and the SAS ODS Graphics Designer in particular. If you are familiar with these concepts, you can skim the first two chapters and move on to the example in Chapter 3.

You might also find the book useful if you are an experienced graph programmer who wants to perform rapid prototyping of your data using the designer. If you want to learn the basics of the Graph Template Language (GTL), the designer can introduce you to GTL code.

What Are the Prerequisites for This Book?

The book requires no programming experience, although you should have a basic understanding of SAS libraries, data sets, and data roles.

What Should You Know about the Examples?

Software Used to Develop the Book's Content

This book assumes that the user has the SAS ODS Graphics Designer, Release 9.2 or later. The designer is included with SAS 9.2 Phase 2 and later.

The examples were created and tested using the designer included with the third maintenance release for SAS 9.4.

Platform Used to Create the Examples

The examples were created in the Windows operating environment. If you are using UNIX, some of the designer's windows might differ from what you see in this book.

Example Code and Data

Most of the examples in this book use data sets provided by SAS and available in the Sashelp library. These data sets include CARS, HEART, and a few others. Sometimes, the number of classifiers was reduced to fit the graph in a restricted space. As a result, modified data sets were used that include a subset of data from the original Sashelp data sets. In addition, custom data sets were needed for an example graph.

When an example requires you to run SAS code, that code is available from:

- the appendix of this book
- http://support.sas.com/publishing/authors/matange.html
- http://support.sas.com/publishing/authors/bottitta.html

Graph Size

The default setting for graph size in the designer is 640px by 480px (pixels). This setting is specified in the Preferences dialog box along with other settings. You can modify these settings by selecting **Tools ►Preferences**.

For this book, the default height is 350px to fit in the available space. When graphs are reduced in size, smaller graphs might have scaled-down font sizes. Also, their numeric axes might display tick values differently. As a result, the graphs that you generate from the examples will not always look identical to the graphs that are shown in the figures. However, both graphs will accurately represent the data.

Styles

The graphs created by the designer use the LISTING style by default. This style and other available styles are optimized for full-color output. Most of the graph examples in this book use the default LISTING style.

Additional Help

Although this book illustrates many analyses regularly performed in businesses across industries, questions specific to your aims and issues might arise. To fully support you, SAS Institute and SAS Press offer you the following help resources:

- For questions about topics covered in this book, contact the author through SAS Press:
  - Send questions by email to saspress@sas.com; include the book title in your correspondence.
  - Submit feedback on the author's page at http://support.sas.com/author_feedback.
- For questions about topics in or beyond the scope of this book, post queries to the relevant SAS Support Communities at https://communities.sas.com/welcome.
- SAS Institute maintains a comprehensive website with up-to-date information. You can get technical support, find resources for a product, and search for information at http://support.sas.com/.

We Want to Hear from You

SAS Press books are written *by* SAS Users *for* SAS Users. We welcome your participation in their development and your feedback on SAS Press books that you are using. Please visit https://support.sas.com/publishing to do the following:

- Sign up to review a book
- Recommend a topic
- Request authoring information
- Provide feedback on a book

Do you have questions about a SAS Press book that you are reading? Contact the author through saspress@sas.com or https://support.sas.com/author_feedback.

SAS has many resources to help you find answers and expand your knowledge. If you need additional help, see our list of resources: https://support.sas.com/publishing.

Chapter 1: Introduction to Creating Graphs

The Value of a Graph 1
Automatic Graphs 2
Creating Graphs Using the Graph Template Language 4
Creating Graphs Using the Statistical Graphics Procedures 6
Creating Graphs Using the SAS ODS Graphics Designer 6
Effective Graphics and the Use of Decorative Skins 8

The Value of a Graph

A picture is worth a thousand words. It is debatable whether this is an old Chinese proverb, or whether it is an adage attributable to a notable historic figure such as Napoleon Bonaparte or Ivan Turgenev in 1862 or Fred R. Barnard in 1927. Whoever said it, the message is clear. For modern data analysis, information is easier to grasp and decode when it is presented in an appropriate visual form.

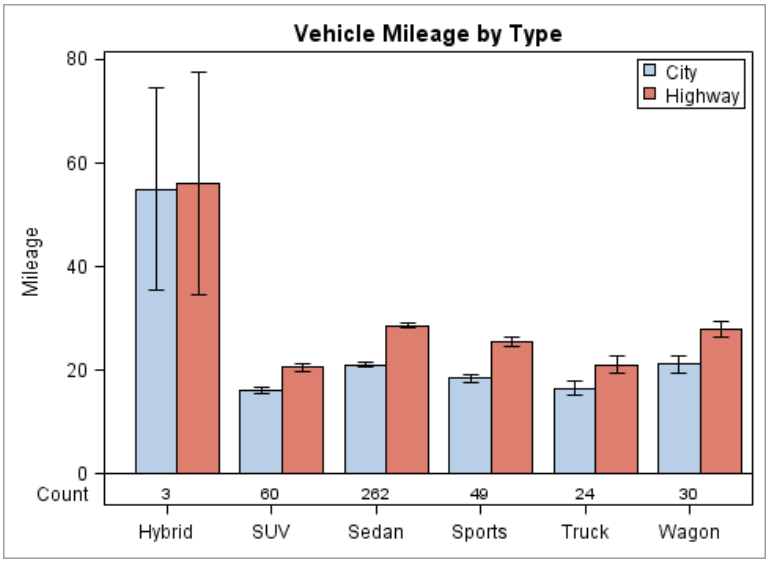
Figure 1.1 shows a table of the mean city and highway mileage, along with upper and lower confidence limits by car type for all cars in the Sashelp.Cars data set. The program to create this data set is shown in “Code for the First Example in Chapter 1” the appendix. Even for this small data set, it is not easy to get a good feel of city and highway mileage across car types.

Figure 1.1 Table of Car Data

Type	Count	City	Hwy	CityLCL	HwyLCL	CityUCL	HwyUCL
Hybrid	3	55	56	36	34	74	78
SUV	60	16	21	15	20	17	21
Sedan	262	21	29	21	28	22	29
Sports	49	18	25	18	25	19	26
Truck	24	17	21	15	19	18	23
Wagon	30	21	28	20	26	23	30

Figure 1.2 shows a simple bar chart of the same data. The graph plots the mean city and highway mileage by car type. It displays the upper and lower confidence limits and the sample size for each car type.

Figure 1.2 Same Car Data Shown in a Graph



Some inferences can be drawn from the graph in Figure 1.2 that are not obvious in the tabular view of the same data in Figure 1.1:

- Mileage for hybrid cars is significantly higher than for the other car types.
- Highway mileage is significantly higher than city mileage for all car types except hybrid.
- Confidence limits and sample size for each car type indicate reliability of the data.

SAS ODS Graphics software, first released with SAS 9.2, has made it very easy to obtain high-quality graphs with little effort in the following ways:

- Obtain automatic graphs from SAS analytical procedures.
- Create custom graphs using the Graph Template Language (GTL).
- Create custom graphs using the statistical graphics (SG) procedures.
- Create custom graphs using the interactive ODS Graphics Designer (the designer).

All of these methods create graphs using a common underlying graphics system based on GTL. Graphs from any method can be used together in your reports with a consistent appearance. Let's now take a brief look at the benefits and audience for each of the methods.

Automatic Graphs

Starting with SAS 9.2, high-quality graphs are automatically produced by many Base SAS, SAS/STAT, SAS/QC, SAS/ETS, and SAS High-Performance Forecasting procedures by merely switching on the ODS Graphics system. No additional graphics coding is required by the user.

Automatic graphs are produced by using the following statements in your program:

```
ods graphics on / options;
 procedure statements;
ods graphics off;
```

Note: Starting with SAS 9.3, ODS Graphics is set to ON by default for SAS procedures that support ODS Graphics when the procedures are executed in the SAS windowing environment.

When ODS Graphics is enabled, graphs and tables are created in the right order and written to the output destination as shown in the following example:

```
ods html;
ods graphics on;

ods select 'Analysis of Variance';
ods select 'Fit Plot';

proc reg data=sashelp.class;
   model Weight = Height;
   quit;

ods graphics off;
```

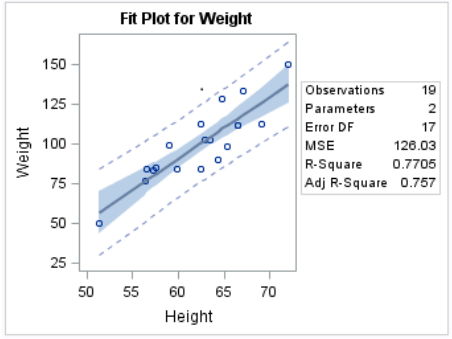
Figure 1.3 Output from the REG Procedure

The REG Procedure
Model: MODEL1
Dependent Variable: Weight

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	7193.24912	7193.24912	57.08	<.0001
Error	17	2142.48772	126.02869		
Corrected Total	18	9335.73684			

The REG Procedure
Model: MODEL1
Dependent Variable: Weight



The audience for these types of graphs is analysts or statisticians.

With SAS 9.2, for both the command line and windowing environment modes, ODS Graphics is off by default and graphics are not created automatically. The default destination is LISTING. In the previous code, the HTML destination is specified and ODS Graphics are enabled.

With SAS 9.3, in command line mode, ODS Graphics is off by default. The default destination is LISTING just like it is for SAS 9.2. However, in the windowing environment mode, ODS Graphics is on by default, and the default destination is HTML. This is a change from SAS 9.2.

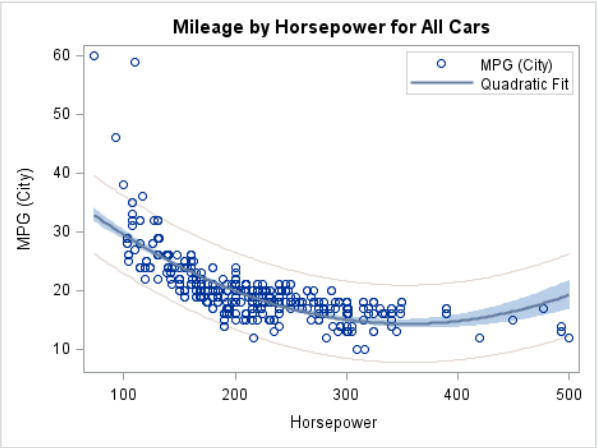
For more information about automatic graphs produced from procedures, refer to the product documentation for SAS/STAT or for the SAS Output Delivery System.

Creating Graphs Using the Graph Template Language

Graph Template Language (GTL) syntax is the foundation of ODS Graphics. GTL is the syntax used to define the structure of a graph. GTL supports many different statements to define graphs that generally fall into one of the following categories:

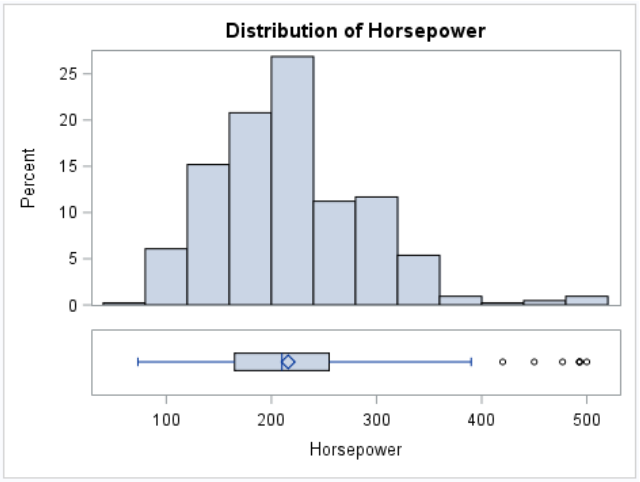
- Single-cell graphs. Such graphs are commonly used in various domains, and they can span from the simple scatter plot to complex model-fit plots with multiple overlaid plots, legends, and statistics.

Figure 1.4 Single-Cell Graph



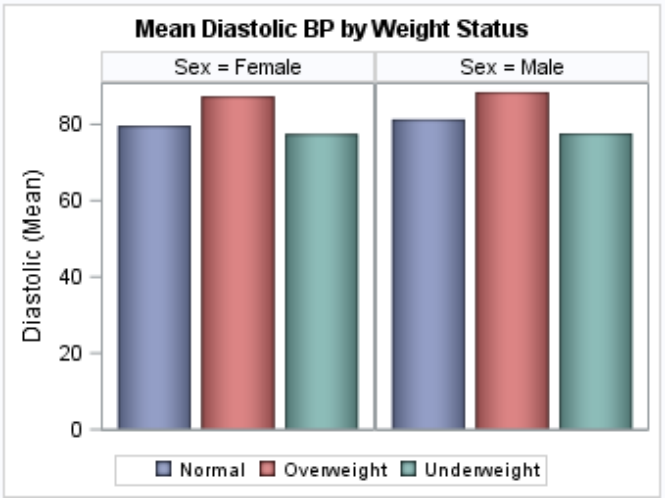
- Multi-cell ad hoc graphs with or without uniform axes. These graphs have multiple cells that can display data. The cells in this layout are in a regular grid that is specified by the user. Each cell can contain multiple overlaid graphs. The graph can have uniform or shared axes.

Figure 1.5 Multi-Cell Graph



- Multi-cell classification panels that are driven by one or more classification variables. The layout contains a regular grid of cells determined by the classification variables.

Figure 1.6 Classification Panel



The automatic graphs produced by SAS procedures like the one shown in Figure 1.3 use pre-defined GTL templates.

You can create your own graph templates using the TEMPLATE procedure and GTL. Then, you can associate the GTL template with your data using the SGRENDER procedure to create the graph.

GTL is a powerful and flexible language for defining the structure of many graphs, from the simplest single-cell graph to very complex paneled graphs. If you want to make persistent changes to the automatic graphs created by procedures, you need to modify the associated template. To do that, you need to have a good understanding of GTL. The audience for GTL is the advanced graph programmer.

The details of GTL can be found in SAS documentation. A detailed description of GTL is beyond the scope of this book.

Note: For SAS 9.3 and SAS 9.4, documentation for ODS Graphics is included in Base SAS documentation. For earlier releases of SAS, it is included in SAS/GRAPH documentation. This change was made because ODS Graphics became part of Base SAS starting with SAS 9.3. SAS/GRAPH is no longer required to use ODS Graphics.

Creating Graphs Using the Statistical Graphics Procedures

If you want to create custom graphs, and you don't really need to make persistent changes to the automatic graphs created by procedures, you can often use the statistical graphics (SG) procedures. These are a set of value-added procedures that are built on top of GTL. These procedures surface a concise syntax to create most of the commonly used graphs in many usage domains. Here are the procedures:

- SGPLOT procedure for single-cell graphs
- SGPANEL procedure for classification panel graphs
- SGSCATTER procedure for comparative scatter plots and matrices

The details of these SG procedures can be found in SAS documentation. For SAS 9.3 and SAS 9.4, details are included in Base SAS documentation. For earlier releases, they are included in SAS/GRAPH documentation. Detailed descriptions of the SG procedures are beyond the scope of this book.

If you prefer to create graphs using procedure syntax, the SG procedures might be the right tools for you. The book *Statistical Graphics Procedures by Example: Effective Graphs Using SAS* provides a quick start to creating graphs using the SG procedures.

The audience for the SG procedures is the graph programmer.

Creating Graphs Using the SAS ODS Graphics Designer

By far, the easiest and fastest way to create a custom graph is by using the SAS ODS Graphics Designer (the designer). The designer is an interactive application, built on top of GTL, which you can use to easily create and design custom graphs.

The designer was developed for a user with one or more of the following characteristics:

- wants to quickly create a graph using an interactive application
- is not familiar with graph syntax and has no desire to learn it
- currently exports data to third-party software just to create graphs

- wants to create quick prototype graphs
- wants to learn the basics of GTL

The designer surfaces the necessary features of GTL in an interactive graphical interface application to create the most commonly used graphs in many domains with zero programming.

The following list highlights some of the tasks that you can accomplish using the interactive designer:

- begin a graph from a gallery of commonly used graphs for a quick start
- customize your graph by adding more plots and insets
- create single-cell graphs, classification panels, and ad hoc layouts
- view GTL code, which is generated while creating the graph
- save your custom graphs to the Graph Gallery for quick access
- save your graphs as SAS ODS Graphics Designer (SGD) files for future use or to share with others
- save your graphs as image files or in the following formats: HTML, PDF, EMF, and PS
- create a graph from the SGD file using the SGDESIGN procedure and send the output to the open ODS destinations with the same or different data

In this book, you learn how to do all of the above tasks and more. The designer is not only a great tool to create your graph, it is a great tool for learning GTL. You can see how GTL is put together every time you make a change to the graph. You can copy GTL code from the code window into the SAS program window and run the code.

By necessity, the designer does not support every feature in GTL. There might come a time when you are unable to make a customization using the designer that might be available in GTL. In this case, you can do most of your work in the designer, and then you can take the generated GTL code into the SAS program window for further customization.

The primary audience for the designer is the user who wants to create a graph using an interactive application. This user is often not familiar with procedure syntax for creating graphs. Users who are familiar with SG procedures or GTL syntax often find the designer useful for rapid prototyping.

Note: You cannot use the designer to customize GTL templates created by the TEMPLATE procedure. Also, you cannot use the designer to customize templates used by SAS procedures to create automatic graphs like the one in Figure 1.3. The reason is that the designer does not support all the features available in GTL, including conditional logic, function evaluation, and more. The templates used for automatic graphs are quite complex and specialized. Furthermore, the designer saves and reads only SGD files, which are essentially ZIP files of the various assets needed by the designer to create graphs. The designer does not read or write template files.

Effective Graphics and the Use of Decorative Skins

Graphs created by the designer are built with the principles of effective graphics in mind. By default, the designer always strives to create a graph that delivers the information with maximum clarity and minimum clutter.

Though initially designed with the statistical user in mind, these graphs are finding increasing usage in non-statistical domains. In these domains, there is often a desire for a flashier graph.

In SAS 9.3 and SAS 9.4, several plot types in the designer support an option that enables you to apply a decorative skin to the plot. For example, the bar chart type includes this option. This option does not change the shape of the bar; instead, it provides a flashier rendering. This option can be used at the discretion of the user. Some examples in this book use this option, such as Figure 1.6.

Chapter 2: Using the Designer

Start the Designer 9
Designer Graphical User Interface 10
Menus and Toolbar 11
Graph Gallery 11
Elements Pane: Plots and Insets 12
Right-Click Pop-Up Menus 13
Create a Graph 13
Graph Terminology 14
Basic Concepts and Task Workflow 15
Graph Types and Layouts 16
Parameters Available for the SGDESIGN Macro 17

Start the Designer

The SAS ODS Graphics Designer (the designer) is included with SAS 9.2 Phase 2 and later.

To start the application in the SAS windowing environment, do either of the following:

SAS Release	Start the Designer
9.2 Phase 2	Submit the following macro from the SAS program window: `%sgdesign();`
9.3 and 9.4	Submit the previous macro or select **Tools ► ODS Graphics Designer**.

The designer opens in a separate window.

To access SAS data sets and other SAS functionality, the designer works in conjunction with another open SAS session. The designer does not work in the SAS session from which it was launched. To accomplish this, when the designer is launched, it opens a new, in-the-background SAS session on the same computer and works in that SAS session to create the graphs.

To create graphs from your data, the designer needs to know the libraries that you have been working with before launching. Therefore, relevant information about all active libraries is sent to the designer, and active libraries are assigned (in a new SAS session) to access your data sets. For

more information, see “Parameters Available for the SGDESIGN Macro” at the end of this chapter.

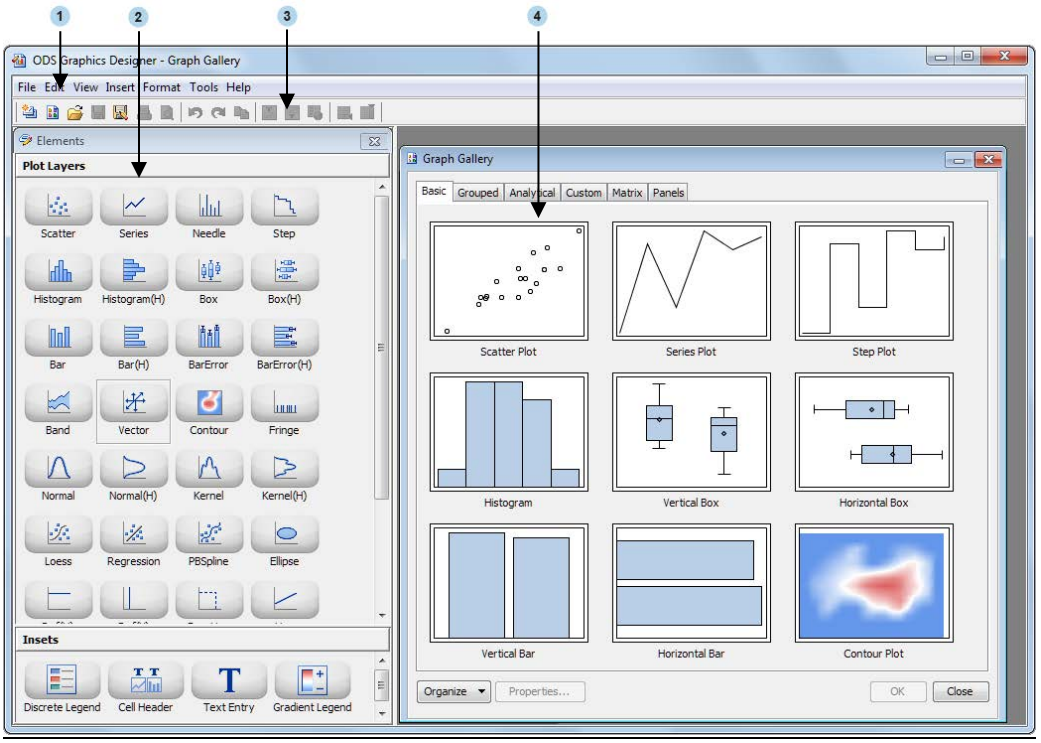
Designer Graphical User Interface

When the designer starts, it displays a graphical user interface in a separate window.

> **Tip**: Sometimes this window might be hidden behind the SAS application window. If so, click on the designer icon ( ) in the taskbar to bring it to the front.

Here are the features of the designer’s main window:

Figure 2.1 The Designer’s Main Window



1. The main menu bar contains menus that you can use to perform a variety of tasks within the designer.
2. The Elements pane contains plots, lines, and insets that you can insert into a graph. To insert an element, click and drag the element onto the graph. The elements in this pane are available only when a graph is open.
3. The toolbar contains icons that you can click to perform common tasks such as saving files and inserting titles or footnotes. The icons on this toolbar are available only when a graph is open.

4. The work area contains one or more graphs that you create and design in the designer. In addition to the graphs, you can display the Graph Gallery, a collection of predefined graphs.

Menus and Toolbar

The main menu bar provides options for managing graphs, graphics elements, and other features. Common menu options are also available on the toolbar.

Here are the menus and their tasks:

File
: open, save, and print graphs. You can save graphs in several formats, and you can save a graph to the Graph Gallery.

  You can export styles that you have created or modified. Creating and editing styles is beyond the scope of this book.

Edit
: undo and redo your actions. You can copy a graph image to the clipboard and then immediately paste it into another application.

View
: display or hide the Graph Gallery and the Elements pane.

  The designer generates GTL code behind the scenes to create the graphs that are being built. You can show or hide the code window from this menu.

Insert
: insert graphics elements such as titles, footnotes, and global legends into a graph.

Format
: modify visual properties of the selected plot. You can apply a different style to the graph.

Tools
: open the style editor tool. You can also update user preferences.

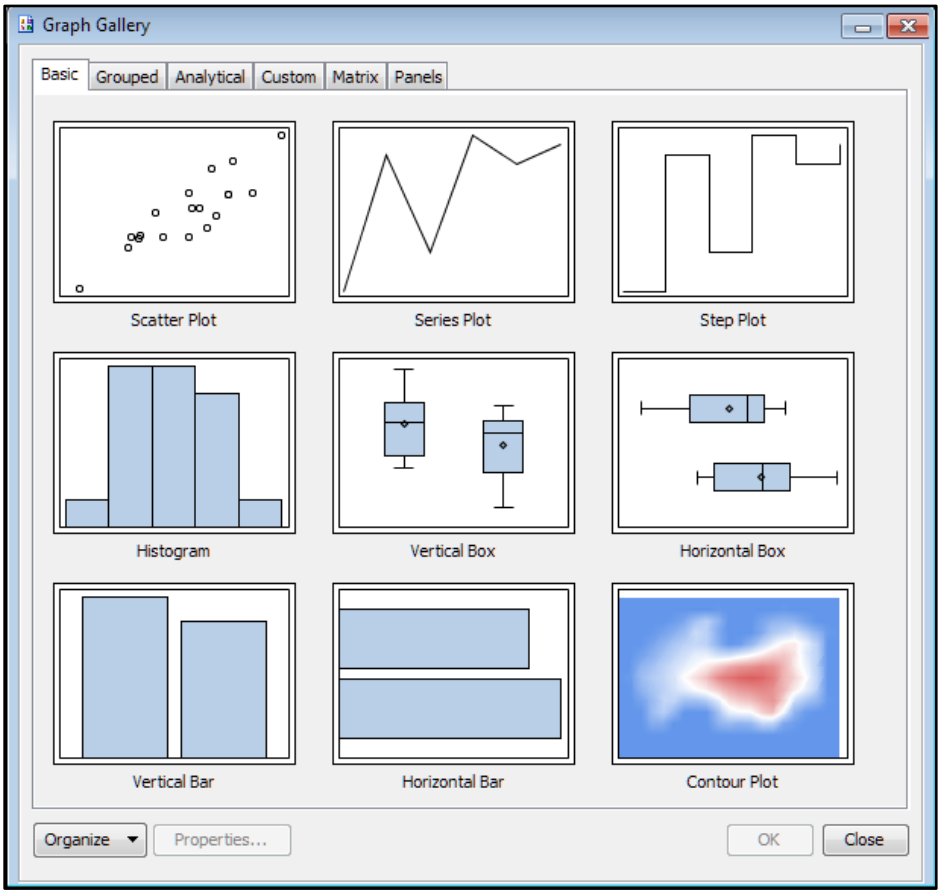
Help
: view the designer's **About** dialog box. Starting with the third maintenance release for SAS 9.4, the menu contains a link to online Help.

Graph Gallery

The work area is on the right side of the main window. It contains the Graph Gallery as shown in Figure 2.2. This gallery provides predefined, commonly used graphs that you can create. The Graph Gallery is organized into groups of graphs. Each group is represented as a tab in the gallery. The following figure shows the default view of the graph icons that are on the Basic tab.

Click on the various tabs to explore the graphs.

Figure 2.2 Graph Gallery



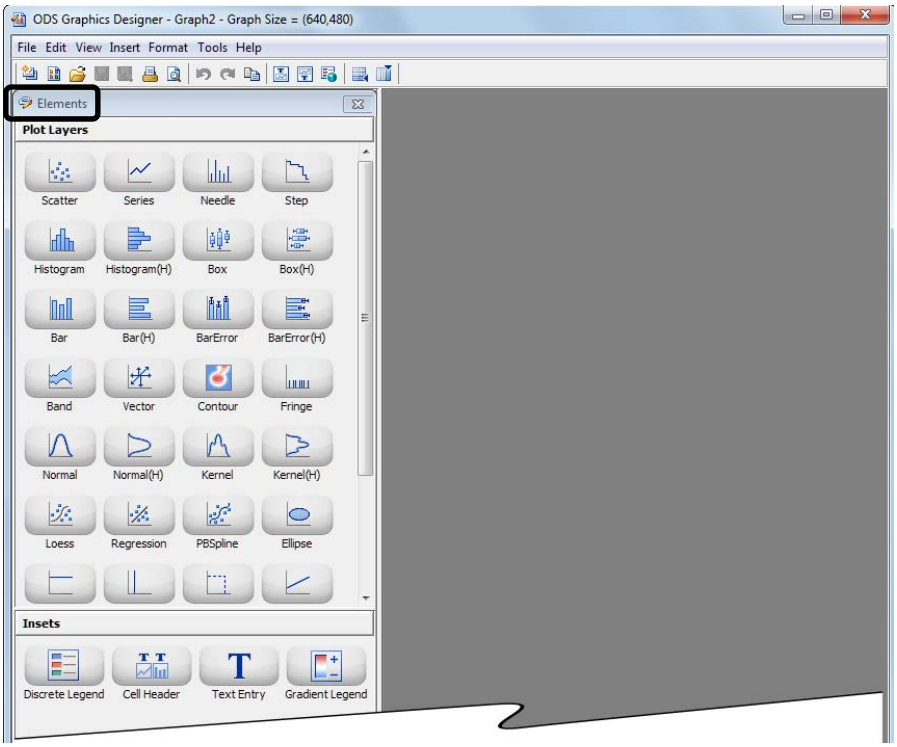
You can choose a predefined graph as the basis for your graph. You can then customize your graph by adding titles, footnotes, legends, additional plots, and other items.

In addition to the predefined graphs, you can add your own custom graphs to the Graph Gallery.

Elements Pane: Plots and Insets

The Elements pane is to the left of the work area. This pane contains icons for the plots and insets that you can add to a graph.

Figure 2.3 Elements Pane



The elements in this pane are available only when a graph is open.

The Elements pane contains the following panels:

- The Plot Layers panel contains icons for different plot types that can be used to design many types of graphs. All of the elements in this panel are plots and lines.
- The Insets panel contains icons for graphics elements including a discrete legend, a gradient legend (for contour plots), a cell header, and a text entry.

Right-Click Pop-Up Menus

Pop-up menus are available for most aspects of a graph. These handy menus apply to plots, legends, axes, graph cells, titles, footnotes, and the graph itself. For example, if you right-click inside a graph cell, and select **Add an Element**, a dialog box is displayed from which you can add a plot, inset, title, footnote, or legend.

Create a Graph

You can create a graph in one of the following ways:

- Select a graph from the Graph Gallery, and click **OK**. This is perhaps the easiest way to create a graph.

  When you open a graph from the gallery, an **Assign Data** dialog box is displayed, showing the placeholder settings for the plot variables. Change the settings as needed for

your graph, and click **OK** to create the graph. This is discussed in more detail in subsequent chapters.

Tip: If the Graph Gallery is not displayed, select **View ► Graph Gallery** to display it.

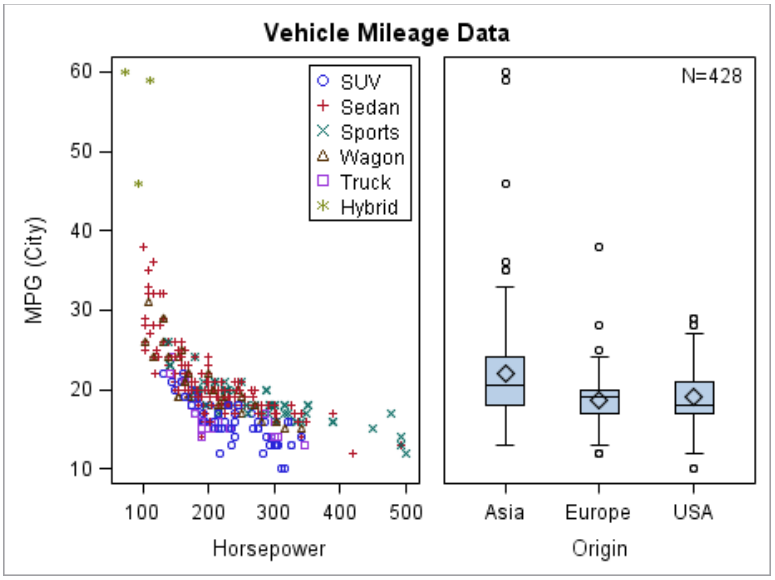
- Select **File ► New ► Blank Graph**. When you start from a blank graph, you must add all the plots, titles, legends, and other elements to create your graph.
- Open a previously saved graph by selecting **File ► Open**.
- Use the Auto Charts feature to generate graphs based on your data and the graph types that you specify. This is discussed in Chapter 6.

Once a new graph is created, it is displayed in a graph window in the work area. If there is a graph in the work area, the Elements pane is active. You can then drag and drop compatible plots or insets onto the graph and customize the graph with titles, footnotes, and other graphics elements.

Graph Terminology

Let's review the terminology used to reference different parts of the graph.

Figure 2.4 Graph Example for Terminology



Term	Description
Graph	The entire entity shown in the example graph.
Cell	A data area of a graph that can contain plots, text, and a legend. The example graph contains two cells.
Plot	A graphical representation of data. In the example graph, the left cell contains a grouped scatter plot and the right cell contains a box plot.

Term	Description
Axis	The axis line, the major and minor tick marks, the major tick mark values, and the axis label. Each cell can have its own independent axes, or the cells can share a common axis. In the example graph, the two cells share the Y axis, but they have their own independent X axes.
Titles and Footnotes	Descriptive text that is displayed above (title) or below (footnote) any cell or plot area in the graph. A graph can have zero or more titles, footnotes, or both. The example graph contains one title, "Vehicle Mileage Data."
Legend	A legend border and one or more legend entries. A graph can have one or more legends. The legend can reside inside a cell (cell legend) or outside a cell (global legend). In the example graph, the scatter plot includes a cell legend.
Inset	An element displaying relevant information. In the example graph, the right cell contains a text entry inset in the upper right corner of the cell.

Basic Concepts and Task Workflow

Creating graphs involves a simple building-block process. The following list summarizes the main steps that you perform to create a graph. Although the steps are listed in a logical order, the order in which you perform them can vary.

