The past twenty years have witnessed a remarkable growth in the development of graphics for statistical analysis. This rapid growth has been made possible by capable and sophisticated computer systems — hardware and software.

The ability of SAS/GRAPH to produce quality graphics for presentation purposes is well known. What may be less well known is the tremendous flexibility in SAS/GRAPH to produce non-standard graphics for the purpose of analyzing data. That flexibility is demonstrated in the following eight graphic examples.

**LIMITATIONS**

One of the promising areas of analytical graphics is interactive dynamic methods using techniques such as painting, brushing, rotation and outlining. While SAS/GRAPH cannot currently handle dynamic methods, the interactive modification of terminal-displayed graphics did appear on the 1987 SAS ballot (#311). It did not receive strong support from SAS users, but hopefully, as animated methods become more popular with the availability of pioneering computer systems, user demand will encourage SAS to respond to this advancement.

**EXAMPLES**

**FIGURE 1: Circular Bar Chart**

Simple bar charts are quite popular and could be used to portray this data. However, since the bars represent times of the day, a bar chart with a circular base and certain characteristics of a 24 hour clock gives a more vivid picture of the information.

**FIGURE 2: Scatter Plot with Bar Charts as Symbols**

This graph allows us to track the crime rate by year over a ten-year period. With the bars representing the percent of each crime solved, we can focus on any particular year for more information.

**FIGURE 3: Bar Chart with Error Bars**

Confidence intervals on proportional bars allows us to see the lack of statistical difference in murders committed by the day of the week. On a regular bar chart the rates may appear significantly different.

**FIGURE 4: Standard Deviation Ellipses**

Each standard deviation ellipse is constructed through the majority of points of a specific group. This allows a visual analysis of the location of groups without the clutter of the actual points.

**FIGURE 5: Framed Rectangles**

The visual impact of area charts can be misleading because of the relative size of each area. The use of framed rectangles can help eliminate this problem. In this example all of the rectangles are the same size; the heights of the bars represent the crime rate per 1000 population.

**FIGURE 6: Trilinear Chart**

The trilinear chart is used to show three "percent variables" that sum to 100. Each point of the equilateral triangle represents one
variable and has a scale that starts at the base of that point. Each scale goes from zero to 100. Observations are plotted and compared. In this example the percent of three types of office visits to a single doctor, by Medicaid recipients are tracked by month.

FIGURE 7: Bivariate Regression Plot

Since the axes of a scatter plot are somewhat arbitrary, we had SAS/GRAPH use box plots as the vertical and horizontal scales. This gives some univariate information on each of the two variables plotted. Jitter plots are included for a univariate measure of density.

FIGURE 8: Bivariate Density Report Plot

This graphic creates a two-variable density report. Although a number of graphics could be used to demonstrate density, this plot includes a scatter plot of raw data points, a scatter plot with sunflower symbols, a scatter plot with hex bin symbols and a three dimensional density trace.

BIBLIOGRAPHY


Chambers, John M. et. al. (1979), Graphical Methods For Data Analysis, Duxbury Press, Boston.


FOR MORE INFORMATION CONTACT:

Terry Allen
Research Analyst
Bureau of Medicaid Fraud
191 East 6100 South
Salt Lake City, Utah 84107

Trademarks: SAS and SAS/GRAPH are registered trademark of SAS Institute, Inc., Cary, NC, USA
Utah Law Enforcement Officers Assaulted by Hour of the Day 1978 - 1987
n = 2,623

Utah Crime Rate per 1,000 population and Clearance Rates by Year
Bar Order — Rape, Robbery, Aggravated Assault, Burglary, Larceny/Theft, Car Theft

Fig 1

Fig 2
Murders by Day of the Week
Utah 1978 - 1987

Fig 3

Standard Deviation Ellipse
Weight, Speed and Position
BYU Football Team

Fig 4
CRIME IN UTAH

Bureau of Criminal Identification
Index Crime Rate per 1000 Pop. by County

Office Visits for Medicaid Recipients
July 1986 – December 1987

EXTENDED ($65)

LIMITED ($40)  BRIEF ($20)

1091