

SAS Graphics: A Tutorial

Glenn Millard

Stephen F. Austin State University

Abstract

To beginners, SAS Graphics can seem confusing and difficult to use. Because of this they might abandon it and try to use a graphics program to accomplish the task. However, SAS/GRAPH is much easier to use than you might first believe and has some advantages over graphics programs. This paper will present SAS Graphics in a way beginners can understand so they can begin to use this powerful tool. Its relationship to other SAS products will also be shown.

Making a Decision

You've got your data, now you want to present it in a concise way to someone else. A graphic of the data is the best way to get the message across. But what kind of graphic and what to use to prepare it. Nowadays the choices are staggering to the user. There are so many graphics and presentation software packages available today that these decisions become much harder to make. Just a short list of some of the choices available would include Microsoft Powerpoint, Harvard Graphics, Deltapoint's Deltagraph, Corel Graphics, Aldus/Adobe Persuasion, WordPerfect Presentations, and others. They all have strong points and weaknesses. What should a user choose?

First of all let me say this, you go with what you know. It takes a lot of time to gain expertise at preparing graphics that look good. If you already know how to use one of these software programs, then use it. That is, if it can do the type of chart you need. There are things you can do in Corel Graphics or Persuasion or DeltaGraph that the others have a difficult time doing. If this is the type of chart or graphic you need then the choice is simple, that's what you use. But if your graph or chart can be done by many of the software packages available then the choice gets much more difficult.

There is something users should be aware of. With all of the above software packages the amount of data you can enter in to produce the chart or graphic is limited. Sometimes you need something that can do something more. Something that can is SAS Graphics. Also, if your data is already in SAS, why spend the time to retype or convert it to a graphics program just to produce your chart. Keep it in SAS and use SAS/GRAPH, if it is available.

What to Use in SAS

If you have decided that SAS will be your choice to produce your graphic, you again have some choices available to you. SAS now has a number of products that can produce graphics, some can produce nice graphics with little programming. SAS/LAB

gives a guided analysis of certain types of data and can produce scatterplots of your data. SAS/INSIGHT can produce a number of charts of your data. The output of both of these products, and others, can be enhanced in the SAS Graphic Editor. These products can produce quick and informative graphics of your data. Still, to have complete control over your chart, working with SAS/GRAPH is the product of choice. If you have had little experience with SAS/GRAPH, using SAS/ASSIST to help with the selecting the initial options in creating your chart can greatly speed up your work. While SAS/ASSIST does is not enabled to produce every type of chart SAS/GRAPH is capable of, most of the common ones are available. Various pie, line charts, plots, and maps can be produced from SAS/ASSIST and the code it produces, that is shown in the log, can be enhanced outside of ASSIST.

If one of these other ways to produce graphics is not what you need then you will be writing code to produce what you need with SAS/GRAPH. SAS/GRAPH is a full featured product that can produce a wide variety of graphs. A partial list includes text charts, horizontal and vertical bar charts; pie star, or block charts; line, scatter, high-low, and bubble 2-D plots, 3-D scatter, surface, and contour plots, and various types of maps. These charts and graphs can be printed on a wide variety of output devices.

Understanding SAS/GRAPH

Upon looking at various SAS/GRAPH manuals and other helps the user just beginning to learn SAS/GRAPH will probably not understand all he or she sees. This is normal if you are used to working with PC based graphic capable programs. SAS/GRAPH is designed to work under a wide variety of environments and some of these lack graphical interfaces. Therefore it is difficult, if not impossible, for SAS to have point and click pop-up interfaces for these non-graphical environments. SAS/GRAPH uses command statements instead to setup all the graphic elements. All of the options and other controls that effect how the graphs look are also text based. Once the user can separate the command that actually creates the graph from the options that control how the graph will finally look, things like color, fonts, labels, and symbol types; then understanding SAS/ GRAPH becomes much easier. Without attempting to cover all the various graph types that can be produced or PROC statements that create them; this paper will explain further all the options available that control the look-and-feel of the graphic. To say that the PC presentation programs can produce better charts than SAS/GRAPH is to have a poor concept of the options available when using the software.