- Start the graph. You can start with a graph from the Graph Gallery, and then add more plots, legends, insets, titles, and so on, to create the custom graph that you need. Or, you can start with a blank graph, add plots, and so on.

  Note: The Auto Charts feature enables you to generate a graph based on your data and the graph type that you specify. This is discussed in Chapter 6.
- Add plots, legends, or insets to a graph. If you started with a blank graph, you must add at least one plot.

  Drag and drop an item from the Elements pane onto a cell of the graph. You can drag and drop more than one plot onto a cell if the plots are compatible. For example, you might drag and drop a fit plot onto a cell that has a scatter plot with numeric variables. Both are compatible plots.

  Often, compatibility can be determined only after the roles and axis settings have been assigned. You might drag and drop a plot that has role assignments that make it incompatible with the current contents of the cell. In this case, a message is displayed, and the new plot is not added.

  For more information about plot compatibility, see Chapter 4.

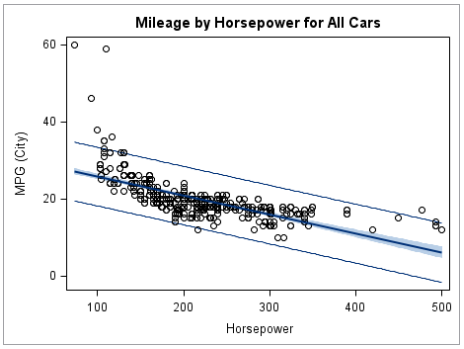
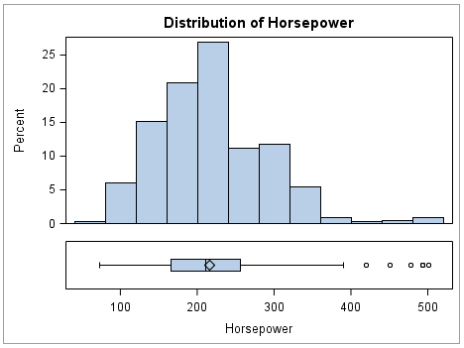
  Some non-plot items, such as the discrete legend and text entry inset, are included in the Insets panel of the Elements pane. These items can be dragged and dropped onto a cell.

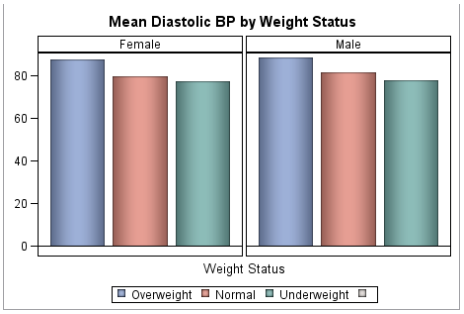
- Assign data roles to a plot. You assign data roles to a new plot when the plot is added to your graph. Assigned data roles can be changed later using the plot's right-click pop-up menu.
- Add titles, footnotes, or global legends. These can be inserted into the graph by selecting the **Insert** menu.
- Assign visual properties to graphs. Visual properties can be assigned by using the plot's right-click pop-up menu. Similarly, visual properties for axes, legends, titles, and so on, can be assigned by using the appropriate pop-up menu.
- You can save the results as an image file for inclusion in a report or as an ODS Graphics Designer file (SGD) that you can later edit. You can save your graphs in the following formats: HTML, PDF, EMF, and PS.

Graph Types and Layouts

With the designer, you can create the following types and layouts of graphs:

Types and Layouts

Type and Layout	Example Figure
Single-cell graph. This graph has only one cell containing all the plots. The graph can have multiple titles, footnotes, and legends. The data for all the plots in a cell must come from a single data set.	
Multi-cell ad hoc graph. This graph has multiple cells that contain plots displaying data. Each cell can have a different set of overlaid plots with legends and insets. This graph can have multiple titles at the top of the graph above all the cells and multiple footnotes at the bottom below all the cells. Each cell can have a different associated data set.	

Type and Layout	Example Figure
Multi-cell classification panel. This graph has multiple cells arranged in a regular grid. The number and arrangement of the cells are determined by the panel variables. The plot type in each cell is the same, using a subset of data for the crossing of panel variables. Cells cannot have legends or insets. This graph can have multiple titles at the top of the graph above all the cells, and multiple footnotes at the bottom below all the cells. The data for all the plots must come from a single data set.	

In addition to these types and layouts, the designer includes shared-variable graphs. In these graphs, different plots are driven by shared variables. Shared-variable graphs support all three layouts described in the previous table. These graphs are discussed in more detail in Chapter 7.

Parameters Available for the SGDESIGN Macro

The SGDESIGN macro that is used to start the designer accepts the following optional parameters:

refresh = Y | N

Default = N. Refresh the list of libraries available to the designer.

While using the designer, you can go into the other open SAS session and continue working with your data sets in the previously assigned libraries, including Work. These new or modified data sets are visible in the designer SAS session. If you modify an existing library assignment or create a new library assignment, you must send that information to the designer before the library can become available. To do this, you can resubmit the SGDESIGN macro with the REFRESH option. This sends the updated information to the designer. Here is an example:

```
%sgdesign(refresh=y);
```

portNum = *integer*

Default = 5310. This parameter indicates the port that the designer uses to communicate with the SAS server. If another application is using port 5310, you can specify a different port for the designer, such as 5320.

dataSets = Y | N

Default = N. This parameter rebuilds the Work data sets. Some of the plots that are provided with the designer depend on data sets that the designer creates in the Work library. If you inadvertently delete some of these data sets, you can re-create them by setting this parameter to Y the next time you start the designer.

For example, to change the port number to 5320 and re-create the data sets, you can submit the following statement:

```
%sgdesign(portnum=5320, datasets=Y);
```

These parameters can be used in any order.

Chapter 3: Create Your First Graph

About This Example 19

Create Your Graph 20

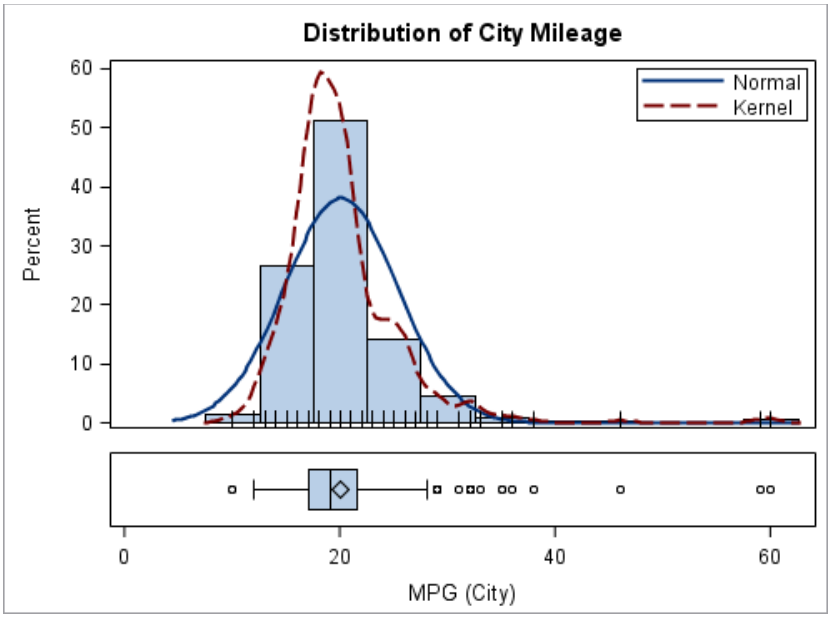
- Create a Histogram from the Graph Gallery 20
- Assign Data to the Histogram 23
- Change the Title and Remove the Footnote 24
- Add Plots to the Graph 25
- Set Plot Properties 28
- Add and Modify a Legend 30
- Add a Row to the Graph 32
- Add a Horizontal Box Plot to the Empty Cell 33
- Use a Common X Axis 35
- View the GTL Code 36
- Copy and Paste the Graph to Another Application 36
- Save the Graph to a File 37
- Save the Graph in the Graph Gallery 37
- Run the Graph in Batch Mode 39

About This Example

Let's jump right in and create a commonly used graph. This example uses many of the key features of the SAS ODS Graphics Designer (the designer). Some of these features are described in more detail later in the book. For this example, the right amount of description needed to create the graph and gain a basic understanding of the process is provided.

Let's make a distribution plot of city gas mileage for all cars in the Sashelp.Cars data set:

Figure 3.1 Distribution of City Gas Mileage



The graph includes the following features:

- a histogram of the MPG_CITY variable from the Sashelp.Cars data set
- overlaid normal density curve and kernel density curve
- an overlaid fringe plot showing individual observations
- an inset legend
- a separate horizontal box plot
- a common external X axis
- a graph title

Create Your Graph

The following sections walk you through the steps of creating your graph.

Create a Histogram from the Graph Gallery

The Graph Gallery is displayed in the work area as shown in Figure 3.2. For graphs that are created from the Graph Gallery, placeholder data is assigned to the graph.

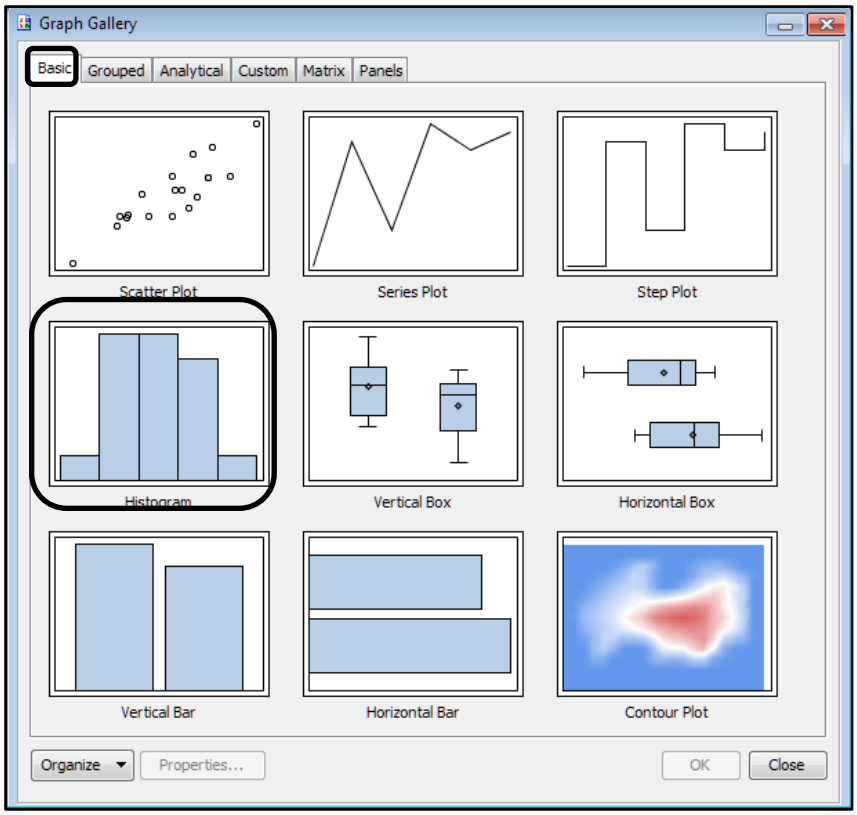
> **Note:** If the Graph Gallery is not displayed, select **View ►Graph Gallery**.

To create the histogram:

1. On the Basic tab of the Graph Gallery, select the **Histogram** icon.
2. Click **OK**.

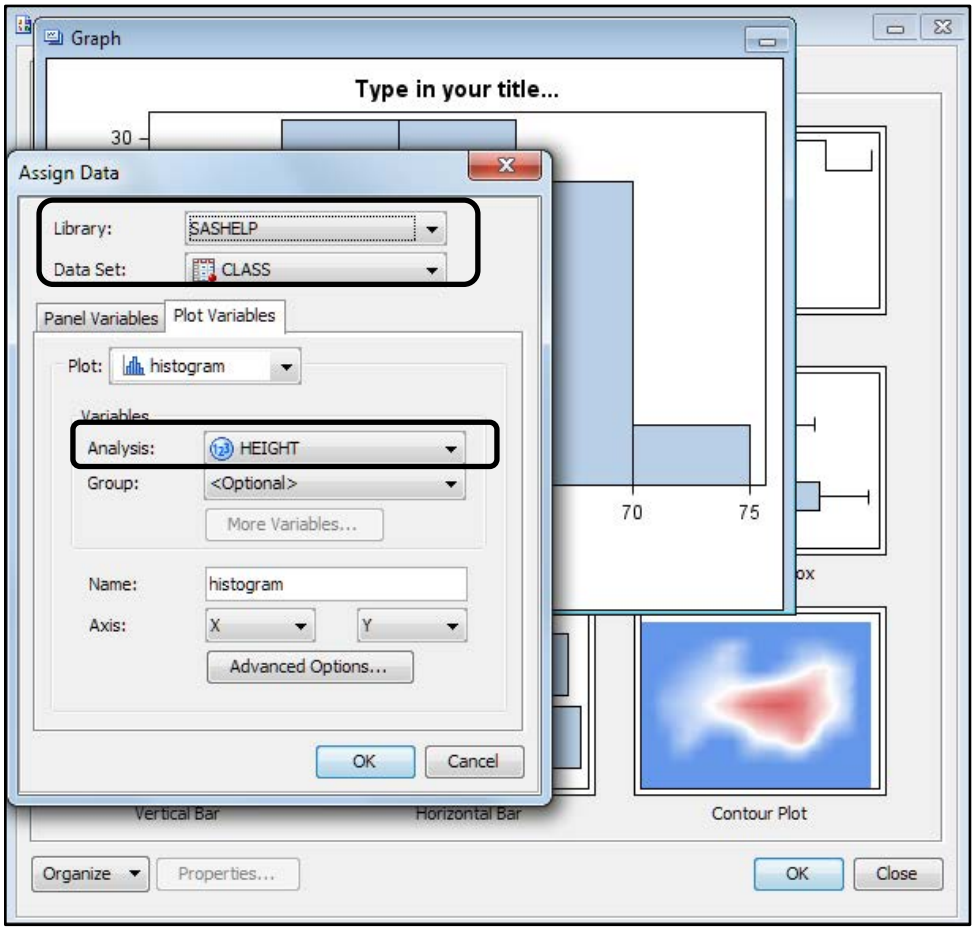
You can also double-click the **Histogram** icon. For future steps, this book uses the double-click action when it is available.

Figure 3.2 Graph Gallery with Highlighted Histogram and Basic Tab



A graph window is displayed that includes a histogram plot. The **Assign Data** dialog box for the histogram appears, showing the placeholder data assignments.

Figure 3.3 Placeholder Data in the Assign Data Dialog Box



Note: Do not click **OK** in the **Assign Data** dialog box. You will change the data assignments in the next step.

The placeholder data enables the designer to show a visual draft of the type of plot that has been included in the graph. In this case, the designer uses the HEIGHT variable from the Sashelp.Class data set. Using this placeholder data, the designer creates the histogram.

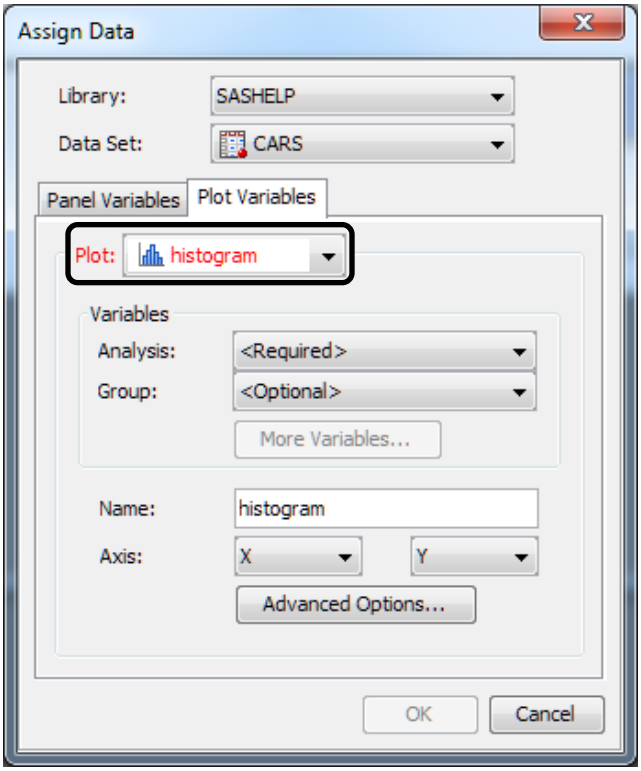
The **Assign Data** dialog box is discussed in more detail in Chapter 4. For now, it's sufficient to know that you use this dialog box to change the data assigned to the plot and to the analysis variable.

Assign Data to the Histogram

Assign the MPG_CITY variable from the Sashelp.Cars data set to the histogram.

1. In the **Assign Data** dialog box, select **CARS** for **Data Set**.

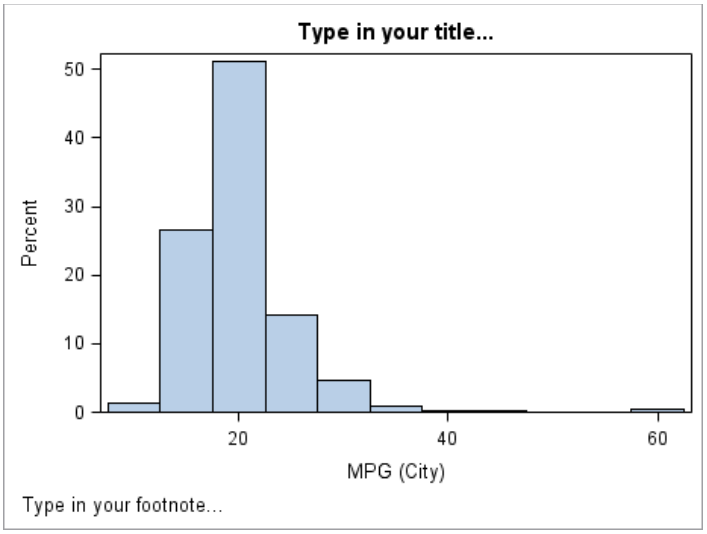
   The previous variable, HEIGHT, is not available in the new Sashelp.Cars data set, so the **Analysis** variable setting has been cleared. Because an analysis variable is required, the settings for the histogram are not complete. As a result, the plot identifier is shown in red and the **OK** button is not available.



2. Select **MPG_CITY** for **Analysis**.
3. Click **OK**.

The designer creates the graph with a histogram and a placeholder title and footnote.

Figure 3.4 Histogram with Title and Footnote Placeholders



Note: Your graph might be a different size from the one shown here. For information about the graph sizes used in this book, see "Graph Size" in **About This Book**.

Change the Title and Remove the Footnote

Replace the placeholder title and remove the footnote.

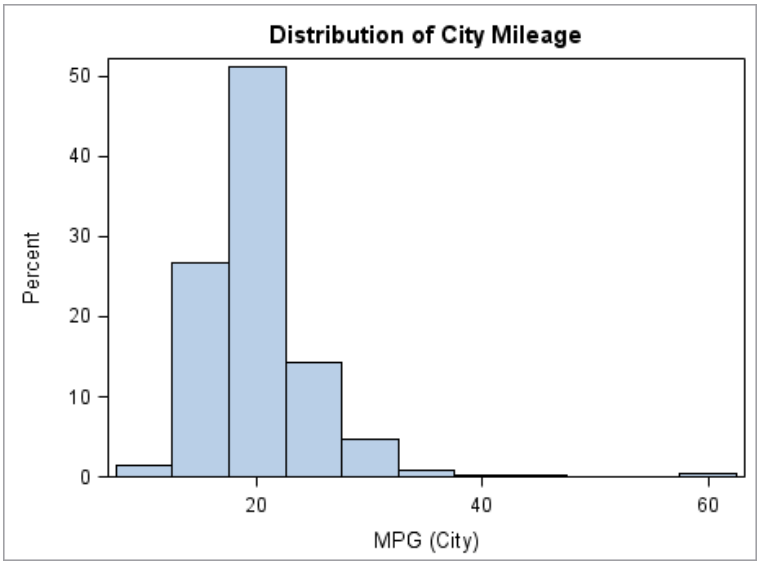
1. Double-click on the placeholder title ("Type in your title"). The placeholder text is highlighted:

2. In the text box, enter **`Distribution of City Mileage`**.
3. To remove the footnote, right-click on the placeholder footnote ("Type in your footnote"), and select **Remove Footnote**.

   Your changes are reflected in the graph.

Figure 3.5 Graph with New Title



Other actions related to titles and footnotes include the following:

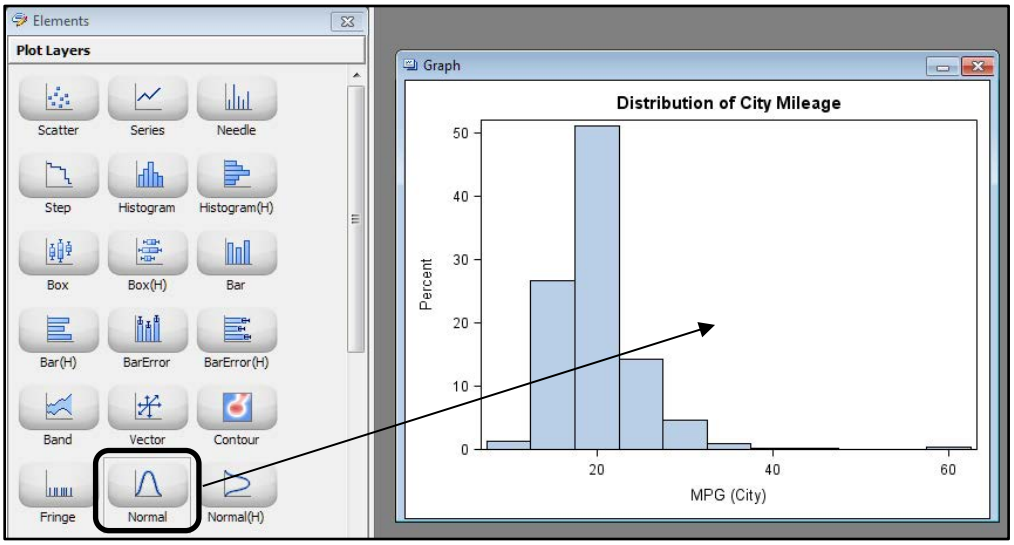
- To set title properties, right-click on the title, and select **Title Properties**. The **Text Properties** dialog box is displayed from which you can customize the visual properties of the title, such as font, color, and so on. You can do the same for the footnote.
- You can insert more titles and footnotes using the **Insert** menu.

Add Plots to the Graph

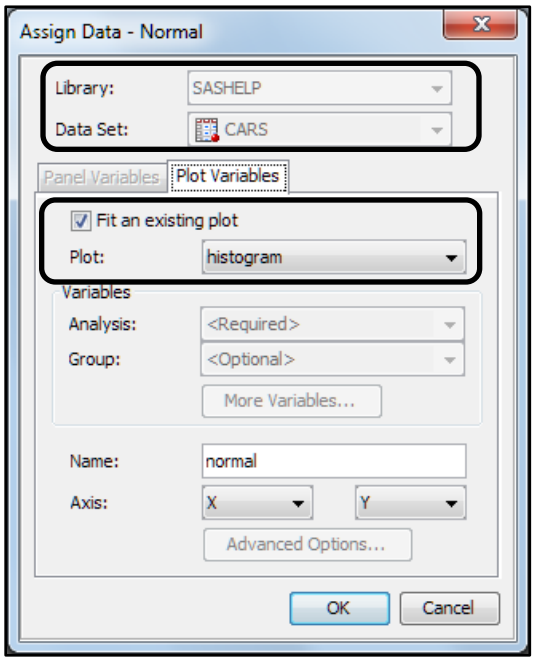
When a graph is displayed in the work area, the Elements pane is active. You can easily add a plot from the Elements pane to the graph cell, assuming the plot being added is compatible with the existing plot and its axes settings in the graph cell. Plot compatibility is discussed in more detail in Chapter 4.

For this example, let's add a normal density curve, a kernel density curve, and a fringe plot to the graph. These plot types are compatible with the histogram and can be added to this graph.

Figure 3.6 Normal Plot in the Elements Pane



1. In the Elements pane, click the **Normal** icon as shown in Figure 3.6. Drag and drop the **Normal** icon onto the graph. The **Assign Data** dialog box for a normal density curve is displayed.



Note the following in the dialog box:

- **Library** and **Data Set** are not available. All the plots in a single cell of a graph must use data from the same data set.

- **Fit an existing plot** is selected by default. With this option, the normal density curve uses the same data settings as the histogram. There is only one plot currently in the graph—the histogram. If there were more plots, you would have a choice of which plot to use for the fit.
- Because **Fit an existing plot** is selected, **Analysis** is not available. The newly added plot must use the same data as the histogram. In this example, the normal density curve is fitted with the same analysis variable as the histogram.

2. Click **OK**. The normal density curve is added to the graph.
3. In the Elements pane, click the **Kernel** (kernel density curve) icon. Drag and drop the **Kernel** icon onto the graph.

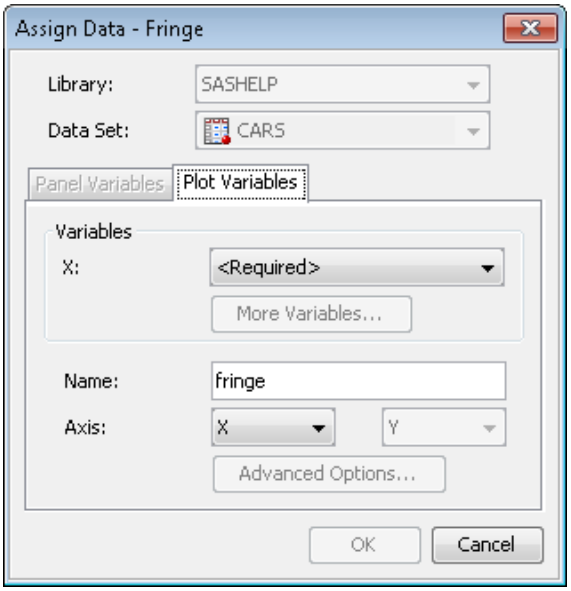
The **Assign Data** dialog box for a kernel density curve is displayed.

This dialog box is similar to the dialog box for the normal density curve. **Fit an existing plot** is selected by default.

4. Keep the default selections and click **OK**. The kernel density curve is added to the graph.
5. In the Elements pane, click the **Fringe** icon. Drag and drop the **Fringe** icon onto the graph.

The **Assign Data** dialog box for a fringe plot is displayed.

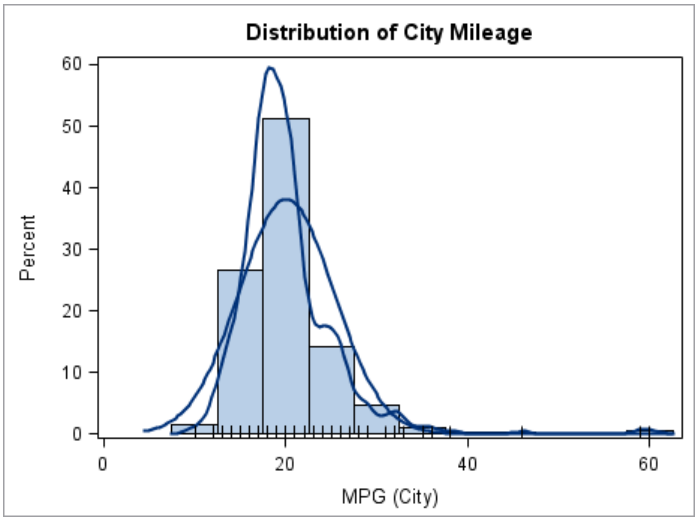
6. Select **MPG_CITY** for **X**.



4. Click **OK**.

The graph is updated with the new plots.

Figure 3.7 Graph with Normal Density Curve, Kernel Density Curve, and Fringe Plot



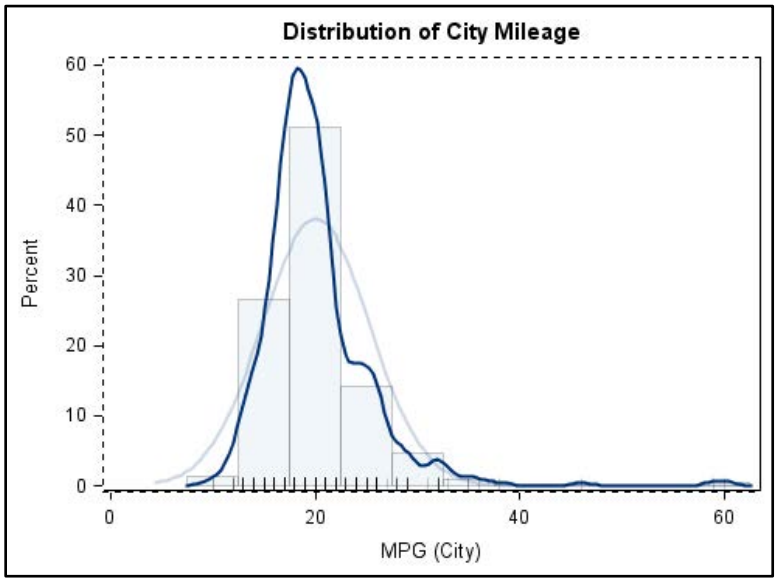
Set Plot Properties

Figure 3.7 shows the distribution of city mileage for all cars in the Sashelp.Cars data set using a histogram, two density curves, and a fringe plot. Because the density curves have the same visual properties, it can be difficult to tell which one is normal and which one is kernel.

To make them clearer, you can modify the visual properties of the kernel density curve. Select the kernel density curve, and then change the properties.

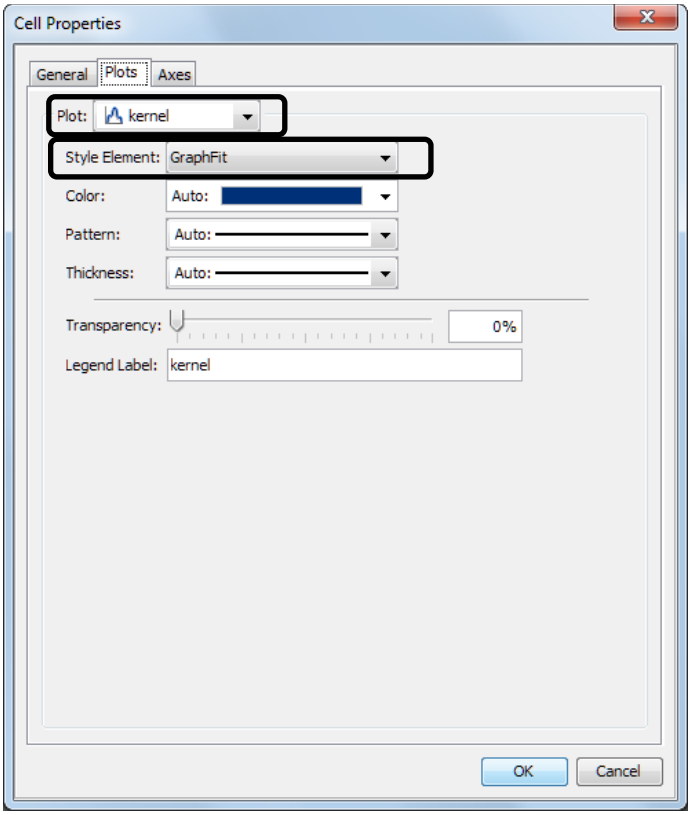
1. In the graph, select the kernel density curve. (The kernel density curve is the taller of the two curves.)

   The kernel density curve is selected and in bold. The other plots in the cell are dimmed.



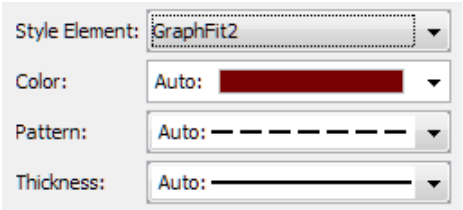
2. Right-click on the curve, and then select **Plot Properties**. The **Cell Properties** dialog box is displayed with the Plots tab selected.
3. Make sure that **kernel** is selected as **Plot**. If not, select **kernel**.

   The style element currently assigned to the kernel density curve is GraphFit, as shown in **Style Element**. (For more information about style elements, see "Visual Properties of a Graph" in Chapter 4.)



4. For **Style Element**, select **GraphFit2**.

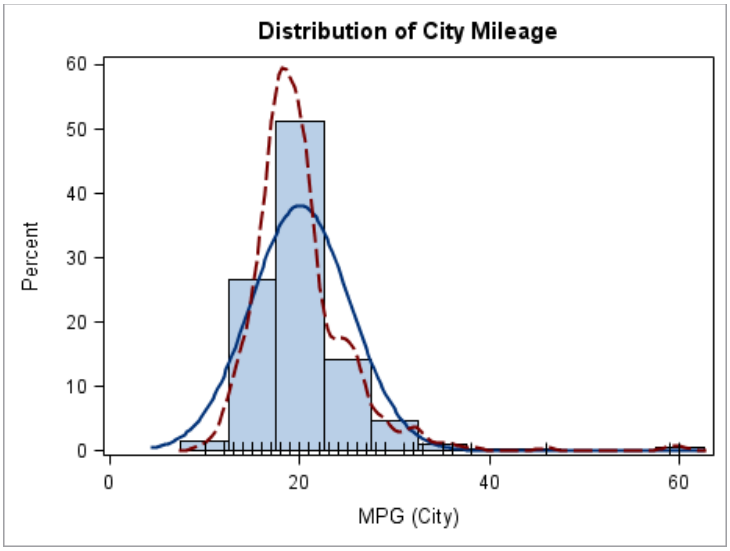
   When you change the style element, the plot's attributes, such as color and pattern, are automatically changed to reflect the new style element.



