AN INTERACTIVE INTERFACE TO SAS/GRAPH FOR CONSTRUCTING CHARTS

Blair J. MacDougall, Gulf Canada Limited

Abstract

With the increasing variety, features and low cost of graphics hardware, it is becoming critical that general user software be device independent. SAS/GRAPH provides this advantage.

This paper describes a software frontend to SAS/GRAPH which allows users with access to an interactive graphics terminal with light pen, joystick or crosshairs to construct nonstandard SAS plots incorporating text, lines and shapes.

This software generates a SAS/GRAPH procedure which constructs the plot on the desired device.

Both SAS and nonSAS users will find this software to be a productivity enhancement tool since it permits the rapid development of word slides, flowcharts and Gantt charts - to name a few.

Introduction

PROC GMAP can be used to generate choropleth maps. However, if PROC GMAP is used to generate a plot containing more than a few simple segments (rectangles, lines, polygons etc.) this can be a time consuming and manual process involving such steps as:

1. generate a sketch (to scale)
2. impose a coordinate system on the sketch
3. determine all coordinates for lines, rectangles and polygons
4. determine the row, column location for text
5. incorporate the calculated coordinates and row, column data into a SAS/GRAPH procedure.
6. debug the procedure

SASCAD provides an alternative to the above approach. A user with access to a TEKTRONIX 4027 or RANTEK 6211 can use the graphics cursor (crosshairs or light pen) to automatically generate the coordinate positions. This simplifies generating GMAP plots since drawing on the screen is accomplished by positioning the graphics cursor on the screen. This combined with SASCAD commands will cause the generation of the desired plot. When finished, SASCAD will generate SAS/GRAPH procedures which will reproduce the graph.

A few ways that SASCAD can be used are:
- entire plots can be generated using SASCAD. The SASCAD generated SAS/GRAPH procedures can then be used to reproduce the plot on other data display devices.
- If the graphics terminal is hooked into a color camera system, a hard copy can be generated directly from the screen.
- portions of plots can be generated using SASCAD. SAS/GRAPH fonts etc. can then be used to produce a more presentable product.
- to create an overlay for SAS/GRAPH plots (only applicable to camera systems).
- to customize a SAS/GRAPH plot by adding labels, arrows, underlining etc. (only applicable to camera system).

Overview of SASCAD

Steps involved in using SASCAD are:

1. under TSO, log onto a TEKTRONIX 4027 or RANTEK 6211
2. execute a CLIST which allocates files and executes SASCAD
3. combine commands - discussed later - along with terminal generated coordinates to generate a graph on the screen
4. exit from SASCAD. This will create:
   - a SAS/GRAPH procedure which, when executed, will reproduce the SASCAD plot
   - a SASCAD drawing file (a device-independent picture description) containing all the information necessary to reproduce the plot. This file can also be used as input to SASCAD and thus serve as
execute the SAS/GRAPH procedure on the desired data display device - such as a hard copy plotter, an IBM 3279 etc. and the original plot is recreated.

**CAUTION**
The current release of FROC GMAP generates all text first (for example, NOTE statements), then generates the shapes and fills them in. On many data display devices, the fill step obliterates the text. No obliteration occurs if the hardware character set is used on such data display devices as the TEKTRONIX 4027 or IBM 3279. SASCAD defaults to the hardware character set. Care should be exercised if this default is overridden.

SASCAD Commands

As has been already mentioned, a user combines commands and terminal generated coordinates to construct a plot. The following brief summary of the commands explains some of the functionality of SASCAD as well as serving as an aid in understanding the included example.

1. **SAS**
   This command terminates the SASCAD session and causes the creation of the SAS/GRAPH procedures that will reproduce the plot.

2. **LINE**
   This command prompts (by activating the graphics cursor) for 2 coordinates. A line will be drawn between the 2 coordinates received.

3. **RECTangle**
   This command prompts for 2 coordinates - the diagonal corners of the desired rectangle. When the second coordinate has been received, SASCAD generates the rectangle.
   The rectangle is filled with the current color selected.

4. **POLYGON**
   This command prompts for coordinates until a "noncoordinate" (i.e. command) has been received. The first and last coordinates of the polygon are joined to complete the polygon.
   The polygon is filled with the current color selected.

5. **C = color**
   This command determines the color used for filling shapes. The "color" can be BLACK, RED, GREEN, YELLOW, BLUE, MAGENTA, CYAN or WHITE.
   The current color is posted in the lower left hand corner of the viewing window for reference purposes.

6. **J = Centre**
   **J = Left**
   **J = Right**

   This command determines the text justification.

7(a) **DRAW n**
   n is the segment number (rectangle, line etc.) to be drawn. Segment numbers are automatically assigned sequentially starting at 1.
   This command is mainly used as a prelude to ERASE. It allows a convenient way to identify the proper segment to be erased. For easy identification, the segment specified blinks on the screen and the graphics cursor moves to the selected segment.

(b) **DRAW ALL**
   The screen is cleared and the entire plot redrawn.

8(a) **ERASE n**
   n is the segment number (rectangle, line etc.) to be drawn.
   This command is similar to DRAW n except that the selected segment will disappear (i.e. be erased) from the screen.

(b) **ERASE ALL**
   All segments are deleted. This is the same as starting over afresh.

9. **NOTE text string**
   The "text string" is a character string to be placed on the screen.
   This command will prompt for a coordinate position and depending on the justification selected (J=), the string will be correspondingly placed.

10. **WRAP text string**
    The "text string" is a character string to be placed on the screen.
    This command is similar to NOTE except that a rectangle is automatically generated to enclose the text. The current color is used to fill the rectangle.

11. **ARROW Left**
ARROW Right
ARROW Up
ARROW Down
This command is used to generate an arrow.