SAS Statements that Enhance your Graph

To produce charts and graphs that have the 'professional' look of many graphics packages you need to understand the statements that enhance to look of your graphic. These include TITLE, FOOTNOTE, LABEL, FORMAT, NOTE, PATTERN, AXIS, LEGEND, SYMBOL and GOPTIONS. They are used by different SAS/GRAPH procedures, some are not available for use with various types of charts. Following is detailed description of these statements and their options.

TITLE*n* 'text'; **FOOTNOTE***n* 'text';

These two statements are usually discussed together because they have the same options available. Up to ten Title lines can be displayed at the top of your output and ten Footnote lines at the bottom. By default these lines are centered on the page. Options available can control the size, color, and font of the text and whether it is underlined or enclosed in a box. You can change its justification and line spacing; draw lines on the picture; and angle text strings and rotate characters. Changing a **TITLE** or **FOOTNOTE** definition cancels all existing definitions at higher numbers. A **TITLE** or **FOOTNOTE** with no text can cancel one or more definitions as well. The definitions stay in effect for all charts produced below the definitions and will continue unless they are reset with further definitions. The following SAS/GRAPH procedures use **TITLE** and **FOOTNOTE** statements: **GCHART**, **GCONTOUR**, **GFONT**, **GMAP**, **GPlot**, **GPRINT**, **GSLIDE**, and **G3D**.

You have a tremendous amount of control regarding text using the **TITLE** and **FOOTNOTE** statements. These statements, along with the **GSLIDE** procedure, can create text slides with little difficulty. These statements are defined outside of the procedure in which the text will appear.

FORMAT; **LABEL**;

These two statements work in SAS/GRAPH the same way they work in normal SAS procedures. The **LABEL** statement replaces a variable name in the output with the specified label. The **FORMAT** statement replaces and groups data values in the output based on values created in a **PROC FORMAT**. These **FORMATs** and **LABELs** must be defined before the output they will appear on.

GOPTIONS;

GOPTIONS controls the global settings for SAS/GRAPH. With this statement you set the default options for the following output. It controls things like fonts, heights, colors, output device and device settings, chart rotation and size, and default symbol and pattern settings. With the proper settings you can preview your output on the screen as it will look on your actual output device. The **GOPTIONS** statement should be one of your first commands, unless you are using it further down in your program to change settings before more output is produced.

NOTE;

The **NOTE** statement is much like the **TITLE** and **FOOTNOTE** statements. It has all of the same options the **TITLE** and **FOOTNOTE** statements do. In addition, it has a few more options available that give you more control over the appearance of the text and its positioning of the page. It also can create line and boxes on the output with more flexibility than **TITLE** and **FOOTNOTE**. Unlike the **TITLE** and **FOOTNOTE** statements which are limited to 10 lines each, you can have as many **NOTE** statements as you need.

The NOTE statement also differs in that it must be defined with the procedure, rather than external to it, and is only active within a SAS/GRAPH procedure.

PATTERNn;

The PATTERN statements specify the colors and/or crosshatching patterns used to fill pies, bars, and other areas in various SAS/GRAPH procedures. It also controls whether the pattern is repeated in the chart. If you do not define specific patterns for your charts, SAS will use a predefined set on your charts. The type of patterns you can have are: solid or empty, or composed of parallel or crosshatched lines. The GCHART, GPLOT, GMAP, and GCONTOUR procedures all use patterns. Fill patterns can also be specified in SYMBOL statements.

You may have up to 99 pattern definitions. The keyword PATTERN is followed by number between 1 and 99. You do not have to start with PATTERN1 and they do not have to be sequential or consecutive. SAS starts processing with the lowest defined pattern and works upward, ignoring gaps. PATTERN statements can appear anywhere in your SAS program. For more information on the type of patterns available look at the SAS/GRAPH Software, Reference, Version 6, First Edition.