5. Click **OK**.

The graph is updated to reflect your changes.

Figure 3.8 Modified Appearance for the Kernel Density Curve



Add and Modify a Legend

In Figure 3.8, the visual properties of the two density curves are now distinct, but it is still difficult to see which one is the normal density curve and which one is the kernel density curve. To be able to identify the curves, add a legend.

The designer provides two types of legends:

Cell legend
is placed inside the data area of a cell. It is available from the Element pane's Insets panel. By default, this legend contains information for all the plots in that cell. It contains entries for only the plots in that cell.

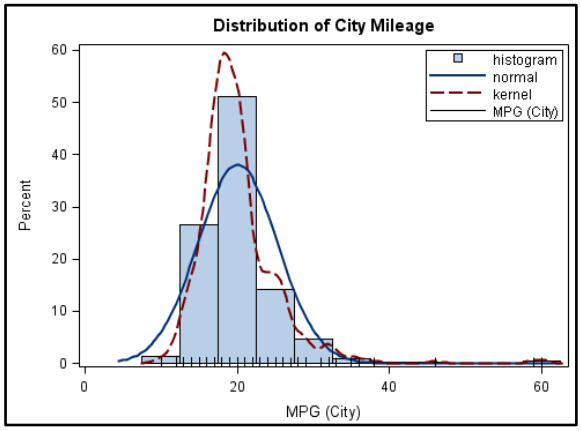
Global legend
is placed outside the cells. It contains entries from all the plots in the entire graph, including multi-cell graphs. A global legend can be added to the graph by selecting **Insert ►Global Legend** or by clicking the global legend toolbar button.

For this example, add a cell legend to the cell in the empty space in the upper right corner. Then, modify the legend to contain only the entries for the normal density curve and the kernel density curve.

1. In the Insets panel at the bottom of the Elements pane, click the **Discrete Legend** icon.

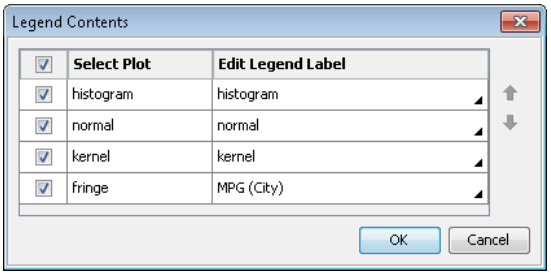
2. Drag and drop this icon onto the upper right corner of the cell.

   A legend that contains all the plots in the cell is added to the graph. However, it is unnecessary to show all the plots in the legend because some of that information is obvious. In this example, the histogram and the fringe plot are easily identified, so remove those entries from the legend.



3. Right-click on the legend, and select **Legend Contents**.

   The **Legend Contents** dialog box is displayed. Initially, check boxes for all the plots in the cell are selected.

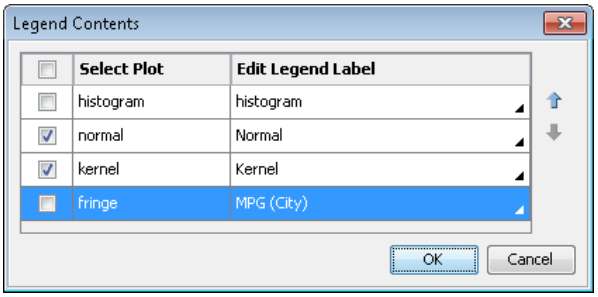


4. Clear the check boxes for **histogram** and **fringe**.

   You can customize the label that is displayed beside the chicklet in the legend. In this example, capitalize the normal density curve and kernel density curve legend labels.

5. In the **Edit Legend Label** column, double-click **normal**. Replace the lowercase **n** with a capital **N**.

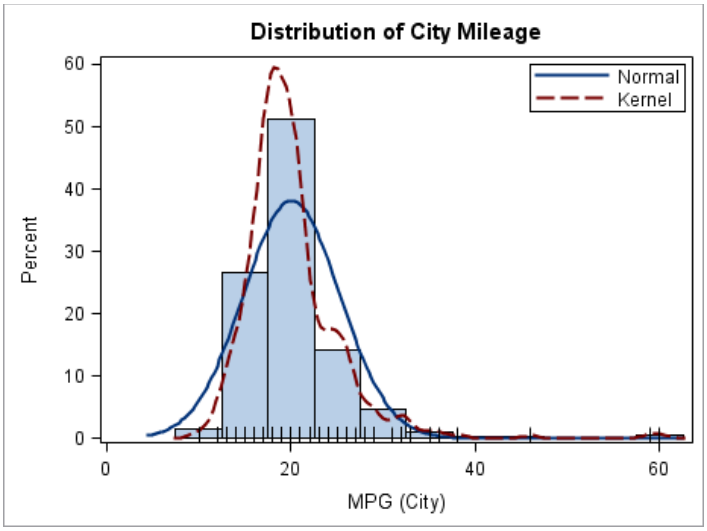
6. Double-click **kernel**, and replace the lowercase **k** with a capital **K**. The **Legend Contents** dialog box should now resemble the following:



7. Click **OK**.

The graph is updated to reflect your changes.

Figure 3.9 Graph with a Cell Legend in the Upper Right Corner



Add a Row to the Graph

Now, let's add a horizontal box plot to the graph in a separate cell below the histogram. To do this, first you have to add a new row to the graph.

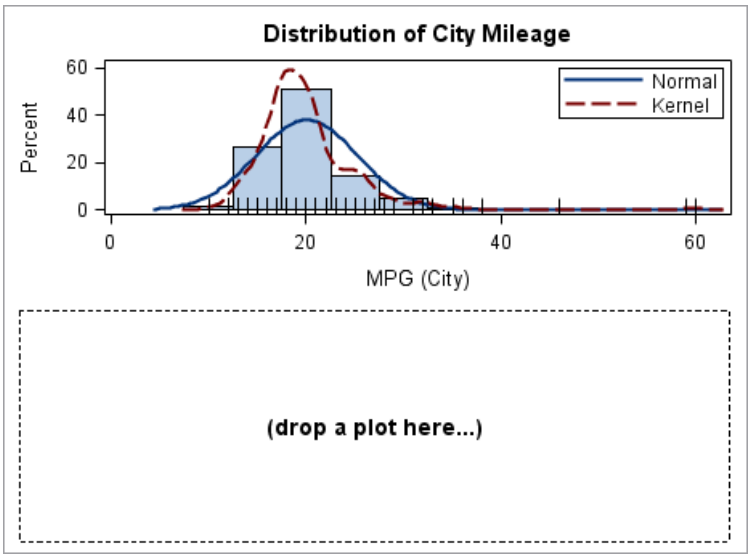
To add a new row, right-click anywhere in the plot area, and select **Add Row**.

The graph area is split into two rows of equal height. You now have a graph with two rows; each row has one cell.

> **Tip**: You can add a column by right-clicking and selecting **Add Column**. Cells are always added in full rows or full columns to create a regular grid. After adding the row for this example, if you then add a column, the graph will contain four cells.

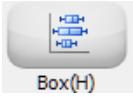
The new cell is empty except for the text "drop a plot here." You can now populate this cell with plots and insets.

Figure 3.10 Graph with Two Rows



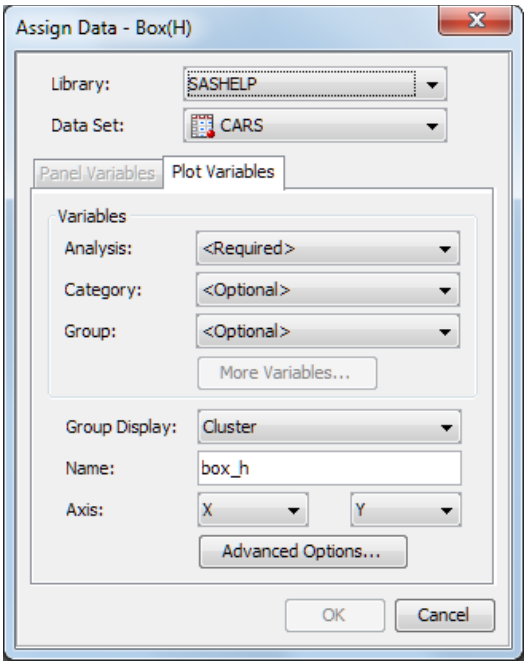
Add a Horizontal Box Plot to the Empty Cell

1. In the Elements pane, click on the **Box(H)** icon, and drag and drop the icon onto the bottom cell of the graph.

2. The **Assign Data** dialog box for the horizontal box plot is displayed.

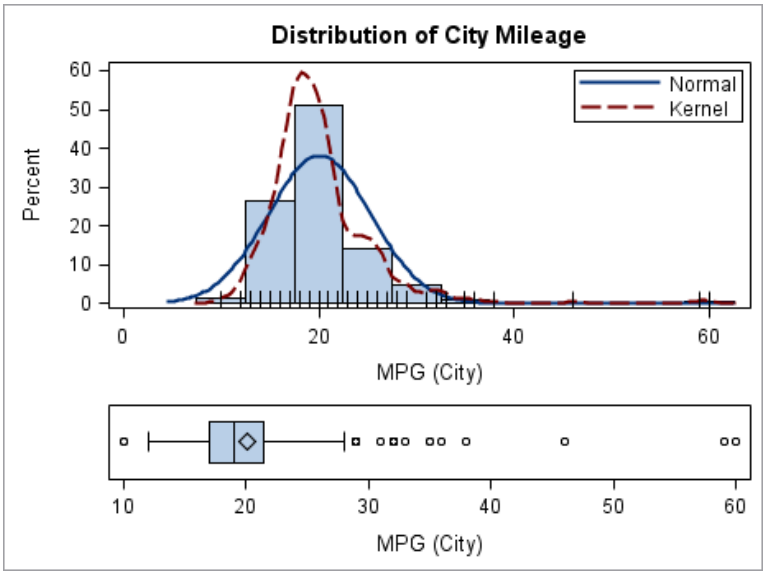
   Library and **Data Set** values are based on the previous settings for the graph. You can keep those settings for the new plot. However, because this is a separate cell, you can select a different library and data set. The requirement about using the same data set applies only to plots in the same cell.



3. For **Analysis**, select **MPG_CITY**.
   For a box plot, the analysis variable is required. **Category** can be set to create box plots by category, but this is not required.
4. Select **OK**.

The box plot is added to the graph.

Figure 3.11 Graph with a Box Plot in the Bottom Row



Starting with SAS 9.4, the height of the new cell is automatically reduced to fit the single box plot.

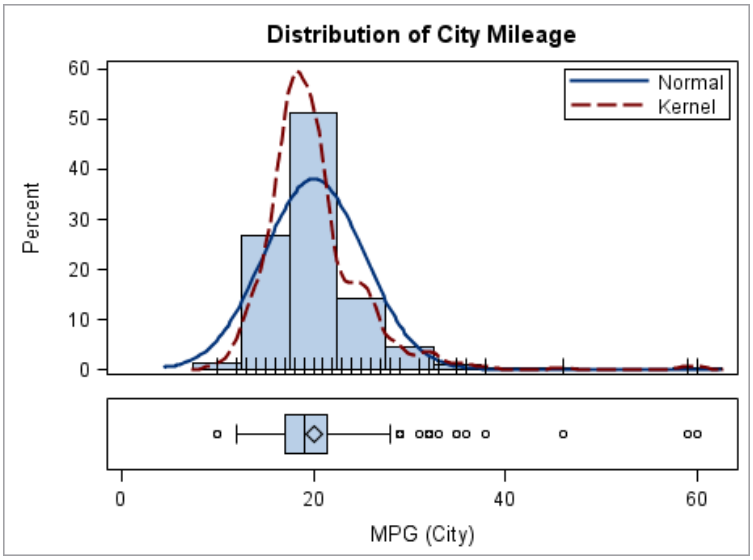
Use a Common X Axis

In Figure 3.11, each cell has its own X axis. The two axes are independent of each other, and their data ranges do not match. In this case, you want the two axes to match. Also, you don't need two separate axes because they take up valuable space in the graph and can be misleading.

To use a common X axis for both rows, right-click on one of the X axis areas, and select **Common Column Axis**.

A common column axis is created for all the cells in the column (two cells in this example). It is displayed at the bottom. The axis range for the common column axis is the union of the ranges for each cell in the column. All plots in each cell in the column are drawn correctly scaled to this new common column axis.

Figure 3.12 Graph with a Common X Axis



The two rows resize to fit their contents. The bottom row is shorter than the top row.

Note: In early releases of the designer, the rows are not automatically resized. If that is the case for you, you can change the height manually.

Position the cursor between the upper and lower row of the graph. A dashed line appears between the rows, and the cursor changes to a two-headed arrow ↕.

Click and drag the dashed line downward to reduce the height of the bottom row.

View the GTL Code

The designer is an excellent tool for learning the Graph Template Language (GTL). The designer generates GTL code as you create a graph.

To view the generated GTL code, select **View ► Code**.

The code window is displayed in the work area for the active graph.

For simplicity, the following figure shows the code window for the state of the graph when it contained only a histogram, a normal density curve, and a title.

Figure 3.13 GTL Code for the Histogram and Normal Density Curve

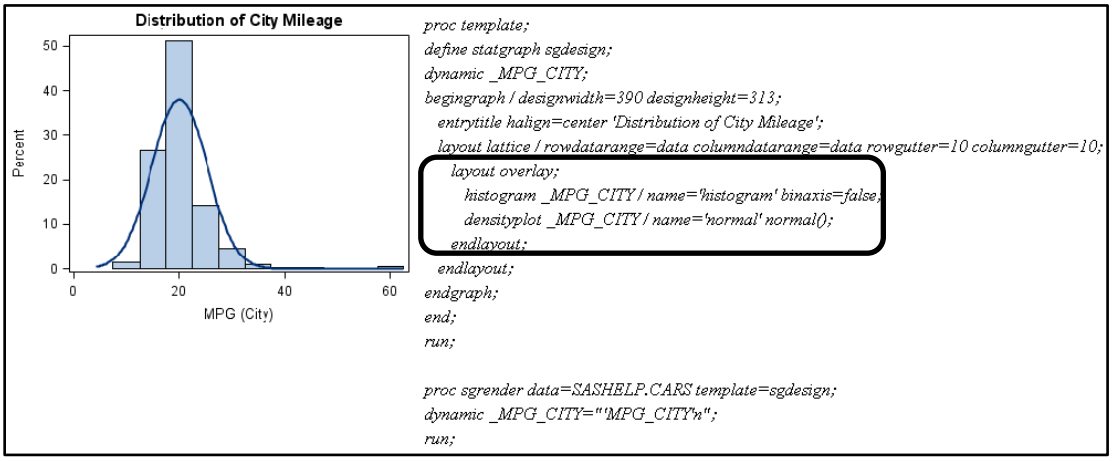


Figure 3.13 shows the GTL code needed to create this graph using the TEMPLATE procedure and the SGRENDER procedure. The boxed section shows the layout overlay block containing the histogram and normal density curve.

You can leave the code window displayed and view the changes to the code as you make changes to the graph.

The code window is Read-only. You can save the code as a SAS file, or you can copy and paste the code into SAS and run the program.

Copy and Paste the Graph to Another Application

At any stage, you can copy an image of the graph to the clipboard. Then, you can immediately paste it into a Word document, an email message, a PowerPoint presentation, or some other application that supports the paste feature.

1. Select **Edit ► Copy**. An image of the active graph is copied to the clipboard.
2. Paste the image into an application by using the application's paste command, such as Ctrl-V.

Save the Graph to a File

Save the Graph as a SAS ODS Graphics Designer File

You can save the graph in the SAS ODS Graphics Designer (SGD) format, which is a metafile format recognized by the designer. These files include the GTL code and other relevant information so that the designer can re-open the graph later for further modification.

1. Select **File ► Save As**.
2. In the **Save** dialog box, select the **SGD** file type.
3. Provide a name for the file, and click **Save**.

You can open a previously saved SGD file by selecting **File ► Open**, and then selecting the file that you want to open. Any SGD files in the selected folder are represented using an icon for the graph.

Note: You use this SGD file later in the book, so be sure to complete the previous step.

Save the Graph as an Image File

You can save a copy of the graph to the file system as an image file. The designer supports multiple industry-standard image formats such as BMP, EMF, GIF, JPG, PDF, PNG, PS, SVG, and TIF. For the PNG format, you can specify a DPI to get higher resolution files.

1. Select **File ► Save As**.
2. In the **Save** dialog box, you can do the following:
    - specify the filename and folder into which to save the file
    - select a file type
    - select image resolution in DPI for PNG files

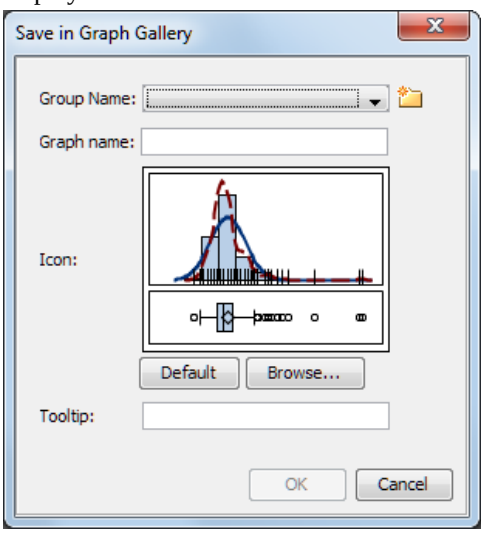
Save the Graph in the Graph Gallery

After you have designed a graph, you can add it to the Graph Gallery. You can then open and reuse the graph like you would any graph in the gallery.

Although graphs cannot be saved on the first six tabs of the gallery, you can add new tabs to the gallery.

To save the graph to the gallery:

1. Select **File ► Save in Graph Gallery**. The Save in Graph Gallery dialog box is displayed.



2. For **Group Name**, select the name of the group into which you want to add the graph. Each group corresponds to a tab in the gallery.

   Group Name contains the names of groups that have been created at your site. It does not contain the names of the default groups. If no groups have been created at your site, or if you want to create your own group, do the following:

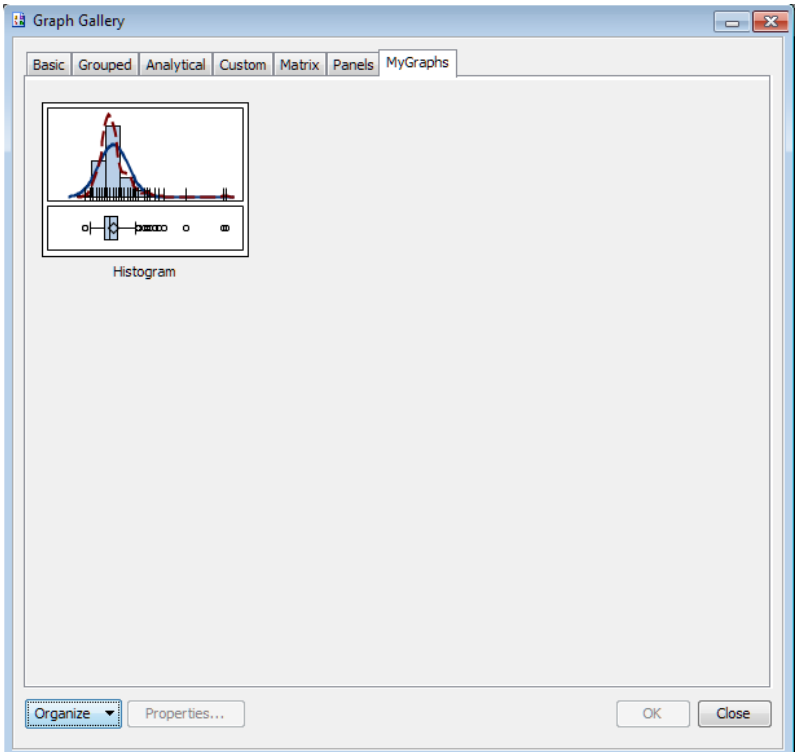
   a. Select the New icon.
   b. In the Create New Group dialog box, specify a name for the group. For this example, specify **MyGraphs**, and click **OK**.

      The new group appears in **Group Name** in the Save in Graph Gallery dialog box.

3. For **Graph name**, enter **Histogram**.
4. (Optional) The designer creates a default graph icon for the generated graph. If you want to replace the default icon with an icon from your file system, click **Browse**, and select a different icon.
5. (Optional) For **Tooltip**, you can provide a description that is displayed as a tooltip for your new graph.
6. Click **OK**.

The graph is saved in the Graph Gallery for future use. Your gallery might look something like this:

Figure 3.14 Graph Gallery with the MyGraphs Tab



Run the Graph in Batch Mode

Graphs saved as SGD files can be run in the SAS windowing environment or in a batch session by using the SGDESIGN procedure.

```
proc sgdesign sgd='c:\histogram.sgd';
run;
```

In the code, replace *c:\histogram.sgd* with the name and location of the SGD file that you saved.

The graph is run using the definition in the SGD file and the original data set used to create the graph. The libref and data set should be available in the SAS session.

SGD graphs can be run with different data as long as all the required variables exist in the new data set. You can specify different data by using the DATA= option in PROC SGDESIGN. This topic is covered in more detail in Chapter 7.

Chapter 4: Understanding Plot Types, Data Roles, and the Visual Properties of a Graph

Review of the Process for Creating Graphs 41

Plot and Insets Groups 42

- Basic Plots 42
- Fit Plots 43
- Distribution Plots 43
- Categorization Plots 44
- Other Plots 44
- Insets 44
- Summary of Combining Plots and Insets 45

Data Assignment When Adding a Plot 45

Data Assignment from the Pop-Up Context Menu 48

Custom Features of Other Assign Data Dialog Boxes 49

- Fit Existing Plot 50
- Model Band Options 51
- Statistics Data in the Assign Data Dialog Box 51

Visual Properties of a Graph 52

Styles and Style Elements 52

- Overview of Styles and Style Elements 52
- Commonly Used Style Elements 53

Properties That Affect the Entire Graph 54

Plot Properties 57

Review of the Process for Creating Graphs

Before moving on to plot types, data roles, and visual properties, let's review the process for creating graphs.

In Chapter 3, you created a distribution plot (shown in Figure 3.1) of city mileage for all cars in the Sashelp.Cars data set. To create this graph, you used a building-block process. You started by creating a simple histogram. Then, you added more details to the graph by layering multiple density curves on the histogram. You customized the axes and the title, and you added a legend. You split the graph into two rows of cells, and you populated the lower cell with a box plot. You used a common X axis for the graph.

This is the same process that you will use to create all graphs in the SAS ODS Graphics Designer (the designer). This process applies to a single-cell graph as shown in Figure 3.9, to a multi-cell ad hoc graph as shown in Figure 3.11, and to multi-cell panel graphs as you will see in Chapter 5.

Just like any good recipe in a cookbook, to create a graph in the designer, you need a set of ingredients and a method. Here you go:

- Typically, you start with a graph from the Graph Gallery. This gives you a graph with an overlay container that contains a plot, a placeholder title, and a placeholder footnote.
- Or, you start with a blank graph with only an overlay container.
- You add plots and assign variables in the **Assign Data** dialog box.
- You can customize the properties for each plot. Remember, in Chapter 3, you specified a different style element for the kernel density curve.
- You can split the graph into multiple cells, and populate each cell with plots.
- You can add and customize titles and footnotes.
- You can customize the axes or use a common axis for multi-cell graphs.
- You can add and customize the legends.
- You can customize the graph properties, and save the graph for further processing.

Although the method is always the same, the ingredients can be different each time. The ingredients include a combination of plots, legends, entries, titles, and footnotes. In this chapter, let's look at the following:

- the behavioral aspects of the plot
- the required and optional variables in the **Assign Data** dialog box
- some of the graph properties that can be customized

Plots and Insets Groups

All the plots and insets that can be used to create a graph in the designer are represented as icons in the Elements pane. (See Figure 2.3 in Chapter 2.)

The icons are ordered by their frequency of use in analytical graphs. The scatter plot is the most commonly used plot.

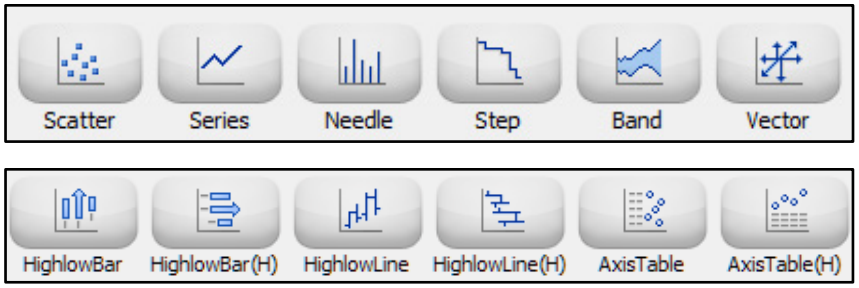
The plots can be grouped into categories. The following sections examine each group and its compatibility with other groups.

Basic Plots

This group contains the Scatter, Series, Needle, Step, Band, and Vector plots. Starting with SAS 9.4, the designer includes Highlow and AxisTable plots in this group. An axis table is a basic plot that displays data values at specific locations along the vertical or horizontal axis. Axis tables are described in Chapter 5.

Basic plots render a visual in which each observation from the data set is represented in the graph. The plots in this group can be combined with each other and with plots from all other groups.

Here are the icons for this group:

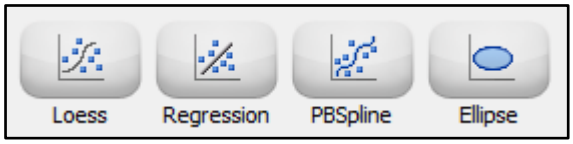


Fit Plots

This group contains the Loess, Regression, PBSpline, and Ellipse plots.

The plots in this group can be combined with each other and with any basic plot. These plots cannot be combined with distribution or categorization plots.

Here are the icons for this group:



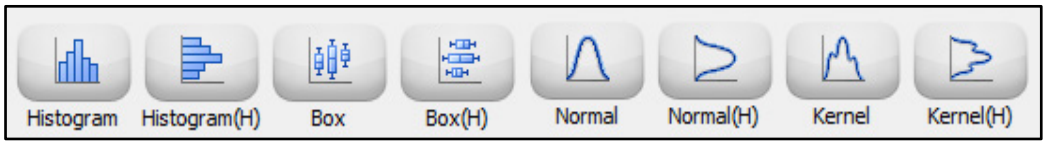
Distribution Plots

This group contains the Histogram, Box, Normal, and Kernel plots. All of these plots are available in either vertical or horizontal orientation.

The following combinations are allowed:

- A vertical histogram can be combined with vertical normal and kernel plots.
- A horizontal histogram can be combined with horizontal normal and kernel plots.
- Vertical and horizontal plots can be combined, but the results might be unpredictable.
- A histogram, normal, or kernel plot can be combined with any basic plot, but the results might be unpredictable.
- Box plots can be combined with fringe plots and reference lines, but not with other distribution plots. Box plots with both category and analysis variables can also be combined with basic and categorization plots.

Here are the icons for this group:



Categorization Plots

This group contains the Bar chart and BarError chart. Both charts are available in either vertical or horizontal orientation.

The following combinations are allowed:

- These charts can be combined with basic plots, reference lines, dropline plots, line plots, and fringe plots.
- These charts cannot be combined with distribution or fit plots.
- These charts can be combined with a box plot that has both category and analysis variables and the same orientation.

Here are the icons for this group:

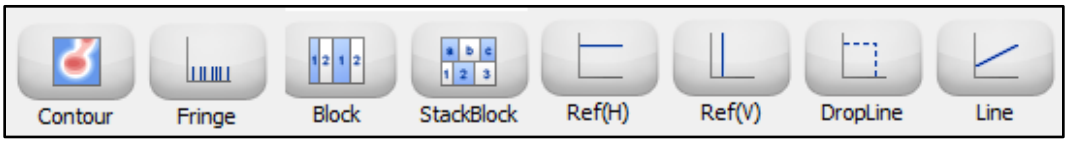
Other Plots

This group contains the Contour, Fringe, Block, StackBlock, Ref (horizontal and vertical), DropLine, and parameterized Line plots.

The following combinations are allowed:

- The contour and fringe plots can be combined with basic plots.
- The ref, dropline, and line plots can be combined with most plots.
- The block and stackblock plots are special plots that can be added to the inner margins of some plots.

Here are the icons for this group:



Insets

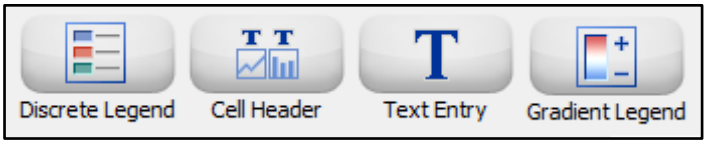
Insets are available from the Insets panel of the Elements pane.

This group contains Discrete Legend, Cell Header, Text Entry, and Gradient Legend.

The following combinations are allowed:

- A discrete legend, cell header, and text entry can be added to any cell.
- A gradient legend is used only with contour plots.

Here are the icons for this group:



Summary of Combining Plots and Insets

Within some compatibility constraints, plots and insets can be combined to create an effective graph. In Chapter 3, you combined a histogram, a normal density curve, a kernel density curve, a fringe plot, and a legend in one cell, as shown in Figure 3.1. All of these are compatible with each other.

Plots can be combined with other plots that are in the same group. Some plots from different groups can be combined as described in the previous sections. For these combinations, the data types on common axes must be compatible.

Data Assignment When Adding a Plot

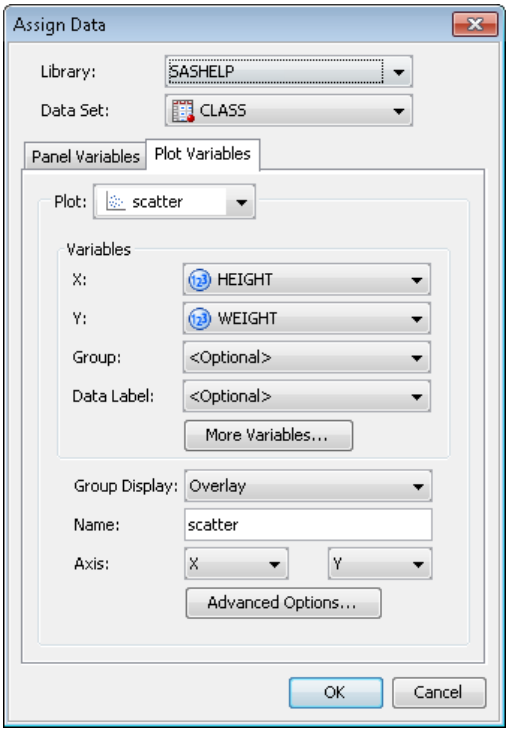
When you add a plot from the Elements pane to a graph, the **Assign Data** dialog box is displayed. In the **Assign Data** dialog box, you assign data variables to various plot roles, such as X, Y, a group role, and so on. The roles that are available depend on which type of plot you are adding.

The dialog box for each plot type is customized for the features of that plot. All **Assign Data** dialog boxes have common features that are applicable to most plots.

Let's look at the general structure of the **Assign Data** dialog box for the scatter plot. Once you understand the structure, you can easily decipher the parts that are specific to each plot.

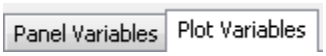
The dialog box contains placeholder data because the scatter plot was created from the Graph Gallery.

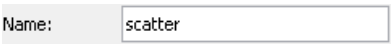
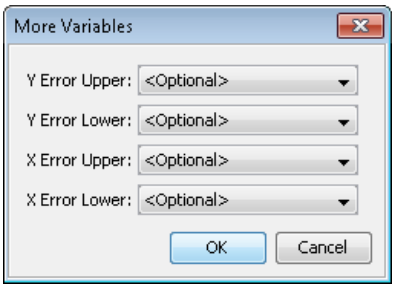
Figure 4.1 Assign Data Dialog Box for a Scatter Plot

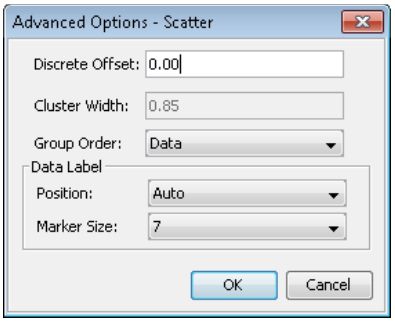


The following table describes parts of the dialog box:

Parts of the Dialog Box for the Scatter Plot

Dialog Box Part	Description
	**Library and Data Set**: All plots in a cell must use data from the same library and data set. When the first plot is added to a cell, these values are editable and can be set. For subsequent plots added to the same cell, these values are already set and cannot be changed.
	**Panel Variables and Plot Variables tabs**: You can specify the plot variables and panel variables (for classification panels). Panels are discussed in more detail in Chapter 5. By default, the Plot Variables tab is selected.
	**Variables**: Each plot has required and optional variables. Drop-down lists are provided for all variables. For a scatter plot, the X and Y variables are required, and placeholder variables are assigned when the plot is created from the Graph Gallery. Some frequently used optional variables can be set using drop-down lists.