The user is prompted for the coordinate of the tip of the arrow.

(12) GRID
This command causes a grid of dots to be generated in the viewing window. These dots do not appear on the SAS/GRAPH generated plot and are used for visual reference during the SASCAD session and by the command EXACT ON.

13(a) EXACT ON
This command causes any further coordinates received to be automatically snapped to the nearest grid point. The graphics cursor will automatically move to reflect this. All lines, rectangles etc. will have vertices on grid points.

Not only does this command ensure that everything lines up, but it also simplifies entering coordinates since approximate coordinates can be entered. SASCAD will automatically adjust the coordinates received to be exact.

(b) EXACT OFF
This command turns the exact feature off. All coordinates are as entered.

Example SASCAD Session
The following is a simple example illustrating a SASCAD session.

Figure 2 shows the proportion of skills required for various levels of management.

To create Figure 2 using SASCAD would involve the following steps.

1) generate a grid to facilitate aligning text and shapes (use GRID command).
2) snap all points to grid cells so that corners abut exactly (use EXACT ON command).
3) position each line of text using the NOTE command. The text is entered first since it is easier to judge the size of the shapes relative to the text.
4) generate the rectangles using the RECT command.
5) generate the remaining shapes using the POLY command.

Color fill can be activated for the RECT and POLY commands.

The following are the commands entered on the terminal to computerize Figure 2. The coordinates following commands such as NOTE, POLY, and RECT were generated by the terminal in response to the user positioning the graphics cursor.

GRID
EXACT ON
NOTE SENIOR MANAGEMENT 00044, 00340
NOTE MIDDLE MANAGEMENT 00044, 00286
NOTE JUNIOR MANAGEMENT 00044, 00229
NOTE TECHNICAL STAFF 00044, 00174
NOTE PROGRESSION

| Relative proportion of skills at various management levels |
|---------------------------------|-----------------|-----------------|
| Senior Management | Technical Knowledge | Analytical Skills |
| Middle Management | Leadership Skills | |
| Junior Management | | |
| Technical Staff | | |
| Progression | | |

Figure 2
The following are the SAS/GRAPH procedures generated by SAS/GRAPH for the above example.

Procedure 1:

\begin{verbatim}
XINC TERM;  
XINC MYDATA;  
MACRO COLOR_1 BLACK;  
MACRO COLOR_2 RED;  
MACRO COLOR_3 GREEN;  
MACRO COLOR_4 YELLOW;  
MACRO COLOR_5 BLUE;  
MACRO COLOR_6 MAGENTA;  
MACRO COLOR_7 CYAN;  
MACRO COLOR_8 WHITE;  
PROC GMAP MAP=XYS DATA=MYDATA;  
ID SHAPE;  
CHORD COLOR=NOLEGEND DISCRETE;  
PATTERN1 COLOR_1 V=S;  
PATTERN2 COLOR_2 V=S;  
PATTERN3 COLOR_3 V=S;  
PATTERN4 COLOR_4 V=S;  
PATTERN5 COLOR_5 V=S;  
PATTERN6 COLOR_6 V=S;  
PATTERN7 COLOR_7 V=S;  
PATTERN8 COLOR_8 V=S;  
PATTERN9 COLOR_8 V=E;  
NOTE SETUP.N=( 5, 20) SENIOR MANAGEMENT;  
NOTE SETUP.N=( 5, 12) JUNIOR MANAGEMENT;  
NOTE SETUP.N=( 5, 4) MIDDLE MANAGEMENT;  
NOTE SETUP.N=( 5, 8) TECHNICAL STAFF;  
NOTE SETUP.N=( 24, 4) BUSINESS;  
NOTE SETUP.N=( 24, 4) PROGRESSION;  
NOTE SETUP.N=( 34, 20) LEADERSHIP;  
NOTE SETUP.N=( 36, 19) SKILLS;  
NOTE SETUP.N=( 46, 5) ANALYTICAL;  
NOTE SETUP.N=( 50, 4) SKILLS;  
NOTE SETUP.N=( 60, 20) CONCEPTUAL;  
NOTE SETUP.N=( 62, 19) SKILLS;  
NOTE SETUP.N=( 25, 25) RELATIVE PROPORTION OF SKILLS AT;  
NOTE SETUP.N=( 29, 24) VARIOUS MANAGEMENT LEVELS;  

DATA XYS;  
INPUT X Y SHAPE;  
CARDS;  
19 70 a  
621 70 0  
621 462 0  
19 462 0  
35 357 1  
179 357 1  
179 105 1  
35 105 1  
35 357 2  
179 357 3  
179 105 3  
275 105 3  
243 357 3  
243 357 4  
275 105 4  
371 105 4  
371 357 4  
371 357 5  
\end{verbatim}
PROC GMAP allows SAS/GRAPH users to generate choropleth maps. SASCAD simplifies the generation of PROC GMAP plots by automating the most tedious and time consuming part of the process.

For further information about this paper contact:

Blair MacDougall
Gulf Canada Limited
401 - 9th Avenue S.W.
Calgary, Alberta CANADA
T2P 2B7
(403) 233-3914

Acknowledgement

The author wishes to thank Mel Huszti for the diagram used in the example.

Figure 3 is the plot generated by the above SAS/GRAPH procedures. All shapes have been generated as empty.

<table>
<thead>
<tr>
<th>RELATIVE PROPORTION OF SKILLS AT VARIOUS MANAGEMENT LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENIOR MANAGEMENT</td>
</tr>
<tr>
<td>MIDDLE MANAGEMENT</td>
</tr>
<tr>
<td>JUNIOR MANAGEMENT</td>
</tr>
<tr>
<td>TECHNICAL STAFF</td>
</tr>
<tr>
<td>PROGRESSION</td>
</tr>
</tbody>
</table>

Figure 3