AXISn;

The AXIS statement is similar to the PATTERN statement and is used with the GCHART, GCONTOUR, and GPLOT procedures. You can have up to 99 axes defined. This statement controls the location, values, and appearance of the axes. For each axis you can control how it is scaled, how the data values are ordered, the location and appearance of the axis line and tick marks, and the text and appearance of the axis label and tick mark values. The angle, color, font, justification, height, and rotation of all text can be controlled. The scaling, color, height, number, location, and width of the major and minor tick marks can be set also. AXIS statements are global and can appear anywhere in the SAS program.

LEGEND;

The LEGEND statement allows you to specify the characteristics of the legend but do not create legends. You can control the position and appearance of the legend box, the text and appearance of the legend text, the size and shape of the legend values, and the text of the labels for the legend values. The GCHART, GPLOT, GCONTOUR, and GMAP procedures can produce legends. LEGEND statements can appear anywhere in your SAS program. All the normal controls for size, color, font, justification, and position exist for the legend text. Controls for color, location, and other attributes exist to control the legend box and the legend entries. Like the PATTERN and AXIS statements above; if you do not specify LEGEND statements, defaults will be used. You may have up to 99 legend statements.

SYMBOL ;

The SYMBOL statement controls the characteristics of symbols that display the data in the GPLOT procedure. Some of these characteristics are: appearance of plot symbols and lines, including bars, boxes, confidence limit lines, and area fills; interpolation methods, how out of range is handled; and the number of times a definition is used. Up to 99 symbol statements can be in your program that control color, font, height and value of text; and color, type, and width of lines and symbols. Smoothed lines and regression lines can be drawn from SYMBOL controls.

Once you have the ability to enhance your output with these statements you can produce charts and graphs that look as good as any other PC-based graphing software. For complete information on all of these statements refer to SAS/GRAPH Software, Reference, Version 6, First Edition.

SAS/GRAPH Procedures

Following is a brief description of the various SAS/GRAPH procedures and information about the type of charts that they can produce:

Proc GCHART:	Vertical Bar Charts, Horizontal Bar Charts, Block Charts, Pie Charts and Star Charts
Proc GPLOT:	Scatter Plots, Needle Plots, Spline Interpolation, and Bubble Plots
Proc GMAP, GPROJECT, GREduce, GREmove	Projected Maps, Choropleth Maps, Surface Maps, and Prism Maps
Proc GPRINT, GSLIDE	Text Slides
Proc G3D, G3GRID	3-D Scatter, Surface, and Contour Plots
Proc GCONTOUR	Contour Plots

Custom Graphics

SAS/GRAPH is not limited to just the above procedures and statements. There are other facilities available that can enhance your graphics even more. One of these is the ANNOTATE facility. It can use information from SAS data sets to add text or other special elements to your output. Proc GREPLAY is available to recreate your graphics and even combine different pages of your graphs onto one page. There is also the DATA Step Graphics Interface that provides functions and calls to the SAS data step so that graphics may be produced from it. Recently the SAS Graphics Editor was added to allow

importing and exporting of other graphic elements, as well as on-screen updating of your graphic output on screens that can support graphic output.

Summary

The SAS System is currently providing many tools to the user to allow him to produce the text-based and graphical-based output he desires. The recent additions of SAS/EIS, SAS/GIS, and SAS Frames have only increased the resources available to the user. The SAS System, SAS/GRAPHICS in particular, can easily produce most of the graphs and charts needed by users today. As I said at the start, use what you know. If you are already a SAS user, then become familiar with the SAS System's graphical abilities.

References

SAS/GRAPH Software, Reference, Version 6, First Edition.

Vincent Tillman, Overview of SAS/GRAPH(R) Procedures and Facilities, SAS Users Group International Conference Proceedings, 1990, pp. 639-644

ACKNOWLEDGEMENTS

SAS is a registered trademark of SAS Institute Inc. in the USA and other countries.

AUTHOR

The author may be reached at:

Glenn Millard
Stephen F. Austin State University
PO Box 6095
Nacogdoches, Texas 75962
Phone: 409-468-1020
Fax: 409-468-3100
email: gmillard@sfasu.edu