Dialog Box Part	Description
	**More Variables**: Often, the plot supports more variables than can be shown in the dialog box. If more variables can be set, **More Variables** is enabled. Click this button to access a second dialog box for setting these variables. For a scatter plot, you can set the X and Y error values as shown later in this table.
	**Group Display**: For plots that support groups, **Group Display** is available. Based on the plot type, groups can be overlaid, stacked, or clustered.
	**Name**: Each plot has a name. The name is used to identify the plot or to reference the plot in legends and other places in the designer. A default system-generated name is assigned, but you can change it.
	**Axis**: Each plot can be assigned to a pair of axes. The defaults are X and Y. However, you can assign the plot to any combination of X, X2, Y, and Y2.
	**Advanced Options**: Some plots support options that control the behavior of the plot. For example, the regression plot supports **Degree**. Click **Advanced Options** to set these options.
	**More Variables Dialog Box**: This dialog box is displayed when you click **More Variables**, which is available for some plot types. This example shows the **More Variables** dialog box for the scatter plot. Variables vary for each plot type.

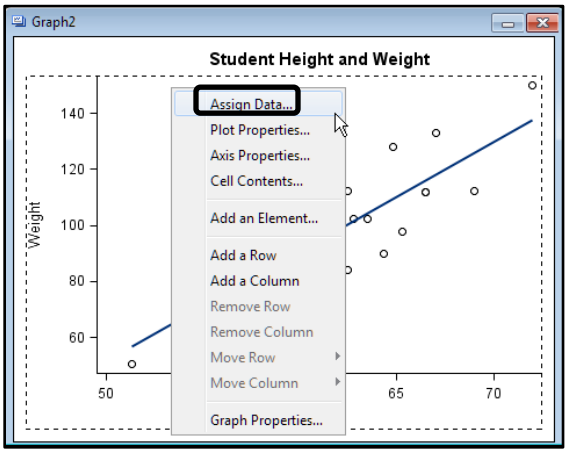
Dialog Box Part	Description
	**Advanced Options Dialog Box**: This dialog box is displayed when you click **Advanced Options**, which is available for some plots. This example shows the **Advanced Options** dialog box for the scatter plot. Options vary for each plot type.

Note: Depending on the release of the designer, parts of the dialog box might vary from what is shown in the previous table.

Data Assignment from the Pop-Up Menu

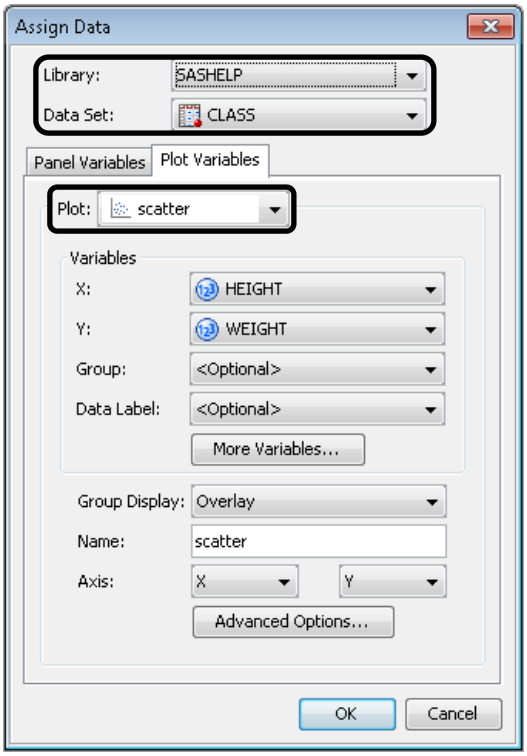
After creating a graph, you might want to make changes to data assignments. To open the **Assign Data** dialog box, right-click on the plot, and select **Assign Data** from the pop-up menu.

Figure 4.2 Pop-Up Menu



The **Assign Data** dialog box is displayed.

Figure 4.3 Assign Data Dialog Box Opened from a Pop-Up Menu



There are two key differences between the **Assign Data** dialog box that appears when adding a plot and the one that appears from the pop-up menu.

- **Library** and **Data Set** are always active in the pop-up **Assign Data** dialog box. When you change these settings, all the plots in the cell use the new settings. If errors are detected, they must be resolved before the dialog box is closed or the plot with errors will be removed.

  For the **Assign Data** dialog box that appears when you add a plot, these values are active only for the first plot. For subsequent plots added to the same cell, these values are set to the previous settings and cannot be changed.
- The pop-up **Assign Data** dialog box contains a **Plot** list. This list contains names of the plots in the cell.

  In the previous example, this list contains a scatter plot and a regression plot. Because you right-clicked on a scatter marker to open the **Assign Data** dialog box, the scatter plot is preselected. However, you can select another plot in the cell by using this list.

Custom Features of Other Assign Data Dialog Boxes

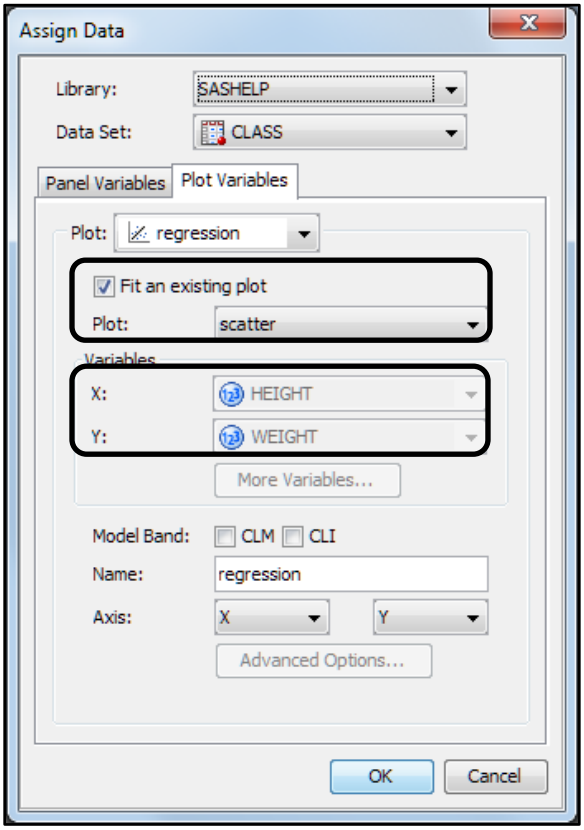
The overall structure of most **Assign Data** dialog boxes is similar to the one for the scatter plot shown in Figure 4.3. However, the dialog box for each plot type is customized to its needs.

Fit an Existing Plot

Certain plots are often used together. Fit plots (LOESS, regression, and PBSpline) are often used with scatter plots, and density plots are used with histograms. In these cases, you frequently want to use the same X and Y variables for the fit plot as you used for the scatter plot. Or, in the case of a histogram, you often want to use the same analysis variable for the density plots as you used for the histogram.

Let's examine this feature as it relates to a scatter plot with a regression plot. The **Assign Data** dialog box for the regression plot is displayed.

Figure 4.4 Assign Data Dialog Box for a Regression Plot



The **Assign Data** dialog box for fit plots and for density plots provides a check box called **Fit an existing plot**. There are several points to consider.

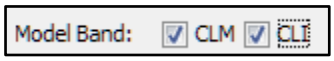
- The **Fit an existing plot** check box is checked by default.
- When the **Fit an existing plot** check box is checked, the **X** and **Y** variable lists are inactive. You cannot select these variables.
- The appropriate existing plot is preselected in the **Plot** list. If the cell has more than one plot, you can select the correct plot from this list.

To fit the plot to a different set of variables, clear the **Fit an existing plot** check box. The **X** and **Y** lists become active, and you can select different variables. Most often, when adding a fit plot or density plot, you simply accept the defaults, and click **OK**.

Model Band Options

Fit plots support confidence bands for the mean (CLM) and for individual (CLI) predicted values. The appropriate check boxes are displayed to enable this feature. The following figure shows these values extracted from Figure 4.4.

Figure 4.5 Model Band Options Selected

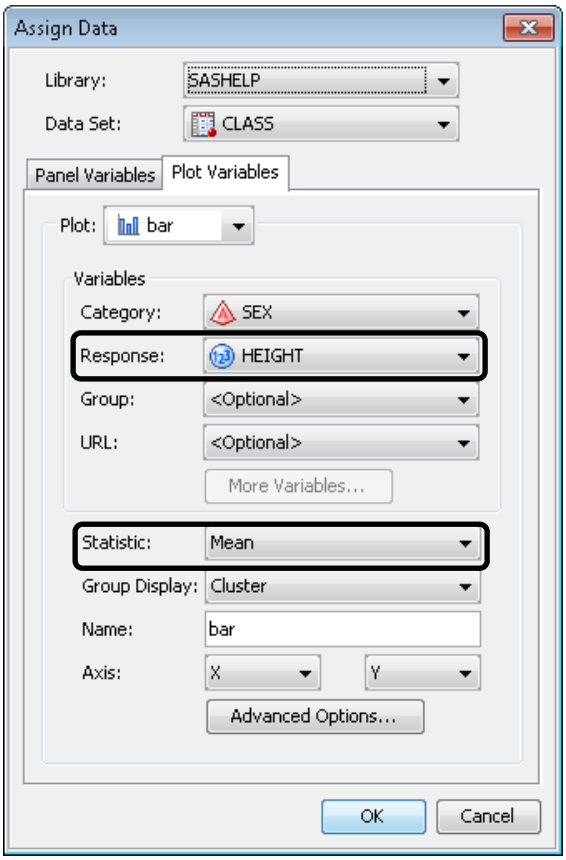


Statistics Data in the Assign Data Dialog Box

The Bar and Bar(H) plots support a **Statistic** list. The selections in this list depend on your settings.

- If you specify an optional variable for **Response**, then the designer calculates the sum or mean of the response variable. From the **Statistic** list, you can select **Sum** or **Mean**.
- If you do not specify a variable for **Response** or if you change the existing setting to **none**, then the designer calculates the frequency or frequency percentage for the category variable. From the **Statistic** list, you can select **Frequency** or **Percent**.

Figure 4.6 Assign Data Dialog Box for a Bar Chart



Visual Properties of a Graph

Graph properties enable you to control the appearance of your graph. Some properties, such as graph size and the applied style, affect all plots and cells in the graph. However, you can also control the appearance of an individual plot in a graph.

Many properties rely on style elements. Style elements enable you to customize a fill color, a line pattern, a font size, and so on, for individual graph elements.

Styles and Style Elements

Overview of Styles and Style Elements

The visual properties of a graph and its plots are derived from the style that is applied to the graph. The following definitions summarize styles and style elements:

Style
is a collection of style elements such as GraphBackground, GraphTitleText, GraphAxisLines, and so on, which affect particular objects in the graph. Style elements are used to render

particular graph elements such as bars, lines, markers, text, and so on. Style elements have descriptive names to help identify which graph object they affect.

The applied style affects all aspects of a graph. There are a number of styles to choose from.

Style element
is a collection of visual attributes such as Color, LineStyle, LinePattern, MarkerSymbol, Font, and so on. For example, the style element used for box plot whiskers consists of attributes for color, line pattern (such as dotted or dashed), and line thickness.

By default, the visual attributes for each object in the graph are derived from a specific style element within the applied style.

You can customize the appearance of your graph by setting graph properties or the individual properties for a plot, axis, or some other part of the graph as follows:

- Apply a different style. Changing the applied style is the easiest way to change a graph's appearance. All aspects of the graph are changed. You can change the applied style from the **Graph Properties** dialog box, which is discussed later in this chapter.
- Change the size of the graph. This is changed from the **Graph Properties** dialog box.
- Apply a different style element to one or more graph elements. If you want more granular control over a plot, you can change the style element applied to a particular object, such as to a kernel density curve. This is what was done in "Set Plot Properties" in Chapter 3.
- Specify hardcoded values for one or more graph elements. For example, suppose you change the style element associated with a kernel density curve. You can also change any of the attributes of the density curve, such as its line color, pattern, and thickness, effectively overriding the attributes of the style element.

Note: When you override an attribute, that attribute is no longer derived from the specified style element. If you later change the style that is applied to the graph, the overridden attribute might conflict with the new style.

Commonly Used Style Elements

Many of the visual properties of a plot are derived from the GraphDataDefault style element. This style element contains a number of attributes used to render non-grouped data items, markers, lines, and colors.

If a plot has a group variable, items in each unique group value are rendered using one of the GraphData1-*N* style elements. These style elements ensure that the plot elements for each unique group value are distinguished by different visual attributes.

Some commonly used style elements are described in the following table:

Commonly Used Style Elements

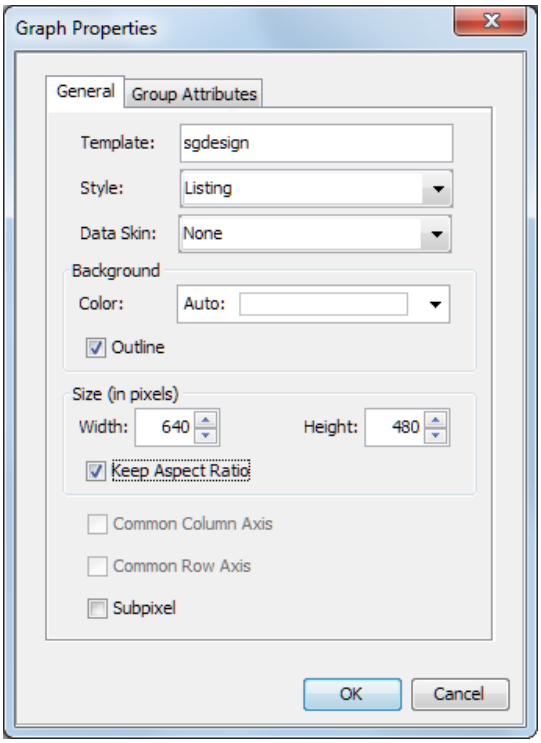
Style Element	Description
GraphBackground	Graph background behind the entire graph
GraphWalls	Wall background behind the data plots inside the axes
GraphTitleText	Graph titles
GraphFootnoteText	Graph footnotes
GraphLabelText	Axis and legend labels
GraphDataText	Data and curve labels for the plots
GraphValueText	Tick values for the axes
GraphAxisLines	Axis lines
GraphGridLines	Grid lines
GraphDataDefault	For plots without a group variable
GraphData1-*N*	For plots with a group variable
GraphFit	For fit and density plots
GraphFit2	Not used by default, but it is available for a second fit plot

Properties That Affect the Entire Graph

Some of the visual properties of a graph affect all graph elements in the graph. For example, changing the style applied to a graph affects all plots, lines, and insets. You specify these properties in the **Graph Properties** dialog box.

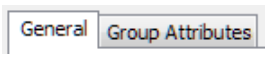
To display the dialog box, right-click on a graph, and select **Graph Properties**.

Figure 4.7 A Typical Graph Properties Dialog Box



Let’s take a closer look at some of the fields and controls.

Parts of the Graph Properties Dialog Box

Dialog Box Part	Description
	**General and Group Attributes tabs**: You can specify general properties, which include the style, graph size, border and color of the graph's background, and other properties. When you click the **Group Attributes** tab, you can change the appearance of attributes for group values. This feature is described in more detail in Chapter 7.
	**Template**: This value identifies the underlying GTL graph template that is used for the graph. The default name for the template varies depending on how the graph is created (for example, from the Graph Gallery or from a blank graph). This feature is for more advanced users. For example, you can change the name if you want to run the code in SAS using a particular template name.

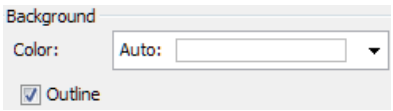
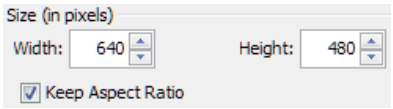
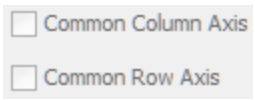
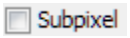
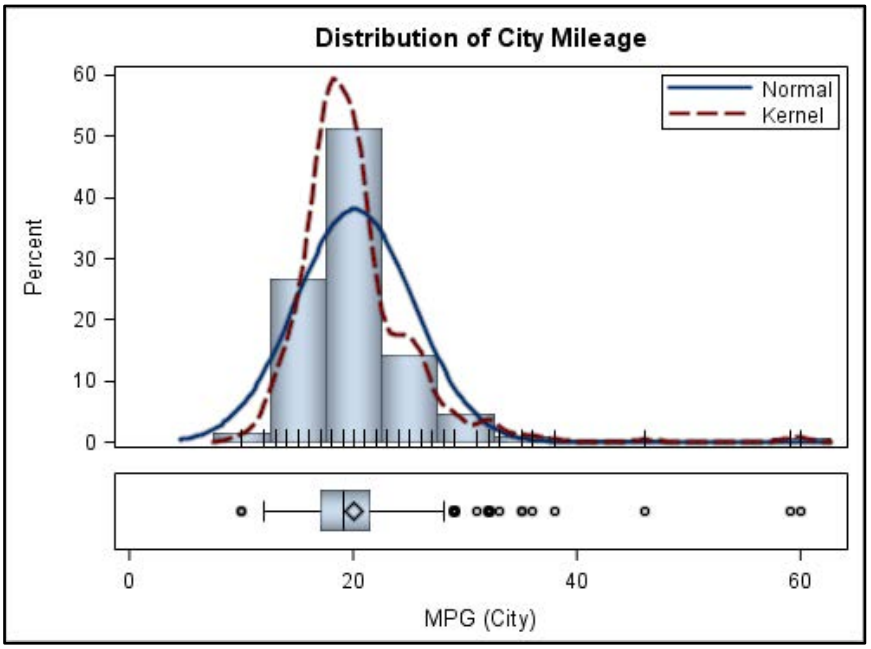
Dialog Box Part	Description
	**Style**: The style that is applied to a graph affects all aspects of the graph. In the **Style** list, icons for all supported styles are displayed.
	**Data Skin**: The data skin applies a special effect for rendering the graph elements of your plots. The data skin is specified for the graph, but it can be disabled at the plot level. An example of applying a data skin is shown in Figure 4.8. A data skin of **Pressed** has been applied to the graph that you created in Chapter 3.
	**Background Color and Outline**: You can change the color of the graph's background. You can control whether the border around a graph is displayed. A color value of **Auto** indicates that the color is derived from the current style. When you change the applied style, the background color changes accordingly. However, if you explicitly specify the color, the color that you specify overrides any color derived from the applied style.
	**Size**: By default, your graphs are 640px by 480px. You can change the width and height of your graph, individually. Or, to resize the graph proportionally, make sure that the **Keep Aspect Ratio** check box is selected. Then, change either the width or the height, and the other dimension changes proportionally. Alternatively, you can drag the side or corner of a graph to resize it. The graph size is displayed in the designer's title bar.
	**Common Column or Row Axis**: You can share or unshare a common column or common row axis. This feature applies only to graphs that contain more than one cell and that have the same axis type. Otherwise, the options are unavailable as shown here. **Tip**: A different method was used to share a common column axis in Chapter 3. As with other features, there is sometimes more than one method.
	**Subpixel**: Select the check box to generate smooth curves and more precise bar spacing. Subpixel rendering is available for line-based plots and bar charts.

Figure 4.8 Graph with a Data Skin Specified



Styles control the default appearance of the entire graph, including its plots. Styles are optimized to produce effective graphics without any changes to the default settings. However, you can override the default settings by changing plot properties.

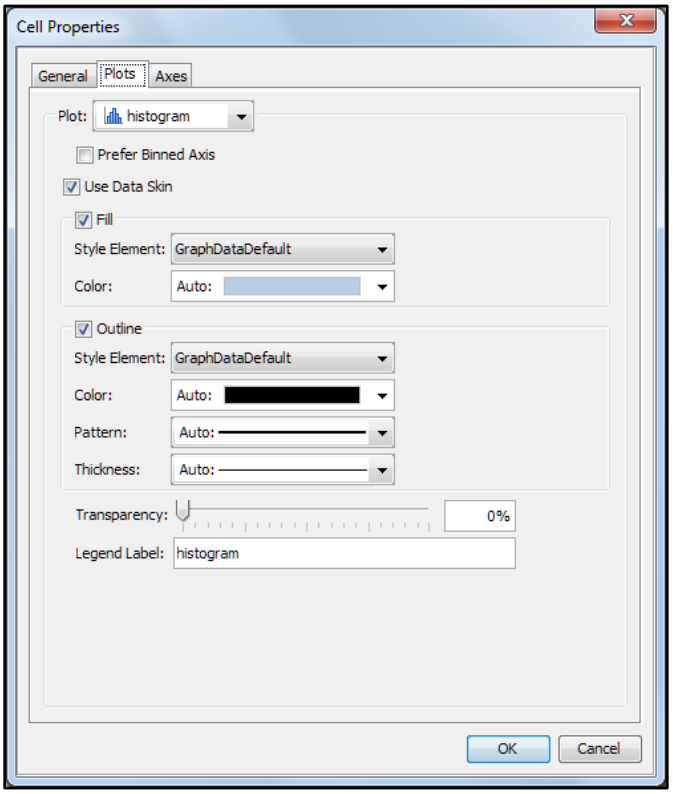
Plot Properties

Plot properties determine features such as lines, fills, and markers that affect the appearance of a plot in the graph. You can customize each plot in the graph to have its own distinctive properties.

Consider the example in Chapter 3.

1. If you previously saved the graph as a SAS ODS Graphics Designer (SGD) file, you can open the graph by selecting **File ► Open**, and then selecting the file that you saved.
2. Right-click on the histogram, and select **Plot Properties**. The **Cell Properties** dialog box is displayed with the **Plots** tab selected.

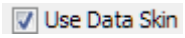
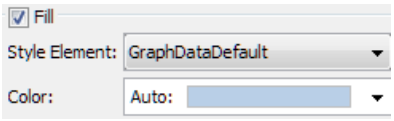
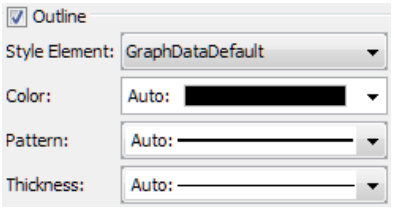
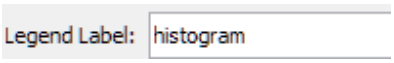
Figure 4.9 Plot Properties for a Histogram



Let's take a closer look at the fields and controls. Although the available properties differ for each plot, many common properties apply to most plots.

Parts of the Cell Properties Dialog Box for a Plot

Dialog Box Part	Description
Plot: histogram	The selected plot is shown in **Plot**. If the cell contains more than one plot, you can select a different plot from this list. This list enables you to specify properties for multiple plots without closing the dialog box. Simply specify properties for a plot, select another plot, and then specify its properties. When you are finished, click **OK**.
Prefer Binned Axis	**Prefer Binned Axis**: This property is specific to histograms. Select the check box to specify that the category axis tick marks coincide with the midpoint of each bin.

Dialog Box Part	Description
	**Use Data Skin**: This option enables the data skin that is specified in the graph properties. The check box is selected by default, but you can clear it.
	**Fill**: Histograms, bar charts, and other plots contain graph elements that have a fill color. When **Fill** is selected, you can customize the fill color. GraphDataDefault is the default style element for a histogram that does not have a group variable. You can select a different style element from **Style Element**. The **Color** list enables you to hardcode a particular color, thereby overriding the style element's color.
	**Outline**: Plots that have fill colors often have outlines. When this check box is selected, you can customize the outline. GraphDataDefault is the default style element for a histogram that does not have a group variable. You can select a different style element from **Style Element**. You can hardcode the color, pattern, and thickness of the outline by selecting the attribute from the list. When a plot has both a **Fill** and an **Outline** check box, as in the case of a histogram, then at least one check box must be selected.
	**Transparency**: Plots can be made transparent. You can use the slider or enter a value up to 100%. A transparency of 100% makes the plot invisible.
	**Legend Label**: You can specify the label that appears in the legend for the plot.

Note: Although the previous example showed the plot properties for a histogram, other plots have similar properties. In general, you can specify colors, sizes, fonts, marker attributes, line attributes, and outlines and fills. The available properties change based on the specific characteristics of each plot.

Chapter 5: Classification Panels and Multi-Cell Graphs

About Classification Panels 61

Create a Classification Panel 63

- About This Example 63
- Create the Graph, Add a Highlow Plot, and Specify the Panel Variable 64
- Add Titles to the Graph 67
- Modify the Axis Properties 68
- Apply a Different Style to the Graph 70

About Multi-Cell Graphs 71

Create a Multi-Cell Graph 71

- About This Example 71
- Create the Graph 72
- Apply a Different Style to the Graph 74
- Change the Marker Symbol for the Scatter Plots 75
- Add a Discrete Legend to the Cell 77
- Add a Global Legend to the Graph 78
- Add an Axis Table in a Separate Cell 80
- Customize the Titles and Remove the Footnote 83

About Classification Panels

A classification panel is a data-driven layout that creates a regular grid of cells based on one or more classification (also called panel) variables. The number and arrangement of the cells are determined by the panel variables. The plot type in each cell is the same, using a subset of the data from the crossing of panel variables. Cells cannot have legends or insets.

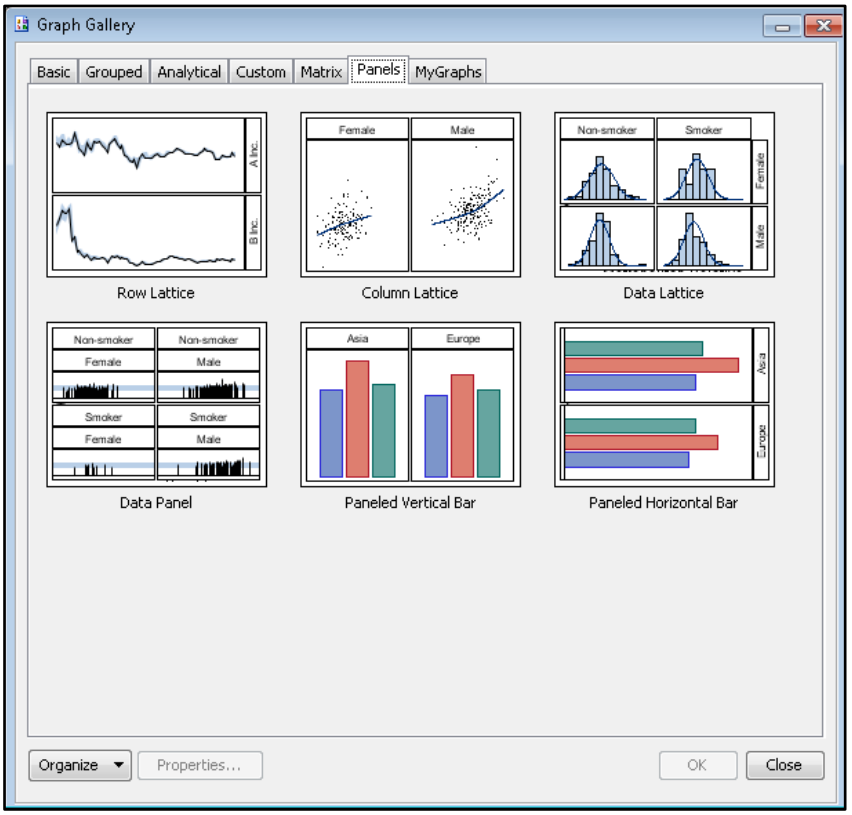
A classification panel can be defined using a lattice or panel layout, as described in the following table:

Layout	Description
Data Lattice	This panel is defined by the row variable, the column variable, or both. A regular grid of cells is created in which the number of rows equals the number of unique values of the row variable. The number of columns equals the number of unique values of the column variable. A cell is created for each crossing of the unique values of the row variable and column variable. Each cell displays only the data that is valid for the combination of the panel variable values.
Data Panel	This panel is defined by one or two panel variables. A regular grid of cells is created in which the number of cells equals all the crossings of the unique values of panel variables that contain data. Each cell has headers that display the values of each panel variable. If a cell does not have data, it is dropped from the grid.

The classification panel can have multiple titles at the top of the graph above all the cells, and multiple footnotes at the bottom below all the cells. All data for the plots must come from one data set.

The Panels tab of the Graph Gallery contains graphs that you can use as the basis of your graph.

Figure 5.1 Panels Tab of the Graph Gallery



Create a Classification Panel

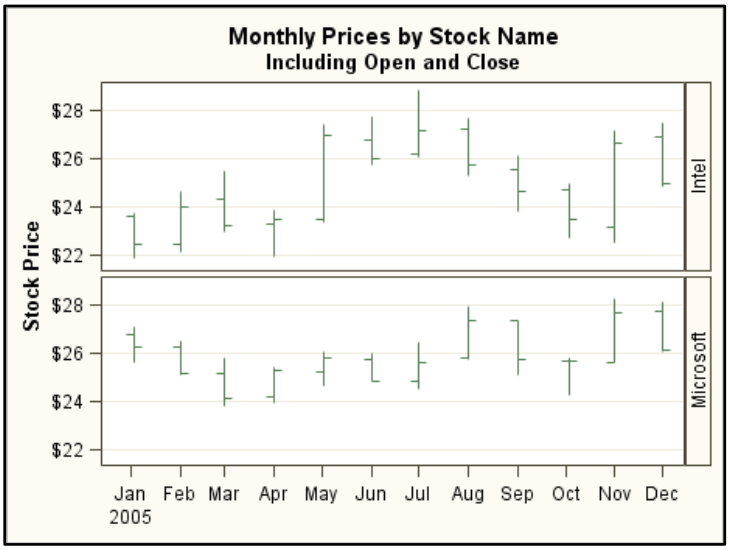
About This Example

This example uses a highlow plot to show stock comparisons that include the high, low, open, and close stock prices. Small tick marks indicate the open and close prices. The open tick marks are on the left side of the highlow lines, and the close tick marks are on the right side.

The panel variable determines the number of cells in the graph. In this case, there are two cells.

This example subsets the data in the Sashelp.Stocks data set. The new data set is called Work.Mystock. In the SAS session, run the code from “Code for the Classification Panel Example in Chapter 5” in the appendix.

Figure 5.2 Graph for This Example



Create the Graph, Add a Highlow Plot, and Specify the Panel Variable

To create the graph, perform the following steps:

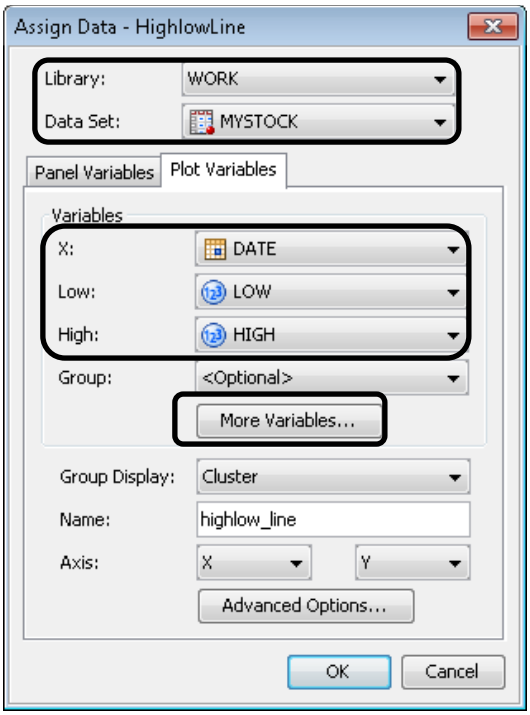
- Create a graph from a blank graph. The Panels tab of the Graph Gallery contains several useful graphs. However, this example uses a highlow plot, so start with a blank graph.
- Assign the data for a highlow plot. This example uses the **More Variables** dialog box in which you can specify more variables, including the stock open and close prices.
- Specify the panel variable. Although you can specify up to two variables, resulting in multiple columns and rows, this example has only one panel variable.

Now, create the graph.

1. In the SAS session, run the code from "Code for the Classification Panel Example in Chapter 5" in the appendix.
2. Select **File ► New ► Blank Graph**, or click the New Blank Graph toolbar button. A graph window is displayed in the work area. This window is blank except for the prompt **(drop a plot here)**.
3. In the Elements pane, click **HighlowLine**, and drag and drop the icon onto the graph window.

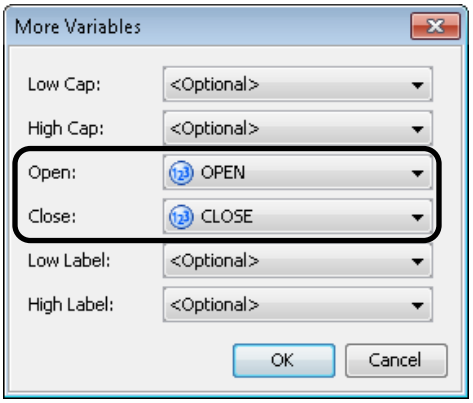
   

4. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **WORK**.
   b. For **Data Set**, select **MYSTOCK**.
   c. For **X**, select **DATE**.
   d. For **Low**, select **LOW**.
   e. For **High**, select **HIGH**.



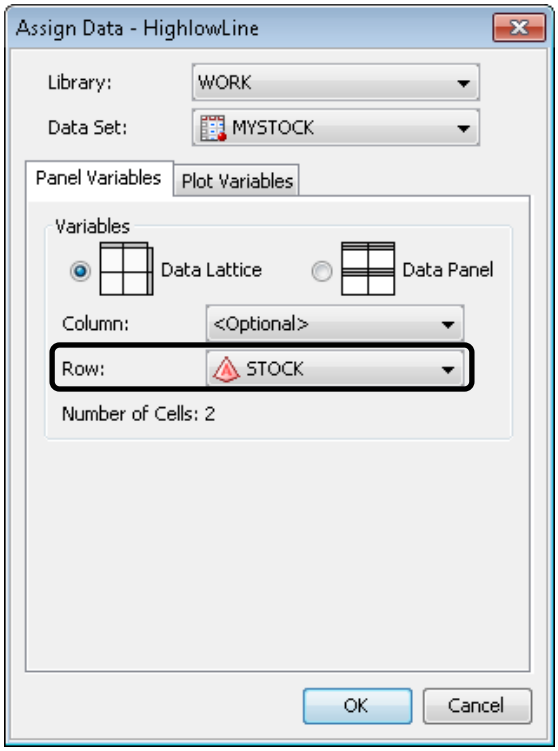
f. Click **More Variables**. The **More Variables** dialog box is displayed.

5. In the **More Variables** dialog box, complete these steps:
   a. For **Open**, select **OPEN**.
   b. For **Close**, select **CLOSE**.



   c. Click **OK**. The **More Variables** dialog box closes.

6. In the **Assign Data** dialog box, complete these steps:
   a. Click the Panel Variables tab.
   b. For **Row**, select **STOCK**. This specifies the panel variable used for the graph. The graph will contain a separate row for each value of the panel variable.

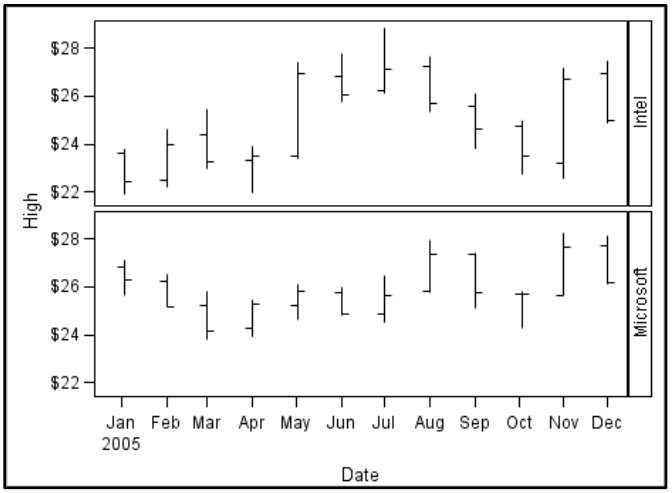


For this example, keep the default data lattice layout.

c. Click **OK**.

The designer creates the following graph in the work area:

Figure 5.3 Panel Graph with a Highlow Plot



Add Titles to the Graph

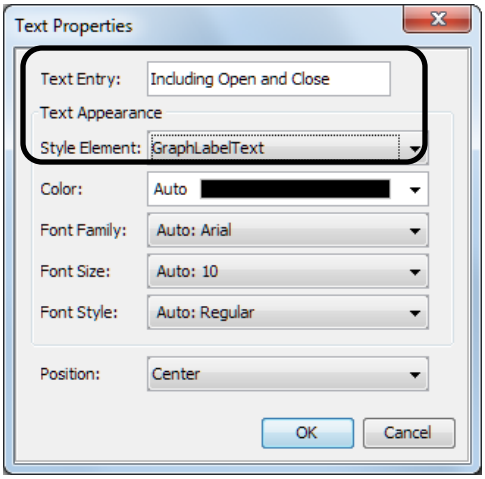
Let's add two titles and change the style element for the second title.

1. Select **Insert ► Title**, or click the Title toolbar button. A new title text box is added at the top of the graph. The text is selected. Enter a new title.

2. In the title text box, enter **`Monthly Prices by Stock Name`**.
3. Select **Insert ► Title** again.
4. Click outside of the placeholder title text to deselect it. Then, right-click on the placeholder title text, and select **Title Properties**. The **Text Properties** dialog box is displayed.

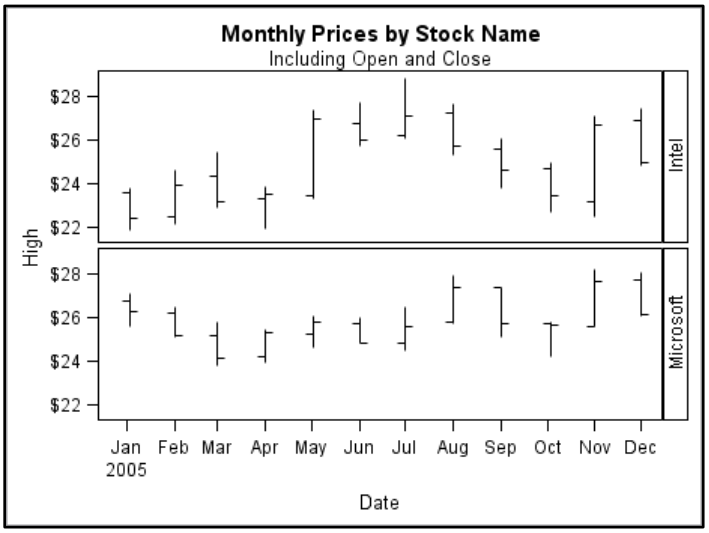
   In addition to specifying the title, you want to change the style element that is applied to the text. The **Text Properties** dialog box enables you to do that.
5. In the **Text Properties** dialog box, complete these steps:
   a. In **Text Entry**, enter **`Including Open and Close`**.
   b. For **Style Element**, select **GraphLabelText**.

   c. Click **OK**.

The graph is updated to include your titles.

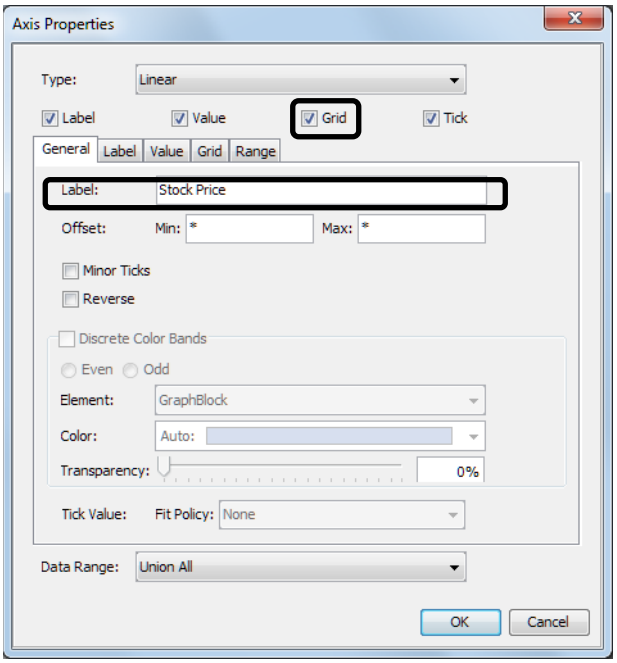
Figure 5.4 Graph with Titles



Modify the Axis Properties

Let's change the label for the Y axis and add grid lines. Remove the X axis label because it is not needed.

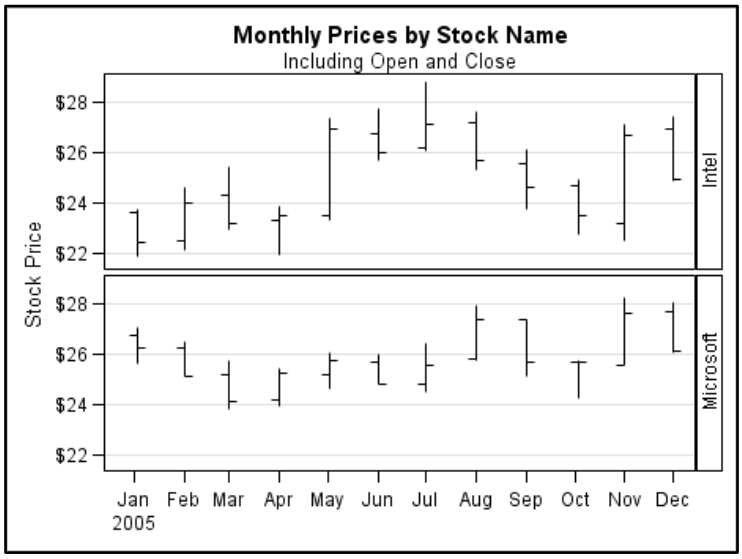
1. Right-click the Y axis (the axis labeled **High**), and select **Axis Properties**. The **Axis Properties** dialog box is displayed.
2. Select the **Grid** check box.
3. In **Label**, enter **`Stock Price`**.



4. Click **OK**.
5. Right-click on the column axis at the bottom of the graph, and select **Axis Properties**. The **Axis Properties** dialog box is displayed.
6. Clear the **Label** check box.

The graph is updated to include your axis changes.

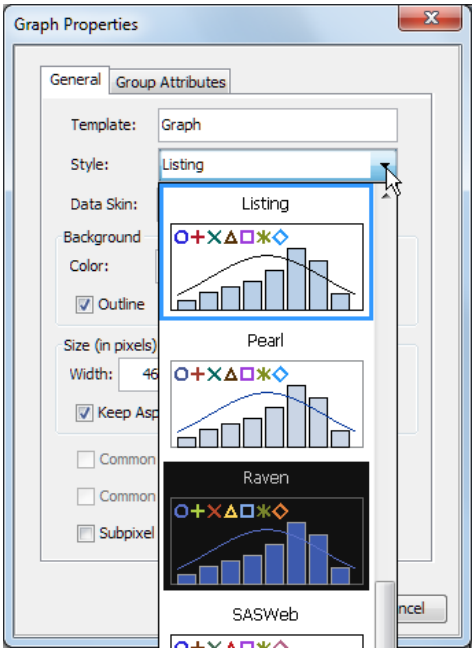
Figure 5.5 Graph with Updated Axes



Apply a Different Style to the Graph

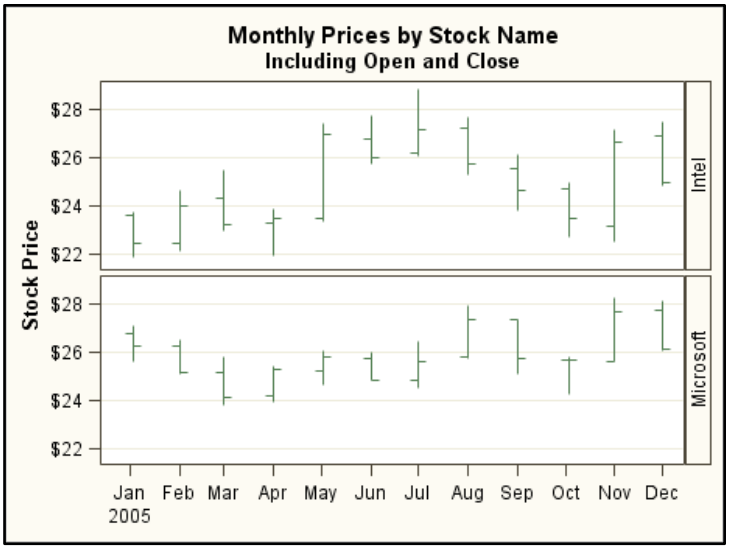
A graph's style controls the default color schemes and visual attributes. You can change the overall appearance of a graph by changing the applied style.

1. Right-click on the graph, and select **Graph Properties**. The **Graph Properties** dialog box is displayed.
2. For **Style**, select **Analysis**.
   When you click the down arrow of the **Style** list, all of the supported styles are displayed.



   You might need to scroll upward to select **Analysis**.
3. Click **OK**.

The final graph is shown in Figure 5.2 and here:



About Multi-Cell Graphs

Multi-cell graphs have a regular grid of cells that are arranged in rows and columns. Each cell can have a different set of overlaid plots with legends and insets. This graph can have multiple titles at the top of the graph above all the cells and multiple footnotes at the bottom below all the cells. Each cell can have a different associated data set.

You have already created a multi-cell graph if you completed the example in Chapter 3. (See Figure 3.1.)

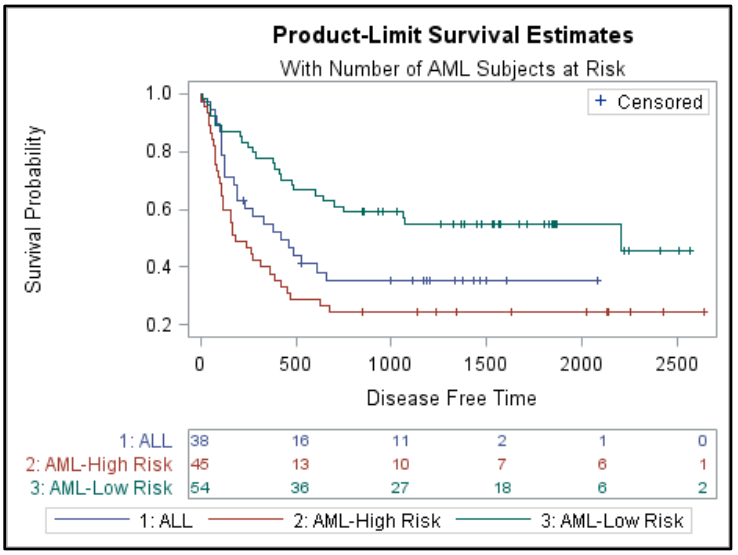
The Graph Gallery contains multi-cell graphs on the Analytical and Custom tabs.

Create a Multi-Cell Graph

About This Example

This example creates a survival plot, which is often used in the clinical and pharmaceutical industries. The top cell contains a step plot and scatter plots to show survival by time by stratum. The bottom cell uses an axis table to display at-risk values. Axis tables are described in more detail later in this example.

Figure 5.6 Graph for This Example



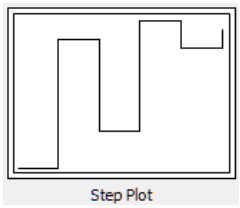
Data for the survival plot is obtained using the LIFETEST procedure. The output is saved in a data set called Work.Survivalplotdata. The code to create this data set is in "Code for the Survival Plot Example in Chapter 5" in the appendix.

Create the Graph

To design the graph, you first select a step plot from the Graph Gallery. You assign data to create the basic survival curves that show survival by time by stratum.

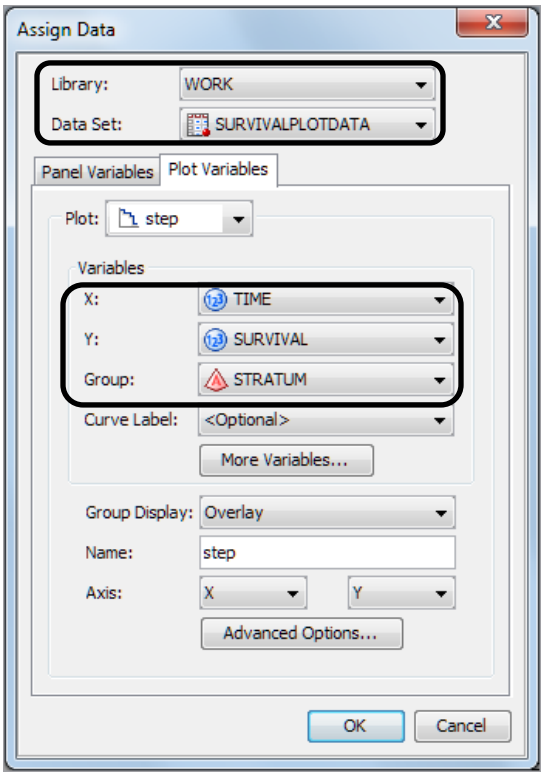
After you create the step plot, add two scatter plots that overlay the censored observations. The first scatter plot is included in a discrete legend. The second scatter plot with a group variable overlays the first. It displays the same markers but with group colors. The second plot is not included in the discrete legend.

1. In the SAS session, run the code from "Code for the Survival Plot Example in Chapter 5" in the appendix.
2. On the Basic tab of the Graph Gallery, double-click **Step Plot**. The **Assign Data** dialog box is displayed.



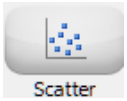
3. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **WORK**.
   b. For **Data Set**, select **SURVIVALPLOTDATA**.
   c. For **X**, select **TIME**.
   d. For **Y**, select **SURVIVAL**.

e. For **Group**, select **STRATUM**.



f. Click **OK**.

4. In the Elements pane, click **Scatter**, and drag and drop the icon onto the graph window. This scatter plot will be used for the discrete legend. For this plot, you do not assign a group variable.

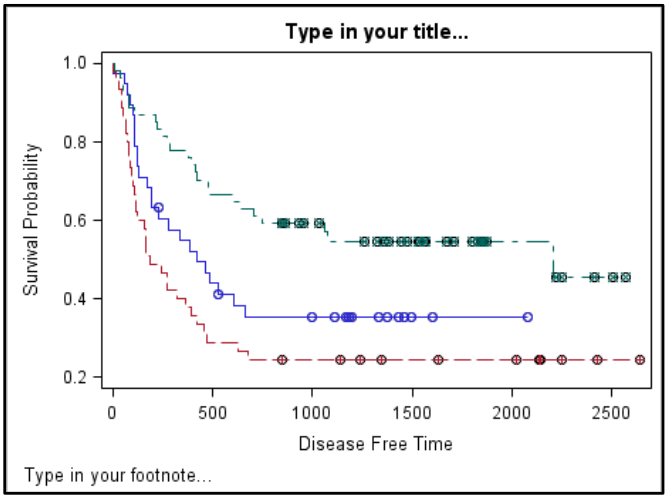


The **Assign Data** dialog box is displayed.

5. In the **Assign Data** dialog box, complete these steps:
   a. For **X**, select **TIME**.
   b. For **Y**, select **CENSORED**.
   c. In **Name**, enter **`Censored`**.
   d. Click **OK**.
6. In the Elements pane, click **Scatter** again, and drag and drop the icon onto the graph window. This scatter plot will overlay the previous scatter plot. However, this scatter plot uses a group variable and shows group colors.
7. In the **Assign Data** dialog box, complete these steps:
   a. For **X**, select **TIME**.
   b. For **Y**, select **CENSORED**.
   c. For **Group**, select **STRATUM**.
   d. Click **OK**.

The designer displays the following graph in the work area. The second scatter plot overlays the first scatter plot. In effect, it hides the latter's markers.

Figure 5.7 Graph with Step and Scatter Plots



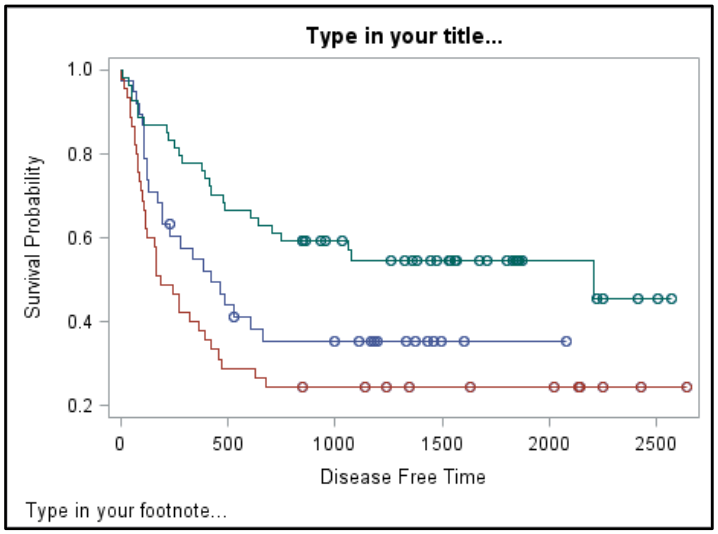
Apply a Different Style to the Graph

The default style uses patterned lines to distinguish the grouped step plot. In this step, apply a style that uses solid lines, which look better with a step plot.

1. Right-click on the graph, and select **Graph Properties**. The **Graph Properties** dialog box is displayed.
2. For **Style**, select **HTMLBlue**.
3. Click **OK**.

The graph is updated to reflect the newly applied style.

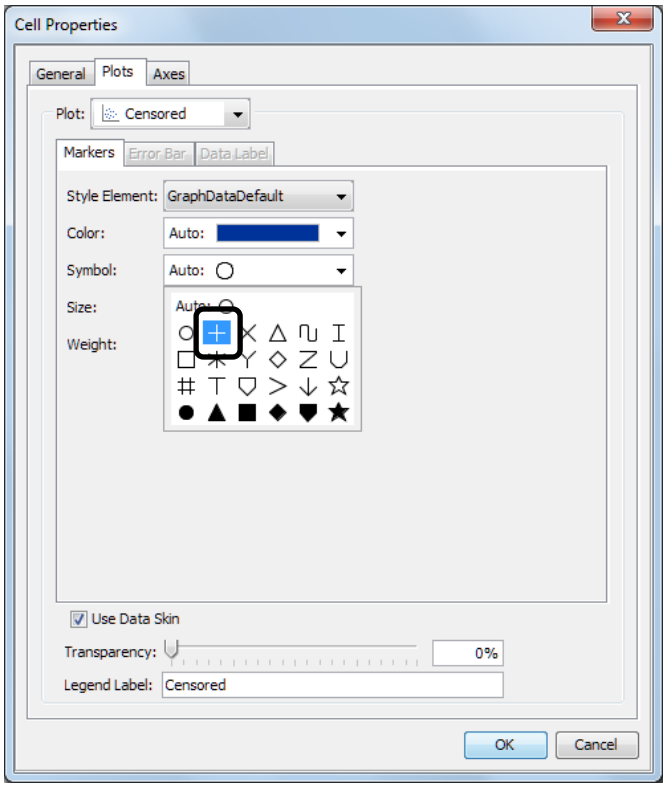
Figure 5.8 The HTMLBlue Style is Applied to the Graph



Change the Marker Symbol for the Scatter Plots

By default, the designer uses circles for the scatter plot markers. Although this marker symbol is fine for most plots, for the survival plot, you want markers that blend well with the step plot. So, change the marker for each scatter plot.

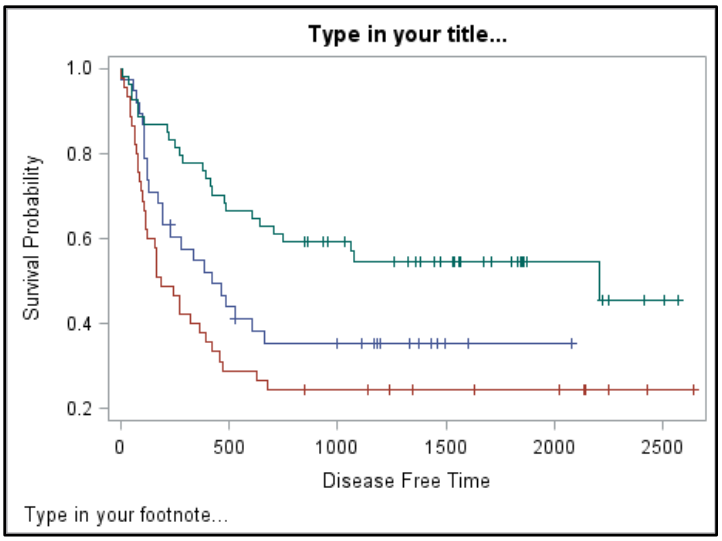
1. Right-click on any plot, and select **Plot Properties**. The **Cell Properties** dialog box is displayed with the **Plots** tab selected. The plot on which you right-clicked is selected in **Plot**.
2. In the **Cell Properties** dialog box, complete these steps:
   a. For **Plot**, select **Censored** if it's not already selected. Because you renamed the plot, it is easy to select the plot that you want.
   b. For **Symbol**, select the plus sign.



c. For **Plot**, select **scatter**.
d. For **Symbol**, select the plus sign again.
e. Click **OK**.

The markers are changed for the scatter plots.

Figure 5.9 Graph with New Marker Symbols



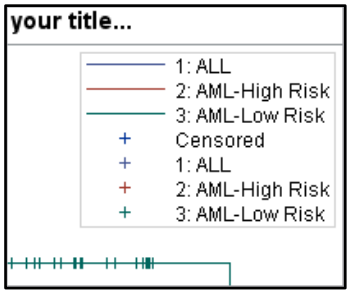
Add a Discrete Legend to the Cell

A discrete legend shows the marker symbol for censored observations.

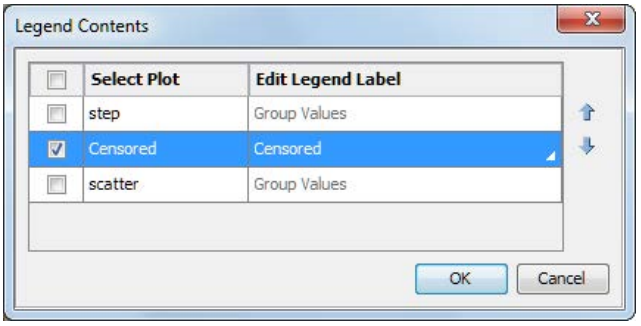
1. In the Insets panel at the bottom of the Elements pane, click **Discrete Legend**. Drag and drop the icon onto the upper right corner of the plot area.

   The legend appears. Notice that it contains all the plots in the cell, as shown in the partial image below. Change the legend to contain only the marker for the **Censored** scatter plot.

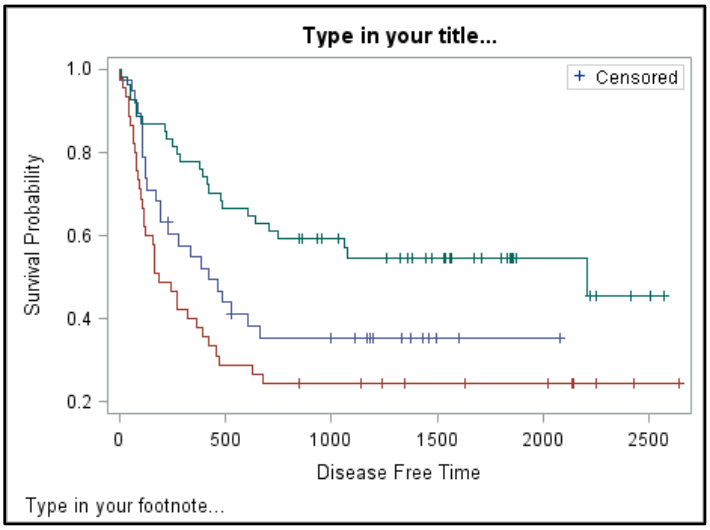
2. Right-click on the legend, and select **Legend Contents**. The **Legend Contents** dialog box is displayed.
3. Clear the **step** and **scatter** check boxes, so that only the **Censored** check box is selected.

4. Click **OK**.

The graph is updated to reflect your changes.

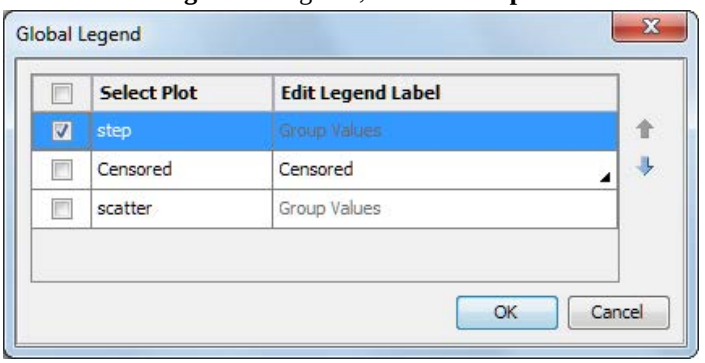
Figure 5.10 Graph with a Discrete Legend



Add a Global Legend to the Graph

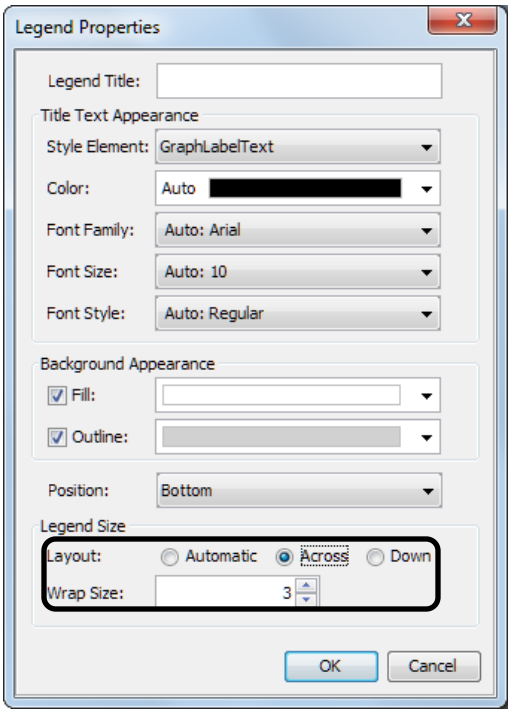
A legend is needed to identify the stratum values. You could add another discrete legend, but adding a global legend enables you to position the legend outside of the cell where there is more room.

1. Select **Insert ► Global Legend**, or click the Global Legend toolbar button. The **Global Legend** dialog box is displayed. Initially, none of the check boxes for the plots is selected.
2. In the **Global Legend** dialog box, select the **step** check box. Then, click **OK**.



The legend is added to the bottom of the graph.

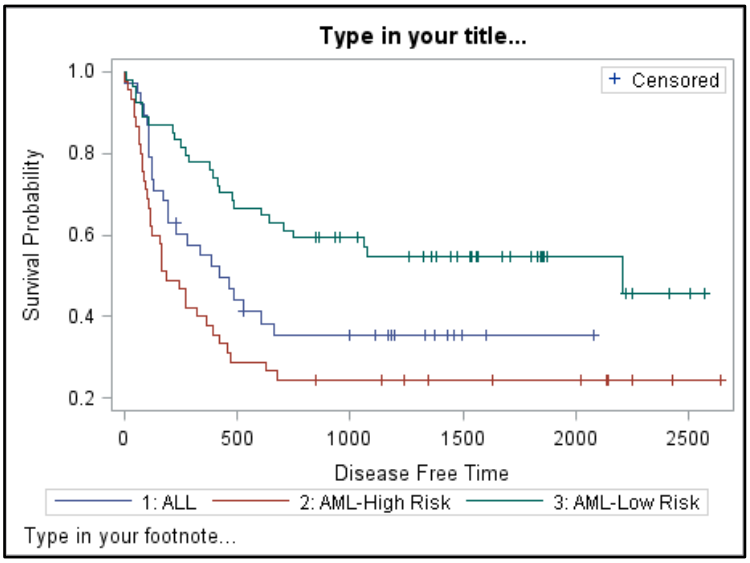
3. Right-click on the legend, and select **Legend Properties**. Notice that **Automatic** is selected for **Layout**.
4. In the **Legend Properties** dialog box, complete these steps:
   a. For **Layout**, select **Across**. This setting extends the legend across in a row. You might need to increase the wrap size for the legend to fit in the row.
   b. For **Wrap Size**, enter or select **3**.



c. Click **OK**.

The graph is updated to reflect your changes.

Figure 5.11 Graph with a Global Legend



Add an Axis Table in a Separate Cell

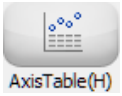
An axis table is a basic plot that displays data values in textual form at specific locations along the vertical or horizontal axis. A graph can have more than one axis table, and you can combine a horizontal and vertical axis table in the same graph.

For an axis table, you specify a variable for X (for a horizontal table) or for Y (for a vertical table). This variable identifies the locations along the axis. You also specify a variable for Value. This variable determines which values are displayed in the axis table.

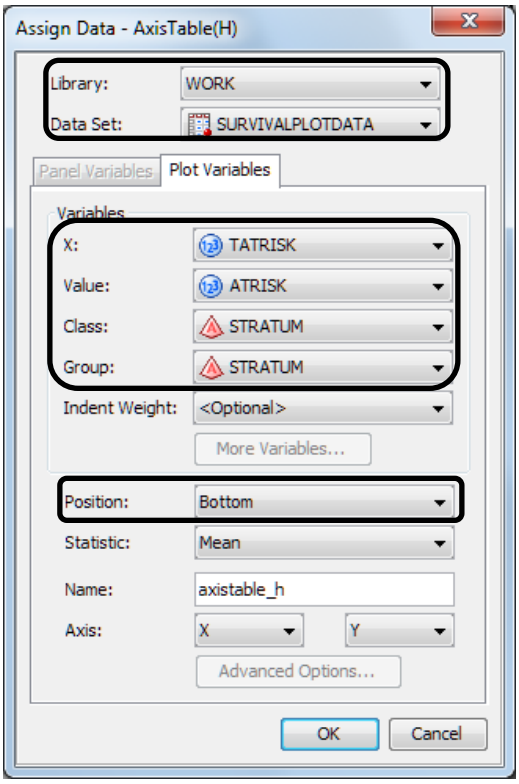
> **Note**: Axis tables are not available for classification panels.

Create a new row, and then add a horizontal axis table to the cell in that row. The axis table will display the at-risk values. Because the bottom row uses the same axis scale as the survival plot in the top row, you can remove the axis values from the bottom row.

1. Right-click on the graph area, and select **Add a Row**. A new row is added below the existing row. In this graph, each row contains one cell.
2. In the Elements pane, click **AxisTable(H)**, and drag and drop the icon onto the bottom cell of the graph.

   The **Assign Data** dialog box is displayed.
3. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **WORK**.
   b. For **Data Set**, select **SURVIVALPLOTDATA**.
   c. For **X**, select **TATRISK**.
   d. For **Value**, select **ATRISK**. The axis table will display at-risk values.
   e. For **Class**, select **STRATUM**. This variable acts as a classification variable for the axis table. The value creates a separate row in the table for each unique classification value.
   f. For **Group**, select **STRATUM**. This value groups the axis table. Each group value is represented by a different color.
   g. For **Position**, select **Bottom**. This value positions the axis table beneath the X axis of your survival plot.

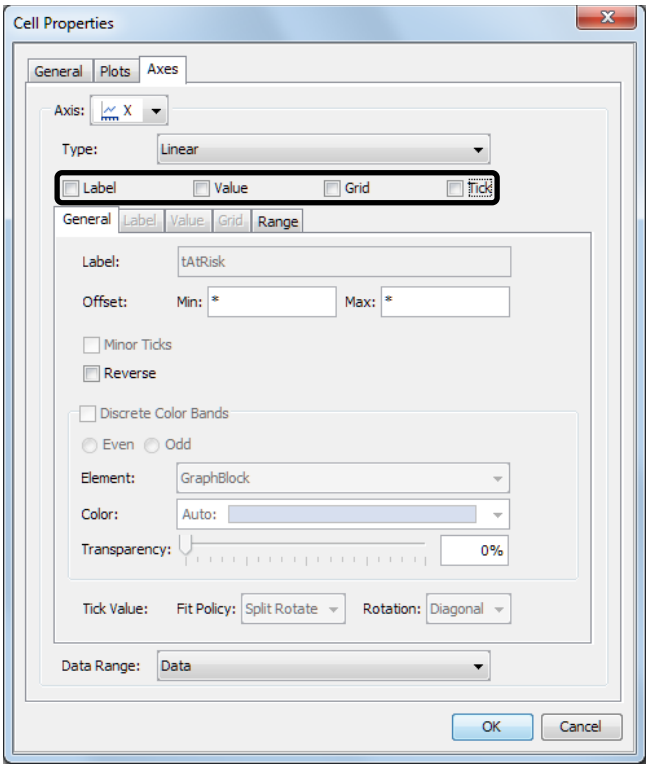


h. Click **OK**. The axis table is added to the bottom cell of the graph.

4. Right-click on the axis for the axis table, and select **Axis Properties**. The **Cell Properties** dialog box is displayed with the Axes tab selected.

   The X axis is selected for **Axis**.

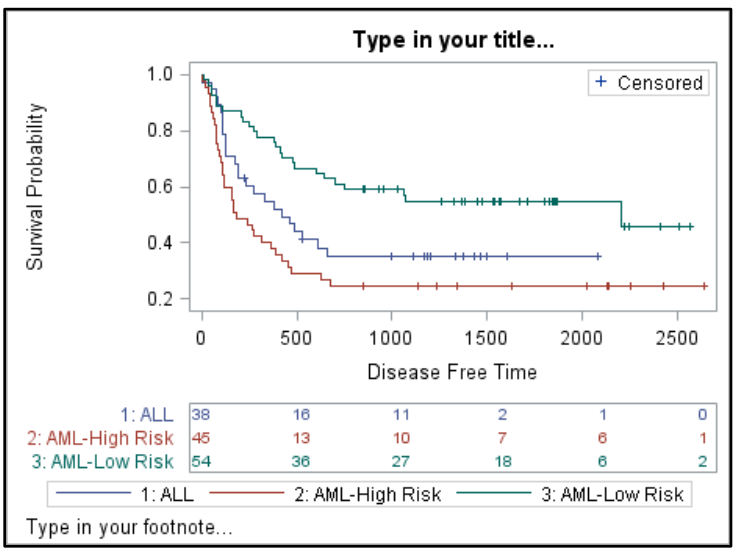
5. Clear the check boxes for **Label**, **Value**, and **Tick**. This action removes the axis from the bottom row.



6. Click **OK**.

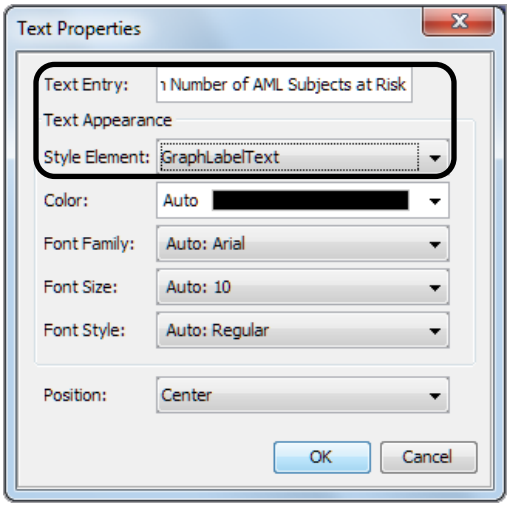
The graph is updated with your axis table.

Figure 5.12 Graph with Axis Table in the Bottom Row



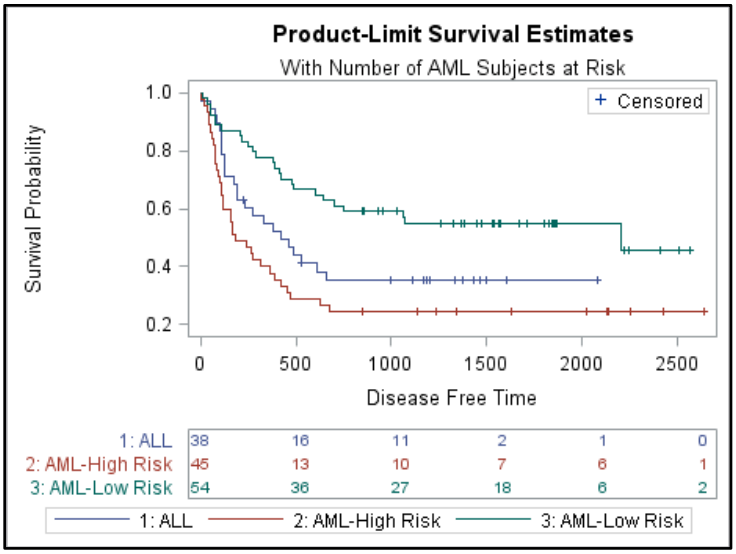
Customize the Titles and Remove the Footnote

1. Double-click on the placeholder title (**Type in your title**). The placeholder text is highlighted.
2. Enter **`Product-Limit Survival Estimates`**.
3. Select **Insert ► Title**, or click the Title toolbar button. A new title text box is added at the top of the graph. The placeholder text is highlighted.
4. Click outside of the placeholder title text to deselect it. Then, right-click the placeholder text, and select **Title Properties**. The **Text Properties** dialog box is displayed.
5. In the **Text Properties** dialog box, complete these steps:
   a. In **Text Entry**, enter **`With Number of AML Subjects at Risk`**.
   b. For **Style Element**, select **GraphLabelText**.



   c. Click **OK**.
6. Right-click on the placeholder footnote (**Type in your footnote**), and select **Remove Footnote**.

The final graph is shown in Figure 5.6 and repeated here:



Chapter 6: Auto Charts: Bulk Generation of Charts

About Auto Charts and Bulk Generation of Charts 85
The Auto Charts Window 86
About the Auto Charts Example 87
Generate Bulk Graphs 88
Customize Your Graph 89
Create Your Graph 89
Add an Axis Table to the Graph 91
Customize the Titles 94

About Auto Charts and Bulk Generation of Charts

In previous chapters of this book, you created a single graph and assigned data to the variables in plots. This process works well when you know the data and what type of graph you want. This is called a chart-centric approach.

But often, you get new data with new variables, and you don't know what type of graph you need or what variable associations exist. In this case, it is useful to see how different variables look in a graph, including how combinations of variables look. This is called a data-centric approach. This chapter discusses an Auto Charts tool that generates graphs in bulk based on different variables.

The Auto Charts tool enables you to create graphs in bulk from a list of variables that you specify and using graph types that you select. Based on your selections, the Auto Charts tool uses a patent-pending process to create multiple graphs using various variable combinations. The tool shows you how many graphs it is going to generate, generates the graphs, and populates icons for each graph in the Auto Charts window. A progress bar is displayed, and the process can be interrupted or restarted at any time.

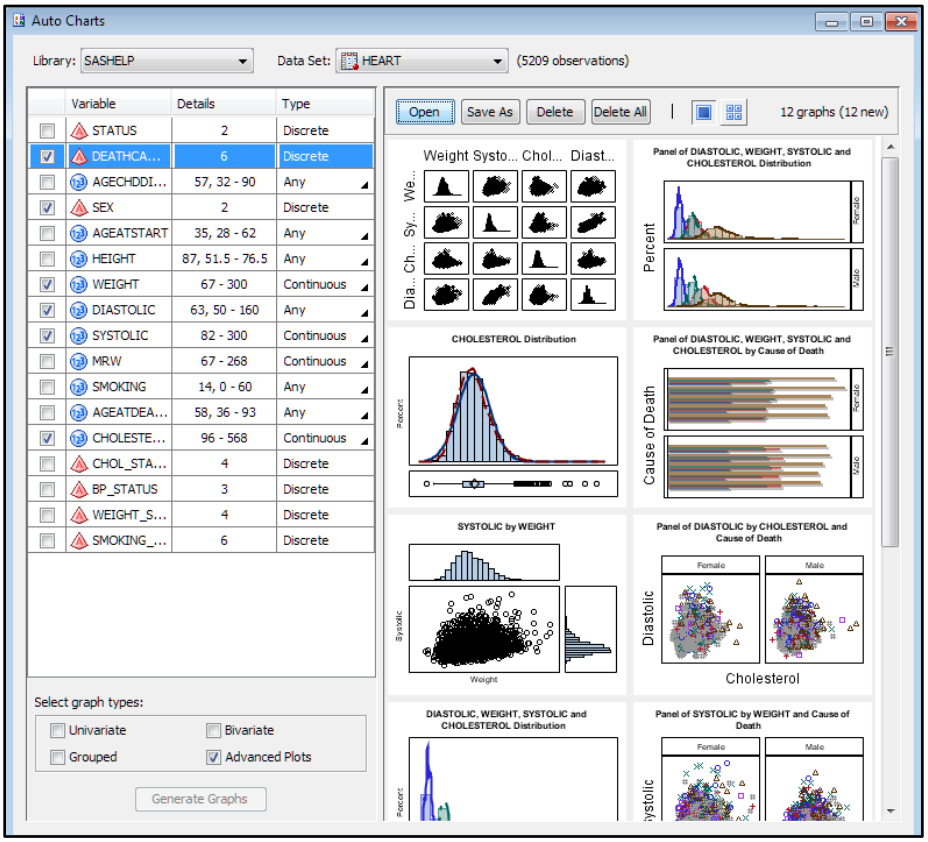
After generating the graphs, you can choose one or more graphs as a starting point. For example, you can modify the automatically generated titles and legends. You can add more plots and items to a graph. You can save the generated graph as an image file or in other formats, including a SAS ODS Graphics Designer (SGD) file that you can later edit.

The Auto Charts tool is ideal for exploring different visualizations of your data. You can generate a series of graphs, and then choose the ones that best display your information. If you are not satisfied with the graphs, you can change a few parameters and generate a whole new set of graphs.

The Auto Charts Window

You specify your data in the Auto Charts window, and the SAS ODS Graphics Designer (the designer) generates graphs for that data. The following figure shows an Auto Charts window that has been populated with sample data and automatically generated graphs:

Figure 6.1 Sample Auto Charts Window



The Auto Charts window has three main panes in which you can perform the following tasks:

Top pane

Specify the SAS library and data set for your graphs.

Left pane

Select one or more variables for your graphs. Specify the types of graphs that you want to generate. Generate graphs.

The top portion of the left pane is a table of variables. The columns contain the following information:

- **Variable** displays the name of each variable in the data set. To select a variable, select the variable's check box.

- **Details** provides more information about the variable values. Character variables and discrete numeric variables display the value count for the variable. Continuous numeric variables display the range of the value. Variables that have a Type=Any setting display the count and the range.
- **Type** displays the data type. Data types include Continuous, Discrete, Time, and Any. The Any value enables the variable to apply to any of the data types that it supports. You can change the data type if a small triangle appears next to it.

The bottom portion of the left pane has four options for the types of graphs that you want to generate.

- **Univariate** and **Bivariate** are selected by default when you first open the Auto Charts window in a SAS session. You can clear either check box.
- Select the **Grouped** check box if you want the results to include grouped plots.
- Select the **Advanced Plots** check box if you want more complex graphs such as classification panels, multi-cell graphs, and so on.

Click **Generate Graphs** when you are ready to generate the graphs.

Right pane

Displays icons for the graphs that are generated by the tool. Use the buttons at the top of the pane to open, save, and delete icons. This pane displays a progress bar showing the number of graphs that will be generated and their progress. The process can be interrupted.

You can open and customize one or more graphs. The opened graph is like any other graph that is built in the designer. You can modify properties and make changes to the data. You can add plots and cells to a graph. If you decide not to use the graphs, you can delete them and generate new ones. You can save any of the generated graphs as image files or in other formats, including an SGD file that you can later edit.

About the Auto Charts Example

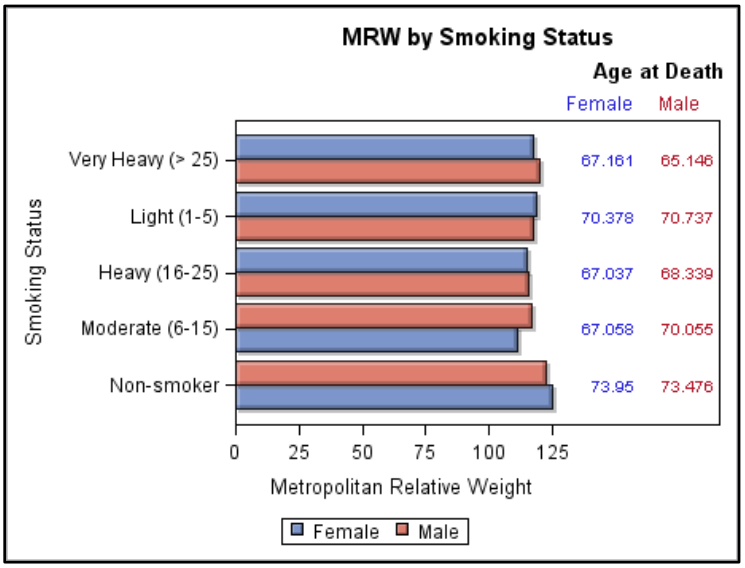
The example in this chapter shows you how to use the Auto Charts tool.

You complete the example in two phases. First, you use the Auto Charts tool to generate the graphs. Then, you customize one of the generated graphs.

This example plots the Metropolitan Relative Weight (MRW), a measure of obesity, for a group of male and female participants. The example shows the association between obesity and mortality, while taking into account the effect of smoking.

The graph consists of a bar chart and a vertical axis table on the right Y axis.

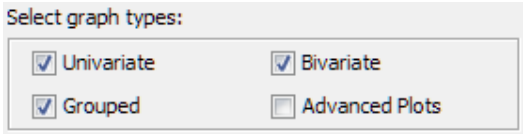
Figure 6.2 Graph for this Example



Generate Bulk Graphs

The Auto Charts tool enables you to generate graphs in bulk from a list of variables that you specify and from graph types that you select. The following steps walk you through this process. Refer to Figure 6.1 when completing these steps.

1. Select **Tools ► Auto Charts**. The Auto Charts window is displayed.
2. In the top pane, complete these steps:
   a. For **Library**, select **SASHELP**.
   b. For **Data Set**, select **HEART**.
3. In the left pane, select the following check boxes:
   SEX
   MRW
   AGEATDEATH
   SMOKING_STATUS
   The left and right panes of the Auto Charts window are resizable. If you cannot see the full variable names, you can drag the border of the left pane to widen it.
4. In the bottom portion of the left pane, select **Grouped**. The **Select graph types** group should look like the following image:



5. Click **Generate Graphs**. The right pane is populated with graph icons.

6. Take a moment to examine the graphs. Notice that all the icons are for single-cell graphs. You want to consider multi-cell graphs, so make a minor change to your selections, and generate another set of graphs.
7. In the right pane, click **Delete All**. This removes all of the icons from the pane.
8. In the left pane, select the **Advanced Plots** check box, and then click **Generate Graphs**. This time there are more results, and the icons include more advanced graphs such as classification panels and multi-cell graphs.

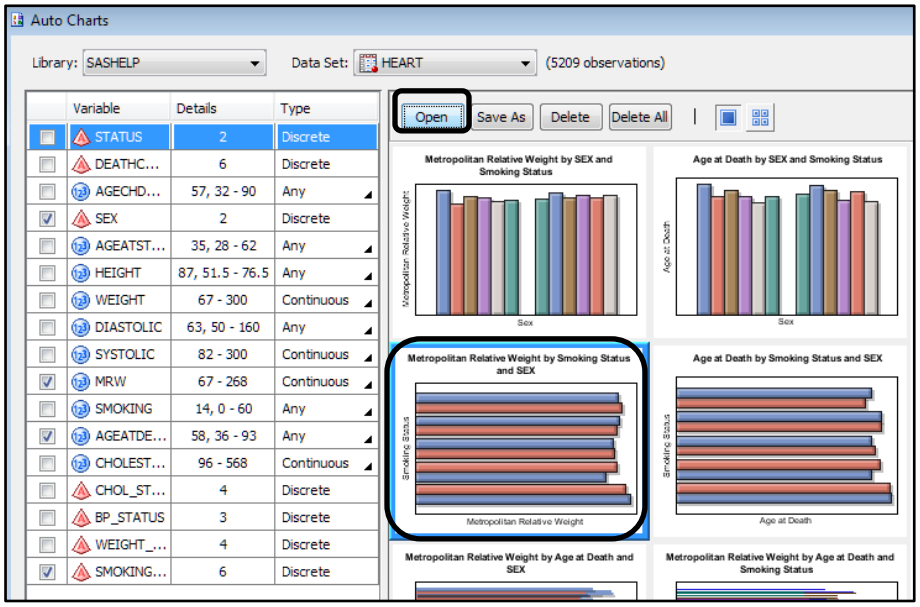
Customize Your Graph

After generating the graphs, you can choose one or more graphs as the starting point for customization.

Create Your Graph

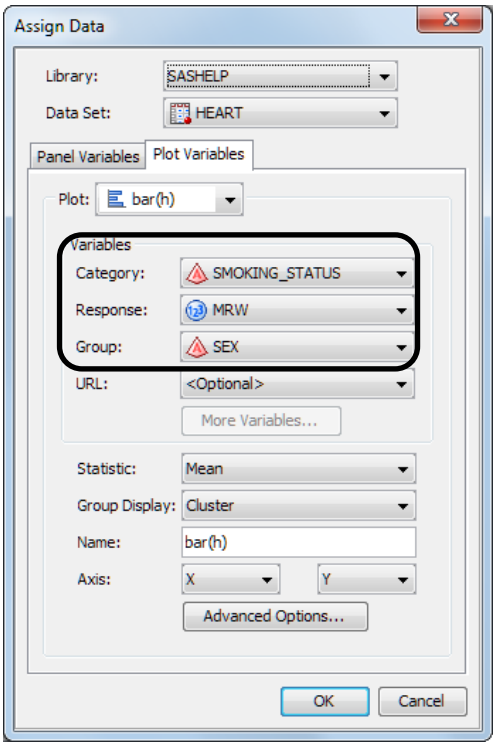
For this example, use a simple bar chart. You start the graph by opening the graph's icon.

1. In the right pane, select the icon for the horizontal bar chart with the title **Metropolitan Relative Weight by Smoking Status and SEX,** and then click **Open**. You can also double-click the icon.



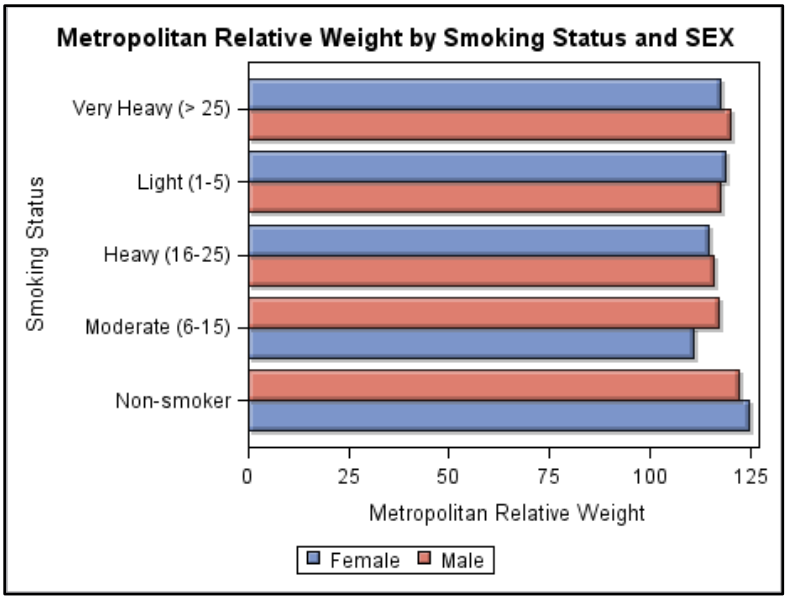
The designer opens the bar chart in the work area as shown in Figure 6.3.

2. (Optional) If you right-click the bar chart, and select **Assign Data**, you see the following data assignments for the **Category**, **Response**, and **Group** variables:



You can change these data assignments as needed to create your graph.

Figure 6.3 Bar Chart



This simple graph contains all the information that you need except for the AGEATDEATH variable. For that, you add an axis table to the graph.

Add an Axis Table to the Graph

About the Axis Table

As described in the survival plot example in Chapter 5, an axis table is a basic plot that displays data values in textual form at specific locations along the vertical or horizontal axis. In this Auto Charts example, the axis table is placed in the same cell as the bar chart. Because it shares the same cell, the axis table must use the same library and data set as the bar chart.

For this axis table, specify a variable for Y to generate a vertical table. The variable identifies the locations along the Y axis. Specify a variable for Value. This variable determines which values are displayed in the axis table.

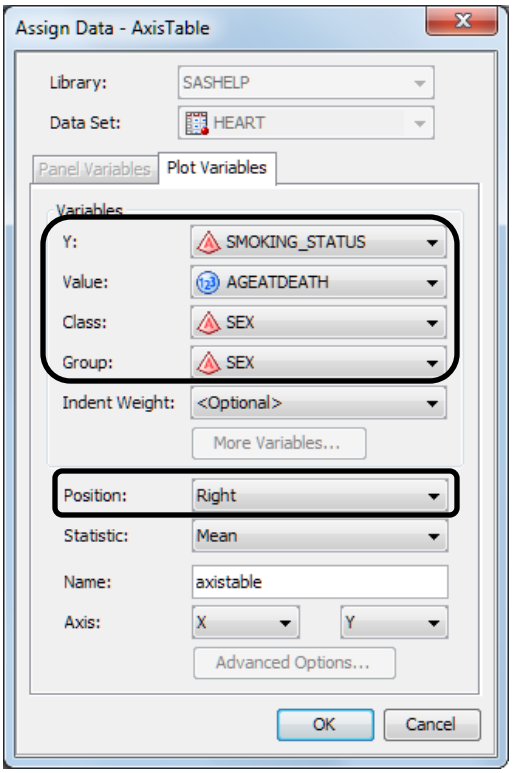
Create the Axis Table

First, create a vertical axis table that displays the age at death for male and female subjects. Assign data in the **Assign Data** dialog box. In addition, reposition the label for the axis table.

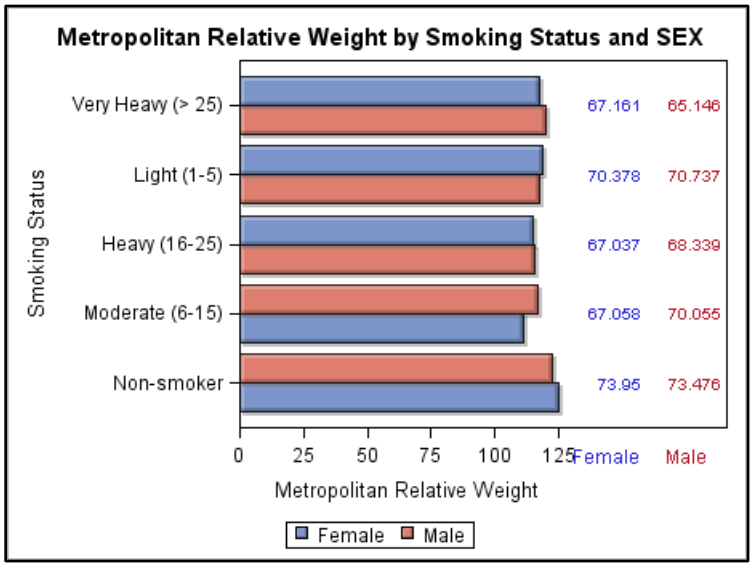
1. In the Elements pane, click the **AxisTable** icon, and drag and drop the icon onto the graph window.

   The **Assign Data** dialog box is displayed. **Library** and **Data Set** are not available because the axis table must use the same data as the bar chart.
2. In the **Assign Data** dialog box, complete these steps:
   a. For **Y**, select **SMOKING_STATUS**. This variable identifies the locations along the Y axis for the axis table. It aligns the axis table with the bars.
   b. For **Value**, select **AGEATDEATH**. This variable determines which values are displayed in the axis table.
   c. For **Class**, select **SEX**. This variable creates a separate column for each unique class value. It acts as a classification variable for the axis table.
   d. For **Group**, select **SEX**. This variable groups the axis table. Each group value is represented by a different visual attribute.
   e. For **Position**, select **Right**. This positions the table along the right Y axis.



f. Click **OK**. The axis table is added to the graph.

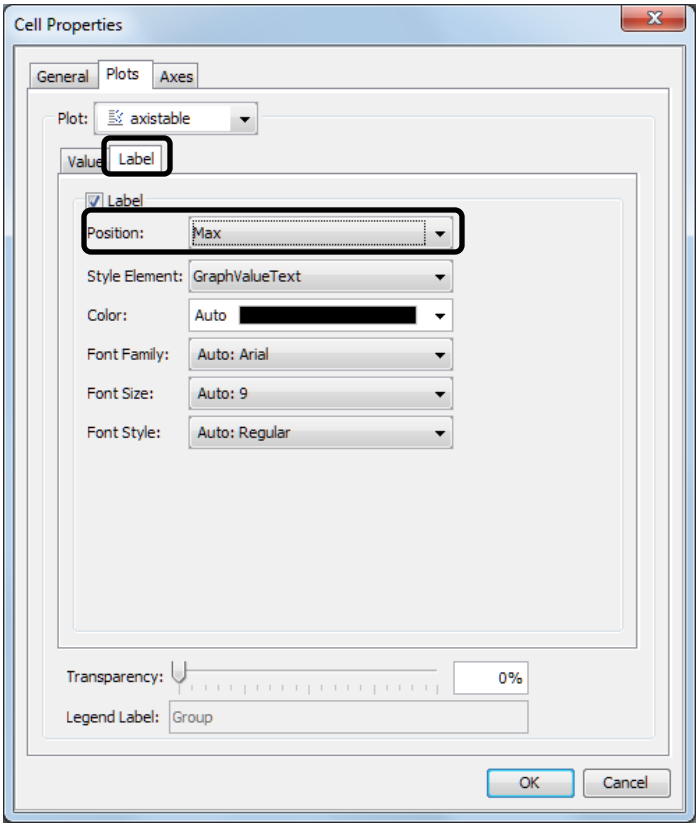


Next, move the axis table labels so that they appear above the axis table.

3. Right-click the axis table, and select **Plot Properties**. The **Cell Properties** dialog box is displayed with the **Plots** tab selected.
4. In the **Cell Properties** dialog box, complete these steps:
   a. For **Plot**, select **axistable** if it is not already selected.

b. Click the **Label** tab, which is directly below **Plot**.

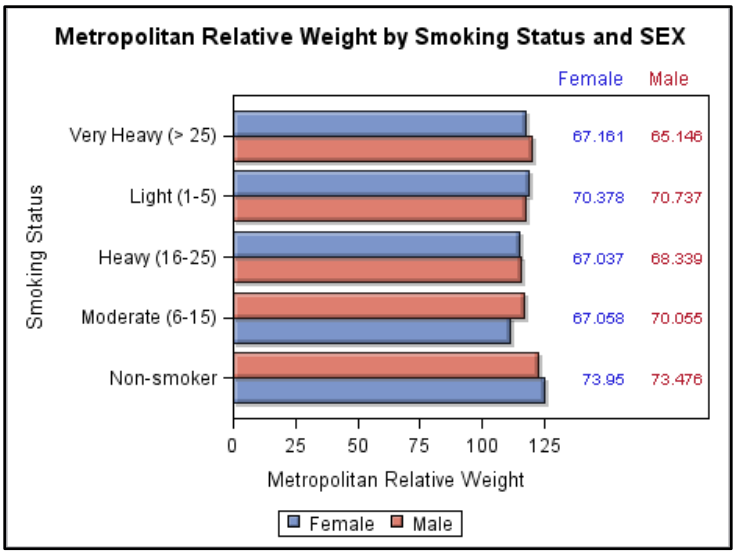
c. For **Position**, select **Max**. This moves the axis table's labels to the maximum end of the axis.



d. Click **OK**.

The graph is updated with your changes.

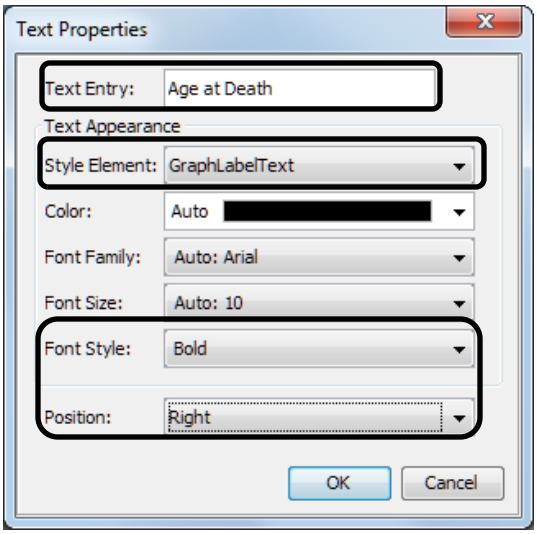
Figure 6.4 Bar Chart with Axis Table



Customize the Titles

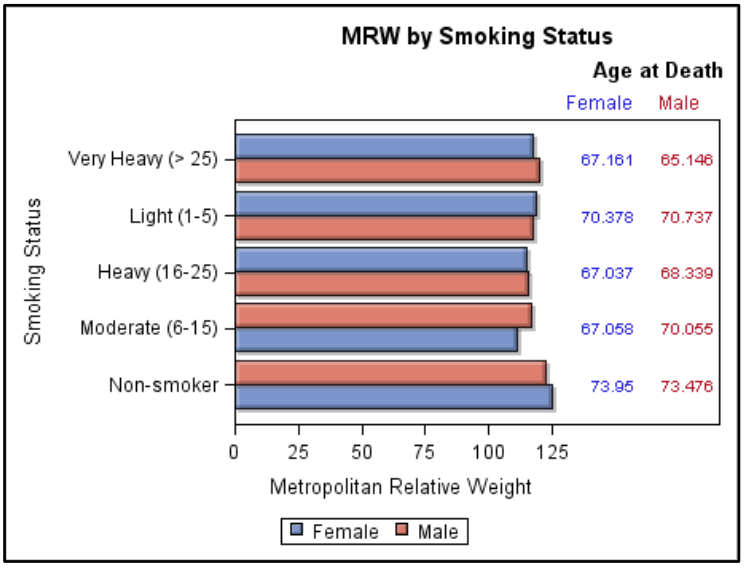
The last step is to shorten the existing title and add a second title above the axis table.

1. Select the title. The text is highlighted.
2. Enter **`MRW by Smoking Status`**.
3. Select **Insert ► Title**.
4. Click outside of the placeholder title text to deselect it. Then, right-click the placeholder text, and select **Title Properties**.
5. In the **Text Properties** dialog box, complete these steps:
   a. In **Text Entry**, enter **Age at Death**.
   b. For **Style Element**, select **GraphLabelText**.
   c. For **Font Style**, select **Bold**.
   d. For **Position**, select **Right**. This positions the new title above the axis table.



e. Click **OK**.

The final graph is shown in Figure 6.2 and repeated here:



Chapter 7: Advanced Features

About the Advanced Features 97

Overview of Graph Reuse 98

Create a Shared-Variable Graph with a Dynamic Title 99

- Create the Shared-Variable Graph 99
- Add Cells and Plots to the Graph 101
- Assign a Different Variable to the Graph 104
- Add a Dynamic Title and Save the Graph 105
- Generate the Graph Using the SGDESIGN Procedure 106

Customize the Axes 109

- About This Example 110
- Create the Graph 110
- Customize the Axis Properties 112
- Add an Axis Table to the Graph 114

Customize the Appearance of Grouped Data 116

- About This Example 116
- Create the Graph 117
- Change the Bar Fill and Outline Color Group Attributes 119

Where to Go from Here 122

About the Advanced Features

This chapter discusses some advanced features of the SAS ODS Graphics Designer (the designer).

First, you learn how to use the designer tools that facilitate reusing your graphs. Some graphs consist of multiple plots that are driven by a few (one or two) variables. Such graphs are easier to define and modify using shared variables.

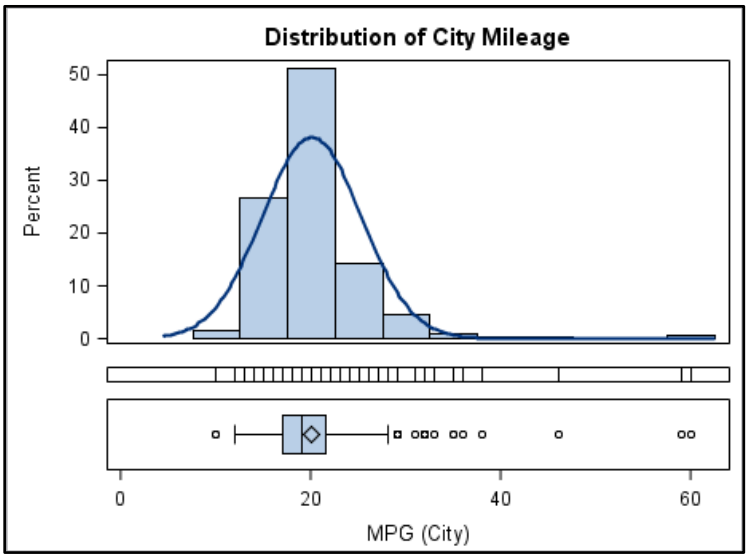
Second, you customize a graph by specifying which tick marks are displayed.

Finally, you learn how to customize the appearance of graphs that include a group variable.

Overview of Graph Reuse

Suppose you want to create the following graph, which is similar to the example that you created in Chapter 3:

Figure 7.1 Three-Cell Distribution Graph to be Reused



The key feature to note about this graph is that it consists of multiple plots, all of which are based on only one variable **MPG (City)**. You want to reuse this graph with different data. For example, maybe you want to show the distribution of engine size rather than city gas mileage. Or, perhaps you want to show the distribution of data other than the Cars data. To make these changes, you would normally have to re-assign data for each cell in the graph. You would also need to change the graph's title.

The designer's shared-variable feature provides an easier way to build and reuse graphs. You first define one or more shared variables, and then associate the shared variables with the data roles in your plots. You build the graph by using the defined shared variables. Changing the data assignment in a graph is simply a matter of changing the data assigned to the shared variables. You make this change once, and the change is applied to all the plots in the graph.

Here are some additional features of shared variables:

- Shared variables can be used in single-cell graphs and in multi-cell graphs, including classification panels.
- Shared variables are most effective for creating graphs that have many plots and that use few (one or two) variables. The graph shown in Figure 7.1 is a good example because it has several plots, but uses just one variable.
- You can run shared-variable graphs in batch mode by using the SGDESIGN procedure. You can specify different variables in the same data set or in a different data set by using the DYNAMIC option.
- You can use the DYNAMIC option to generate a dynamic title that changes to match the data that is used to generate the graph.

Note: Dynamic usage is relevant only if you use the SGDESIGN procedure to generate the graph. Shared variables, on the other hand, are useful for graphs created by the designer and for graphs that are generated by the SGDESIGN procedure.

Create a Shared-Variable Graph with a Dynamic Title

In this example, you create a graph that has three cells with different types of plots, all of which use the same variable. For this example, the right amount of explanation required to create the graph and gain a basic understanding of the process is provided. For more details, see the *SAS ODS Graphics Designer: User's Guide*.

Create the Shared-Variable Graph

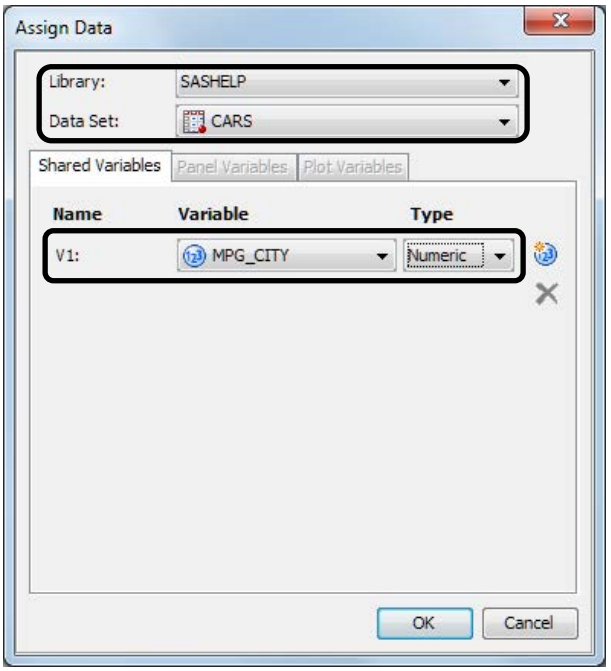
When creating the shared-variable graph, the first step is to assign the data to one or more shared variables.

1. Select **File ► New ► Blank Shared Variable Graph**. The **Assign Data** dialog box appears with the Shared Variables tab selected. The other tabs are displayed but are not available.

   By default, the dialog box contains one shared variable named V1. You can define more as needed.
2. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **SASHELP**.
   b. For **Data Set**, select **CARS**.
3. Assign a data variable to the shared variable named **V1**:
   a. For **Variable**, select **MPG_CITY**.
   b. For **Type**, select **Numeric**.

      Although you can keep the default type **Any**, it is good practice to specify a variable type. Some plots, such as histograms, require that the variable be a particular type.

      Once you specify a variable type, **Variable** contains only the variables of that type.

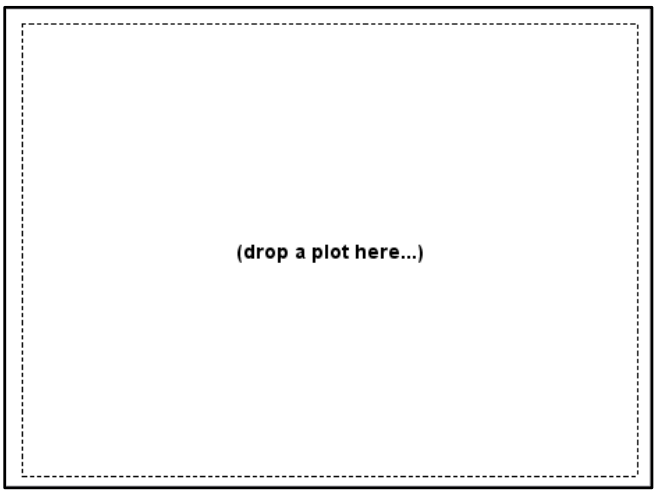


To add another shared variable, you would click the Add a Variable icon , and then specify the variable and type. Shared variables are identified as V1, V2, and so on. This example uses only one shared variable.

4. Click **OK**.

A graph window is displayed in the work area. This window is blank except for the prompt **(drop a plot here)**.

Figure 7.2 Initial Graph Window



Add Cells and Plots to the Graph

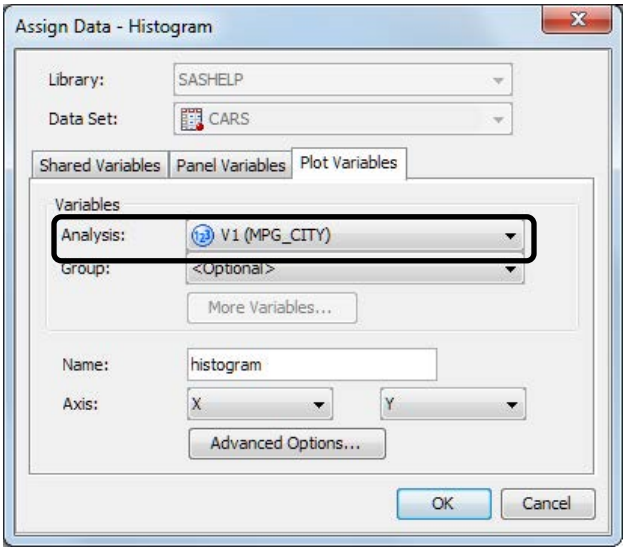
You are now ready to add plots.

1. In the Elements pane, click **Histogram**, and drag and drop the icon onto the graph window.

   The **Assign Data** dialog box for the histogram is displayed. **Library** and **Data Set** are unavailable because they have already been set for the graph.

2. In the **Assign Data** dialog box, complete these steps:
   a. For **Analysis**, select **V1 (MPG_CITY)**.
   b. Click **OK**.

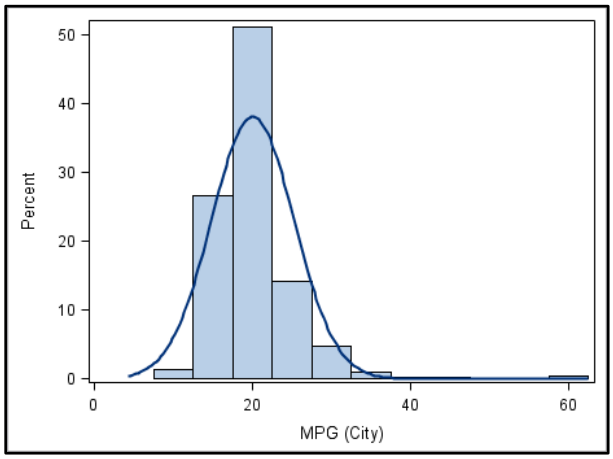
   The histogram is added to your graph.

3. In the Elements pane, click **Normal**, and drag and drop the icon onto the graph window.

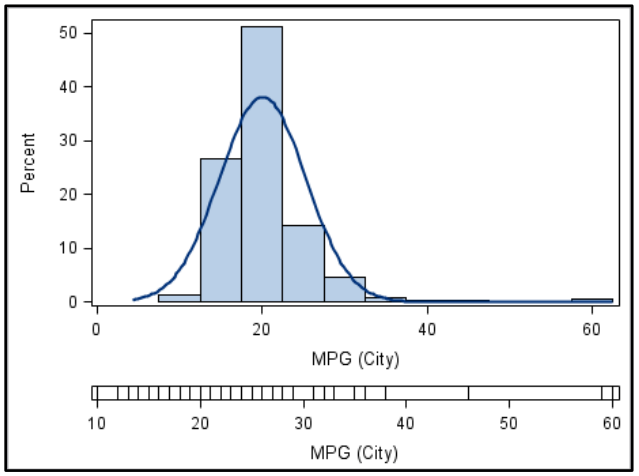
   The **Assign Data** dialog box is displayed.

4. For **Analysis**, select **V1 (MPG_CITY)**. Click **OK**.
   Your graph looks like the following:



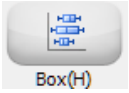
5. Right-click anywhere in the cell, and select **Add a Row**. The graph area is split into two rows. Each row contains one cell.
6. In the Elements pane, click **Fringe**, and drag and drop the icon onto the bottom cell of the graph.

   The **Assign Data** dialog box is displayed.
7. For **X**, select **V1 (MPG_CITY)**. Click **OK**.
   The fringe plot is added to the bottom cell of your graph.



8. Right-click in either cell, and select **Add a Row**. A third row is created below the existing two rows.

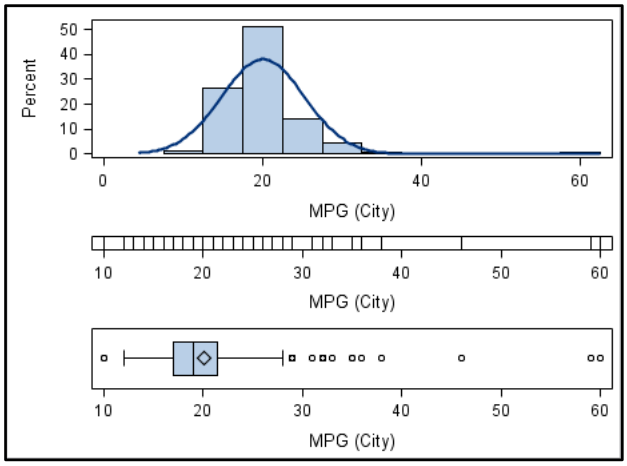
9. In the Elements pane, click **Box(H)**, and drag and drop the icon onto the bottom cell of the graph.



The **Assign Data** dialog box for the horizontal box plot is displayed.

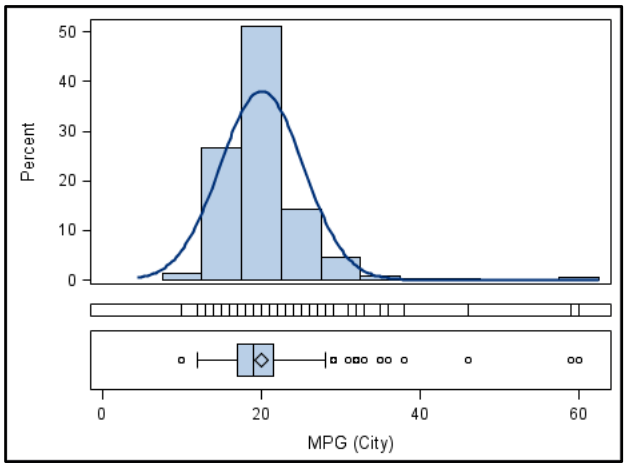
10. For **Analysis**, select **V1 (MPG_CITY)**. Click **OK**.

The horizontal box plot is added to the bottom cell of your graph.



11. Right-click on one of the X axes, and select **Common Column Axis**.

A common column axis is created for all the cells in the column (three cells, in this case) and is displayed at the bottom. The axis range for the common column axis is the union of the ranges for each cell in the column. All plots in each cell in the column are now correctly scaled to this new common column axis.



The graph is the same as the one shown in Figure 7.1, except that this graph has no title yet.

Assign a Different Variable to the Graph

You have created a very common and useful graph to visualize the distribution of gas mileage for vehicles. The graph has multiple plots, all of which use the same analysis variable. This type of graph can be used to visualize the distribution of any analysis variable, such as horsepower in the same data set. Or, you could use it to visualize cholesterol or systolic blood pressure in the Sashelp.Heart data set.

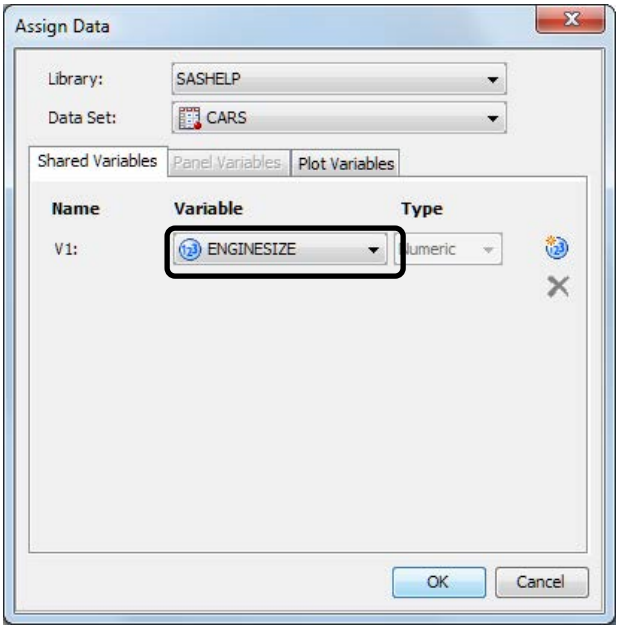
Once you have created a shared-variable graph, you can easily reuse it to visualize the distribution of other analysis variables by setting the shared variable to a different data variable in the same data set or in a different data set. You make this change in the **Assign Data** dialog box for any of the plots in the graph. The change is propagated to all plots in the graph.

In this example, you want to show the distribution for engine size, so you assign the ENGINESIZE variable to the V1 shared variable. The new variable must be the same type (numeric, in this case) as the original variable.

1. Right-click inside the plot area of a cell in the graph, and select **Assign Data**. The **Assign Data** dialog box is displayed.
2. Click the **Shared Variables** tab.
3. For the **V1** shared variable, select **ENGINESIZE**.

   The variables available depend on the variable type. For example, if the type is **Numeric**, then only numeric variables are listed. For a type of **Any**, all variables are listed.

   You cannot change the data type for any variable that is currently used by any plot in the graph. In this case, **Type** is unavailable.

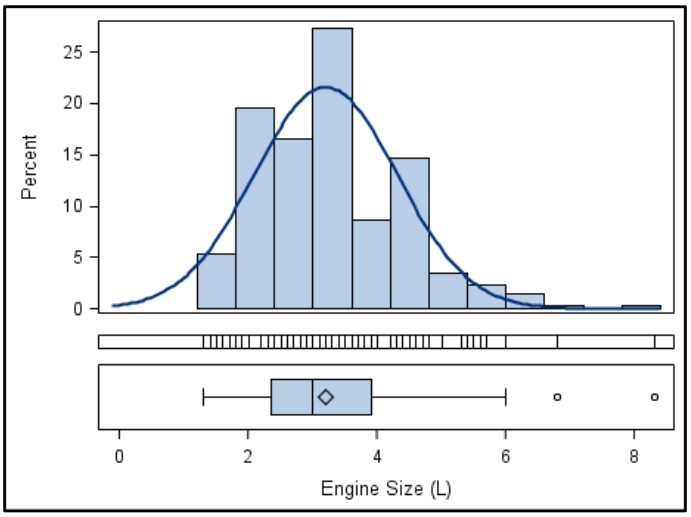


4. Click **OK**.

Tip: You can change the library or data set if you want to use different data. Then, you would specify a variable from the new data set.

All the plots are updated to show the new variable.

Figure 7.3 Graph with Engine Size Variable



Add a Dynamic Title and Save the Graph

When you create a graph in the designer, you can add a title to reflect the content of the graph. In this example, if the analysis variable is ENGINESIZE, you might add a title to say "Distribution of Engine Size."

A nice feature of the designer is that you can define and save a graph as a SAS ODS Graphics (SGD) file. Then, you can use the SGDESIGN procedure to run the graph in the SAS windowing environment with a different data set or variable, such as the SYSTOLIC variable in the Sashelp.Heart data set. Although you can easily change the analysis variable to SYSTOLIC, what can you do about the title that still says "Distribution of Engine Size"?

You can use the following special construct in the title string:

dyn(*DNAME*)

DNAME is a name that you want to associate with the text that is generated. The name cannot contain any special character other than an underscore (_). In addition, *DNAME* must start with an alphabetic character.

It is easy to add dynamic content to a title:

1. Select **Insert ► Title**, or click the Title toolbar button. A new title text box is added at the top of the graph. The text is selected.

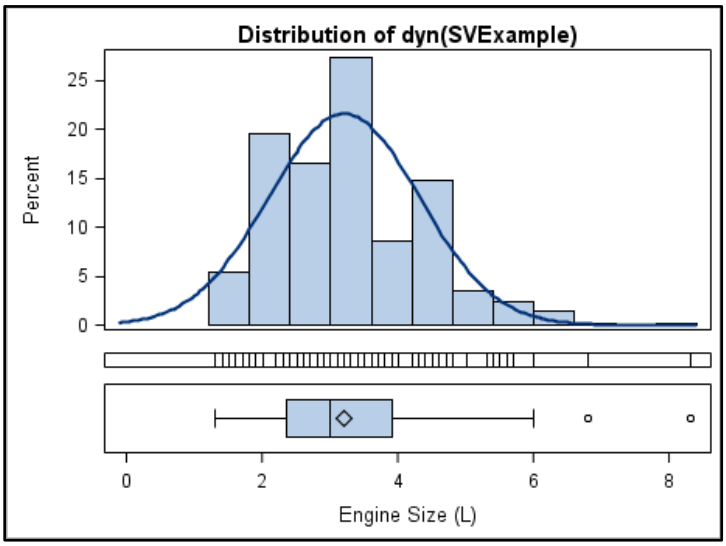
   Type in your title...

2. In the title text box, enter **`Distribution of dyn(SVExample)`**.

3. Save the graph so that you can reference it in the SGDESIGN procedure. Complete these steps:
   a. Select **File ► Save As**.
   b. Select a location or keep the default location.
   c. For **File name**, enter a descriptive name, such as **svExample**.
   d. For **Files of type**, select **SGD Files (*.sgd)**. (This should be selected by default.)
   e. Click **Save**.

The graph is updated with the new title.

Figure 7.4 Graph with Dynamic Content in the Title



Tip: Dynamic content can be added to footnotes, text entries, cell headers, and axis labels. For more information, see the *SAS ODS Graphics Designer: User's Guide*.

Generate the Graph Using the SGDESIGN Procedure

This step includes three runs of the SGDESIGN procedure to produce three graphs with different data.

Set the ODS Destination

In SAS, run the following code to specify the ODS LISTING destination. This output matches the designer's default output. You can close the HTML destination because it is not needed.

```
ods listing;
ods html close;
```

Generate a Graph That Shows the Data Currently Defined in the SGD File

By default, the SGDESIGN procedure uses the data that is currently defined in the SGD file. The graph that you saved in the previous step uses the Sashelp.Cars data set and the ENGINESIZE

shared variable. You need to specify only the path to the SGD file and the dynamic content for the graph title.

In SAS, run this code to generate the default output:

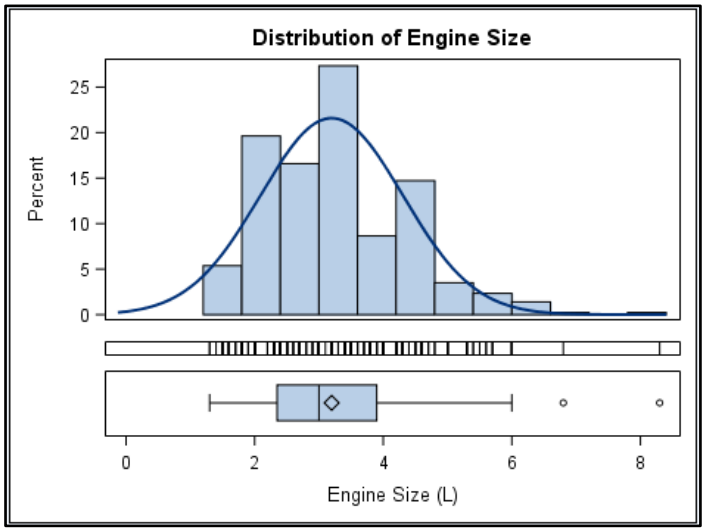
```
proc sgdesign sgd="path-and-filename"; /* ❶ */
  dynamic SVExample="Engine Size"; /* ❷ */
run;
```

❶ Replace *path-and-filename* with the path to the graph. For example, the path might be `C:\SGDFiles\svExample.sgd`.

❷ The DYNAMIC statement specifies the value for the dynamic text used in the graph title. The value is a character string and must be enclosed in quotation marks. The text that you provide replaces the **dyn(SVExample)** expression in the title.

Here is your new output:

Figure 7.5 Default Data and Dynamically Generated Title Text



Note: When the length of the resolved title differs from that of the placeholder `dyn(DNAME)` title, you might see wraparounds or other minor text-placement differences.

Generate a Graph That Shows City Gas Mileage

If you want to show city mileage rather than engine size, you can specify the MPG_CITY shared variable in the SGDESIGN procedure. MPG_CITY can replace ENGINESIZE because both are the same type of variable (numeric).

In SAS, run this code to generate the output:

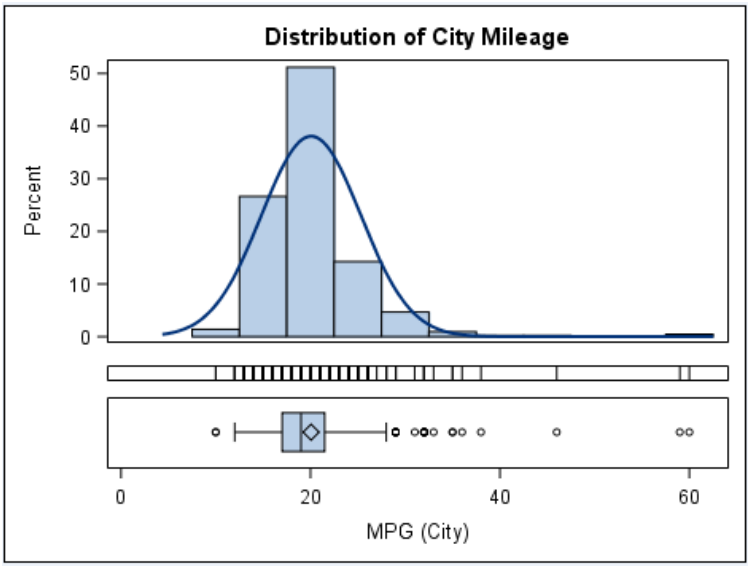
```
proc sgdesign sgd="path-and-filename";
  dynamic V1="MPG_CITY" SVExample="City Mileage"; /* ❶ */
run;
```

❶ The DYNAMIC statement specifies the value for both of the following:

- the shared variable V1. MPG_CITY is a column name and must be enclosed in quotation marks.
- the dynamic text used in the graph title.

Here is your output:

Figure 7.6 City Gas Mileage and Dynamically Generated Title Text



Generate a Graph That Uses Different Data

Let's show cholesterol distribution using the Sashelp.Heart data set. You must specify the library, data set, and dynamic variables. For the shared variable, CHOLESTEROL can replace ENGINESIZE because both are the same type of variable (numeric).

In SAS, run this code to generate the output:

```
proc sgdesign sgd="path-and-filename"
        data=sashelp.heart; /* ❶ */
dynamic V1="cholesterol" SVExample="Cholesterol"; /* ❷ */
run;
```

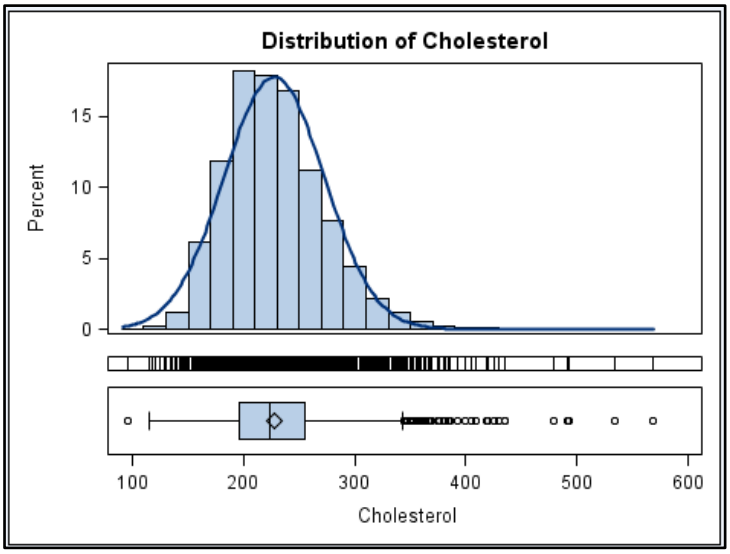
❶ The DATA= option specifies the library and data set.

❷ The DYNAMIC statement specifies the value for both of the following:

- the shared variable V1.
- the dynamic text used in the graph title.

Here is your output:

Figure 7.7 Heart Data and Dynamically Generated Title Text



Reset the ODS Destination

Run this code to close the ODS LISTING destination and re-open the HTML destination:

```
ods listing close;
ods html;
```

Summary

This example showed how you can easily reuse graphs with different data using shared variables. In addition, you used the SGDESIGN procedure to produce several graphs with different data and different titles.

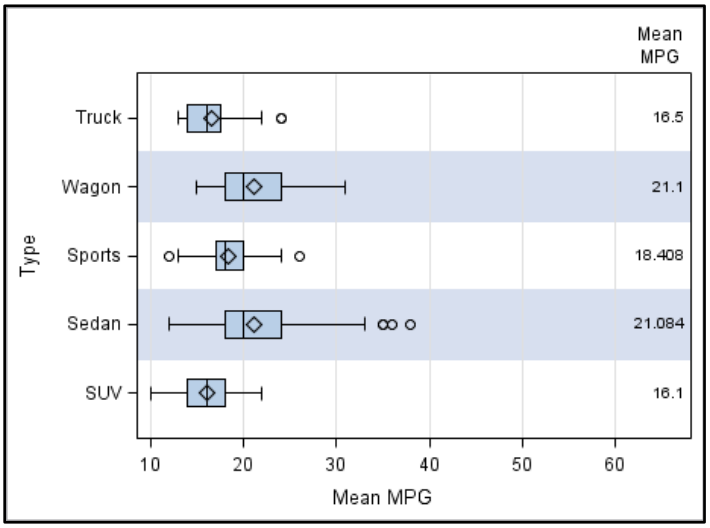
Customize the Axes

Axes have many properties that you can set. For example, you can adjust the range, specify which tick marks are displayed, set offsets, show grid lines, and change axis labels.

About This Example

This example shows you how to remove tick values from the axis. You add color bands and grid lines, and create an axis table.

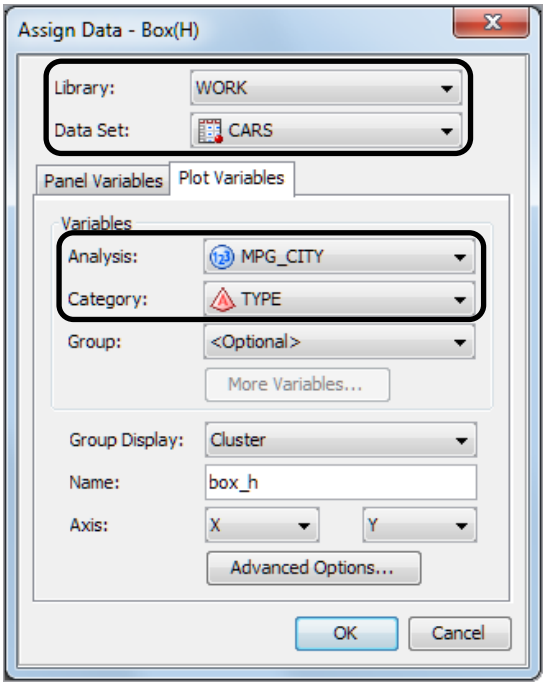
Figure 7.8 Graph for This Example



Create the Graph

1. In the SAS session, run the code from "Code for the Axis Customization Example in Chapter 7" in the appendix.
2. Select **File ► New ► Blank Graph**, or click the New Blank Graph toolbar button. A graph window is displayed in the work area. This window is blank except for the prompt **(drop a plot here)**.
3. In the Elements pane, click **Box(H)**, and drag and drop the icon onto the graph window.

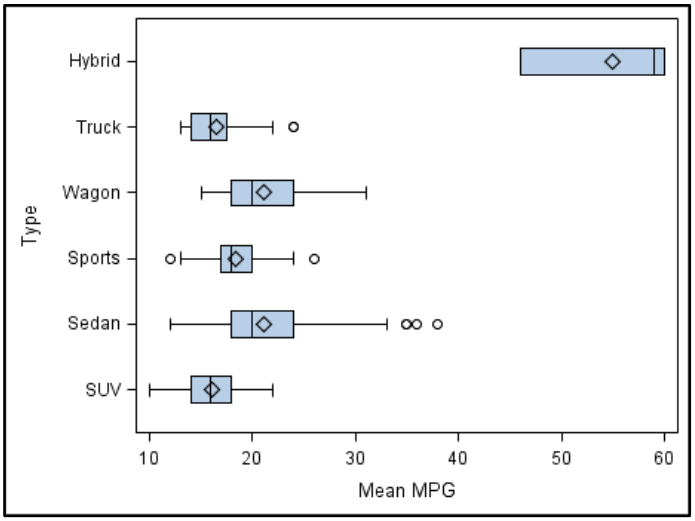
4. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **WORK**.
   b. For **Data Set**, select **CARS**.
   c. For **Analysis**, select **MPG_CITY**.
   d. For **Category**, select **TYPE**.



e. Click **OK**.

The designer creates the following graph in the work area:

Figure 7.9 Initial Graph for this Example



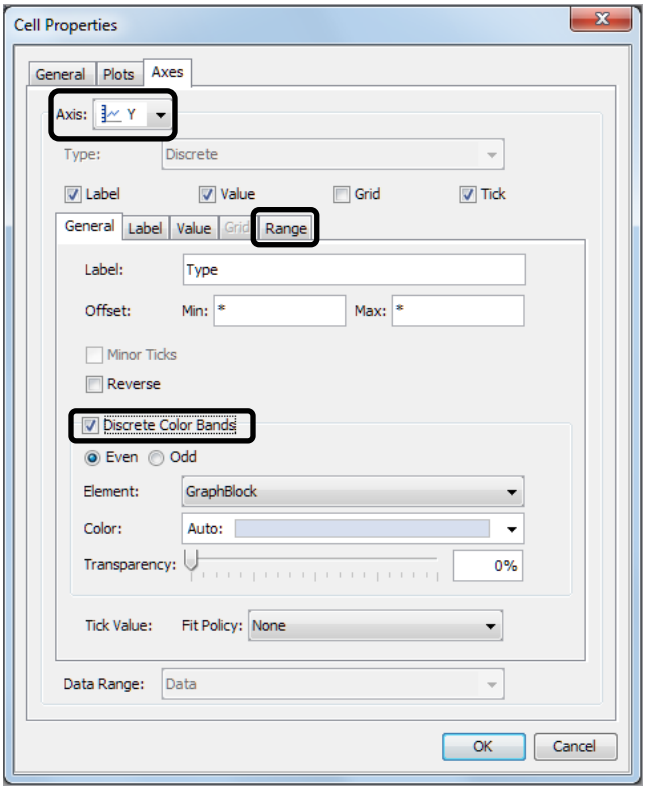
Customize the Axis Properties

In this example, you want to see only non-hybrid vehicles. Therefore, remove the **Hybrid** category from the axis. And, show color bands and grid lines.

1. Right-click the Y axis, and select **Axis Properties**. The **Cell Properties** dialog box is displayed with the **Axes** tab selected.

   The Y axis should be selected for **Axis**. If it is not, select it.

2. Select **Discrete Color Bands**.



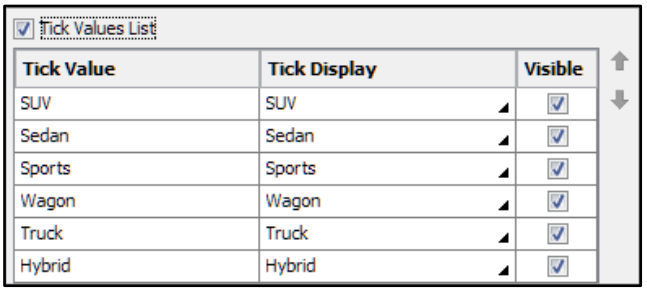
3. Select the **Range** tab.

   The contents of the Range tab vary by the type of axis. For a discrete axis like the one in this example, you can use a tick values list to customize the range. Linear, date, and logarithmic axes provide different features for customizing the range.

4. On the **Range** tab, complete these steps:

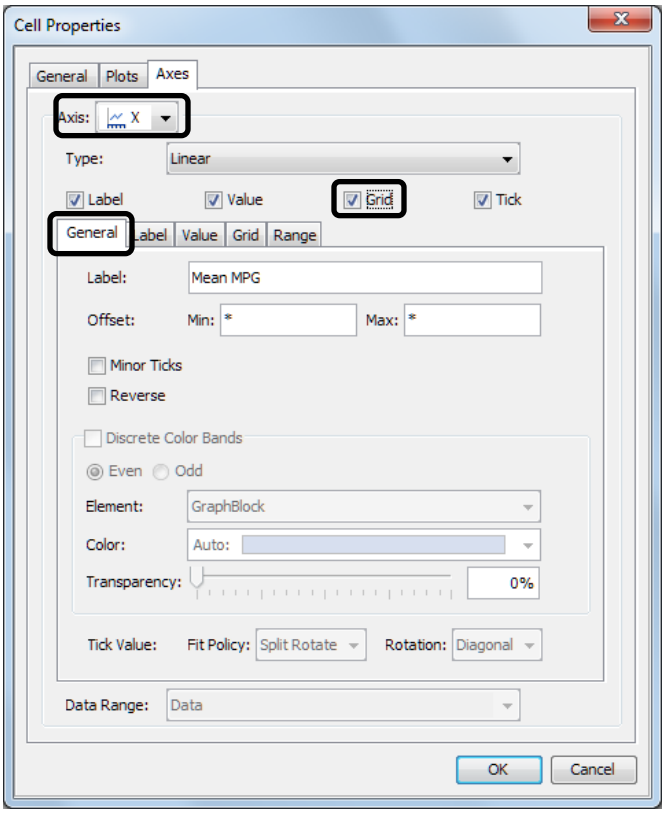
   a. Select the **Tick Values List** check box. The tick values list becomes available for editing.

The list contains three columns. For each tick value listed in column 1, you can change the value that is displayed in column 2. You can clear the check box in column 3 to hide the tick value.



b. In the **Hybrid** row, clear the **Visible** check box.

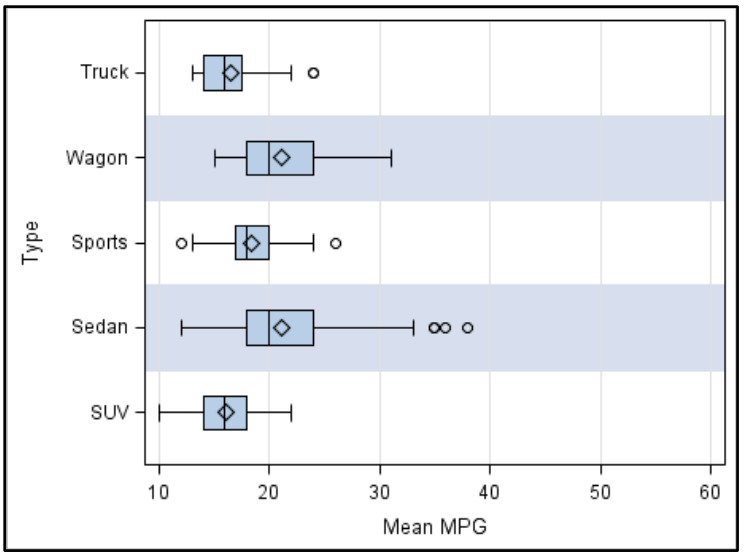
5. Select the **General** tab.
6. For **Axis**, select **X**.
7. Select the **Grid** check box. This option creates grid lines for the X axis values.



8. Click **OK**.

The graph is updated to reflect your changes.

Figure 7.10 Changes to the Axes



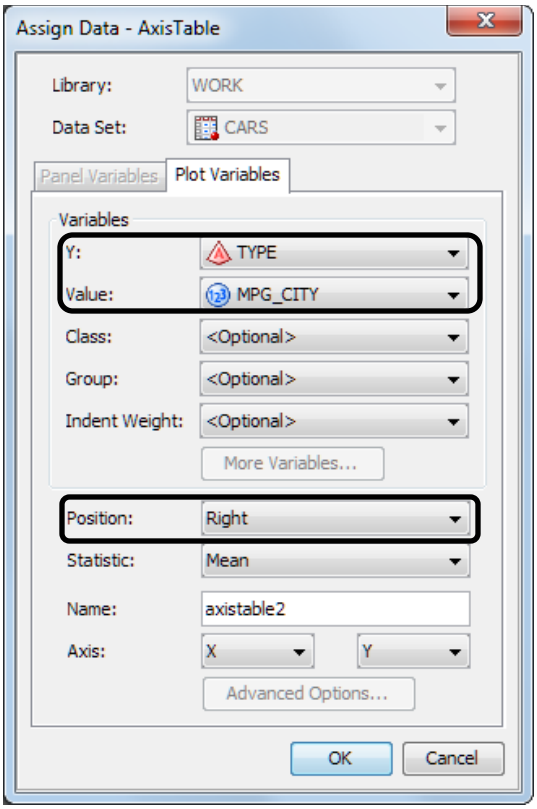
Add an Axis Table to the Graph

Let's add a Y axis table on the right side of the graph that shows the mean mileage. With the color bands, this makes it easier to align the numbers with the rows in the graph.

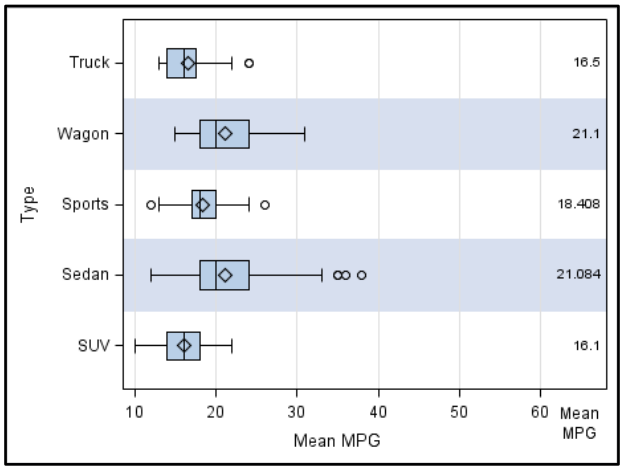
1. In the Elements pane, click **AxisTable**, and drag and drop the icon onto the graph window.

   The **Assign Data** dialog box is displayed. **Library** and **Data Set** are unavailable because the axis table must use the same data as the existing plot.
2. In the **Assign Data** dialog box, complete these steps:
   a. For **Y**, select **TYPE**. This value identifies the locations along the Y axis for the axis table. It aligns the axis table with the boxes.
   b. For **Value**, select **MPG_CITY**. This value determines which values are displayed in the axis table.
   c. For **Position**, select **Right**. This value positions the table along the right Y axis.



d. Click **OK**. The axis table is added to the graph.

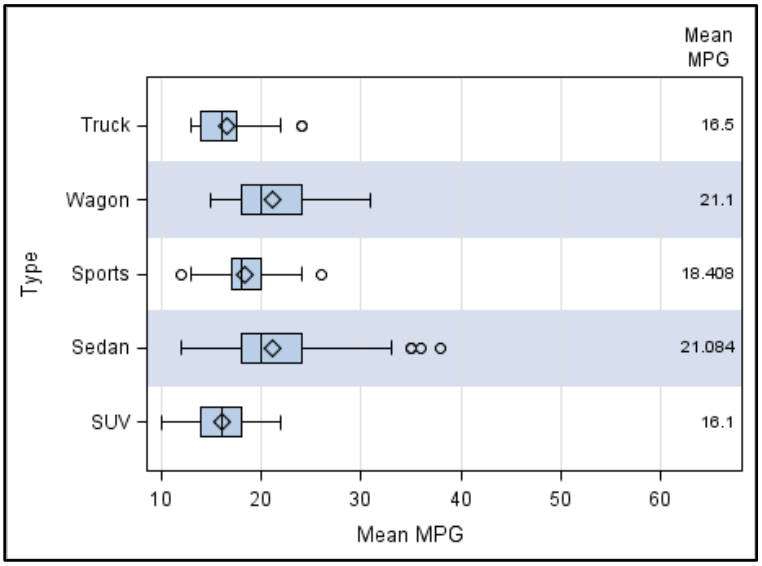


Next, move the axis table label so that it appears above the axis table.

3. Right-click the axis table, and select **Plot Properties**. The **Cell Properties** dialog box is displayed with the **Plots** tab selected.

4. In the **Cell Properties** dialog box, complete these steps:
   a. For **Plot**, select **axistable** if it is not already selected.
   b. Click the **Label** tab.
   c. For **Position**, select **Max**. This moves the axis table's labels to the maximum end of the axis.
   d. Click **OK**.

The graph is updated to reflect your changes, as shown in Figure 7.8 and repeated here:



Customize the Appearance of Grouped Data

In previous examples, you customized the colors used in your plots. This section deals with grouped data and explains how to customize the appearance of graphs that include a group variable.

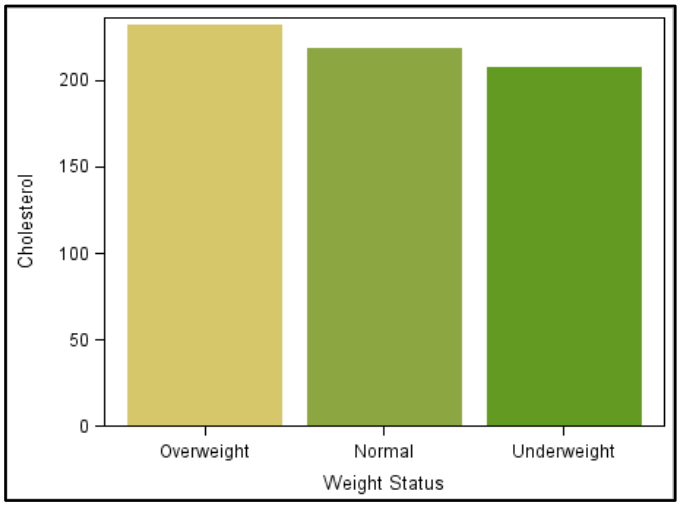
About This Example

When you apply a group variable to your graph, by default, the designer rotates through the attributes (such as colors, marker symbols, and line patterns) for the presentation of each unique group value. The attributes are derived from the GraphData1–GraphData12 style elements for the style that is in effect.

You can specify the attributes that are rotated for these group values. You can change the number of attributes that are rotated. In this example, you do both.

This example creates a bar chart that shows cholesterol levels for groups of patients based on weight status. You change the colors of the bar fill and outline. You might want to customize these colors to match your organization's brand.

Figure 7.11 Graph for This Example



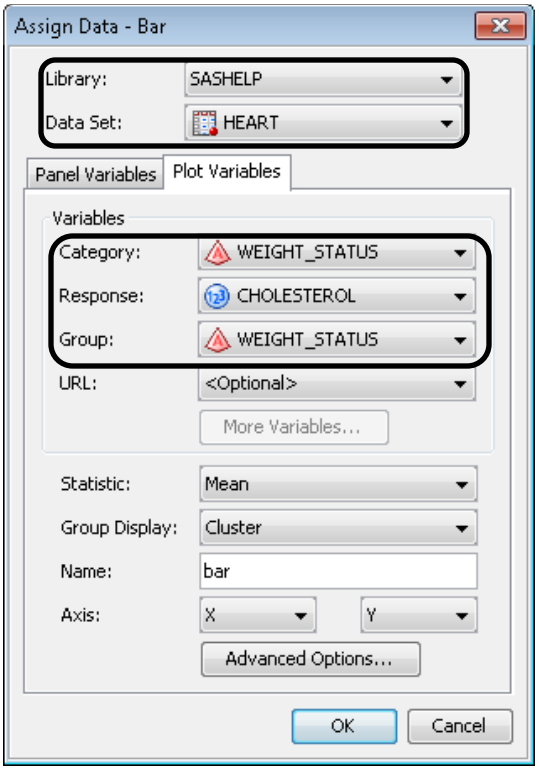
Create the Graph

In this step, create a grouped bar chart.

1. Select **File ► New ► Blank Graph**, or click the New Blank Graph toolbar button. A graph window is displayed in the work area. This window is blank except for the prompt **(drop a plot here)**.
2. In the Elements pane, click **Bar**, and drag and drop the icon onto the graph window.

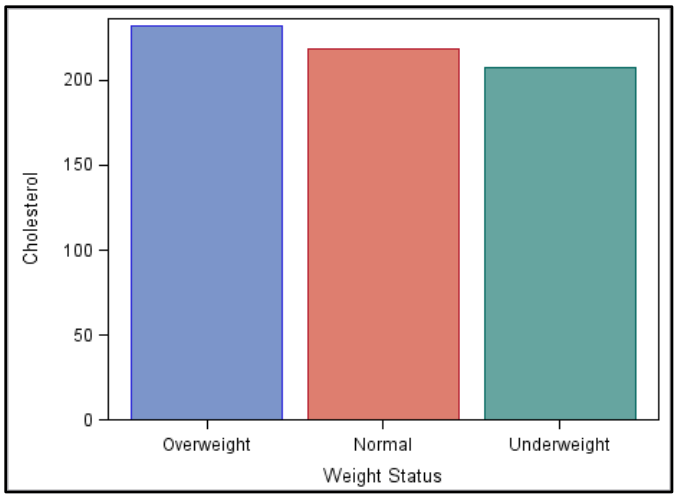
3. In the **Assign Data** dialog box, complete these steps:
   a. For **Library**, select **SASHELP**.
   b. For **Data Set**, select **HEART**.
   c. For **Category**, select **WEIGHT_STATUS**.
   d. For **Response**, select **CHOLESTEROL**.
   e. For **Group**, select **WEIGHT_STATUS**.



f. Click **OK**.

The designer creates the following graph in the work area:

Figure 7.12 Initial Grouped Bar Chart

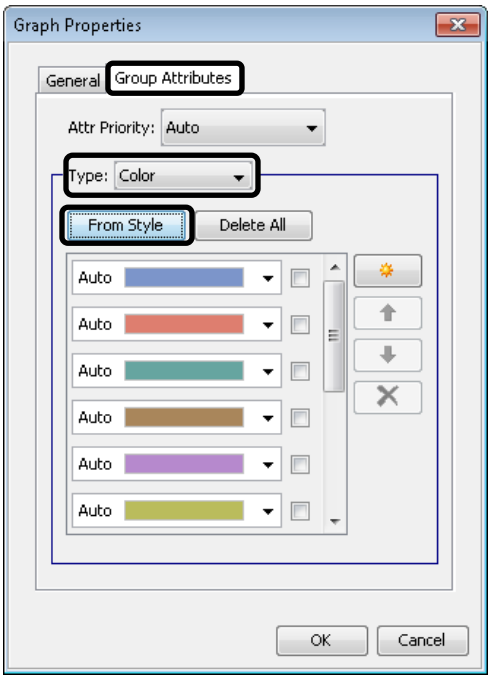


Change the Bar Fill and Outline Color Group Attributes

The designer provides an editable list of attributes for each graphics element, such as bar fill and outline color.

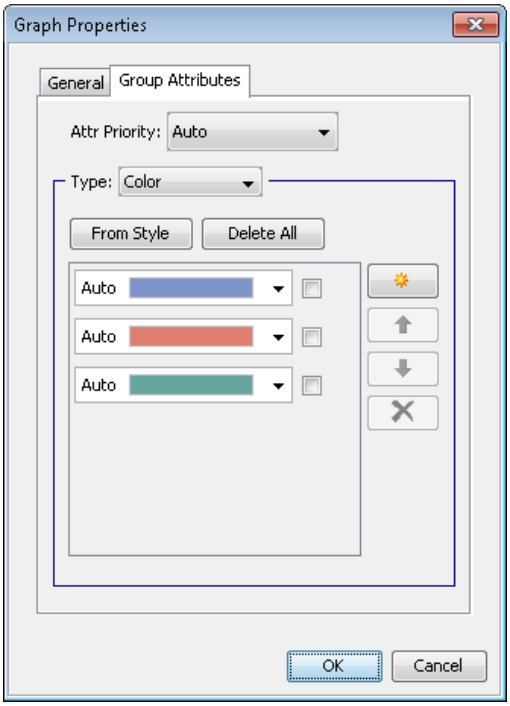
First, reduce the number of color attributes that are rotated for your group values. Then, change the colors that are rotated. These steps are performed for both bar fill and outline colors so that they match each other.

1. Right-click on the graph, and select **Graph Properties**. The **Graph Properties** dialog box is displayed.
2. Click the **Group Attributes** tab.
3. For **Type**, make sure that **Color** is selected. This selection affects the bar fill colors.
4. To reduce the number of colors, complete these steps:
   a. Click **From Style**. A list of colors for the current style is displayed. Notice that the first three colors in the list are the colors used in your bar chart.



   For this example, retain only three colors.
   b. Starting with the fourth color, select the check box next to each color. You might need to scroll down to select these colors.

c. Click the Delete ✕ button. All of the selected colors are deleted from the list.



5. To change the colors, complete these steps:

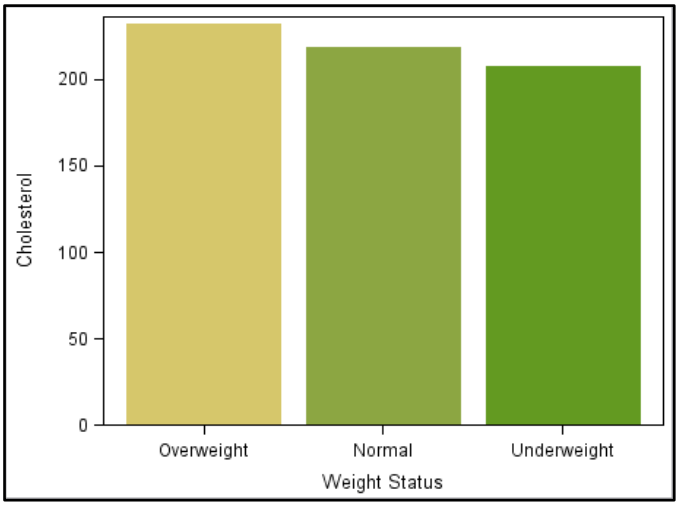
a. To change the first color in the list, select a gold color from the color list box.

b. To change the second color in the list, select a light green color from the color list box.

c. To change the third color in the list, select a dark green color from the color list box.

6. To change the colors for the outline so that they match the bar fill, complete these steps:
   a. For **Type**, select **Contrast Color**.
   b. To reduce the number of colors, repeat step 4.
   c. To change the colors, repeat step 5.
7. Click **OK**.

The graph is updated to reflect your changes, as shown in Figure 7.11 and repeated here:



The designer cycles the colors in the order in which they are specified in the attribute list, which now includes only three colors. In the future, if more categories are added to the data for weight status, the list cycles through the three colors, and then repeats for the new categories.

Where to Go from Here

This book covered the main features of the designer. There are a number of features that were not covered, such as:

- How to use the Style Editor to create your own custom styles
- How to set preferences
- How to manage graphs in the Graph Gallery
- How to create scatter plot matrices

For complete information about the designer, see the *SAS ODS Graphics Designer: User's Guide*.

Code for Select Examples

Code for the First Example in Chapter 1 123
Code for the Classification Panel Example in Chapter 5 124
Code for the Survival Plot Example in Chapter 5 125
Code for the Axis Customization Example in Chapter 7 126

Code for the First Example in Chapter 1

The following code produces the output shown in Figure 1.1:

```
/*--WORK.CARMEANS--*/
proc means data=sashelp.cars noprint;
  class type;
  var mpg_city mpg_highway;
  output out=carmeans
         mean=mean_city mean_highway
              lclm=lcl_city lcl_highway
              uclm=ucl_city ucl_highway;
  run;

data carmeans;
  set carmeans(where=(_type_=1));
  drop _type_;
  format mean_city mean_highway lcl_city lcl_highway ucl_city
          ucl_highway 3.0;
  label mean_city='City';
  label mean_highway='Hwy';
  label lcl_city='CityLCL';
  label ucl_city='CityUCL';
  label lcl_highway='HwyLCL';
  label ucl_highway='HwyUCL';
  label _freq_='Count';
  run;

proc print data=carmeans noobs label;
run;
```

Code for the Classification Panel Example in Chapter 5

The following code produces the Work.Mystock data set that is used for the classification panel example shown in Figure 5.2. Copy, paste, and run this code in the SAS session before performing the example:

```
data mystock;
  set sashelp.stocks;
  format date date.;
  where stock in ("Microsoft" "Intel") and
       (date >= "01jan2005"d);
run;
```

Code for the Survival Plot Example in Chapter 5

The following code produces the Work.Survivalplotdata data set that is used for the survival plot example shown in Figure 5.6. Copy, paste, and run this code in the SAS session before performing the example:

```
proc format;
   value risk 1='ALL' 2='AML-Low Risk' 3='AML-High Risk';
   run;
data BMT;
   input Group T Status @@;
   format Group risk.;
   label T='Disease Free Time';
   datalines;
1 2081 0 1 1602 0 1 1496 0 1 1462 0 1 1433 0
1 1377 0 1 1330 0 1  996 0 1  226 0 1 1199 0
1 1111 0 1  530 0 1 1182 0 1 1167 0 1  418 1
1  383 1 1  276 1 1  104 1 1  609 1 1  172 1
1  487 1 1  662 1 1  194 1 1  230 1 1  526 1
1  122 1 1  129 1 1   74 1 1  122 1 1   86 1
1  466 1 1  192 1 1  109 1 1   55 1 1    1 1
1  107 1 1  110 1 1  332 1 2 2569 0 2 2506 0
2 2409 0 2 2218 0 2 1857 0 2 1829 0 2 1562 0
2 1470 0 2 1363 0 2 1030 0 2  860 0 2 1258 0
2 2246 0 2 1870 0 2 1799 0 2 1709 0 2 1674 0
2 1568 0 2 1527 0 2 1324 0 2  957 0 2  932 0
2  847 0 2  848 0 2 1850 0 2 1843 0 2 1535 0
2 1447 0 2 1384 0 2  414 1 2 2204 1 2 1063 1
2  481 1 2  105 1 2  641 1 2  390 1 2  288 1
2  421 1 2   79 1 2  748 1 2  486 1 2   48 1
2  272 1 2 1074 1 2  381 1 2   10 1 2   53 1
2   80 1 2   35 1 2  248 1 2  704 1 2  211 1
2  219 1 2  606 1 3 2640 0 3 2430 0 3 2252 0
3 2140 0 3 2133 0 3 1238 0 3 1631 0 3 2024 0
3 1345 0 3 1136 0 3  845 0 3  422 1 3  162 1
3   84 1 3  100 1 3    2 1 3   47 1 3  242 1
3  456 1 3  268 1 3  318 1 3   32 1 3  467 1
3   47 1 3  390 1 3  183 1 3  105 1 3  115 1
3  164 1 3   93 1 3  120 1 3   80 1 3  677 1
3   64 1 3  168 1 3   74 1 3   16 1 3  157 1
3  625 1 3   48 1 3  273 1 3   63 1 3   76 1
3  113 1 3  363 1
;
run;
ods graphics on;

/*--Get survival plot data from LIFETEST procedure--*/
ods output Survivalplot=SurvivalPlotData;
proc lifetest data=BMT plots=survival(atrisk=0 to 2500 by 500);
   time T * Status(0);
   strata Group / test=logrank adjust=sidak;
run;
```

Code for the Axis Customization Example in Chapter 7

The following code produces the Work.Cars data set that is used for the axis customization example shown in Figure 7.8. Copy, paste, and run this code in the SAS session before performing the example:

```
data cars;
  set sashelp.cars;
  label MPG_City="Mean MPG";
run;
```

Index

A

advanced features
- about 97
- creating shared-variable graphs with dynamic titles 99–109
- customizing appearance of grouped data 116–122
- customizing axes 109–116
- Graph Reuse 98–99

advanced options 47
Advanced Options Dialog Box 48
appearance, customizing of grouped data 116–122
Assign Data Dialog Boxes
- custom features of other 49–52
- statistics data in 51–52

attributes, overriding 53
Auto Charts tool
- about 85
- example 87–88
- window 86–87

automatic graphs 2–4
axis
- about 47
- customizing 109–116
- customizing properties 112–114
- defined 15
- modifying properties 68–69

axis tables
- about 91
- adding in separate cells 80–82
- adding to graphs 91–94, 114–116
- creating 91–94

B

Background Color and Outline tab (Graph Properties dialog box) 56
band plot 42–43
Bar chart 44
bar fills, changing 119–122
BarError chart 44
Batch mode, running graphs in 39
Block plot 44
Box plot 43
bulk generation, of charts 85
bulk graphs, generating 88–89

C

categorization plots 44
Cell Header 44–45
cell legend 30
Cell Properties dialog box 58–59
cells
- adding axis tables in separate 80–82
- adding discrete legends to 77–78
- adding horizontal box plots to empty 33–35
- adding to graphs 101–103
- defined 14

charts, bulk generation of 85
classification panels
- about 61–63
- creating 63–71

columns, adding 32
Common Column or Row Axis tab (Graph Properties dialog box) 56
confidence bands
- for individuals 51
- for the mean 51

Contour plot 44
copying and pasting graphs to other applications 36

D

data, assigning to histograms 23–24
data lattice 62
DATA= option 108
data panel 62
data set 46
Data Skin tab (Graph Properties dialog box) 56
dataSets=Y|N parameter 17
discrete legends
- about 44–45
- adding to cells 77–78

distribution plot 43
distribution plot example
- about 19–20
- adding horizontal box plots to empty cells 33–35
- adding legends 30–32
- adding plots to graphs 25–28
- adding rows to graphs 32–33
- assigning data to histograms 23–24
- changing titles 24–25

copying and pasting graphs to other applications 36
creating graphs 20–39
creating histograms from Graph Gallery 20–22
modifying legends 30–32
removing footnotes 24–25
running graphs in Batch mode 39
saving graphs in Graph Gallery 37–39
saving graphs to files 37
setting plot properties 28–30
using a common X axis 35
viewing GTL code 36
DropLine plot 44
DYNAMIC statement 98, 108
dynamic titles
adding 105–106
creating shared-variable graphs with 99–109
dynamic usage 99

E

Edit menu 11
Elements pane 10, 12–13
Ellipse plot 43
examples
Auto Charts tool 87–88
distribution plot 19–39
highlow plot 63–71
Metropolitan Relative Weight (MRW) 87–95
removing tick values from axis 109–116
survival plot 71–84

F

File menu 11
files, saving graphs to 37
Fill tab (Cell Properties dialog box) 59
fit plots 43, 50–51
footnotes
defined 15
removing 24–25, 83–84
Format menu 11
fringe plot 25–28, 44

G

General Attributes tab (Graph Properties dialog box) 55
global legends 30, 78–79
Gradient Legend 44–45
Graph Gallery
about 11–12
creating histograms from 20–22
saving graphs in 37–39
Graph Properties dialog box 55–57
Graph Reuse 98–99
Graph Template Language (GTL)
about 6
creating graphs using 4–6
Graphs 2
viewing code 36
GraphAxisLines 52–53
GraphBackground 52–53
graphical user interface (GUI) 10–13
graphs
adding axis tables 91–94, 114–116
adding cells to 101–103
adding global legends to 78–79
adding plots to 25–28, 101–103
adding rows to 32–33
adding titles to 67–68
applying styles to 70–71, 74–75
assigning variables to 104–106
automatic 2–4
copying and pasting to other applications 36
creating 13–14, 15–16, 41–42, 64–66, 72–74, 89–91, 117–118
creating using different data 108–109
creating using Graph Template Language 4–6
creating using SAS ODS Graphics Designer 6–7
creating using SGDESIGN procedure 106–109
creating using Statistical Graphics (SG) procedures 6
customizing 89–95
defined 14
layouts of 16–17
multi-cell 71–84
multi-cell ad hoc 5
properties affecting 54–57
running in Batch mode 39
saving 105–106
saving in Graph Gallery 37–39
saving to files 37
single-cell 4
terminology 14–15
types of 16–17
value of 1–2
visual properties of 52
GraphTitleText 52–53
Group Attributes tab (Graph Properties dialog box) 55
group display 47
group variable example 116–122
grouped data, customizing appearance of 116–122
GTL
See Graph Template Language (GTL)
GUI (graphical user interface) 10–13

H

Help menu 11
highlow plot example
- about 63–64
- adding highlow plots 64–66
- adding titles to graphs 67–68
- applying styles to graphs 70–71
- creating classification panels 63–71
- creating graphs 64–66
- modifying axis properties 68–69
- specifying panel variables 64–66

highlow plots, adding 64–66
Histogram plot 43
histograms
- assigning data to 23–24
- creating from Graph Gallery 20–22

horizontal box plots, adding to empty cells 33–35

I

image files 37
individuals, confidence bands for 51
Insert menu 11
insets
- about 12–13, 42
- combining with plots 45
- defined 15
- types 44–45

Insets panel 13

K

kernel density curve 25–28
Kernel plot 43

L

layouts, of graphs 16–17
Legend Label tab (Cell Properties dialog box) 59
legends
- adding 30–32
- defined 15
- modifying 30–32

library 46
LIFETEST procedure 72
Loess plot 43, 50–51

M

main window 10–11
marker symbol, changing for scatter plots 75–76
mean, confidence bands for the 51
menu bar 10
menus
- about 11
- data assignment from pop-up 48–49
- right-click pop-up 13

Metropoliitan Relative Weight (MRW) example
- about 87–95
- adding axis tables to graphs 91–94
- creating graphs 89–91
- customizing graphs 89–95
- customizing titles 94–95
- generating bulk graphs 88–89

model band 51
More Variables Dialog box 47
MRW
- *See* Metropolitan Relative Weight (MRW) example

multi-cell ad hoc graphs 5, 16
multi-cell classification panels 5, 17
multi-cell graphs
- about 71
- creating 71–84

N

name 47
needle plot 42–43
normal density curve 25–28
Normal plot 43

O

ODS destination, setting 106
ODS Graphics
- on by default 3
- off by default 4

outline color group attributes, outlining 119–122
Outline tab (Cell Properties dialog box) 59

P

panel variables 46, 64–66
Panels tab (Graph Gallery) 62–63
parameterized Line plot 44
parameters, available for SGDESIGN macro 17–18
PBSpline plot 43, 50–51
placeholder data 22
Plot Layers panel 13
Plot tab (Cell Properties dialog box) 58
plot variable tabs 46
plots
- about 12–13, 42
- adding to graphs 25–28, 101–103
- basic 42–43
- categorization 44
- combining with insets 45
- data assignment when adding 45–48
- defined 14
- distribution 43
- fit 43
- fitting existing 50–51

properties of 57–59
setting properties 28–30
PNG format 37
pop-up menu, data assignment from 48–49
portNum=*integer* parameter 17
Prefer Binned Axis tab (Cell Properties dialog box) 58
properties
affecting graphs 54–57
axis 68–69, 112–114
of plots 57–59
setting for plots 28–30

R

Ref plot 44
refresh=Y|N parameter 17
REG procedure 3
Regression plot 43, 50–51
right-click pop-up menus 13
rows, adding to graphs 32–33

S

SAS ODS Graphics Designer
creating graphs using 6–7
graphical user interface (GUI) 10–13
starting 9–10
SAS ODS Graphics Designer (SGD) format 37
scatter plot 42–43, 45–48, 75–76
series plot 42–43
SGD file 106–107
SGDESIGN macro, parameters available for 17–18
SGDESIGN procedure 39, 98, 99, 105–109
SGRENDER procedure 5, 36
shared-variable graphs
creating 99–100
creating with dynamic titles 99–109
single-cell graphs 4, 16
Size tab (Graph Properties dialog box) 56
skins 8
StackBlock plot 44
Statistical Graphic (SG) procedures, creating graphs using 6
statistics data, in Assign Data Dialog Boxes 51–52
step plot 42–43
Style tab (Graph Properties dialog box) 56
styles/style elements
about 52–53
applying to graphs 70–71, 74–75
commonly used 53–54
Subpixel tab (Graph Properties dialog box) 56
survival plot example
about 71–72
adding axis tables in separate cells 80–82
adding discrete legends to cells 77–78
adding global legends to graphs 78–79
applying styles to graphs 74–75
changing marker symbol for scatter plots 75–76
creating graphs 72–74
customizing titles 83–84
removing footnotes 83–84

T

TEMPLATE procedure 5, 36
Template tab (Graph Properties dialog box) 55
terminology 14–15
Text Entry 44–45
titles
adding to graphs 67–68
changing 24–25
customizing 83–84, 94–95
defined 15
toolbar 10, 11
Tools menu 11
Transparency tab (Cell Properties dialog box) 59

U

underscore (_) 105
Use Data Skin tab (Cell Properties dialog box) 59

V

variables 46–47, 104–106
vector plot 42–43
View menu 11
visual properties, of graphs 52

W

window, Auto Charts tool 86–87
work area 11

X

X axis, using a common 35